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ENGINEERS OF THE SOUTHWEST PACIFIC 1941-1945 Volume VIII

Critique

By the Office of the Chief Engineer, General Headquarters

Army Forces, Pacific

MAJOR GENERAL HUGH J. CASEY, *Chief Engineer*

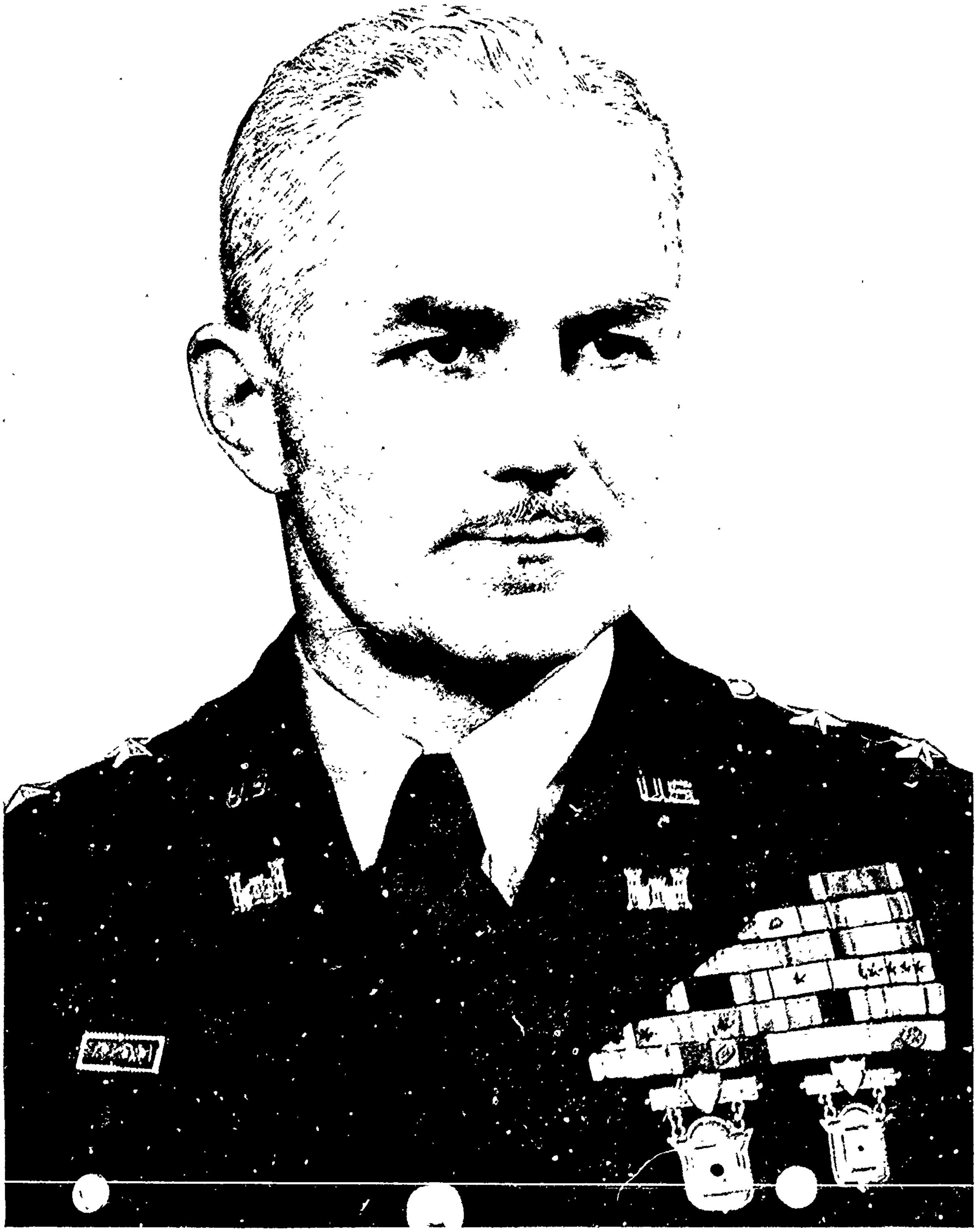
REPORTS OF OPERATIONS

UNITED STATES ARMY FORCES IN THE FAR EAST

SOUTHWEST PACIFIC AREA

ARMY FORCES, PACIFIC

1950



Major General Hugh J. Casey
Chief Engineer, General Headquarters, Army Forces, Pacific

Foreword

Critique is written with a tribute to those Engineers who gave their lives and a salute to those who carried through to a successful end the proud and demanding services traditional to the Corps of Engineers. Several hundred pages of criticism follow. By comparison the few commendations contained herein are dwarfed. It must be remembered, however, that a critique written in the interest of correcting old errors and improving new methods could not possibly in a meager few hundred pages presume to cover the very many remarkable and outstanding achievements of the Engineers in the Southwest Pacific. To portray the glory with which these understaffed men enhanced the history of the Corps of Engineers is not the aim of this volume.

Progress is made by trial and error. The almost incredible progress of the Engineers in the Southwest Pacific could not have been achieved by timid men stymied by fear of making mistakes. The tremendous Engineer achievement in the Southwest Pacific was flung at the enemy by venturesome men coolly accepting and condemning their own errors, recognizing their own weaknesses, and attempting to eliminate both while in full stride. The on-the-spot reactions of these Engineers, therefore, rather than the glory which is the natural outcome of such open-eyed, decisive action, is reflected in the following pages. For their incalculable contribution to victory it is indeed only a small expression of gratitude and recognition to record the recommendations and conclusions reached by these courageous men in the dread academy of total war. They are, therefore, presented individually throughout the volume, and in summation in the last chapter, for consideration of those who will compile and promulgate the standing operating procedures of the future. They should not be construed as approved military doctrine but as representing only impressions of procedures in specific situations which might or might not apply in different sets of circumstances.

Indirectly, the incidental faults emphasized here do, of course, reflect the vastness of activities, and the magnificent, widespread efforts of all ranks of Engineers. Their remarkable accomplishments have added lustre to the proud traditions of the Corps of Engineers, and with the hope of keeping this brilliance throughout subsequent pages of Engineer history, this critique is written. The errors that these men themselves have pointed out are recorded for the future maintenance of the high standards they have set. The heritage they have handed down is accepted with profound pride and a deep sense of obligation to keep their castled banner flying high on the horizons of the future.

Hugh J. Casey

HUGH J. CASEY
Major General
Chief Engineer

Tokyo, Japan
31 December 1948

ENGINEERS OF THE SOUTHWEST PACIFIC

1941–1945

VOLUME I

ENGINEERS IN THEATER OPERATIONS

VOLUME II

ORGANIZATIONS, TROOPS AND TRAINING

VOLUME III

ENGINEER INTELLIGENCE

VOLUME IV

AMPHIBIAN ENGINEER OPERATIONS

VOLUME V

COMBAT ENGINEER OPERATIONS

VOLUME VI

AIRFIELD AND BASE DEVELOPMENT

VOLUME VII

ENGINEER SUPPLY

VOLUME VIII

CRITIQUE

Preface

THIS REPORT of the Chief Engineer, General Headquarters, Army Forces, Pacific, covering the activities of the Corps of Engineers in the Southwest Pacific during World War II, has been compiled to provide valuable reading and research material for higher staff levels of all branches of the military establishment and all officers of the Corps of Engineers, United States Army. Studies of this kind should be vital to the Army General Staff in formulating any plans for future operations. Engineer activities in World War II have been so varied in doctrine and procedure in the different parts of the world that it will be many years before any one officer or group of officers can attain a thorough mastery of how matters were handled in each theater. These studies should indicate to succeeding generations the character and extent of difficulties involved in the Southwest Pacific Theater, and the requisite solution of problems upon which may depend the difference between victory and defeat in any future conflict. They should also provide an excellent source of worthwhile information for the various training, research, development, and supply agencies operating under the Chief of Engineers. It is believed that the present report will have great value to the Army in general and to the Corps of Engineers in particular. It should prove of interest to members of the Legislative Branch of the Government whose activities are concerned with the operations of the Department of the Army. The reader interested in making a more detailed study will find an abundance of references to source materials in the footnotes and bibliographical lists. For the convenience of a wide variety of expected readers, many of whom will not be engineers, every effort has been made to depart from strictly Engineer terminology in an endeavor to lose for none the basic qualities of good, well-presented material coupled with significant detail and reader interest.

During the course of World War II in the Southwest Pacific there was little opportunity, because of the pressure of operations and the extreme shortage of Engineer officers, to compile an over-all report of Engineer operations. Immediately after V-J Day some effort was made towards a chronological report on a much less ambitious and thorough scale than the present series. Not until 15 March 1946, however, when the present Editor and staff arrived in Tokyo was this project approved for the detailed expansion contained in these volumes and work undertaken in earnest. This group by no means constituted an adequate research and writing force. Besides the actual writing of these volumes, the staff was obliged to conduct all of its own interviews, accumulate source materials, and reorganize the wartime files of the Office of the Chief Engineer, GHQ, AFPAC, to facilitate research. Absence from the Theater of numerous individuals who took part in the making of Engineer history during the war immeasurably retarded compilation of these volumes. Flying trips were made throughout Japan, Okinawa, the Philippines, and Hawaii to secure the accounts of the remaining, scattered, well-informed individuals. With the several staff members spread throughout the Southwest Pacific in search of material, the Editor, aside from routine travel throughout the Theater, was obliged to fly down to Australia for the necessary information to integrate Australian Engineer effort during the war into these reports. In this connection conferences were held with the wartime and present Engineer in Chief, AHQ, Australian Army, members of the staff of the Engineer in Chief and ranking personnel of the Royal Australian Air Force and its Engineers at Victoria Barracks. Both Melbourne and Brisbane were visited on this trip to contact former members of the inactivated Allied Works Council, and at Sydney the Editor interviewed the remaining staff of the Australian Base Section, U. S. Army. Valuable documents were obtained from all.

Considerable amounts of the records in the Southwest Pacific had been shipped by various headquarters to depositories in the United States and were not available for inclusion in the work accomplished in the Theater. Coverage of these sources had to be postponed until the staff's return to the United States. For 10 months the Southwest Pacific was combed for source material to compile this record of the Engineers' tremendous contribution to the war effort. Every possible facet of information was exhausted. Accounts of operations were gleaned from lieutenants and generals alike; basic records ranged from isolated company reports to histories of armies. Some of the source material was not so complete as could be desired; there were too few engineers engaged in this "Engineers' War" to devote the time necessary for meticulous reports. Fortunately, however, there was more than one report of each campaign. By reciprocal transposition an account of the whole operation was made possible. Credit for a considerable amount of information regarding the defense of the Philippines must be given to the personal files of the Engineer, USAFFE, which, in the hectic days of the fall of Bataan, were buried at fearful risk by a friendly Filipino and later dug up and returned to their owner. These yellow, moldy pages contained a wealth of dramatic material. There can be little doubt that other material of value has been destroyed and completely lost to posterity. Records in the chaos of war lead a precarious existence.

With all sources of material in the Southwest Pacific completely drained, the staff returned to the United States. Engineer officers with wartime service in the Southwest Pacific who could be located in the United States were promptly solicited for details. The archives in Washington, D. C., and vicinity yielded material which had evaded the writers in the Theater. The Australian Military Mission in Washington contributed additional Australian reports. More recently the Editor returned to the Theater for the purpose of performing added research incidental to finalizing various manuscripts for printing. Upwards of 60,000 engineer photographs were collected and cataloged, the photo files of the Signal Corps and Army Air Forces were thoroughly scanned—all for the purpose of presenting the best possible pictorial coverage of the text. The Editor has selected the most illustrative, knowing full well that conditions of climate, personnel, and timing have materially precluded a striking photographic coverage that would carry with impact the true message of engineer effort expended. Similar problems were encountered in the selection of appropriate materials for graphic presentation. The staff for art direction and for varied problems incidental to actual publication was even more limited than the writing staff. Nevertheless, these volumes contain as composite a picture of the "Engineers' War" in the Southwest Pacific as is possible.

This report has been organized into eight volumes, the first covering a general, over-all narrative designed to give the non-Engineer a substantial picture of the role played by the Engineers in the conflict while supplying the technical reader with a comprehensive background as an introduction to the subsequent and more detailed volumes. These latter embrace organizations and troops and training; engineer intelligence; operations of Amphibian Engineers, and of Combat Engineers; development and construction of bases and airfields; and the vast problems of engineer supply. Every attempt has been made to make these books stand on facts as they were reported; they do not necessarily represent the views of GHQ, AFPAC, or the Department of the Army. On questions involving controversial issues, opinions rather than facts, a neutral stand has been taken. Since, however, these opinions may nevertheless be of extreme value to the military establishment, they have been consolidated into a volume based on conclusions, criticisms, and recommendations.

Critique is a compilation of such conclusions, criticisms, and recommendations, presented in narrative form by campaign from the beginning to the end of World War II in the Southwest Pacific. It is a composite appraisal, emphasizing exceptional or inadequate performances of the Engineers, including, where possible, reasons involved, corrective measures employed, and the recommended changes in Engineer standing operating procedures for the future. Analyses and deductions of Engineer officers from the highest to the lowest levels of staff and command are recorded, covering the problems of engineer organization, administration, intelligence, amphibian and combat operations, construction, capacity and adequacy of personnel, training, and supply. Problems incidental to operating with other branches of the armed forces of the United States as well as Allied arms and services are disclosed, ofttimes verbatim from the reports of the participants. The effects on engineer operations of abrupt revisions in plans because of rapidly changing strategical requirements are recorded together with on-the-spot reactions of the Engineer planning staffs involved. A few incidents of distinguished service are related to remind the reader occasionally that the critique material contained in this volume was not the sum total of Engineer performance. The final, over-all chapter embraces in digest form the most often recurring factors stressed by the Engineers in the Southwest Pacific. Every effort has been made through numerous personal interviews and perusal of all the considerable research material available to include in this volume as many of the controversial issues that arose as possible, although the paucity of analytical material in records and correspondence composed under stress of fast-moving operations has naturally had a limiting effect. Each criticism and recommendation uncovered, however, has been presented with complete impartiality and coordinated with a minimum of narrative background in an endeavor to eliminate for the reader too much repetition of material contained in other volumes of the series.

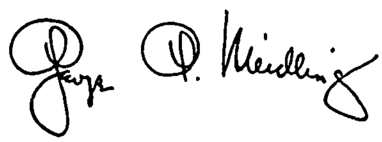
The method of documentation employed in the various volumes of this report was found inappropriate to the orderly presentation of *Critique*. Footnotes have, therefore, been eliminated, at least for purposes of documentation, in favor of a bibliographical list at the end of each chapter indicating the documents used in its preparation. Readability, for the average military reader, as a consequence, has been improved without losing for the researcher, the key to a more extended study and exploitation of the subject. At the end of the volume, certain aids to the reader have been provided: a chronology; a glossary defining technical terms, short titles, and abbreviations which appear in the text; a guide to the system of documentation employed; and an index.

For complete appreciation of the magnitude of Engineer operations in the Southwest Pacific, the reader is referred to Volume I of this series, *Engineers in Theater Operations*, which is a prelude to the study of this and other volumes of the series, covering in narrative form prewar conditions and planning, preparations, and the actual conduct of major campaigns from Pearl Harbor to the occupation of Japan and Korea.

Acknowledgment is made to Miss Edna E. Schultz for the compilation of this volume after extensive research, both in the Theater and the United States, including the collection and study of every available engineer report for the selection and correlation of materials of an analytical nature. This research and writing, considerable in scope, required special application and effort because items of critique value were rare and only spasmodically referred to in the mass of documents collected. Gleaning such material was only half the task; diverse excerpts had to be complemented and expanded into well-rounded interpretations, and the many remotely connected conclusions had to be combined and written into consecutive and logical sequences. When the Editor, during his return to the Theater in late 1948, uncovered considerable additional material, extra time and effort had to be applied in scrutinizing the newly acquired documents. A searching study for all possible excerpts of a critique nature once again had to be initiated. Selected new subjects had to be integrated with old while preserving continuity. Those details already covered in the original manuscript on which new comments were available could now be amplified. Inserting the new material and further development of the old eventually involved practically a complete rewrite of the volume to give the reader a broad and scrupulous analysis on as many engineer activities as possible.

Many officers of the Corps of Engineers gave their time and effort to reading and criticizing preliminary manuscripts, and personally or through correspondence gave the Editor valuable information and recommendations. In this connection, special appreciation is extended to Brig. Gen. Samuel D. Sturgis, Jr., former Engineer, Sixth Army; Brig. Gen. George J. Nold, former Engineer, Tenth Army; Brig. Gen. Herbert B. Loper, former Engineer, U. S. Army Forces, Pacific Ocean Areas, and Chief, Intelligence Division, Office of the Chief Engineer, General Headquarters, Army Forces, Pacific; Brig. Gen. Dwight F. Johns, USA, Ret., former Chief Engineer, U.S. Army Forces in Australia; Brig. Gen. William F. Heavey, USA, Ret., former Commanding General, 2d Engineer Special Brigade; Col. Harry A. Skerry, USA, Ret., former Engineer, North Luzon Force, and I Philippine Corps; Col. Albert G. Matthews, USA, Ret., former Engineer, U. S. Advanced Base, New Guinea; Col. Miles M. Dawson, CE, former Chief, Supply Division, Office of the Chief Engineer, General Headquarters, Army Forces, Pacific; Lt. Col. William C. Chenoweth, USA, Ret., former Engineer, South Luzon Force, and II Philippine Corps, and the latter's assistant Lt. Col. Harry O. Fischer, CE, for their continued interest and the material and comments they have supplied from personal experiences in these campaigns.

Department of the Army facilities provided by the Chief of Engineers have materially aided early publication. And in this concluding volume of the series it is considered fitting to reemphasize previous or separate acknowledgments of the superior efforts displayed by members of the Editor's small staff which attained, at most, an approximate average total of eight civilian associates. Many long and trying hours of work have been applied by these few assistants, particularly when meeting deadlines. They have operated under conditions of limited personnel, funds, and work areas, and have performed varied and numerous tasks with exceptional efficiency. Among the daily operations of this skeleton force have been research, writing, style checks, manuscript typing and assembly, complete art and printing layouts including incidental liaison with affected reproduction agencies, proofreading, and diverse administrative procedures of which individual distribution of approximately 3,000 copies of each volume of the series together with property accountability related thereto represented only one function. The perseverance of effort and interest devoted to these various and often involved duties under exacting circumstances by the entire staff thoroughly merit an over-all acknowledgment of appreciation in addition to any individual recognitions tendered severally, and it is hereby extended without qualification. In conclusion, this volume, even more than any other of the series, is indebted to Maj. Gen. Hugh J. Casey for the many personal interviews afforded in the production of this critique as well as his personal guidance and direction to the Editor in the compilation of all of the volumes.



GEORGE A. MEIDLING
Lt. Colonel, Corps of Engineers
Editor

Washington, D. C.
1 December 1949

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CHAPTER I

The Philippine Defense

7 December 1941–6 May 1942

The Engineer Situation

From Australia to Japan conclusions based on engineer operations in the Southwest Pacific can possibly be well organized topic by topic and, for the most part, present no conflict with basic modern conceptions of military engineering and normal duties of the Engineer unit commander and the Engineer staff officer. But in the defense of the Philippines, in general, and the island of Luzon, in particular, with unorthodox procedures the only possible medium of survival,[1] an attempt at a conventional analysis of applied engineering principles would be somewhat inconsistent.

Time and again engineers were confronted with situations demanding unprecedented action entirely foreign to past training and teaching, imperative action that possibly would never be dictated again in another hundred campaigns. *It was not that engineer training was remiss or military texts lacking in correct doctrines; it was simply that engineers and engineer missions were projected against a back drop of over-all unpreparedness in the Philippines.*

It was, therefore, apparent that it was not a question of normal military engineering and engineer staff work for an orderly defensive campaign, but *catch-as-catch-can* engineering service in a battle for survival until additional men and supplies might reach the Islands. Engineer unit commanders or Engineer staff officers in this campaign did not of necessity follow the well-established doctrines prescribed by field manuals, utilizing trained engineer troops and military engineer supplies and equipment for the accomplishment of their missions. On the contrary, the engineer mission in this chaotic set of circumstances required the utilization of every ounce of ingenuity to exploit again and again the civilian resources of the land for materiel, labor, and technically trained personnel, and by improvisation at its maximum to carefully and eco-

[1] *Editor's note:* The reader is advised to have first read the appropriate chapter of *Engineers in Theater Operations,* Vol I, this series, together with comparable chapters of selected succeeding volumes of the series including engineer organizations, troops and training; engineer intelligence; operations of amphibian engineers and of combat engineers, development and construction of bases and airfields; and engineer supply. In this way, he will gain the maximum benefit from the detailed factual data and chronological treatment of engineer operations. No attempt is made to report within this volume anything other than the most important opinions and conclusions within time or campaign periods.

nomically expend the limited amounts of each where they would do the most good.

Why was all this necessary? While Japanese forces approximating five highly trained divisions and supporting troops landed in northern Luzon on 10 and 22 December, not to mention the strength of forces landing to the south of Manila (see Map No. 1, "Philippine Islands, 1941"), American and Philippine forces available for resistance consisted only of: (1) a new military command, United States Army Forces in the Far East (USAFFE), with little yet in organized staff, General Douglas MacArthur having only recently returned to active duty as its commanding general; and (2) 19,000 U. S. Army troops (many of whom had only recently arrived), 12,000 Philippine Scouts (of which number approximately 2,300 of the older and better trained Scouts were attached to the various units of the Philippine Army as instructors), and about 100,000 newly mobilized Philippine Army troops. Of the latter the small Philippine Army Air Corps plus only one infantry regiment and school cadres from other divisional units of the ten Philippine Army reserve divisions had been inducted into the service of the United States since 1 September 1941. The mobilization and induction of the second infantry regiment of each of the divisions had been initiated on 1 November. Division headquarters and service elements had been mobilized and inducted by about 20 November, while the third infantry regiment and the artillery regiments of each division had not been mobilized or inducted until after the outbreak of hostilities. Individual units and staffs therefore had never worked together before, equipment was antiquated and inadequate, and training deficient. Philippine Army troops were equipped only with the outmoded Enfield rifle. Many did not even have shoes or canteens, much less bayonets, steel helmets, or gas masks. They had no transportation, and engineer equipment was virtually nonexistent. Such were the meager assets which USAFFE stretched into a working skeleton of a tactical command. At least the organization of the undeveloped defensive forces into consolidated subordinate commands was modern. They *sounded* adequate and effective: the North Luzon Force, South Luzon Force, Visayan–Mindanao Force, Far East Air Force, Philippine Coast Artillery Command, USAFFE Reserve Force, and the Philippine Department.

Of these limited resources, Lt. Col. (later Maj. Gen.) Hugh J. Casey, CE, Engineer, USAFFE, could claim within the engineer echelon only: (1) the engineer combat battalion (14th Engineer Combat Battalion) organic to the Philippine Division, a Philippine Scout unit with U. S. Army officers, just recently reorganized from a regiment to a battalion when the division was changed from a rectangular to a triangular divisional organization; (2) the 803d Engineer Aviation Battalion, an understrength U. S. Army unit employed as Army[2] troops (including the 809th Engineer Aviation Company (Separate) as a lettered company of the battalion to avail itself of the heavy-duty equipment allowed a separate company under existing Tables of Organization and Equipment); (3) relatively untrained, unequipped Filipino engineer combat battalions, organic to the Philippine Army divisions, capable of little better than pioneer work; (4) an engineer staff section, known as the Office of the Department Engineer, within Headquarters, Philippine Department (then virtually a service command); and (5) the Engineer Section, USAFFE, comprised of the Engineer and a very limited staff.

No engineer units were available for assignment as Force Engineers to the North and South Luzon Forces. Dependence for such services, when required, had to be placed upon partial or complete withdrawal of engineer battalions from divisions in line or in reserve.

Each divisional engineer battalion (Philippine Army), consisting of a headquarters company and three line companies, totaled approxi-

[2] *Editor's note:* Throughout this chapter the word "Army" considers Hq, USAFFE, as being on the Army level, although the designation was never officially made.

July 1941. Troops of the 14th Engineers, the only trained combat engineer unit in the Philippines at the time of the formation of USAFFE, executing a bridging problem.

mately 16 officers and 375 men. As far as known, none of these engineer battalions organic to the 10 Philippine Army reserve divisions received any basic training after organization of USAFFE and prior to the outbreak of hostilities. Time was not available. The basic training course of these raw recruits was destined to write in blood the phrase, "You cannot buy time," on the pages of history. In the United States the basic training course was generally 13 to 17 weeks in length. In the Philippines training began by going out to help defeat an overpowering enemy. In 17 weeks and 3 days (8 December 1941–9 April 1942) these inductees could look forward to completion of their basic training if they survived. It was to involve being forced into Bataan and then fighting until no longer able to hold together as a military unit. At the moment, however, they were beginning without modern tools or equipment, nor was there much likelihood that any would reach them. Ten engineer battalions—and not a bulldozer.

Engineer Commissions to Civilians

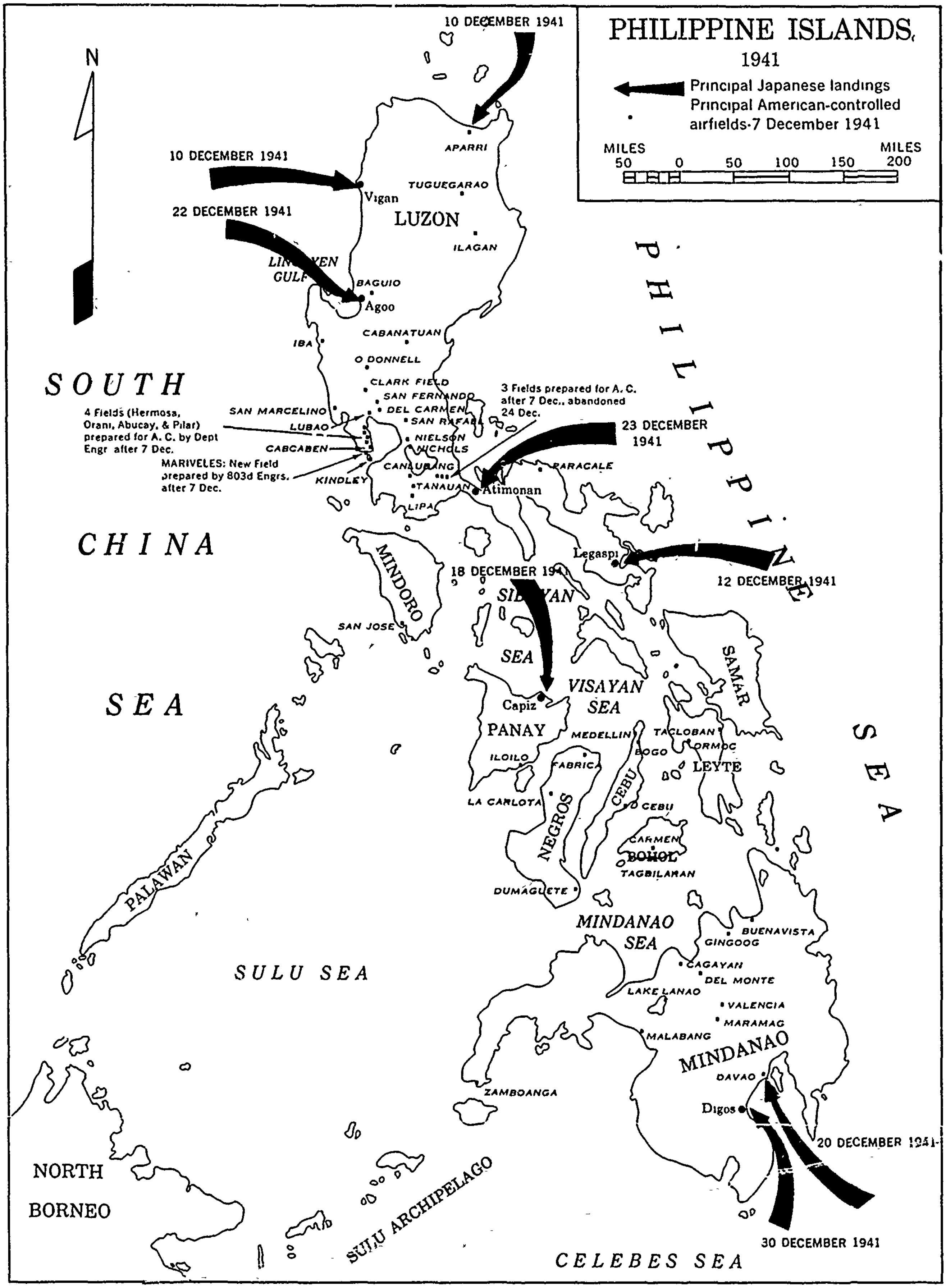
At no invasion point (see Map No. 1) were there sufficient defending troops to stop the enemy on the beaches or over such a potentially wide area of inland operations, so it evolved upon USAFFE to delay if not stop the enemy's progress by preparing successive defensive positions and executing countless demolitions whereby the enemy would be denied the use of facilities important to an uninterrupted advance. The latter became the principal engineer mission, and immediately the need for qualified, technically trained personnel became evident. The personnel records of engineer societies, mining companies, and the few industries immediately contacted, were promptly perused for technically trained personnel. The response of these men was gratifying. Mining engineers, contractors' straw bosses, anyone and everyone with technical or supervisory engineering ability was contacted and absorbed into the limited Corps of Engineers' personnel in the Islands. Under stress of the situation, some were commissioned in less than 15 minutes and given rank considered commensurate with their training and experience, the Engineer, USAFFE, assuming that administrative action would eventually catch up and confirm these appointments. These hurriedly commissioned officers were given letters to the Quartermaster for issue of whatever clothing was available that even remotely resembled a uniform. Arms were secured for them even from the wounded in hospitals, and they were immediately dispatched on engineer missions pertaining to various phases of the demolition program. These men, in turn, persuaded numerous Filipino miners and laborers who had worked under them in civilian pursuits to join their parties.[3]

However, no definite officer procurement policy had been established. Subsequent administrative action in some cases, therefore, imposed somewhat of an injustice upon these trained civilians whose desperately needed services had dictated allocation of rank proportional to responsibilities assumed. Many recommendations for commissions were returned for administrative reasons. Some men served throughout the Bataan campaign as officers, yet by the end of the hostilities had never been officially commissioned. Lack of a definite officer procurement policy unfairly denied such men the recognition they should have been given for critically urgent and outstanding services performed.

Demolitions

Delay and harassment of the well trained and equipped enemy forces along their routes of advance were the only logical defensive tactics possible of execution by the ill-equipped and untrained USAFFE troops on Luzon prior to the

[3] *Editor's note:* Upon completion of demolitions, many of these men were subsequently incorporated into the later activated 301st (soon changed to 302d) Engr (C) Regt organized from stragglers and whatnot to furnish support to II Phil Corps on Bataan.



SOURCE: OCE, GHQ, AFPAC (Historical).

MAP NO. 1

retreat to Bataan. Demolitions were their first and last effective resort. Hundreds of bridges were destroyed. However, even these desperate tactics sometimes suffered from lack of coordination in subordinate tactical commands causing premature destruction of certain bridges. Yet, proper coordination under existing circumstances approached the impossible. Lack of adequate communication systems only added to the already existing confusion. The "walkie-talkie" and similar signal devices were still under development. USAFFE elements operated with signal equipment which had been developed almost entirely during World War I, and even such equipment was available only in extremely limited amounts. No mobile signal equipment was available. As a result, some demolition parties on roads failed to receive instructions or else were confused by conflicting orders and even language difficulties.[4] Subordinate tactical commanders on occasion would get their withdrawing units across a bridge and with inadequate information of the over-all situation, including troops behind them, would instruct some outranked, bewildered Filipino Engineer second lieutenant, responsible for its demolition, "Blow the bridge." Other harassed commanders entirely failed to issue orders for destruction of routes, leaving behind untrained Philippine Constabulary personnel with apparently no instructions on demolitions. In addition, engineer bridge data, developed in book form and including computations of demolition charges and wiring diagrams for every bridge on Luzon, had to be reworked as demolitions progressed before the advance of the enemy. Fragmentary records of pages cut from this demolition book, which the Engineer, Philippine Department, had almost religiously kept up to date over a long peacetime period as bridges had been repaired or rebuilt, were found in lower echelons from time to time, but the ultimate disposal of the book and reasons for unavailability of the information it contained were lost in the chaos that prevailed. The danger of this highly classified data falling into enemy hands had undoubtedly loomed larger to its custodians than on-the-spot reworking of the information it contained.

Even detonation of charges on the Calumpit bridges highway and railroad) was effected with apprehensions of premature demolition. When withdrawal into the Bataan peninsula was initiated for a final defensive stand, responsibility for protection of the South Luzon Force (SLF) from northern attack until it cleared Calumpit en route to Bataan fell upon Maj. Gen. Jonathan M. Wainwright and his North Luzon Force (NLF). Intensive and rapidly increasing enemy pressure from the east to cut off the South Luzon Force in the vicinity of Calumpit had to be stemmed. Immediately upon contact between the North and South Luzon Forces, the efforts of Headquarters, USAFFE, NLF, and SLF, were concentrated on strengthening the east flank guard. A last, desperate attack was prepared against Baliuag to delay the fast moving, overpowering enemy thrust from that direction as column after exhausted column of the SLF main body poured over the bridge. The Manila-Calumpit demolition group, attached to NLF from the Engineer Section, USAFFE, was sent 29 miles back into territory now heavily threatened from the south to detonate bridges previously prepared by the group south of the Pampanga River on the road to Manila. These were to be blown in numerical sequence from south to north on orders of authorized officers of the South Luzon Force after passage of the SLF rear guard and any covering forces or tanks.

The SLF rear guard had originally been instructed to clear Calumpit Bridge not later than 0600, 1 January 1942. This highway bridge and the adjacent railroad bridge were to be held until the rear guard, its covering forces, and the east flank guard, as well as the Manila-Calumpit demolition crew, had crossed. The entire opera-

[4] *Editor's note:* Some concept of the language problem can gained from the experience of an American officer instructor who, in the training period immediately before the outbreak of hostilities, was using six different language interpreters when he addressed his regiment.

tion was expected to be completed in sufficient time to detonate the bridges about 0600. However, the swiftly moving tactical situation grew more pressing. Authority was secured through G–3, USAFFE, to advance the time of clearing the highway bridge to 0400, 1 January, and the SLF rear guard was ordered to speed up its movement. Meanwhile, following a tank attack late in the afternoon of 31 December, artillery was concentrated on Baliuag to hold back the advance of the enemy. The Engineer, NLF, had already moved to the advance command post at the Calumpit Bridge and was reorganizing stragglers to cover the approaches and crossings of the two bridges over which enemy aircraft were making bombing attempts. The over-all situation could only be described as unstable and foreboding. At 2100 that night the Executive Officer, Engineer Section, NLF, telephoned Headquarters, USAFFE, from the NLF command post regarding a possible further advance in time of clearance and demolition. By this time most of the rear echelon at Headquarters, USAFFE, had already moved out, and the call was taken by the Engineer, USAFFE. This officer issued orders to hold the bridges at least until the time set to insure withdrawal of the entire South Luzon Force.

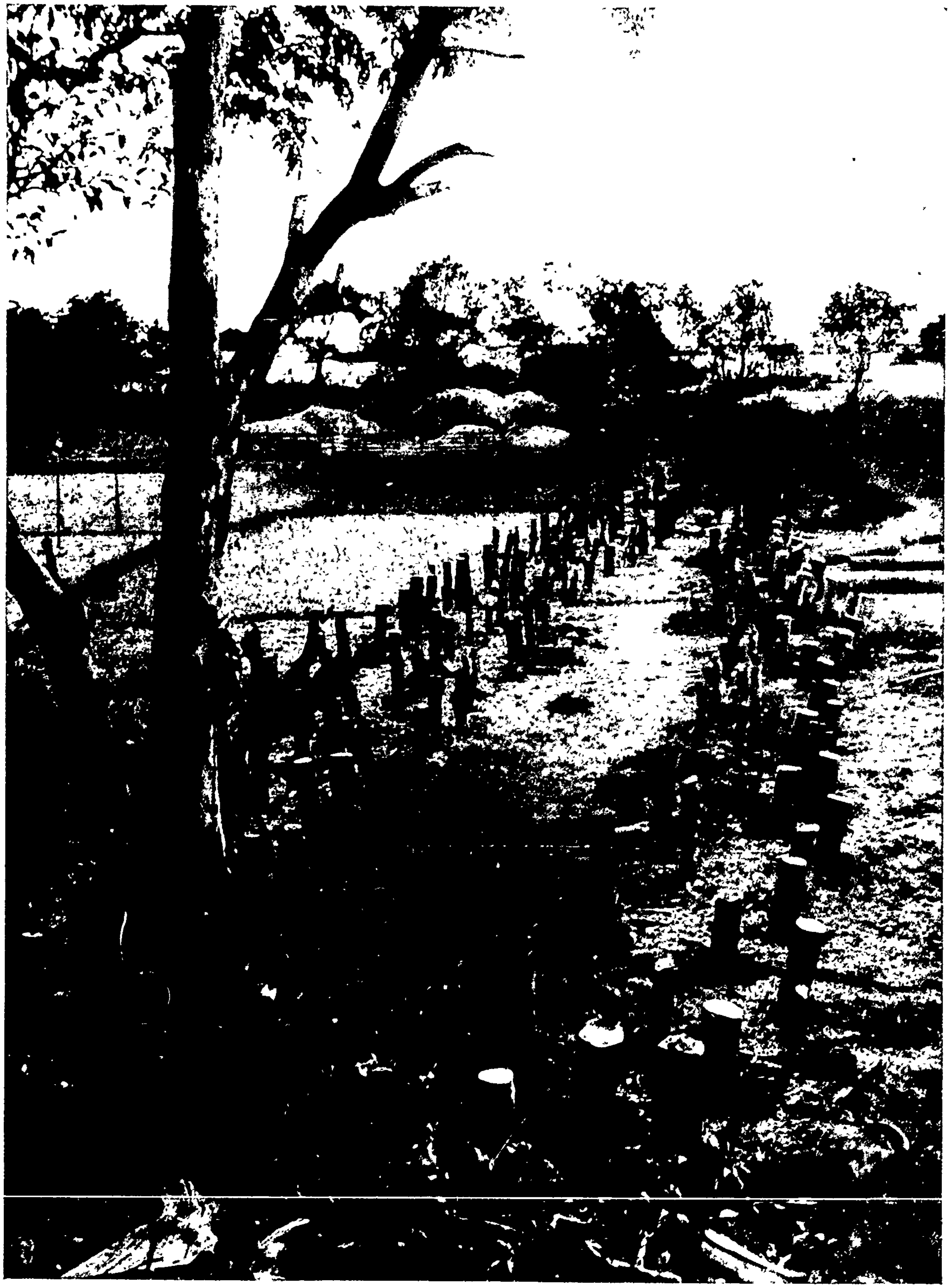
The soundness of these orders was more than confirmed during the early morning hours of the following day. The SLF rear guard cleared Calumpit Bridge at 0300, 1 January. However, the east flank guard, which had been holding off the enemy to permit passage of the SLF rear guard, was attacked in the midst of its withdrawal and could not cross the bridge until approximately 0500. When it had crossed, the main mission of the North and South Luzon Forces was accomplished.

Spasmodic firing had begun immediately south of the bridges. Upon completion of the east flank guard's crossing, the commanding general, NLF, after conferring with the tactical commanders present, considered blowing the two structures. The Engineer, NLF, however, reported that the Manila–Calumpit demolition group had not yet crossed the bridge and requested that demolition be delayed as long as the tactical situation permitted. To this the commanding general gave his approval and extended the firing time to 0600. It was still very dark and a covering force of one battalion was in position at the crossings, awaiting the arrival of the demolition group. By 0545 no blasts indicating demolition of bridges had yet been heard or flash of explosions observed towards Manila. The tactical situation was discussed in all its phases and the commanding general, NLF, again extended the time for the destruction of the bridge until 0615.

As dawn was beginning to break, the firing from the southern bank of the Pampanga increased. Tension mounted as critical time passed awaiting the arrival of the demolition group. No messages had been received at the advance command post, NLF, either from the Manila–Calumpit demolition group or higher headquarters. Even momentous decisions were mocked by the lack of adequate signal communications. Unable to contact the demolition group in the Manila area, there was no way for these tactical commanders at Calumpit to know that the Japanese forces in southern Luzon had temporarily ceased their northern advance. Under the circumstances, General Wainwright felt the situation was becoming serious. If bridges to the south had not been blown as planned, a mechanized pursuit from the Manila area was, therefore, a definite possibility. In the light of day, now only a matter of minutes away, such a pursuit of an untrained army by a skillful and energetic enemy having complete control of the air had to be prevented. Weighing the tactical importance of making the broad, unfordable Pampanga a real obstacle, before broad daylight gave the enemy an opportunity to interfere with blowing the bridges, against waiting for a small group, which could withdraw by other routes if they had not already become casualties, left only one decision. Regardless of reluctance

Effectiveness of 1941 engineer demolition of two Calumpit bridges is verified by photograph taken in 1945 after liberation of Luzon. Japanese occupation forces never attempted repairs. The bridge in use was constructed by U. S. Engineers in 1945.

Engineer, in inadequately defended forward position on Bataan, readying a "Molotov Cocktail" for use against Japanese tanks.



Engineer-constructed tank trap on Bataan. Shortages of engineer equipment, supplies, personnel, and time precluded the preparation of more adequate defenses.

or regret, it had to be made. The retreating forces had to be given a chance to complete preparation of their defenses on Bataan without waiting any longer for the uncertain arrival of the demolition group.[5]

Turning to the Engineer, NLF, General Wainwright gave the inevitable order: "We cannot wait any longer. Blow the bridges." [6]

The covering force was withdrawn a safe distance to each flank. The Engineer, NLF, went to the demolition group waiting at the two abutments and instructed them to blow the highway bridge at 0615 and the railroad bridge immediately thereafter.

The thunderous blasts of detonation roared their defiance at the enemy. But no appreciable enemy forces reached the bridges until several hours after demolition.

Regardless of all exigencies, however, demolitions adhered sufficiently to a pattern to permit as orderly a withdrawal to Bataan as possible under the chaotic circumstances prevailing. Despite lack of coordination, conflicting instructions, and nonmilitary training of demolition crews, the effective delaying of the enemy principally by destruction of facilities rather than tactical ground action was the basic strength of resistance against a greatly superior force, and the greatest single factor in retarding the enemy advance. The over-all demolition mission, with particular emphasis on destruction of facilities in Central Luzon, was performed completely and effectively. (See Map No. 2, "Principal Demolitions, Luzon, P. I., December 1941.")

Considerably abetting the success of the USAFFE demolition program was the Japanese lack of coordination between their air and ground forces at the crucial time of withdrawal by the South Luzon Force across Calumpit Bridge. While battered defending troops were desperately attempting to delay the enemy's main effort to cut off the South Luzon Force before it could safely cross the bridge, Japanese air units failed to provide their ground forces with the support which could seriously have jeopardized the entire success of the withdrawal to Bataan. A sufficient concentration of enemy aircraft during this period could readily have destroyed the motorized retreating columns as well as the bridge. Yet, despite the previous almost total destruction of the Far East Air Force and the resulting enemy air superiority, only a few Japanese aircraft made several bombing attempts at the bridge. These were driven off in a remarkable display of accuracy and coordination by antiaircraft fire. The limited ammunition of these batteries was expended at the most critical time and place. The ultimate fate of the withdrawal was balanced on the accuracy of their fire; of necessity the bridge was fully and heavily loaded with dynamite, and even a near hit could have served the enemy's purpose.

Defensive Positions

An important engineer mission in the planned defense of Luzon was the laying out and initial development of the main and reserve battle positions on Bataan which had been reconnoitered and selected some time prior to the outbreak of hostilities. In late December, immediately upon the decision to put War Plan Orange No. 3 (WPO-3) (approved War Department plan for the defense of Manila) into effect and withdraw into Bataan, the Philippine Division with its 14th Engineers was given the mission of laying out and organizing a forward position from Mauban to Abucay through Mt. Natib and Hacienda, and a reserve battle position from Bagac to Orion through Mt. Samat.[7] Several thousand local

[5] *Editor's note:* Though initially trapped by the Japanese and later cut off from an established route of withdrawal, the Manila Calumpit demolition group pursued and accomplished its mission despite the most harassing circumstances. All military personnel received decorations from NLF, and practically all of the miners attached to the group were later commissioned.

[6] Quoted in Pers Ltr, Col H. A. Skerry, USA (Ret) (formerly, Engr, NLF, and I Phil Corps), to Editor, 4 Jun 49, sub: Comments on Defense of the Philippines. In OCE, GHQ, FEC (Hist).

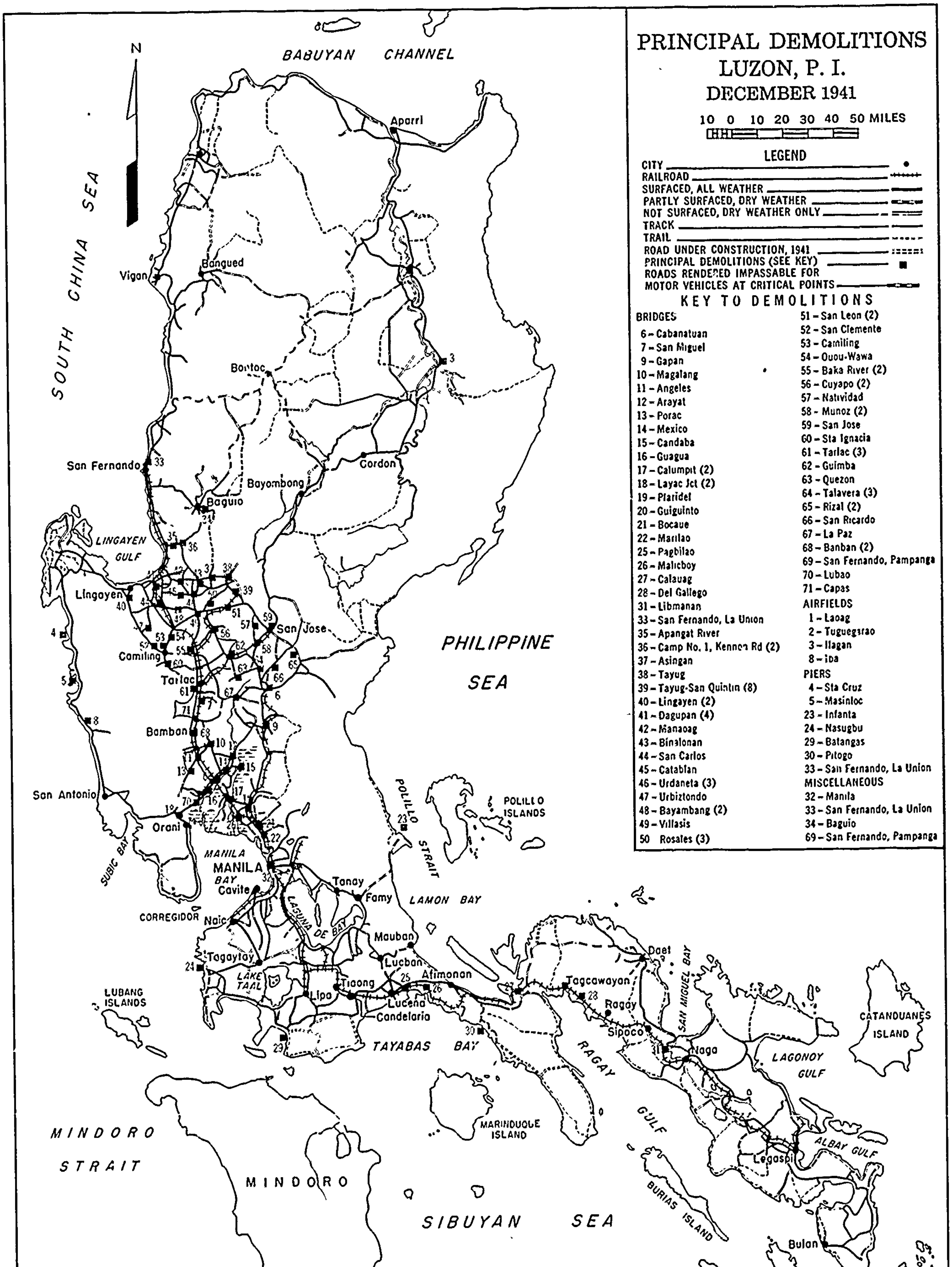
[7] *Editor's note: See* Map No. 3, "Disposition, Bataan Defense Force, 6-16 January 1942," and Map No. 4, "Second Battle of Bataan, 15 March-9 April 1942," Vol I, this series.

Filipinos were assigned to specific areas in these localities to assist in this work. Coast Artillery recruits and mining engineers were quickly gathered and employed to expedite preparations. When the main, reserve, and switch positions had been taped out, trails and access roads were prepared by the 14th Engineers, and work on coast artillery gun emplacements in the Bagac area was initiated by the Construction Division, Office of the Department Engineer. The Engineer, I Philippine Corps, and the Engineer, II Philippine Corps, upon arrival on Bataan, immediately initiated additional reconnaissances and improvements of the hastily laid out battle positions. One of the major problems, however, was trying to get front-line tactical units to work aggressively at fortifying their positions. Yet these carefully selected positions later proved major factors in the defense of Bataan with the limited forces available.

The improvement of defensive positions after their occupation by defending troops should be more closely supervised and reviewed by division, corps, and army staffs, to insure, in coordination with their respective Engineer staff officers, development of positions to their maximum defensive strength. When effecting initial troop dispositions, many tactical units on Bataan had deployed virtually their entire strength on the front with almost no provision for a local reserve. Even within some entire division sectors, commanders distributed virtually all units on a single front line with no organization in depth and with no provision for all-around defense. It is a basic principle that no disposition of forces can be made along a front which would prevent a determined enemy from employing a superior force at any point of his choosing and effecting a penetration. Unless reserves in depth are available to counter that penetration, the entire position may be rolled up or its communications and supply routes cut. Too often the organization of local defensive positions did not take full advantage of the potentialities of the terrain. Similarly, both tactical wire and machine-gun emplacements were poorly situated with little provision for gaining the ultimate security of interlocking bands of coordinated grazing fire. In many instances inadequate clearing of jungle thickets in front of bands of wire afforded the enemy attacker complete cover and concealment until contact with the wire was made.[8] Dead spaces in defensive positions were not defended by individual riflemen in fox holes. These and many other basic deficiencies approached the rule rather than the exception, forcibly depicting incomplete training of troops in the fundamentals of defensive ground operations. In desperate circumstances such as these, economy of effort must also be considered in addition to the basic objective of effecting the strongest defensive position within limits of terrain and resources. The staff engineer must, therefore, be on the alert to advise his commander in time to prevent any needless expenditure of time, personnel, and supplies in the organization of the ground. The commander, himself, must have a well-grounded understanding of requirements essential to establishing a strong defensive position and have confidence in the recommendations of his staff engineer. He, too, must make personal reconnaissances.

By the end of January 1942, the defending forces had withdrawn to the reserve battle position. Despite repeated inspections by officers from the Engineer Section, USAFFE, and Engineers, I and II Philippine Corps, little improvement other than in beach defenses had been effected. (See Appendix I, "Engineer Reports and Recommendations on General Deficiencies in the Bataan Defense, USAFFE, 31 January–8 March 1942.") However, even here wire was still placed too far out, where wave action beat it down. Automatic weapons, situated in the cliffs, were placed without regard for cross-fire support and, because of their loca-

[8] *Editor's note:* Tactical wire was never installed as envisioned in usual military doctrine. A unit that had a 4-strand fence along the final protective line was considered well wired. The double-apron fence was used sparingly because of the extreme shortage of wire.



SOURCE: OCE, GHQ, AFPAC (Historical).

MAP NO. 2

tion, were limited to ineffectual, plunging fire on the beach. Similarly, defenses against frontal attacks did not fully exploit the advantages that local terrain features could afford. Interior positions such as the front of the 2d Philippine Constabulary Regiment from the Pantigan River to a junction with the 12th Infantry line on the Pilar-Bagac road were handicapped by fox holes too close to the tactical wire which was erected in a straight line with automatic weapons sighted to provide ineffective fire perpendicular to the wire. Fire was masked by crests of slopes; natural approaches were not defiladed by automatic weapons. Shelter halves were pitched directly over or in the rear of fox holes with fields of fire cleared between fox holes and tactical wire but not beyond the wire. Positions were still not organized in depth. Correction of these deficiencies was impeded because it was not clearly understood by many tactical commanders that proper organization of a position was a basic function and responsibility of the infantry unit charged with the occupancy and defense of the sector.

Clear understanding and the prompt corrective action characteristic of U. S. Army troops, however, could not be readily achieved with untrained Filipino troops. With one exception, the divisions were Filipino throughout, and the language barrier was most difficult to handle. Many of the partially trained Filipino officers above the grade of major were unable to cope with the required speed and intensity of operations under combat conditions. In many infantry and engineer battalions there was only one U. S. Army officer. These American officers had been assigned to the Philippine Army units as instructors—without command authority. Some of these officers with strong personalities and great diplomacy succeeded in being the real commanding officers of the units. Many did not.

It was soon evident that giving instructions to an American was one thing while giving them to the average partially trained Filipino was quite another. For example, the simple advantages of flanking machine-gun fire would be explained to some inexperienced machine gunner or his lieutenant on the main line of resistance. On checking the next day, more often than not it was found that direct fire at more distant targets had been entirely disregarded and the gun had been clamped along the final protective line of barbed wire—and on occasion on the wrong side. In some cases it became necessary to physically demonstrate when to use direct fire on distant targets and when to switch to the final protective line of flanking machine-gun fire along the outside of the tactical wire. This was done by sending defending troops in front of the main line of resistance to represent attacking infantry.

Language difficulties and inadequate training in means and missions of local commanders were not the only obstacles to establishing and maintaining effective defensive positions. Equipment, tools, and supplies available to Corps and divisions were far below minimum requirements. For instance, the only mechanized equipment in the entire I Philippine Corps was 1 bulldozer and 2 small portable rockcrushers, only one of which could be used because of the shortage of gasoline. The 4 organic engineer battalions were equipped with hand tools of the World War I category except for tools required for the organization of the ground in jungle country. Of these latter tools, such as picks, shovels, axes, saws, and bolos, there was a glaring deficiency while the supply of barbed wire was inadequate throughout all sectors.

In any situation, however, where trained officers, men, and supplies are meager, as prevailed in Bataan, courage and ingenuity become of primary importance. These can be nurtured and inspired only by personal leadership, encouragement, and assistance of those in command. Notwithstanding unavoidable difficulties of language differences, shortages, and grim circumstances, therefore, the reports of the Engineer, USAFFE, and his assistants stressed the lack of personal reconnaissance by tactical commanders and their staffs as the underlying cause for weakness of defensive positions. Persistent emphasis achieved results. Headquarters, USAFFE, issued a command directive on 13 February 1942 for immediate and adequate personal reconnaissance by all Corps, sector, and division commanders. (See Appendix II, "Personal Reconnaissance, Headquarters, USAFFE, 13 February 1942.") By the middle of March, largely as a result of continued engineer technical advice given to infantry units, tactical wire had been relocated, and adequate fields of fire had been cleared, including cliff faces along the beaches.

Clearing of cliff faces was occasioned by technical advice resulting from a lesson learned the hard way. At this early date defending forces had not fully understood Japanese theories of circumventing various defenses. Beach defenders, therefore, had found their positions threatened by the simple enemy expedient of landing directly on the narrow shingle below cliffs instead of using the coves where movement would be considerably less arduous but where beach defenses were the strongest. From the shingle the enemy scaled the cliffs and established their strong points on the promontories between the coves, thus dominating the beach defense position.[9] For this reason 80,000 square yards of cliff face were cleared to allow accurate observation and fire on the Japanese should they attempt to scale the cliffs. The Japanese on more than one occasion chose to land or attack through difficult terrain rather than through easy terrain well defended.

Engineer Supply

A workable engineer service supply plan had been originated and had been supplemented from time to time prior to World War II by the Engineer, Philippine Department. Over-all responsibility for engineer supply planning shifted to the Engineer, USAFFE, upon his appointment on 9 October 1941. Personnel was not available to organize a supply section within his office and the Engineer had to directly concern himself with engineer supply policies and planning. While added impetus was given to over-all supply matters, there followed emphasis in particular on plans for the allocation of combat engineer materials, their resupply, and the designation of strategically located depots for distribution. The Engineer, USAFFE, continued and expanded earlier plans for the inventory of privately owned supplies located in the Islands and took special measures to accelerate the flow of needed engineer supplies and equipment from the United States. Unfortunately the inadequacy of prewar military depot stocks in the Philippines and the sudden projection of hostilities on a new command with only a partially completed supply plan, left much to be desired in successful engineer supply administration—particularly when followed almost immediately by the total elimination of supply replenishment possibilities from the United States. The Engineer, USAFFE, had only one remaining source at his disposal with which to bolster the supply situation throughout the campaign—local procurement, to the point of commandeering civilian supplies with the approval of the commanding general, USAFFE. The latter method was, however, administered judiciously, without undue discomfort or hardship to the civilian population, and then only after payment had been made or materials receipts issued to the owners.

This in substance was the final supply plan—local procurement, exploited to its fullest possibilities. It brought more than temporary success, but, with resupply sea lanes entirely cut, it was certain to eventually exhaust itself.

The administration of supply matters, as was the case for all engineer operations, was a 24-hour-a-day job, the limited personnel assuming its responsibility catching "cat naps" when and where possible. Engineer supply personnel, under untold difficulties of transport and other lack of means, did a superlative job in applying

[9] *Editor's note:* It is of interest to note that the only units that reached their initial objectives on Omaha Beach without casualties during the Allied invasion of Normandy, France, in 1944, were Ranger companies which attacked the cliff positions at the west end of the beach area.

the bulk of the Islands' civilian demolition and construction supplies to the needs of the military engineers. Needed engineer supplies of every description were requisitioned from civilian stocks. By a directive issued by the Engineer, USAFFE, all commercial stocks of explosives were confiscated within 24 hours after the outbreak of hostilities and placed under constabulary guard. All private stocks of petroleum products were secured. Contractors' equipment was procured to augment the limited equipment of engineer units. Heavy earth-moving equipment employed on the construction of the Caliraya hydroelectric project was taken for airdrome and road construction. Lumber mills were secured, railroads were taken over, trucks, cars, and busses were requisitioned. These commercial busses, painted a brilliant red, were camouflaged as best as possible with foliage, there was little paint. Requisitions for supplies were screened with cold-blooded calculation as to where they would do the most good.

No unit engaged in organizing a tactical position near a wire fence received any barbed wire until it had taken down the fencing in its area and utilized it. Improvisation at its maximum was the order of the day. This enforced economy necessitated constant reconnaissance by the limited personnel administering the engineer supply program. To the last minute preceding the fall of Manila this personnel also did a superior job in evacuating engineer material to Bataan and Corregidor. Arbitrary priorities on movements from Manila to Bataan handicapped the engineers in more ways than one in the critical week between Christmas Day, 1941, and the New Year. *Groceries and bows and arrows* (rations and ammunition) received the only recognized priority. Little regard was shown for the equally urgent needs of fuel for diesel power plants and equipment, gasoline to keep transportation and equipment moving, barbed wire for defensive positions, stand-by power plants, and minimums of all stocks indispensable to a continued, successful engineer service. Transportation of such required essentials practically had to be forced by desperate engineer personnel. Later these engineers recruited and operated their own water transportation system to supplement the overtaxed and understaffed G–4 controlled water transportation. In view of continual enemy bombing after Manila had been declared an open city and all antiaircraft defenses had been removed, the reassembly of scattered native boat crews and loading personnel after air raids was no small problem.

The Supply Officer, Office of the Department Engineer, Philippine Department, exercised highly commendable effort in improvising transport for engineer supplies. Although operating without any priority, he managed to assemble lighters and the tugs to move them to loading points. In the general chaos of evacuation and bombing, Manila Bay had become a sea of confusion and it was not always possible to move lighters to Corregidor, especially in the last hectic days of evacuation. Some, as soon as they were loaded, were set adrift in the Bay to provide at least a 50–50 chance of salvage for the desperately needed supplies. During the whole month of January 1942 the engineer launch *Night Hawk* scoured Manila Bay for these lighters and managed to salvage many of them with their contents almost intact.

While it is normal to think first of rations and ammunition in any rapidly deteriorating military situation, it must be kept in mind that a deficiency of critical fuel and engineer supplies may even endanger the ultimate utilization of vital ration and ammunition requirements. *Balanced* over-all supplies are infinitely more valuable than large *unbalanced* stocks of a few vital items.

Extreme difficulties were encountered by the Engineer, USAFFE, and other engineers throughout the command in securing an appreciation of the importance of, as well as the actual allocation of, the necessary transportation for movement of engineer supplies. Much motor transportation was performing uncontrolled travel, while considerable amounts of engineer and other vitally needed stocks could not be evacuated to Bataan because of a lack of transportation. However, special provisions had been taken by the Engineer, USAFFE, to destroy the immobilized stocks which could not be evacuated prior to their falling into enemy hands.

There were, unfortunately, instances of failure to carry out directives during the chaotic days that followed which increased the burdens of the already overtaxed supply situation. One such instance developed when an engineer combat battalion (Philippine Army) retreated in confusion instead of executing an orderly withdrawal from a previous position. Abandoned organic supplies in this instance included 140 rolls of barbed wire, 2 tons of dynamite, and 1,700 shovels.

The absence of spare parts supplies severely handicapped the operation of engineer heavy equipment. An unrepairable radiator meant another piece of equipment out of operation, for there were no spares; and bomb fragments were exceedingly destructive to radiators. Tractors with hydraulic lifts became immobilized when a high-pressure hose became broken; there were no replacements or substitutes on Bataan. This latter condition particularly affected trail construction, since practically all smaller size dozers were hydraulic operated.

The extreme shortage of petroleum products during the latter phases of the campaign had a profound effect upon the extent of vehicular and construction equipment usage in engineer operations. Probably for the first time in their experience, Engineer staff officers found themselves considering engineer tasks according to the amount of diesel fuel or gasoline that might be consumed in their accomplishment. In other words, regardless of the necessity of a job being done, it meant that if it was a "400-gallon" or a "600-gallon" job, it oftentimes had to be eliminated entirely or reduced to an "80-gallon" job. Sledges and hammers were all too often used to procure crushed rock in the immediate vicinity of rock crushers deadlined for lack of motor fuel.

Utilization of Engineer Troops

Abnormally large and varied demands for engineer support required divisional engineers to accomplish, in addition to their normally assigned duties, missions usually assigned to corps and army engineer units, which were nonexistent in the Philippines. And yet, untrained division commanders time and again diverted their engineer units from essential road building to front-line field fortification and beach defense construction which was the normal responsibility of the troops occupying these positions. The situation was so acute as to necessitate issuance of a command directive to all commanders clarifying the primary duties of engineer troops. (See Appendix III, "Use of Engineers, Headquarters, USAFFE, 9 February 1942.") Engineer staff officers should be trained to recommend strongly to their commanders, and commanders should be fully cognizant of, the proper employment of engineer troops on vital engineer missions. These do not include the digging of fox holes and front-line machine-gun emplacements, the erection of barbed wire for an entire division, and the occupation of outpost lines of resistance, all basically the functions of the occupying units. Division commanders particularly failed to weigh the importance of steady application of engineer effort to certain engineer responsibilities, such as constant road maintenance. Work on the important road network of Bataan was frequently held up while the engineers employed on it were diverted to detailed organization of defense positions. Although the latter was important, the road work, more vital in maintaining communications in the entire defensive position, was at a standstill when engineer units were diverted from it. Moreover, most of the fortification work could have been performed by the occupying infantrymen.

On more than one occasion, division commanders committed their engineers as infantry only to find later that the engineers had experienced heavy casualties and that they were still faced with the job of performing essential engineer work with even further reduced, inadequate means. It is not intended to convey the idea that a commander is never justified in committing his engineers to action, but rather that their utilization should be fully considered from every angle before decision is made to commit them. In some instances on Bataan, there was no alternative. One such incident was the employment of Company A, 803d Engineer Aviation Battalion, as infantry when the enemy made a sudden and unexpected thrust to cut off the West Road on Bataan. This engineer company, an element of the only U. S. Army Engineer unit in the Philippines, and practically the only well-trained, well-equipped engineer organization available for specialized work, was charged with maintenance of this road which represented I Corps' only route of supply. The enemy's drive to cut off this only line of communication with the service command and Corregidor was initially opposed by a pursuit squadron acting as infantry. When this unit was overpowered and forced to withdraw, Company A, 803d Engineers, together with miscellaneous Filipino and air force troops, which were immediately available in the area, was necessarily committed to action until reinforcements could be made available. These troops, without infantry training, much less jungle combat tactics, succeeding in holding off the finest Japanese jungle troops in the Philippines. Upon relief, however, the engineer company of 92 men had experienced 50-percent casualties in 2 hours of jungle fighting. Shortly thereafter it was moved to Corregidor, a broken unit. Important construction projects and vital communication lines were, of course, adversely affected and delayed not only by such emergencies, but too often by ill-advised command decisions committing engineers to assist in furtherance of advances when infantry units were available. Almost invariably resumption of engineer tasks had to be undertaken later by decimated engineer forces.

Roads

Engineer road construction and maintenance personnel performed extensive work under considerable handicaps on the roads along the west shore of Bataan from Mariveles to Moron and on the Pilar–Bagac route across Bataan.[10] The unimproved roads on Bataan consisted of unconsolidated dust to a depth of about 8 inches in the dry season, and a proportionate or greater amount of mud when wet. There was a serious lack of centralized and active control of traffic under the provost marshal. Military police assigned to traffic control were often overruled by individual commissioned officers traveling the various routes. Motor vehicles were frequently operated at high speeds in violation of standing orders. Deficiencies in road discipline and controlled use of motor vehicles were apparent. Lack of the latter was evidenced on several occasions by the use of large passenger busses to transport a few Philippine Army soldiers at a time to Mariveles on personal business. Routes and locations of command posts, supply points, and dumps, in the interest of a false sense of security, were mostly unmarked; this added to the general traffic confusion and impeded road maintenance operations. To these handicaps must be added the occasional ill-advised withdrawal of engineer road crews to perform duties which, as pointed out previously, should have been the responsibility of other troops, while the vital roadwork remained at a standstill. There was also the chronic shortage of engineer personnel, petroleum products, and engineer equipment.[11]

Native labor had to be utilized to the fullest extent although their hand methods were both slow and primitive. Experience showed that the method of paying natives by the hour for

[10] *Editor's note: See* Maps Nos. 3 and 4, Vol I, this series.

[11] *Editor's note:* During February 1942, all engineer units in II Phil Corps were placed under control of the Corps Engr and used on a coordinated road program of construction and maintenance. An adequate road net resulted but for the most part gasoline was, by then, too scarce to allow using it.

crushing and applying rock to a roadbed resulted in less work accomplished than when a system of paying them on a piecework basis was used. An area enclosed in a rectangular form of bamboo poles was assigned to each native as his daily quota and the individual was paid for the crushed rock contained therein regardless of how many hours he devoted to the task.

At bridge sites on the main supply routes vulnerable to destruction by enemy air raids or infiltration, bridge timbers were stocked in readiness for immediate repair while work progressed on road maintenance. This provision for the rapid reconstruction of possibly disrupted vital communication and supply routes typified the need for constant advance engineer planning.

The over-all shortage of equipment and personnel, reducing engineer roadwork generally to that which could be accomplished only by hand methods and tools, acutely stressed the requirements essential to sustain a full and adequate measure of engineer support in future operations. Provision of ample road construction equipment and sufficient road organizations is indispensable to an early and complete use of available roads. Battles do not wait.

Native Labor

Available native labor was inadequate to perform the heavy engineer tasks and the multitude of labor jobs required by other services. Energetic attempts to encourage natives from the hill country areas to work for USAFFE attained little success. This condition was largely due to the male native's belief that his family would not be properly cared for with food and protection during his absence, that he might lose his meager homestead, and that he probably would not be paid for his services. Recruiting was more successful when he was allowed to bring along his family and household goods but this in turn increased the confusion and supply problems within the defense lines.

The native labor situation on Bataan was bad enough at best, but became even more difficult after the reestablishment of civil government there. The maintenance of civil government in an area where troops were engaged in combat caused many abuses by the natives, such as pilfering, bribery, and misappropriation of rations intended for laborers and soldiers. A considerable breakdown of discipline among civilian labor groups was evidenced. For example, a deserter who had been delivered to the provost marshal compound for disciplinary action expected of civil authorities was allowed to return to the work area within 24 hours. Engineers imposed a *no work–no eat* policy in their labor camps with effective results. The establishment of martial law, however, would have permitted the military to take direct action without resort to civil law processes.

As the military situation deteriorated, these civilians would quit their jobs whenever conditions became hazardous. It was apparent that military discipline had to be inaugurated into the labor organization if the numerous construction assignments were to be completed. Authorization was requested for the organization of 14 provisional labor companies to be established either through voluntary enlistments or by the process of induction and though induction was not authorized, several such companies were organized.

During the first 2 weeks of January 1942, a daylight work schedule for the large number of civilian laborers and their supervisors on Corregidor gave only partially effective results. Because of daily air raids, little work was accomplished and much of the time was spent in shelters. It was necessary to arrange work schedules so as to permit the bulk of the work to be performed at night, where possible, to assure constant and greater production. Smaller groups were retained for daylight operations, for emergency work, and for work which could be performed with some protection during air raids.

Engineer Intelligence

Many areas in the Philippines were completely unmapped. However, in keeping with the limited appropriations, the selection of mapping projects in the years prior to World War II was entirely appropriate and adequately met map requirements for the defensive combat operations, particularly those on Luzon. No terrain studies other than local engineer reconnaissance could be made by engineer units in the early phases of the conflict. Primarily no engineer personnel were available for that assignment, and, furthermore, it was soon obvious that no organized stand could be maintained north of the Bataan Peninsula. Initially, military survey maps, and certain bridge plans procured from the Bureau of Public Works and the Manila Railroad to assist demolition crews, constituted the principal release to the defending forces. However, when the situation became more stabilized on Bataan some detailed terrain studies were prepared for the command.

The general underestimation of the vital importance of engineer supplies was again demonstrated by the difficulties encountered in securing evacuation priorities for water transport of the limited map reproduction equipment. This equipment was scattered throughout several locations in the Manila area. A large quantity of it, excepting equipment at the Watsonal Building, was loaded aboard a casco which was to be towed to Engineer Island to pick up additional supplies before moving to Corregidor. The casco was lost even before it reached Engineer Island. The glass negatives and aluminum plates to be picked up at Engineer Island were successfully transported to Corregidor by launch the following day. In the meantime, reproduction equipment from the Watsonal Building had been trucked to Cabcaben on Bataan, transferred to two lighters, and moved to Corregidor. These lighters had been the only craft readily available. One was of the flush deck type and heavy parts of the machinery had to be deck loaded despite the danger of their sliding overboard. Upon reaching Corregidor during a heavy bombing, the barges were necessarily dispersed and anchored for protection. At the mercy of heavy seas, they were driven aground in shoal water where only small craft could reach them. Efforts to pull them off proved fruitless. Machinery slid into the sea from the flush deck type vessel which was listing, and practically all of the cargo was a total loss. Lightweight items were salvaged by whale boats and by lugging small amounts up the bluff which rose sharply from the beach.

A contributing factor to the loss of this equipment was, of course, the emphasis on rations and ammunition and the low priority accorded engineer supplies in the movement from Manila. Vital supplies to keep the Ozalid machines in operation were left in Manila and map reproduction personnel thereafter were handicapped in producing copies of maps in any great quantity. Typical of the improvisation resorted to under these circumstances was the incident when the lamp for the Ozalid machine, glass for the two sunlight blueprint frames, and the glass cylinders for the blueprint machine were all broken at Corregidor. Engineer personnel took glass from post exchange display cases, constructed a number of flat frames, set them up in a circle around a small searchlight, determined the proper exposure, traversed the light from frame to frame, and the crew removed prints and reloaded in a continuous operation. In spite of difficulties, essential minimum requirements of vitally needed tactical maps and road and trail maps were supplied to the troops.

Engineer Morale

A shortage of quinine developed. Its loss as a preventive took its toll. Food supplies dwindled, reducing rations to two partial meals a day, both necessarily eaten before dark to prevent cook fires from disclosing positions to the enemy. Troops got weaker and weaker. Sick, hungry men lack the stimulus for aggression or work. However, the work required of the engineers, although a hardship under the circumstances, carried a compensatory advantage. Because they were actively engaged, their morale was better. They were not confined to fox holes and the interminable waiting which is war's greatest hazard to morale.

Conclusions

The well-established principle that had long required Engineer officers to be well grounded in the basic tactics and requirements of the various arms and services paid dividends during the defense of the Philippines. Qualified staff officers in general were at a premium. Engineer staff officers found themselves normally well forward in the field, carrying out much of their engineer responsibilities, and, thereby, in a position to note many deficiencies outside their own particular branch. The constructive comments of these Engineer staff officers were, therefore, tendered with the approval of their commanders in a cooperative spirit of filling immediate needs. The issue of infringement on the duties of hard-pressed staff officers of other branches never arose in the anomalous predicament, and any helpful advice proved of inestimable value regardless of its source. These comments were accepted and welcomed in the spirit in which given, and not only proved of assistance to fellow staff officers and commanders then, but are considered worthy of consideration by future general and special staffs in preparation for any similar eventuality. (See Appendix I.)

The majority of the difficulties encountered in the defense of the Philippines were caused, over and above the almost complete lack of means, by violations of basic command functions requiring no comment other than reiteration of the need for trained commanders and staffs at all times. These men should be indoctrinated with their responsibility to inspect continually and personally the activities and units under their jurisdiction, to encourage and assist their subordinates by clarifying difficulties, and to become thoroughly acquainted with the actual conditions within their respective fields of operations by personal observation rather than by reported information.

However, mere academic training in general tactics even at the best service schools is not sufficient. This must be backed up by active service with troops and large-scale field maneuvers at proper intervals of time throughout the officer's career. More Engineer officers should take short tours of intensive field duty with other arms and services, and vice versa. The benefit in actual battle is obvious. Planning for all-embracive coordinated action should not be left until war is imminent and chaos prevails. At best, a vast amount of confusion should be anticipated whenever war strikes. Telescoping the length of time required to adjust men's conception of action from a peacetime to a wartime basis with a minimum of confusion in a sudden emergency can only be accomplished by rugged and realistic peacetime maneuvers.

Whenever an Engineer officer becomes a member of a headquarters special staff, at any level of command, he must coordinate his efforts with all; not only with other special staff members, but especially with the members of the general staff and the chief of staff. His most important duty is to see that the primary engineer mission to increase the combat effectiveness of the over-all command by every engineer means possible is carried out vigorously. A thorough and intimate knowledge of the over-all tactical situation, reinforced by timely personal reconnaissance, best assures success. Sharing of essential information gained by personal reconnaissances of all staff officers should be routine.

A lesson to be drawn from the defensive campaign in the Philippines and the subsequent American-Filipino guerrilla operations was that the native soldier would follow wherever he was led if his leaders were honest, fearless, and willing to share front-line dangers. The native is apt to get careless, and unless personal reconnaissance is maintained day after day, orders will be disregarded, defenses neglected, and both the command, and the organization of the ground for which it is responsible, will fall into disrepair. The emphasis on personal contact between the American commander and his native subordinates cannot be overstressed.

The sharing of front-line dangers at the appropriate time and place always has constituted one of the criterions for effective leadership. Unfortunately, there were too few young American officers to lead or instruct Philippine Army platoons of either infantry or engineers. And before the native soldier will effectively follow where he is led and help accomplish the mission of his unit, there are two conditions that must be fulfilled. First, he must be trained. Second, he must be given an especially capable type of leadership. To say that untrained native soldiers, led by a trained American officer, are effective against trained enemy troops in a serious attack or a determined defense is a dangerous threat to all training doctrines. In the battle positions, the necessity of the holding battalions (backed up by reserves) along the main line of resistance remaining in place at all costs is the very essence of defensive doctrine. The company and battalion defense areas are simply made up of separate platoon defense areas that must be mutually supporting and prepared for all-around defense. The problem is to so train and lead this small basic unit that it will fight in place and will not precipitate a withdrawal.

An untrained platoon led by a trained officer may maintain the integrity of a static battle position. It is problematical, however, if this same unit, organized as part of a counterattacking regimental or corps reserve, will advance and maintain alinement with adjacent units. Assuming that it does advance, the question is whether this platoon can hold together and keep on destroying enough of the enemy in conjunction with adjacent and following platoons to drive the enemy out of the position and close the gap. Probably not. With little training in rifle marksmanship, scouting, patrolling, musketry, and combat principles of the squad and platoon, this type of unit is usually unable to advance in close terrain to a position where it can attain maximum destructive power. These are disagreeable facts, but proven incidents of the battlefield. In time, of course, the trained platoon leader gets his platoon well trained and transforms it into an effective fighting unit. The native soldier, if not a casualty by this time, acquires the "know how."

If subsequently this same native soldier becomes a guerrilla and participates in operations where "hit and disappear" may be the general tactics rather than large formal tactics, he has developed into a fine type of fighting man. In the words of the Engineer, North Luzon Force, "Would that the USAFFE could have started the war with guerrilla trained troops!" [12] However, by the end of the war, the original USAFFE Philippine Army private and second lieutenant had acquired quite a stature as the enemy losses in Bataan bore witness.

When beleaguered U. S. defensive forces are observed digging in by use of bayonets, mess kits, and flattened tin cans because nothing else is available, a bitter, but unforgettable lesson is learned. *Vulnerable outposts should at all times stock an adequate war reserve of up-to-date engineer equipment and supplies under a central control.* Equipment should be maintained for use at short notice, and should be under continuous inspection. Replacements for deteriorated parts and supplies should always be readily available. In addition, this same type of modern equipment should be issued to troops for their training in its use, and sufficient troop strength should be maintained to send out training cadres to new units.

The Japanese surprise attack at Pearl Harbor and the ensuing chaos in the Philippines indelibly indicated the need for stationing *sufficient* forces

[12] Quoted in Pers Ltr, Col H. A. Skerry, USA (Ret) (formerly, Engr, NLF, and I Phil Corps), to Editor, 4 Jun 49, sub: Comments on Defense of the Philippines. In OCE, GHQ, FEC (Hist).

and supplies at distant outposts to hold such areas for the period of time necessary to allow reinforcements to reach them.

In this connection, the extreme importance of supplying adequate map coverage and reproduction facilities to the reinforcing units should be firmly instilled in the minds of those responsible for over-all logistical planning. Experiences in the defense of the Philippines and subsequent campaigns vividly emphasized the urgency of providing map reproduction plant and materials to all expeditionary forces on adequate priority when issuing military impedimenta.

Most of these recommendations, of course, depend upon adequate prewar appropriations. Within the funds available, however, the limited, unprepared, and underequipped personnel defending the Philippines made the most of what was at hand and put up the greatest effective resistance possible under the circumstances. General Wainwright, succeeding General MacArthur as commander of the forces in the Philippine Islands, continued the grim and courageous defense long beyond the accepted limits of human endurance. The effects of this desperate resistance, absorbing a sizable portion of Japanese strength, proved of long range strategic value despite the inevitable, tragic surrender. The delay gained through the gallant efforts of these exhausted defenders of Bataan permitted men and materials to be dispatched to Australia, New Caledonia, and other Pacific Islands as a measure of preparation against the spreading tentacles of the enemy. An unforgettable epic was added to history on Bataan by brave men who will long be remembered with the deep respect reflected by General MacArthur's tribute to them: [13]

> The Bataan Force went out as it would have wished, fighting to the end its flickering forlorn hope. No Army has ever done so much with so little, and nothing became it more than its last hour of trial and agony.

And their hard, losing fight will irrevocably recall the ageless wisdom of General George Washington's admonition—particularly to that small fraction of these original United States Army Forces in the Far East who survived the end of World War II—"In time of peace, prepare for war."

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[13] Press Release as quoted in Pers Ltr, Col H. A. Skerry, USA (Ret) (formerly Engr, NLF, and I Phil Corps), to Editor, 20 Jul 49. In OCE, GHQ, FEC (Hist).

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CHAPTER II

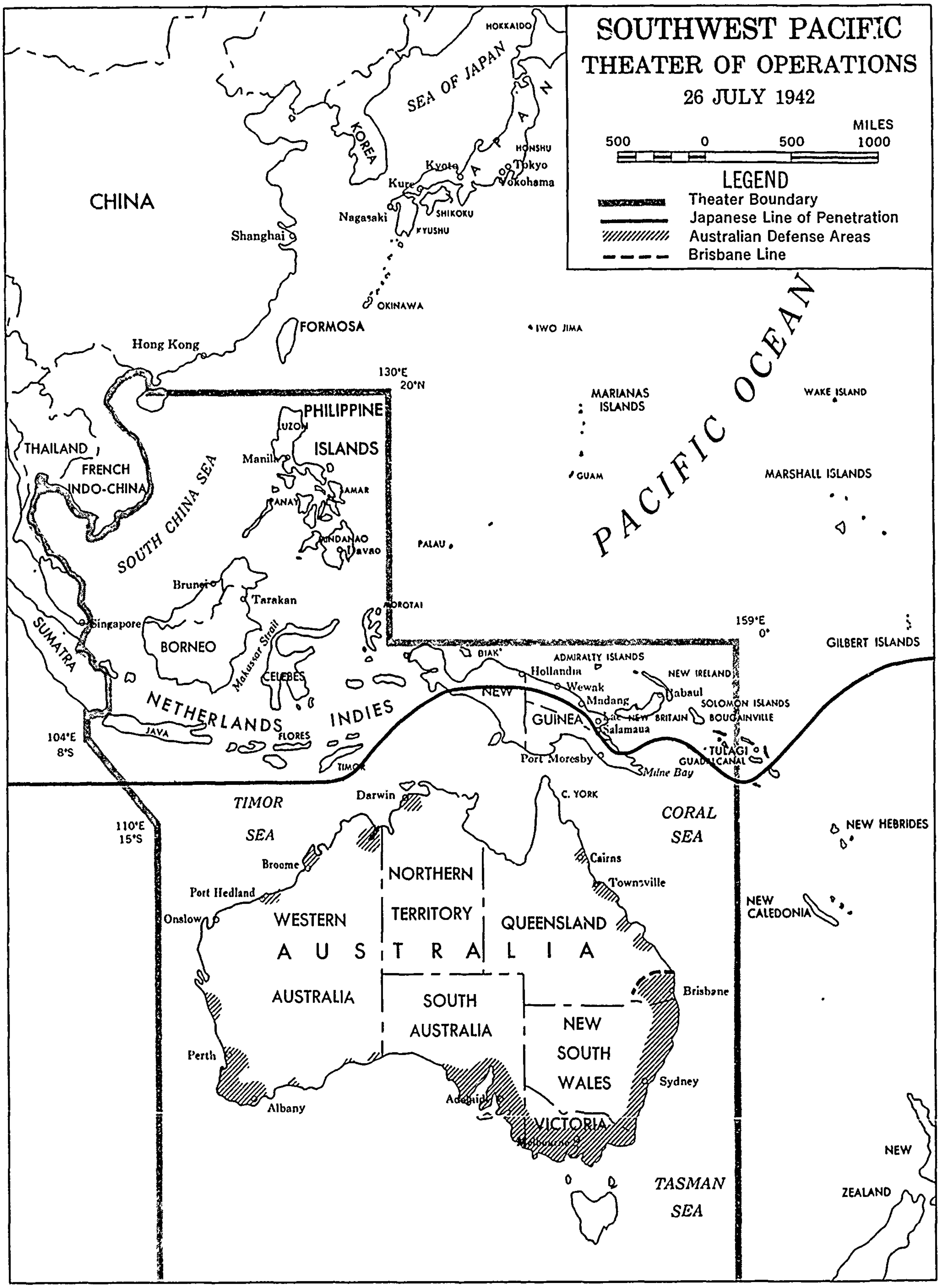
Operations in Australia, 1942

The Engineer Situation

Following the establishment of General Headquarters, Southwest Pacific Area (GHQ, SWPA), under the command of General Douglas MacArthur on 18 April 1942, the responsibilities and activities of the engineers in Australia promptly assumed considerable proportions which continued to grow in scope throughout the year.

The Japanese drive in early 1942 had steadily gained momentum. The Netherlands Indies had been attacked. Lae and Salamaua in New Guinea had been seized. Australia waited tensely for the threatened impact, but was determined at all costs to hold the industrial southeastern section of the continent. Australian efforts, therefore, had been almost exclusively concentrated on preparations incidental to a strategic plan of defense along a line of resistance which they had selected halfway down the Australian east coast, and sometimes referred to as the "Brisbane Line." (See Map No. 3, "Southwest Pacific Theater of Operations, 26 July 1942," and Chronology.) In line with this policy, Darwin, Cairns, and Townsville on the continent, and Port Moresby in New Guinea were being evacuated of all civilians as rapidly as transportation permitted. By early March 1942 Townsville had been left with approximately half of its normal population of about 30,000. All southbound trains were crowded to the guard rails with men, women, and children moving to Brisbane and the south. A great many stores and other commercial buildings were closed and their personnel evacuated.

The comparatively few U. S. troops which had arrived in Australia 15 days after the Japanese attacks at Pearl Harbor were concentrated in northern Australia with Darwin and Townsville as their main centers of activity. No engineer troops had been included in this original convoy. Subsequent to the designation of these troops as United States Army Forces in Australia (USAFIA), establishment of the Engineer Section, USAFIA, had initially been effected through a fixed-fee contract with Sverdrup & Parcel, a United States architect-engineer firm already located on the continent. Prior to United States entry into the war, this firm had been working with the Corps of Engineers, U. S. Army, in connection with design and construction of an air-ferry route for bombers from Hawaii through New Caledonia to the Philip-



SOURCE: OCE, GHQ, AFPAC (Historical).

MAP NO. 3

pines, and across Australia, through Java, to Burma. Upon establishment of the Engineer Section, USAFIA, this firm, under the fixed-fee contract, had made its personnel available for preparation of designs, drawings, and specifications, and for the supervision of certain military construction projects in Australia. Before the termination of the contract, some U. S. Engineer troops had reached Australia. The staff of this firm, all desirous of an active role in the war, however, volunteered for service with the Corps of Engineers when the contract terminated.

The first of the U. S. Engineer troop units to arrive had been one engineer aviation battalion, soon followed by two engineer general service regiments. These had been augmented by two engineer battalions, separate (colored), which were subsequently reorganized into two engineer general service regiments in order to secure additional Tables of Organization equipment and increased officer supervision. One engineer depot company, two engineer dump truck companies (colored), one engineer topographic company (corps), and one engineer topographic battalion (army) (less survey companies) for mapping activities, followed. The only other engineer units were two engineer combat battalions, organic to two divisions, and for a period one of these battalions was short one company. Such was the constitution of the engineer echelon for the defense of the Southwest Pacific and its ultimate recapture.

Before the Japanese conquest of the Netherlands Indies and the establishment of USAFIA, the primary mission of U. S. troops in Australia, as the only command maintaining an administrative and supply link between the United States and all U. S. troops in the Southwest Pacific, had been the dispatch of maximum supplies to the Philippines and the Indies. Upon the establishment of USAFIA on 5 January 1942, this mission had been incorporated with the task of preparing bases for reception of long-range aircraft to operate in support of the Philippines and Allied forces to the north of Australia and constructing depots for the assembly and repair of aircraft. As Japanese moves into the Netherlands Indies threatened Australia and cut off all further aid to the Philippines, however, these troops had suddenly become U. S. forces in an area under immediate threat of enemy invasion. It was clear that U. S. ground troops, as well as air units, would be required in preparation for future action against the Japanese, and that initially these forces would be stationed on the Australian mainland. Immediate preparations for the reception of heavy ground combat troop reinforcements, as well as air units, to meet the rapid development in the tactical situation had, therefore, considerably increased the scope of U. S. military activities on the continent. Locations of some base depots had to be altered in a modified plan for the dispersion of U. S. Army Air Forces units and facilities, and camps for the reception and training of incoming ground troops had to be planned for locations mainly in the southern states of Australia.

The already heavy engineer phase of USAFIA's operations on the continent had increased proportionately. The now greatly expanded construction requirements had to be met by the limited number of engineer units available with inadequate equipment, personnel, and materials. After General MacArthur's assumption of command and revision of planned tactics from a defensive to an offensive concept, however, engineer responsibilities intensified to even greater proportions. An urgent and vital need arose for roads, port facilities, water supply, hospitals, some degree of shelter for both troops and supplies, and increased heavy airdrome construction in forward areas, including supporting facilities. These had to be established in largely undeveloped areas of a country as large as the United States but with little more than 5 percent of its population. Only 1½ percent of the continent of Australia had been mapped at the outbreak of World War II. Operational areas were subject to intense tropical rainfall. Communication facilities were relatively undeveloped, and railroads, as a means for transportation of heavy supplies, were handicapped with operational deficiencies and changing gauges in each of the several States of the continent. (See Map No. 4, "Orientation Map, Australia, 1942.") Port cargo handling facilities were limited. And time for the establishment of the requisite improvements was critically short. For the revised, counteroffensive plans also involved operations in the even less developed areas of New Guinea and the Solomon Islands which would necessarily be dependent upon scheduled receipt of troop units, materials, and equipment from well developed staging areas and bases in Australia.

The small engineer potential found itself faced with incredibly heavy obligations. Beyond the need to develop Australia as a springboard for vast military operations, were the immediate and heavy demands for additional airdromes. These demands were urgent and justifiable. Tactical success was dependent upon a construction program to facilitate operations of the Allied Air Forces, the primary tool both of offense and defense. However, the long runways, taxiways, and numerous hardstandings, all of heavy construction, required by heavy and fast U. S. aircraft called for considerable man-hours of skilled labor and vast quantities of heavy equipment. Such labor and equipment were not available in even a remotely adequate quantity. The need for trained and equipped engineers was desperate, for, over and above the inadequacy of total engineer units available, all of them were understrength for work in forward areas shortly after arrival. Expanding responsibilities of higher headquarters had necessitated retaining some detachments for activities in rear areas with a resultant depletion of strengths at forward bases. These engineer units, therefore, generally averaged about a 15-percent shortage in officers, and from a 10- to 15-percent deficiency in enlisted personnel.

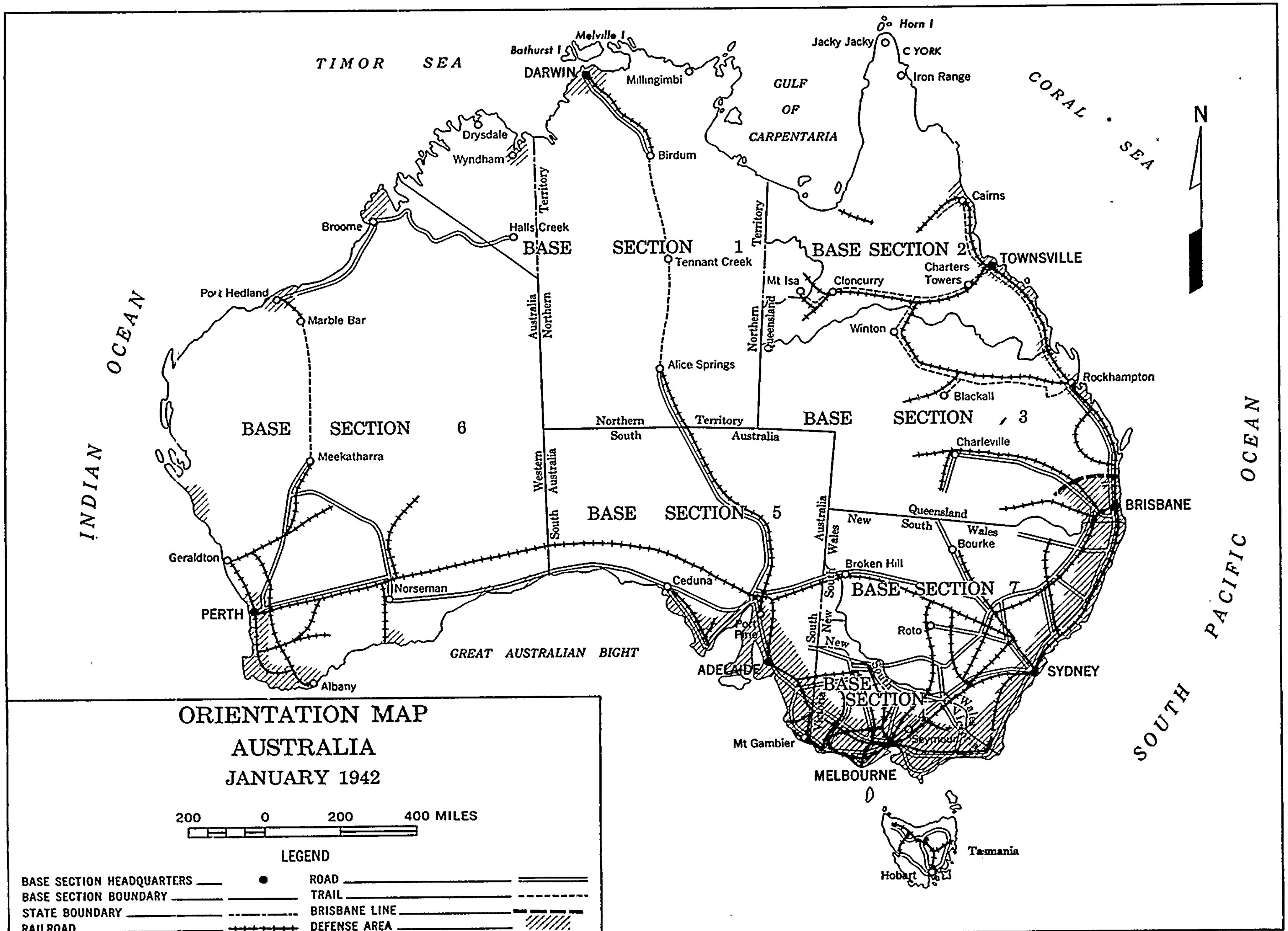
Fortunately, the engineers could rely for support upon other engineering organizations, both civilian and military, at work in the Theater. Construction of all rear area facilities supporting base establishments, particularly after June 1942, was performed principally by the Allied Works Council, the Australian Government's civilian construction agency. This organization, a product of Australian–American cooperation, was organized in February 1942, and was destined to become the vital "Army behind the Fighting Forces." [1] In the forward operational areas of Northern Territory, northern Queensland, and New Guinea, now vulnerable to attack from the Indies and the Coral Sea, construction for U. S. forces was performed by U. S. Army Engineer troops assisted by the occasional detail of Royal Australian Engineers, and native labor provided by the Australian New Guinea Administrative Unit. Lack of personnel, however, both civilian and military, handicapped early completion in all areas.

Planning

General MacArthur's strategy, soon after assuming command of the Southwest Pacific Area (see Map No. 3), was in sharp contrast to the then current Australian defensive plans of holding the industrial southeastern section of the continent below the "Brisbane Line" at any price. The Australians had made and initiated extensive plans of denial to the enemy involving demolition of ports, industries, and miscellaneous facilities, throughout the entire continent with emphasis on the territory north of the "Brisbane Line." (See Maps Nos. 3 and 4.) [2] General MacArthur, as indicated, contemplated an of-

[1] Hugh Buggy, *Pacific Victory* (Issued under the direction and by the authority of the Australian Minister for Information, n. d.), p. 32.

[2] *Editor's note.* Preliminary demolitions executed under this plan considerably handicapped subsequent operations. For example, Samarai, at the southeastern tip of New Guinea, ideal for a convalescent station or rest camp, was denied for use as either because of extensively damaged docks, wrecked buildings, and complete destruction of the island water supply system. The order for demolition of the pier at Portland Roads was fortunately rescinded in time, and this single deepwater landing point along the Cape York Peninsula on the northern extremity of Queensland, Australia, was saved to provide deepwater approach for the support of airfields in that forward area.

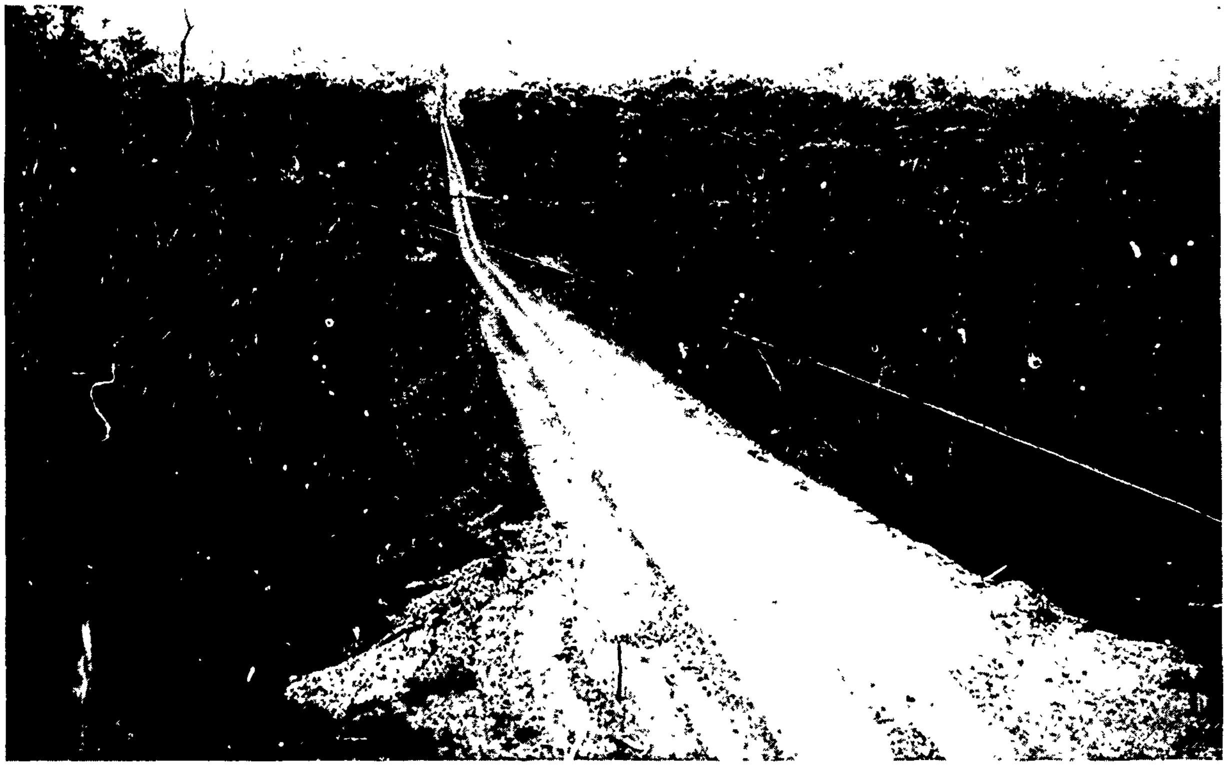


SOURCE: OCE, GHQ, AFPAC (Historical)

MAP NO. 4

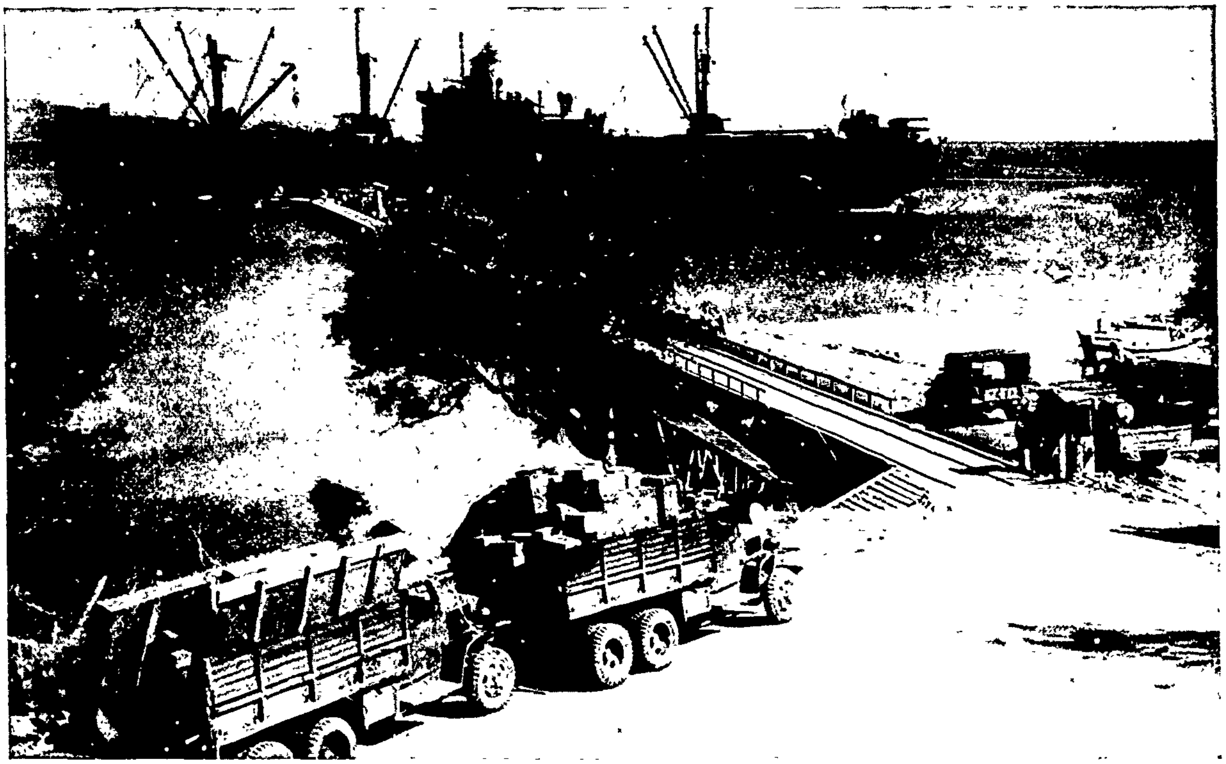
The North–South Road was constructed after the outbreak of World War II as the only overland link between southern and north central areas of Australia. This photograph shows the traffic control point at the intersection of this road with the Mt. Isa–Tennant Creek Road.

Convoy of U. S. Army trucks moves toward Darwin, Australia, over the Mt. Isa–Tennant Creek Road while the road was still under construction.

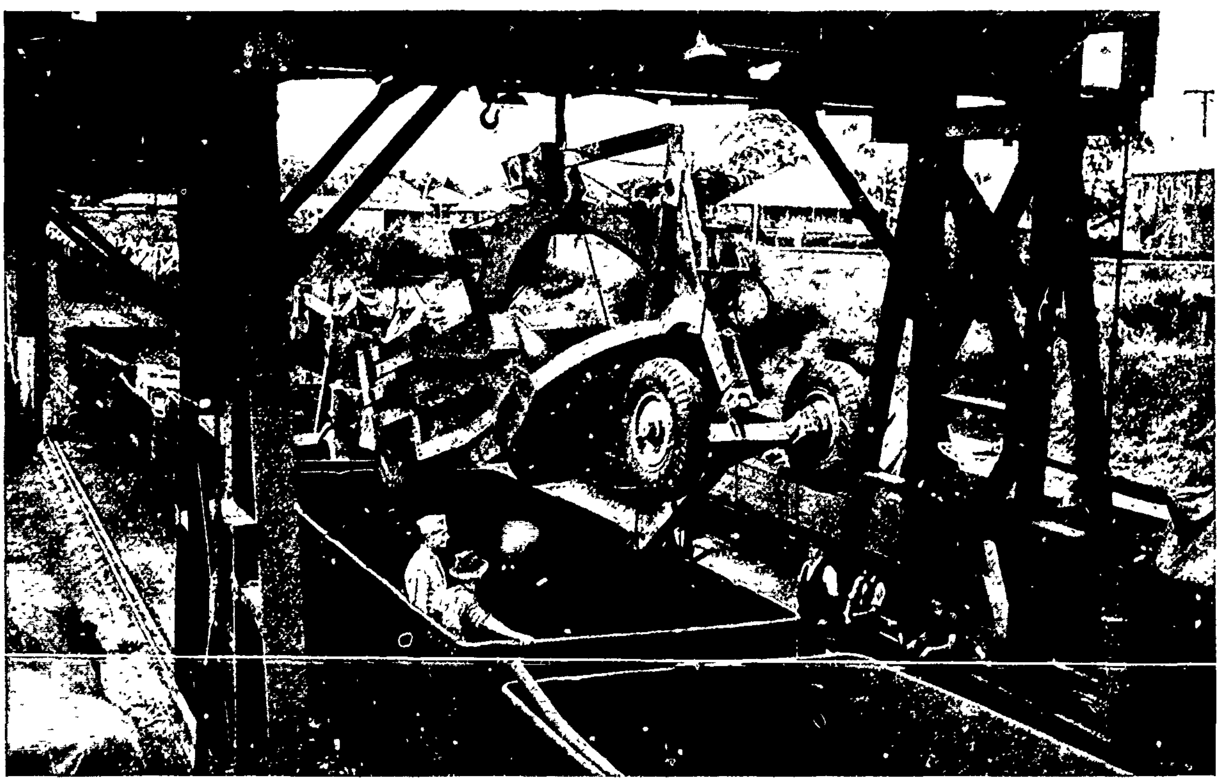


Elevated section of the Inland Defence Road sweeping through thickly wooded, unimproved country between Duaringa and Charters Towers, Australia.

Another section of the Inland Defence Road constructed when the Japanese threatened to cut rail and highway communications along the east coast of Australia.



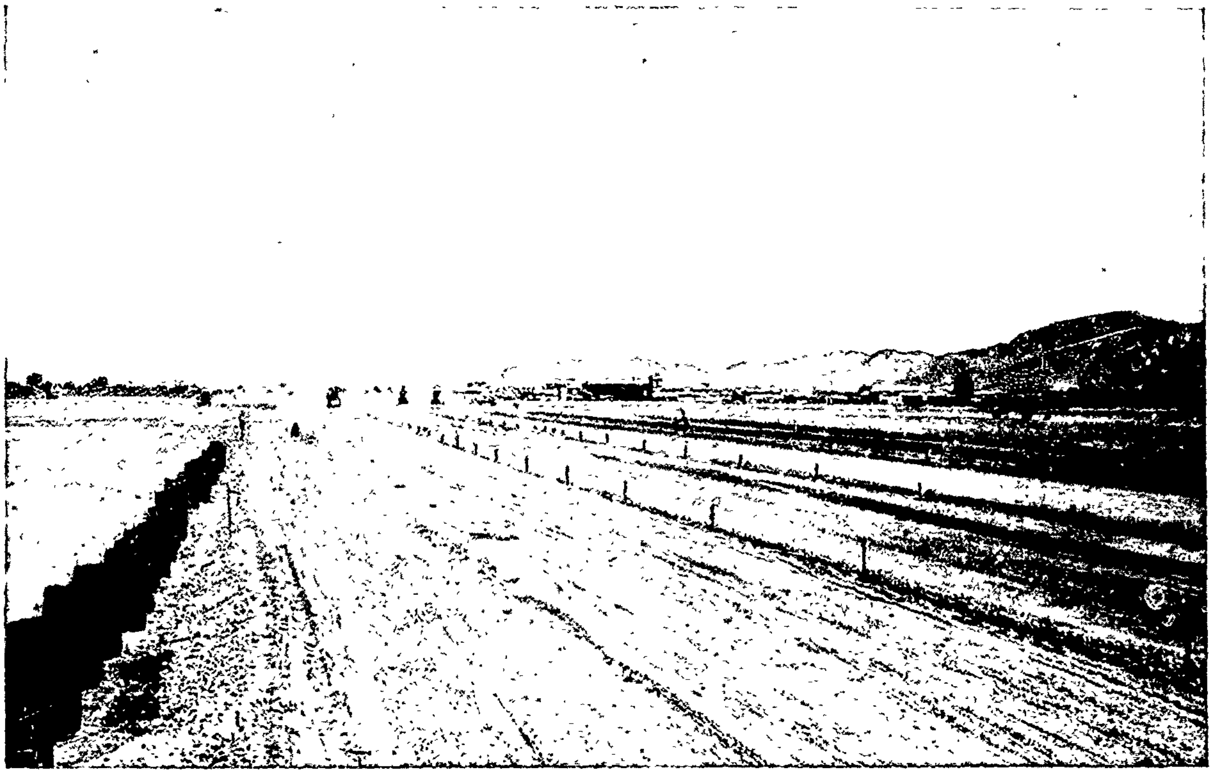
Hastily constructed port facilities in northern Queensland, Australia, to meet demands for troop movements to New Guinea.



Engineer earth-moving equipment in Australia is transferred from one narrow gauge railway to another, but different gauge, railway.

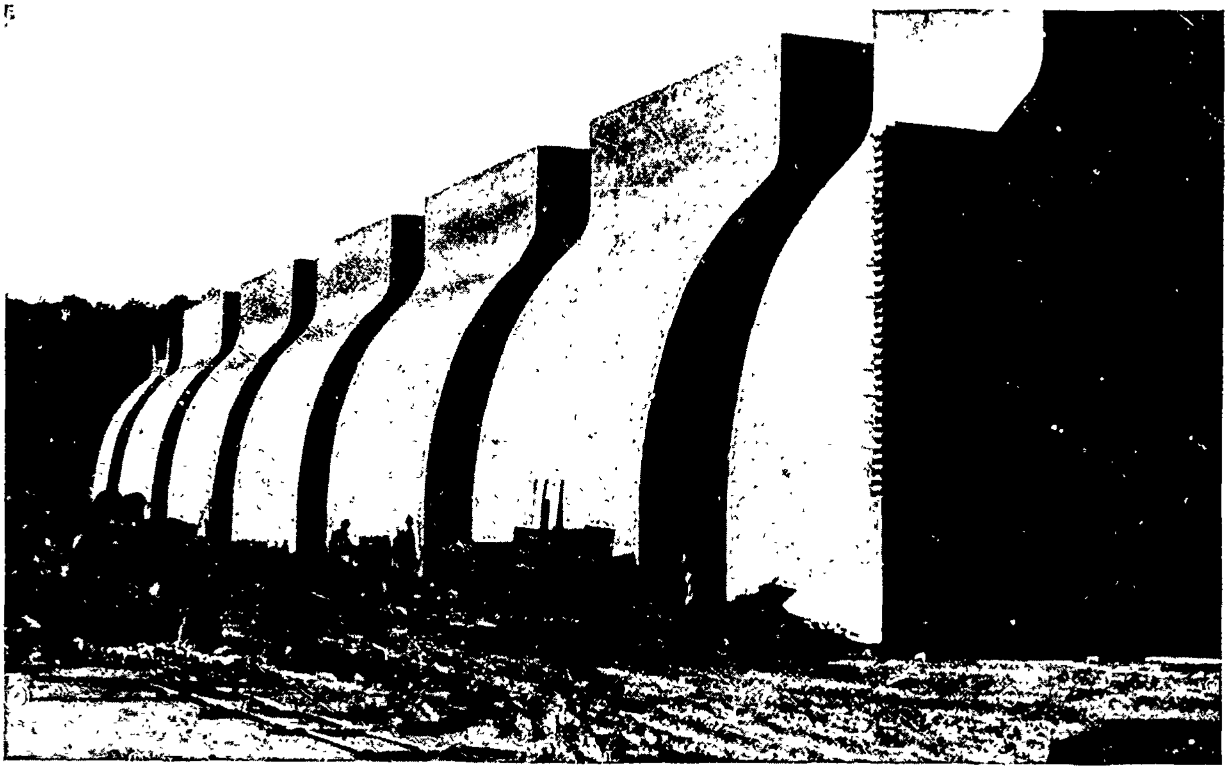
View of Ekibin Hospital, typical example of Engineer construction work in Base Section 3, Australia.

Aerial view of Hedley Park, Australia, showing Igloo-type buildings in foreground and flat-top lattice truss construction at center right.



Engineers employing heavy equipment on construction of Garbutt Field, Townsville, Australia.

Aerial view of Eagle Farms Airdrome, near Brisbane, Australia; one of the most important U. S. air bases on the continent.



Airplane engine testing facilities under construction by Allied Works Council forces in Australia.

Australian civilians apply bitumen to an airfield runway on the continent.

fensive. His concept was to stop the Japanese in New Guinea and start pushing forward, depending largely on the early development of bases in Australia (along the coastal areas of Northern Territory and Queensland) and in New Guinea for the staging and support of his tactical forces. This plan was accepted by the hard-pressed Australians. It offered a fighting chance; existing defensive plans of denial could always be resorted to if the offensive should be lost.

Concurrent with establishment of supporting bases for future operations, General MacArthur's plans also required the development of a large number of major airdromes with base ports to supply them. Future operations would depend upon air cover for success, but tactical air support to be effective, in turn, depended upon air supremacy. This could only be achieved by provision of numerous air bases from which Allied aircraft, with fighter escort, where possible, could conduct long-range bombing attacks against enemy installations in New Guinea and related islands.

Planning for airdrome construction, already well underway, was increased and accelerated. On 18 March, the day following his arrival with General MacArthur and his staff, Brig. Gen. (later Maj. Gen.) Hugh J. Casey, subsequently appointed Chief Engineer upon establishment of GHQ, SWPA, had set forth on an inspection of the forward areas in Australia. Within 10 days he and Brig. Gen. H. H. George had boarded a seaplane and were making a reconnaissance of possible airdrome sites in Papuan New Guinea. Australian Engineers were already working on the two sites having the most obvious possibilities of development: a small rolling turf commercial strip, Kila, and Seven Mile Drome, later known as Jackson Drome, the principal airdome in the Port Moresby area. Reconnaissance was continued for additional airdrome sites, a conference was held with the Australian Engineers, and arrangements made to send U. S. Engineer troop reinforcements into the area. This reconnaissance by the Chief Engineer preceded a tremendous acceleration of activity to develop Port Moresby not only as a strong central air base, but as a principal defensive point for forward ground operations. Ideally situated for quick reinforcement from Australia, it could be maintained to stop any further Japanese advance.

Selection of Airdrome Sites

Initially, responsibility and authority had been widely delegated to a few officers in forward areas and haphazard field improvisation in the selection of sites seemed to prevail. Some sites selected for airfields during those early days indicated little appreciation of the necessity of supply to aerial units. Airfields had been designated for construction in areas prohibitive to surface supply even when, at the time, less than five C-47 transports were available in the Theater for air supply. Gradually, however, as more engineers, equipment, and time became available, selection of sites for airdromes evolved into a more practical routine. On instructions that airdromes would be required in certain areas, initial studies were made of information from a variety of sources including preliminary intelligence reports, map surveys, aerial reconnaissance, and ground inspections. Aerial reconnaissance, however, ofttimes presented a problem. Suitable military reconnaissance aircraft were frequently unavailable. It was necessary in such instances to charter commercial or private airplanes with care being exercised to secure the services of aerial observers having a knowledge of the reaction of local soils under traffic and the class and quality of timber which grew on the various soils, together with the ability to recognize them from both aerial reconnaissance and interpretation of aerial photography. Flights were made over selected areas at heights of about 5,000 feet, and all possible sites were noted. If a site showed promise, it was circled by the airplane, sometimes only a few feet from the ground, and observed from various angles, especially as to possibility of surface transportation supply. In this manner about 20 percent of the original sites considered as possibilities in the area were selected for ground inspection. The ground party, already provided with information regarding prevailing winds and rainfall, was then handed the result of the aerial reconnaissance. This party collected data on existing grades and general terrain and on sources of gravel, types of timber, and other factors affecting suitability of the site. Based on this information, sketch maps were prepared showing the position, number, and length of possible runways together with a report on any available facilities. Detailed surveys of the most promising sites were then carried out to collect all necessary data on which final designs and estimates could be based.

Logistical Balance

From the very beginning of U. S. Army operations on the Australian Continent, one of the major planning problems was trying to assign the limited engineer strength available to the many and varied projects at the time needed over this vast area of operations. The desperate shortage of engineer troops, properly equipped and staffed with officers trained in construction, severely restricted both logistical and operational planning. This deficiency of engineers had originated with the initial provision of a small unbalanced engineer strength disproportionate to the over-all troop strength being allocated to the Theater. The lack of balance grew progressively worse as engineer strength failed to increase proportionately with the subsequent building up of tactical air and ground forces. From early 1942 U. S. Army Air Forces elements in the Theater received material increases in strength, which, in turn, increased the demands for construction of airdromes, access roads, shelter, and water supply to meet operational requirements. Construction needs of the service elements of these air units also had to be satisfied. The build-up of ground force strength in Australia, prior to tactical employment elsewhere, created further demands for engineer construction. Yet, in spite of continued pleas for additional support, the overworked engineer construction forces in the Theater (43d and 46th Engineer General Service Regiments, 91st and 96th Engineer Battalions (Separate), and 808th Engineer Aviation Battalion, plus two dump truck companies) were not reinforced by even one additional U. S. Army Engineer construction unit for almost an entire year after May 1942.

These factors meant that the few U. S. Engineer units in the Theater worked on a 7-day-week, 24-hour-day, 3-shift basis to construct facilities with limited plant and personnel. Such continued pressure under strenuous tropical conditions with a deficiency of balanced diet impaired the physical condition of these troops. Still as more tactical units continued to arrive in the Theater, proportionately increased construction requirements had to be met with whatever exhausted forces the engineers could muster. There was no alternative until the general tendency to overload the tactical echelon without adequate provision of service support could be overcome.

On the contrary, adding to the burden was the serious lack of supply and plant maintenance personnel, and the need to augment the underdeveloped Australian Engineer units. The authorized strength for the Corps of Royal Australian Engineers was limited by policies dating back to World War I, when the Australians had merely developed and shipped supplementary tactical forces to Europe and left the solution of logistical problems for these forces entirely in the hands of the British and French. In early World War II operations in the Middle East they were again thinking and making preparations in terms of tactical forces without the complementary service forces needed to maintain them. When confronted with the immediate threat of enemy invasion of their homeland, the Australians found themselves without the balanced means of organizing integrated and self-supporting forces. Provision of the compensatory engineer strength for these forces further weakened the limited, available U. S. Engineer potential.

By and large, there is a basic deficiency in all commands in evaluating logistic problems and making adequate provision for them. There exists a strong tendency on the outbreak of war in the organization of theaters of operations and subordinate task forces to provide tactical elements without suitable supporting engineer, quartermaster, or ordnance service units. This bias persists despite the fact that logistics are what keeps a military force operating. Our future tactical commanders most urgently need training in logistical problems and knowledge of what it takes to keep anything from a regimental combat team to a field army going. They should recognize logistics as a controlling factor in planning all operations, particularly those of the U. S. Army, which, it is hoped, will always be made up of *expeditionary forces,* fighting any future defensive wars outside of the United States and away from American shores. Therefore, it is essential to recognize and make preparations for the fact that *expeditionary forces* cannot take with them all the things often taken for granted in training maneuvers in the United States such as highways, railroads, ports, and civilian assistance. Provision of such needed facilities for the support of elements in the field must be given particular consideration, and adequate service units for their establishment and maintenance assigned in sufficient time and number.

Consequently, in going into an undeveloped objective area the engineer component should be a large, well-balanced one based on a doctrine that goes much further than merely the supply of combat (divisional) engineer units. Its determination should be based primarily on an estimate of the over-all engineer mission with supplementary breakdowns for each specific type and phase of engineer responsibility. For example, engineer construction should be carefully considered in terms of battalion-months of construction effort required, and of the period in which it must be executed. Basic construction units should be provided to meet this schedule. Based upon the combined total number of engineer combat and construction units required, a balanced force of engineer auxiliary units, such as equipment, maintenance, and heavy shop companies for maintenance of plant, depot companies for storage and handling of engineer supplies, topographic units to meet mapping requirements, and engineer boat and shore regiments for close support to amphibian landings, should be provided to make a well-balanced and coordinated engineer component.

Even after planning a balanced engineer component, individual units will prove most ineffective in theaters of operations unless they arrive from the Zone of Interior with authorized personnel, equipment, and tools intact. Assembling engineer units and their equipment together at the time and place needed presented an all but insoluble problem to engineer planners during this early phase of operations. Yet, as far back as World War I, it was stated that an engineer unit without its equipment and tools is like an artillery unit without its guns. The statement was again confirmed in World War II. However, despite well-established basic staff doctrines, circumstances beyond the control of the War Department necessitated the shipment of many engineer units like infantry, with only their hand tools. As a result, untold battalion-months of work were lost when urgent construction requirements necessitated assignment of units without their heavy plant because of separation during voyages into or within this theater of operations.

It should further be emphasized, in going into a remote, unimproved operational area, that certain operational facilities which are provided by the engineers should be constructed in advance of the arrival of the units which will occupy and operate such facilities. For example, if airdromes are not provided in advance of the squadrons or groups which are to operate from them, the air units are of little value. It is important, therefore, that before each increment in tactical strength occurs, the engineer units which are to prepare and maintain installations for these tactical elements be made available in time to insure readiness of the facilities when most needed.

It is to be stressed again and again that an over-all balanced force of men and equipment of all arms and services, even of reduced total strength, is far more effective than a much larger total force of unbalanced tactical components. Lacking balance, the effective effort of the total force is limited to the capacity of one of its controlling elements, irrespective of whether that element is a tactical or a particular service component.

Economy of Construction Effort

In an endeavor to conserve the limited engineer potential, all types of proposed construction projects were screened to determine those nonessential to the strategic and tactical situation. On occasion an adamant stand on the part of the Chief Engineer, GHQ, SWPA, was required to maintain economy of construction. For example, considerable agitation arose for a railway link, consisting of 180 miles of 3-foot 6-inch gauge, between Charleville and Blackall in the Australian State of Queensland, as an emergency route in the event of the cutting of the coastal railway by Japanese action. (See Map No. 4.) However, at the time, the existing Charleville–Blackall road was usable and its widening and improvement well underway. The Chief Engineer, GHQ, SWPA, therefore, despite urgent importunities, disapproved the proposal. With an adequate highway available for possible emergency traffic, provision of an auxiliary railway link could, under the circumstances, only be considered superfluous and a drain on already inadequate resources. Moreover, this proposal had established a contagious precedent. Many other demands from various sections of the Australian Commonwealth arose and were strongly pushed, each section desirous of similar precautionary improvements. Despite considerable pressure, the Chief Engineer, GHQ, SWPA, prevented a wholesale diversion of effort to projects that would have mushroomed to consid[illegible] able proportions. It was pointed out that the execution of these projects would make a great demand on an already overloaded and inadequate transportation system in addition to requiring a large diversion of labor and equipment already insufficient for more urgently needed military construction. Several thousand miles of essential military roads as well as improvements to existing roads were required, and airdromes, warehouses, water supply, camps, depots, hospitals, and related facilities had to be produced by the limited plant and labor available.

Economy of construction was maintained despite pressure, and the Chief Engineer, GHQ, SWPA, carefully and impartially screened numerous requests and reviewed many projects in order to prevent expenditure of the limited engineer effort for anything but essential military requirements.

Allocation of Equipment

In view of U. S. Engineers and Australian Engineers both depending to a considerable extent on the Allied Works Council (AWC) for the procurement of engineer heavy equipment in Australia, screening in this connection was also eventually necessary to insure balanced allocation. Initially the Australian Engineer units were neither equipped nor equipment-minded and their early requests for heavy equipment were relatively small. This would probably be true of any country where the population is not so mechanically inclined as in the United States. In Australia, under established precedents of emphasis on tactical forces to the detriment of service forces, it was even more typical not to think in terms of large quantities of equipment, particularly since their engineer organizations lacked the personnel to operate and maintain it. However, after seeing U. S. Engineer units operating, their requests for equipment gradually increased. Therefore, to maintain a proper balance of available equipment between Theater forces, requisitions were screened and approved by the Chief Engineer, GHQ, SWPA, to insure that items requisitioned and allocated were actually essential to operations and that full use was being made of available stocks and local sources. In addition, AWC was not in a position to determine the relative operational priority of allocation in the event, for instance, that the same item which was needed in Australia for construction was also needed in a forward operational area. This civilian agency would have been equally handicapped in trying to determine the relative priority in the allocation of a given item of engineer equipment between one of the Allied engineer services building up its supply level and the need of using that same item for construction in Australia. Control of allocation through AWC was, therefore, maintained by the Chief Engineer, GHQ, SWPA. The retention of such control at the Theater level will always be important in expeditionary forces to guarantee the best utilization of equipment. Under circumstances involving varied and conflicting Allied channels of supply and distribution, strategic and tactical purposes would best be served if the Theater commander retained actual control of all allocations to guarantee best utilization.

Operational Components

Australian Support

Cooperation and mutual reciprocity determine the balance between success and failure of military forces when operating in an Allied country. Throughout World War II the Office of the Chief Engineer, GHQ, SWPA, and the Theater's over-all engineer program benefited by close coordination and cooperation with the Australians. As soon as U. S. Engineers began operations in Australia, a consolidation of interests was established without which widespread engineer missions would immediately have been stymied through an extreme shortage of suitable manpower and materials. Only young, physically fit men could possibly carry out the engineer construction required in Australian tropical and semitropical areas; only local resources supplementing the spasmodic arrival of U. S. shipping could provide the supplies necessary to initiate the engineer program. Prompt personal approach to Australian public authorities received a gratifying and encouraging response. Hard pressed by their own needs, but recognizing the over-all importance of combined effort, Australian agencies made all men and materials possible available to the U. S. Engineers.

However, there is no perfection in war, and although Americans and Australians worked hand in hand, some differences and difficulties were inevitable. Australian cooperation in the supply of local labor to the U. S. Engineers undoubtedly decimated available manpower for Australian requirements, but at the same time their own adherence to public opinion and peacetime regulations occasioned a greater drain than necessary. Local objections in certain areas to the use of U. S. Army colored troops as stevedores around the docks necessitated the alternate employment of local labor. Unloading operations were constantly being delayed because local labor persisted in observing peacetime labor regulations of no work on rainy days in areas subject to considerable rainfall. Moreover, problems connected with unloading of shipping became even more significant as local coal strikes continued in varying degrees throughout the war, and necessitated heavily increased coal shipments from the United States which had to be discharged promptly for maintenance of essential industries.

The establishment of a Theater military mapping program initially presented somewhat of a problem. Various agencies of the several Australian States were operating in conjunction with the military on mapping requirements. Only fragmentary coordination existed between the Australian military and these agencies, which had functioned more or less independently in peacetime. Differences in scale, methods of reproduction and distribution, and map coverage of areas prevailed. With the speed-up of mapping operations soon after the establishment of

GHQ, SWPA, dependent upon certain topographic facilities under U. S. control and others under Australian control, a definite need for coordination of activities existed. This was quickly and effectively adjusted. The Chief Engineer, GHQ, SWPA, immediately called a mapping conference of all affected agencies, initiated preparation of agenda and specific rules, and suggested procedures which facilitated agreement and eliminated time-consuming discussions about differences in the future for all concerned.

With engineers so few and engineer operations so extensive in scope, every possible means was employed to conserve engineer efforts and eliminate any possibility of duplication of effort. In this connection an early interchange of engineer information and engineer intelligence was effected between the Australian military forces and the U. S. Army on the highest staff levels. However, if additional officers had been available and the policy had been extended to include the use of Engineer liaison officers between subordinate engineer components of Australian and U. S. forces, even greater dividends would have resulted. Even so, the interchange of experience data and training references that was effected proved of considerable benefit. Any technical intelligence developed, any training pamphlets prepared by either force, were exchanged for dissemination to all engineer units.

Duplication of some effort, however, could not be entirely avoided because of long, involved administrative methods to which the Australians, like the British, were bound by custom. Approvals of proposed construction projects through a system of committee procedures often developed into considerable delays at a time when speed was most needed in implementing military engineer plans. In accord with Theater policy, which was determined by the critical shipping situation, most construction materials had to be obtained in Australia. Procurement of engineer supplies for use in either New Guinea or Australia and the initiation of construction projects in Australia required the submission of a project proposal by the Chief Engineer, United States Army Services of Supply (USASOS),[3] through numerous committees. (See Chart No. 1, "Flow Chart, Authorization Procedure—U. S. Construction Projects in Australia.") Approval by any one committee was contingent on subsequent approval of corollary committees (the chart shows only the basic framework); yet disapproval by any one committee was final and without recourse. Eventually, if progressively approved, a construction project proposal reached the Australian Minister of the Army, who then routed it through his own office for the completion of various administrative checks and actions. This set in motion a number of intradepartmental committees and conferences which usually made requests on USASOS for additional detailed engineer data or expert testimony to further substantiate the need for the requested project.

In view of these time losses, USASOS had established a working agreement with the Allied Works Council whereby AWC would initiate construction immediately upon receipt of a USASOS requisition without waiting for completion of financial arrangements. (See Chart No. 1.) The Allied Works Council did this with the knowledge that the United States constantly maintained an allotment of several million dollars in its construction account in Australia to cover the possibility of any insurmountable administrative impasse wherein Australian funds could not be made available. Nonetheless, the Australian War Cabinet never fully concurred in these expedients to get construction underway, and throughout 1942 and 1943 considerable correspondence was exchanged between Allied military and Commonwealth authorities on the topmost level in attempts to bring about a satisfactory solution to this problem. As an example: [4]

[3] *Editor's note:* USASOS, purely a service organization, had the primary task of providing service support for USA forces in the Theater in terms of GHQ, SWPA, directives.

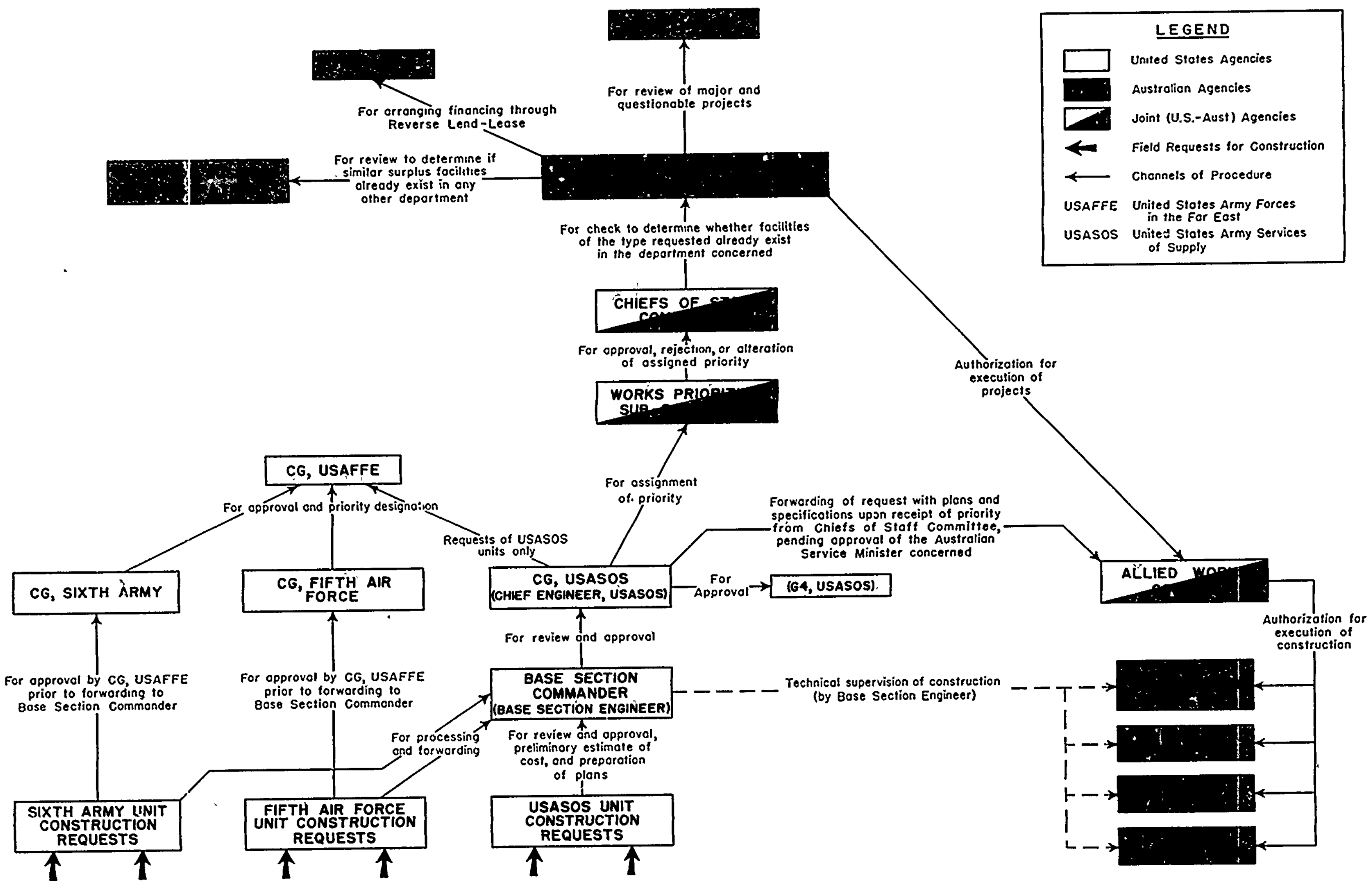
[4] Ltr, CinC, SWPA, to The Prime Minister of Australia, 14 May 43, no sub. In Records Section, GHQ, SWPA.

FLOW CHART

AUTHORIZATION PROCEDURE–U.S. CONSTRUCTION PROJECTS IN AUSTRALIA

(Costing over £5000 and undertaken by the Allied Works Council)

JULY 1943



SOURCE: OCE, GHQ, AFPAC (Historical)

CHART NO. 1

GENERAL HEADQUARTERS
SOUTHWEST PACIFIC AREA

A. P. O. 500,
May 14, 1943.

My dear Mr. Prime Minister,

I have received and carefully considered your letter of March 20th and its enclosed "Suggested Procedure for American Works Projects."

On the whole and insofar as it corresponds with that followed during most of the past year, the suggested procedure has worked well. There are, however, two aspects of the conference's recommendation which must inevitably cause serious delays in starting construction and which, therefore, I believe inefficient and undesirable. These are the requirements that the Australian Services and departments shall review the projects given a priority by the Works Priorities Sub-Committee and approved by the Chiefs of Staff Committee and that the Allied Works Council shall not commence work until ministerial or secretarial approval has been given.

There is grave danger of seriously retarding the war effort, if the projects planned and considered by military and naval experts must be reviewed and passed upon by authority after authority. I do not and cannot have any objection to the submission of the construction requirements of the United States Forces with full explanations to a competent board of review, nor can I object to the procedure necessary to keep the companion services or departments of the Australian government adequately informed of the United States program. The interested services and departments, however, are represented on the Works Priorties Sub-Committee and the various representatives on that Sub-Committee are free to seek the advice of any of their service or departmental associates in forming an opinion as to items on the agenda. To have a further review of a project by any service or department acting entirely alone, is a duplication with consequent waste of valuable time, and therefore detrimental to the true interests of all concerned.

I also recognize the validity of cabinet control of the financial aspects of the program, but no administrative process should prevent the start of construction until the details of payment have been worked out.

As a practical exemplification of what I mean, some thirteen United States projects, approved by the Chiefs of Staff Committee, have not yet received ministerial approval and the Allied Works Council is becoming increasingly reluctant to continue work on them. . . . As some projects have been in the hands of the appropriate Minister since February, it is apparent that the proposed procedure has already proved unwieldy, slow and consequently unsatisfactory in actual operation.

I solicit such action as you may deem appropriate to remedy the present stagnation, which unless prompt steps are taken can be expected to further rapidly deteriorate.

Most sincerely,
DOUGLAS MACARTHUR

The Right Honorable John Curtin,
Prime Minister of Australia,
CANBERRA, A. C. T.

It is not intended to convey that bureaucratic methods are never necessary in connection with budgetary control in times of peace. But in time of war when the life of a country is at stake, some review and analysis of these procedures should definitely be made with the view of streamlining them to a minimum of administrative control regardless of monetary cost. Economy has its place, but in time of war anything saved at the expense of speed is too often an investment in defeat. Speed and success are synonymous in war. Regardless of cost, quick, decisive action must be maintained. Some modification in administrative procedure was eventually effected, but all delays could not be overcome.

The Corps of Royal Australian Engineers (RAE) operated under even more considerable procurement difficulties. Australian military personnel responsible for troop supply did not have proper authority for procurement. Funds for purchases were made available only after the military requirement had been approved by a succession of civil and departmental authorities to whom the Australian Government had delegated authority over the Army. These authorities, who had little knowledge of military requirements and no direct responsibility for the success of military operations, had the power of veto and delay, and had to be convinced that the service need existed. Australian Treasury control appeared always to be greatly influenced by the views of these civilian officials who seemed unable to understand that in war the question of cost is not paramount.

A group of RAE officers in a brochure of lessons learned from World War II stressed the difficulties imposed upon their operations by these procedures and recommended the following corrective measures: [5]

i. It would be of advantage to have in the Government more men who have served their country in the Armed Forces in war.

ii. Military officers should be given authority commensurate with their responsibility. Should this authority be improperly exercised, or should the Government lack confidence in its senior army officers, they should be replaced, not rendered impotent.

iii. Those in control should realise that the dominant factors in war production are manpower and materials, rather than money.

These are not proposals for the elimination of Parliamentary control. However, attention is drawn to the fact that the Government failed to accept its responsibilities, by delegating authority over the army to boards, committees and advisers, who had no direct responsibility for the efficient working of the army, no adequate knowledge of its requirements.

In USA the Army prepares the estimates between January and March; they are considered by Congress between April and June, and passed by it either in toto or in part by mid-June. On 1st July funds are paid by Treasury into the Army accounts. These are then expended in a normal business way by the Army officers. The USA method is recommended as it associates authority with responsibility.

Other factors also contributed a hampering effect on Australian support to military engineer operations. When the imminent danger of invasion had passed, some Australian interests naturally became more or less postwar-minded. This attitude partially nullified certain endeavors to reduce the burden on supply shipping from the United States. Local supplies of lumber appreciably diminished. New shipbuilding for postwar activities reduced available manpower and consumed steel which was needed for more urgent construction. The USASOS program of prefabricated building production encountered considerable difficulty. Construction of assembly facilities for engineer landing craft fell behind schedule. As the threat to their mainland diminished, some Australian civilian and commercial efforts in pressing the war to a speedy and successful conclusion waned and became diverted to planning for peacetime endeavors.

[5] RAE, n.d., Some Lessons from the War, 1939–1945 (Ms). In Records Section, GHQ, SWPA.

However, beyond the differences and difficulties which are almost axiomatic when joint operations must be initiated in an Allied country, Australian–American cooperation and coordination played a considerable part in supporting the offensive combat missions which eventually led to a mutual victory. The U. S. Engineers were indebted in no small measure for the tremendous assistance provided by the Australian Commonwealth in the successful accomplishment of the over-all engineer mission.

U. S. Engineer Troops

In this undeveloped theater of operations requiring a preponderance of engineer troops, there was actually a galling shortage. Basic engineer needs in the Theater were, in order, engineer troops, more engineer troops, and then, more engineer troops. As previously indicated, progressive increments of U. S. Army Air Forces operational elements increased the extensive construction responsibilities of the limited and unreinforced engineer units available. The immediate and heavy demands for airdromes with their pertinent access roads, ports, and supporting facilities required a maximum output of all available engineer effort. As a consequence, with only one engineer aviation battalion in the Theater, it became necessary to utilize the two engineer general service regiments available almost solely on airdrome construction. Similarly, it became necessary to convert the two engineer battalions, separate (colored), both unadapted by training, organization, or equipment for heavy airdrome construction, into engineer general service regiments to spread the thin construction potential as far as possible.

These two engineer battalions, separate, were over 1,200 in strength and, as constituted, had too few officers for the large unwieldy companies and too little equipment for efficient performance of construction work. Disciplinary trouble and lack of sufficient supervision had resulted in a somewhat low standard of performance in contrast to the superior performance of the engineer aviation battalion and the engineer general service regiments on the same type of work in similar environment. Therefore, authority was obtained to reconstitute these two battalions into two general service regiments, each of two battalions of three companies each, to permit greater officer and noncommissioned officer supervision and an increase in organic heavy equipment. Additional officers were provided to make up the difference in authorized commissioned strength, and the slight increase in enlisted strength involved was assigned locally from replacements. Local resources were utilized to the fullest extent for additional heavy construction equipment authorized, and the working power of these battalions was thereby almost doubled.

On occasion an Allied Air Forces or U. S. Fifth Air Force tendency to direct movement of specific engineer units to certain airdrome sites, indicating type of methods and construction, was noticed. Recurring pressure for the allocation of engineer aviation units solely to the air forces had to be actively resisted in the interest of efficient execution of the over-all engineer construction mission. *It was pointed out time and again that an airdrome in itself was wholly helpless unless the necessary roads, ports, and oil storage facilities, plus a degree of hospitalization, warehousing, and similar service support, were provided.* Then, too, nothing would be gained by establishing two independent construction forces operating in parallel on the same construction program, even if economy of force was not of the essence. Both would have to draw upon the same limited Theater reserve stocks of construction equipment, materials, spare parts, lubricants, and transportation. It was, rather, necessary to pool Theater engineer construction elements, whether engineer general service or engineer aviation units, under the service organization responsible for over-all Theater construction (USASOS—initially designated USAFIA), with priority of effort applied in accordance with relative precedence of urgent requirements already established by the Theater commander. *The need, not the branch of service, was the determining factor.* Construction was, therefore, combined and integrated while priorities were adjusted here and there to produce at each location an efficiently functioning and complete military installation instead of one or more unsupported parts dependent upon future construction for their effective combined operation.

Actually the air forces construction program benefited the most from this pooling of engineer construction resources under one command. Economy of engineer force stems from control of all engineer troop unit dispositions being maintained at the highest headquarters level. While the only engineer aviation battalion initially available in the Theater was diverted when necessary to other than airdrome construction, various other engineer units in the Theater were almost continuously diverted from ground force construction assignments to urgent airdrome construction and even to perform ground crew work for air units. Engineer dump truck and general service units were utilized for long periods hauling gasoline and bombs and loading bombers. These activities were quite apart from normal engineer functions but were countenanced and executed with the knowledge that the job had to be done by whatever means available.

There is, during wartime, a definite need for flexibility of organization and speed of operations. Assigning engineer aviation units to urgently needed general construction elsewhere, and engineer general service units to air forces construction when necessary was a considerable timesaving expedient to the limited engineer troop strength available. The movement of engineer units with their heavy equipment constitutes at all times a heavy drain on transportation. This can often be avoided by assignments of missions to engineer units in the general locality, irrespective of the designation of the units. Aviation engineers, simply because of their descriptive title, should not be considered as being *earmarked* solely for airdrome construction in a theater of operations. Any type of engineer unit in SWPA was applied to any and all types of construction missions with no arbitrary division drawn or allowed to slow down operations. However, when engineer units through training and experience showed a special aptitude for particular work, such as road or airdrome construction, for instance, they were utilized, whenever feasible, for the type of work for which best adapted.

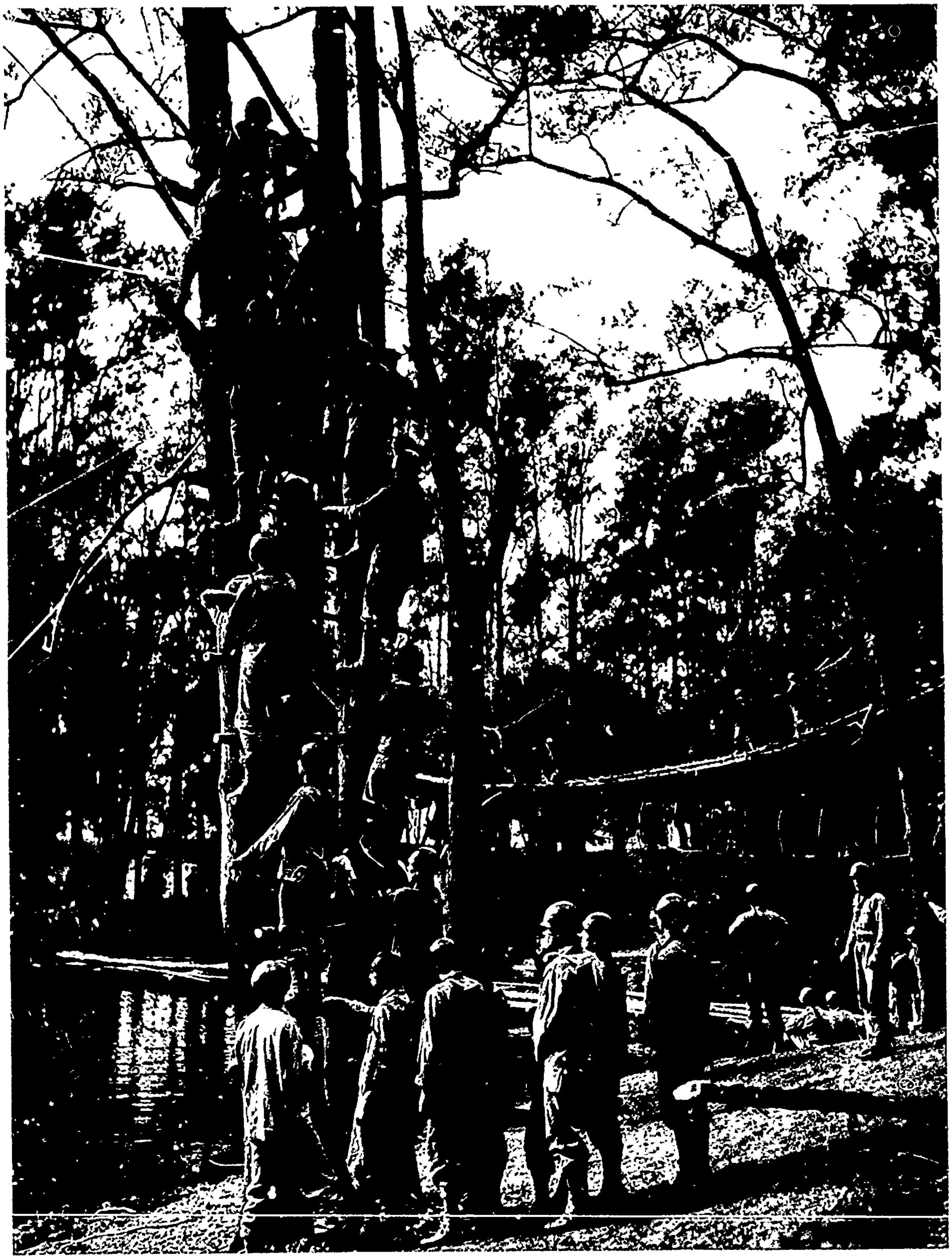
Engineer construction units were not the only engineer component in short supply during these initial counteroffensive preparations. Despite repeated requests for an engineer maintenance company to provide adequate repair and upkeep services for the extensive amount of plant being employed, none was received throughout 1942. Only one engineer depot company had been provided for the entire Theater, and this was, of course, woefully inadequate to handle the tremendous quantity of engineer equipment and materials to be processed, besides effecting the complicated receipt and issue of spare parts. Moreover, this single company had to be broken up into small detachments to administer over-all engineer supply operations at numerous localities in an area extending over 2,000 miles from Port Moresby, New Guinea, to Melbourne, Australia.

All U. S. Engineer units in the Southwest Pacific, with the exception of engineer combat battalions, had limited opportunity for continuous and progressive engineer training. The extensive amount of engineer construction required, the divergence of such construction over the vast extent of the Australian Continent with its limited communication facilities, and the extreme urgency for rapid development made it necessary to employ all available engineer troops on actual construction. However, all these engineer units, in addition to their normal engineer functions, were liable to be committed to action as combat reserves. It was, therefore, essential that they receive some instruction in combat principles including use of small arms and special weapons, security on engineer operations in movement and bivouac, signal communication in combat, defensive combat exercises, and sufficient precision drill to insure smart and well-disciplined military units. One day a week, when possible, was allocated to such military training, and although initially a handicap to construction activities, this training subsequently increased the work output of these men. Needless to say, when called upon to face combat operations, such training proved a deciding factor in the success of over-all operations.

The applicatory system of engineer training was constantly stressed, whereby training in the specific principle concerned was given under assumed tactical situations. In this way, the units, in addition to the technical instruction received, were also trained in the execution of their engineer operations under conditions which might subsequently be encountered in actual combat or in forward operational areas.

Similarly, all troop units should be instructed to observe proper camouflage discipline by dispersal of vehicles and shelter and by utilizing maximum existing cover. Inspections as late as 1943 found camouflage and camouflage discipline generally deficient in Australia and even in New Guinea. Numerous white tents existed in almost every Australian camp visited. Regardless of a lack of paint and dyeing materials to camouflage these tents, there was no apparent excuse for failure to use local materials to attain a degree of camouflage. The white tents could have been immersed in mud puddles, grass stained, or similarly camouflaged by other methods. Unless all troops are routinely trained in this respect, serious losses can result from initial enemy aerial operations. Obviously units cannot be transformed overnight into being thoroughly trained in this particular. Long before an emergency is imminent, stress should be placed on insuring that all units exercise proper camouflage discipline during all training periods.

One highly successful training procedure was to assign U. S. Army Engineer replacement personnel with Australian Engineer reinforcement

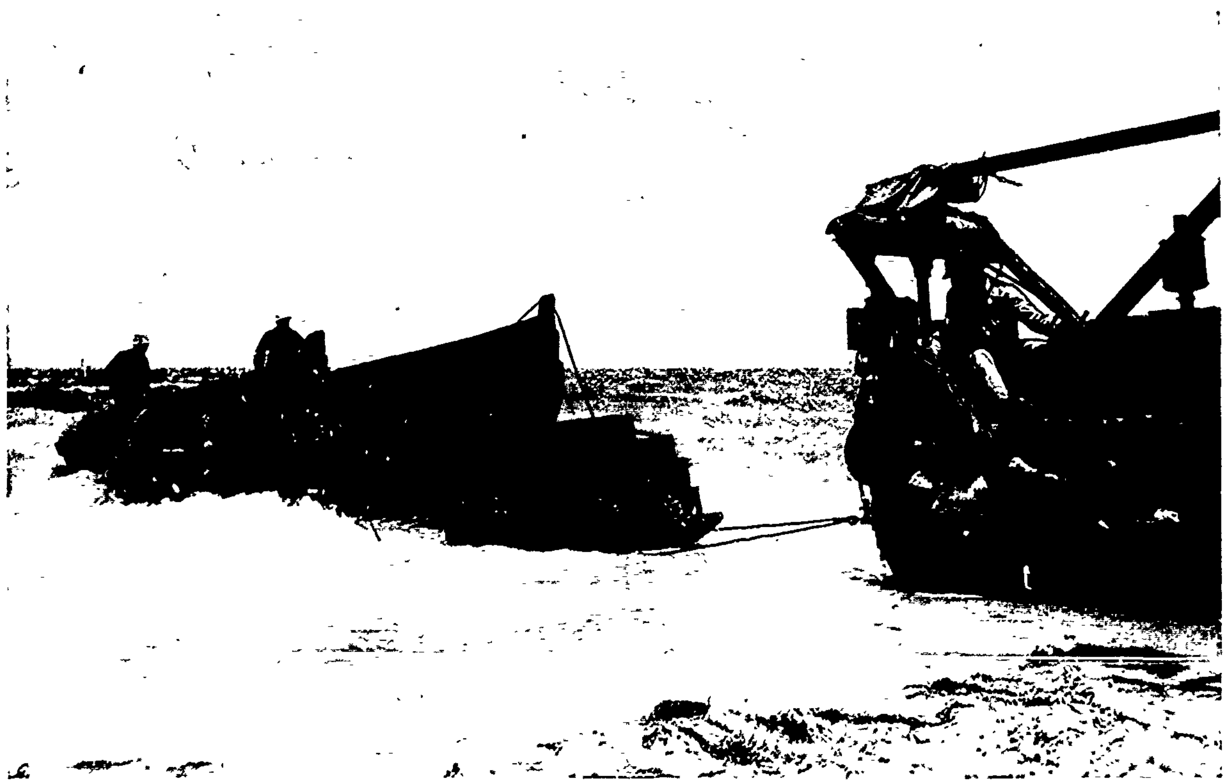


Engineer unit training in Australia with river crossing expedients.

General Douglas MacArthur inspecting Engineer training at Camp Strathpine, Australia.

Engineers construct a bridge while on a 3-day tactical problem at South Yorkies Beach, near Cairns, Queensland, Australia.

Engineers stage a realistic assault landing on the beach of the Amphibious Training School at Toorbul Point, Australia.



Engineer bulldozer hauls a sled load of rations ashore from an LCVP during training maneuvers at Toorbul Point, Australia.

Platoon Drill, 648th Engineer Topographic Battalion, in front of Base Map Plant, Melbourne, Australia.

Inspection of the 1603d Engineer Map Depot Detachment on roof, BMP, prior to establishment of forward map depot at Finschhafen, New Guinea.

components at the Royal Australian Engineer Training Center at Wagga Wagga, New South Wales. United States Army Engineer units, because of shortages, were already using certain Australian equipment. Through this combined training, utilizing the same equipment and training aids for both elements, mutual savings of teaching personnel, equipage, and space were effected. Constant improvements were made in the training schedules to keep the training center abreast of the most recently developed engineer doctrines, and aside from any technical advantages gained, this training increased considerably the mutual understanding between U. S. and Australian Engineer troops.

Mutual appreciation and understanding in themselves ofttimes provided the means for broadening of vision, furthering experience, and perfecting procedures for the future. Prior to the war, very few Royal Australian Engineer (RAE) officers in the permanent military forces had had more than minor engineering experience. Most of these officers had been engaged on administrative duties which provided little chance for engineer training. The lack of opportunities for acquiring advanced engineering experience in Australia's permanent military forces, however, was soon recognized by the Australian Engineers after extended service with U. S. Army Engineer personnel as evidenced by their post-hostilities recommendation to correct it:[6]

> It would be of great value to the nation [Australia] if the Corps of RAE were constituted similarly to the Corps of U. S. Engineers, and executed major national works in peacetime. Not only would the officers acquire engineering experience in major works, but in time of war there would be much less strain on civilian engineer resources.

Engineer Equipment

Promptly upon initiation of engineer operations in Australia and New Guinea, a need for almost complete mechanization of construction units with increased operator ratings for the future manifested itself. Upon entry into World War II engineer doctrines under existing Tables of Organization and Equipment presupposed that many engineer tasks performed by either combat or general service engineer troops would be principally accomplished on a one-shift basis by hand labor supplemented by a small number of machines. Actually the reverse was true, and the extremely important construction program was completed only by virtue of employing mechanical means wherever possible on a 24-hour, 7-day-week basis.[7] For the most part, picks and shovels rusted in the Southwest Pacific, while graders and dozers were stopped only for maintenance purposes.

In order to accomplish the necessary work with the pitiably limited engineer troop strength and equipment available, the maximum use had to be made of the more productive equipment. For instance, even the small Osgood (*mess kit*) or similar type power shovel could in one pass excavate the amount of earth it would require a man from half to three-quarters of an hour to dig. The Osgood could load a 1½-ton truck in 1 to 2 minutes, employing three men: the shovel operator, the truck driver, and the truck spotter. It would take ten men, in addition to the truck driver and squad leader, about 15 minutes to load an equal amount by hand shoveling. It was obvious that even this inadequate mechanical plant produced more in less time and required fewer men on the operation. It was equally obvious that no productive machinery could be allowed to stand idle 12 to 16 hours a day because only one operator was authorized by Tables of Organization and Equipment. As a consequence, multishift operation was adopted despite lack of training, organization, operator ratings, and prevailing basic doctrines.

In these early chaotic days even around-the-clock operations could not balance the shortage of productive equipment. United States Engi-

[6] *Ibid.*

[7] *Editor's note.* Tables of Organization in time of war should definitely provide for 2 or 3 operators per unit of heavy equipment in the interest of over-all conservation and effectiveness.

neers had to rely to a great extent on the Allied Works Council for the supply of additional equipment and spare parts. They also exploited sources of civilian equipment already available in Australia in order to equip engineer units for the jobs they had to perform. This involved, necessarily, the procurement of nonstandard equipment of varying models and ages. Everything available had to be utilized, which, of course, resulted in further aggravating the already insurmountable difficulties of the maintenance situation. There was no engineer maintenance company, and, as previously indicated, the only engineer depot company was necessarily decimated into ineffective detachments throughout the vast expanse of the Theater. By the end of 1942, all construction equipment, intensively engaged under difficult operating conditions, generally on a 24-hour basis, required heavy replacements.

Yet the efficiency of engineer operations was based largely upon the efficiency of equipment. Because of the exceptionally hard service required of engineer plant, its efficiency was poor and breakdowns were frequent. Repair and maintenance, on the other hand, were complicated by lack of standardization. For example, it took 132 different engines to run the equipment normally issued to engineer construction units, whereas only 5 engines of different speed and power characteristics were actually necessary to power the same equipment. As another example, when the 46th Engineer General Service Regiment arrived in Australia from the Zone of Interior, they had 7 dozers of 5 different manufactures. This would have provided excellent training in peacetime, but at the far end of a tenuous supply line in wartime, it seriously curtailed engineer equipment operations. Such instances clearly evidenced that the procurement and issue of standard makes and models of engineer equipment with a maximum of interchangeability of parts, at least for distant operational theaters, should be unequivocally demanded for the future.

Construction

Airfields

The construction of airfields was the most important single engineer construction responsibility in the Theater. Basic design criteria for airfields, however, soon proved unsuitable to meet the special conditions encountered and a completely new set had to be devised under stress. In March 1942, official airfield design standards contemplated a clearing 1,000 feet wide with a pavement 300 to 400 feet wide along the center line of the clearing. Airdromes were to consist of three crossing runways in the direction of the three principal winds. Runway length was to be determined by the type of aircraft for which constructed; fighter aircraft required a length of 3,000 feet, medium bombers 4,000 feet, and heavy bombers at least one runway of 5,000 feet. The fluidity of the tactical situation, however, was such that any runway might have to accommodate any or all of the three types of aircraft. Consequently, all construction had to be designed to care for the greatest possible requirements. Furthermore, the overloading of aircraft operating over much greater distances than contemplated in their design, increased the take-off run and required extension of the clearance zone beyond the end of the runway. Another factor was the condition of aircraft returning from combat with defective hydraulic systems and battle-weary pilots. As a consequence, airfield lengths were nominally set at 7,000 feet with reasonable decreases being accepted where necessary.

Length was stressed over width. It was considered that even a battle-weary pilot, wounded, with defective reaction time and vision, could successfully aline his aircraft in prolongation of a narrow field. He could not very well control his air speed, his actual point of touching the pavement, or the length of his landing run, but he could aline his aircraft on any runway if its length was adequate. Earliest revised designs, therefore, with few exceptions, called for runways paved 100 feet wide with 25-foot aprons on either side, which permitted the extra construction effort formerly required for provision of wider runways to be applied to increased length. In no case observed did an aircraft crack-up occur because of running off a narrow pavement.

The layout of three crossed runways, as had been followed initially in airdrome construction to the north and west of Townsville (see Map No. 4), Australia, was also soon discarded. It became apparent that the stall-in, three-point type of landing was a peacetime maneuver for aircraft of slow landing speed. All combat aircraft in the Theater tended to land on two wheels at speeds approximating 100 to 125 miles an hour. Therefore, a moderate crosswind made little difference in either landing or take-off, and alinement of runways to cover all directions of varying winds was unnecessary. Another factor in influencing the decision to discontinue this type of layout was the vulnerability of crossed runways. Enemy bombs dropped at the intersection of two or more runways could effectively put all of them out of action. In addition, this type of construction had consumed time and tied up heavy earth-moving equipment, both of which were seriously limited. The crossing of runways required careful surveying and subsequent balancing of cuts and fills since the grade at the intersection was, of course, the governing elevation of all runways. However, by eliminating the intersection, each individual runway could be located separately to make optimum use of the ground without regard to a governing grade not required by the runway itself.

Development of maximum effective air strength was naturally dependent upon the availability of fully operating airdromes capable of handling all air traffic demands. These demands, usually increasing by increments, were, therefore, satisfied by the successive construction of parallel runways where needed. At locations where intense and hazardous operations were sometimes required, these were supplemented with a crash strip for malfunctioning aircraft returning from combat.

At the very beginning of construction operations in the Southwest Pacific, the need for close coordination and understanding between Allied Air Forces elements and Theater engineers was evident. They are a mutually dependent, inseparable team. Neither could function without the support of the other. The need for mutual confidence in each other's performance of their mission immediately arose when the engineers went into the Northern Territory and Queensland areas of Australia and into portions of New Guinea (see Map No. 3) during dry weather to establish a maximum number of airdromes of minimum operating characteristics as quickly as possible. There was the strong possibility, of course, that these airdromes would not be 100 percent operational before the advent of the rainy season. However, dry weather was ahead, and the engineers' immediate concern was to build as many lightly built airdromes as possible in the least time to provide a greater dispersal of aircraft and the maximum number of points from which to operate. The Allied Air Forces, concerned also about continuing operations into the rainy season, were naturally apprehensive of "bogging down." The engineers, however, adhered to their basic plan. Instead of assigning all their limited construction resources on one airdrome of permanent, all-weather construction at a time they divided them and hastily set up the greatest number of dry-weather fields possible.[8] A tremendous amount of such work was done at Horn Island (see Map No. 4), Jacky Jacky, Iron Range, and numerous other airstrips on the Australian Continent, and on those in New Guinea,

[8] *Editor's note.* In northern Queensland, airfield construction was initiated at the beginning of approximately 9 months of dry season. In the interest of conserving a limited engineer potential, drainage work at that time was largely postponed since it would not be needed for some time, and the tactical situation could readily change so as to eliminate the necessity for any further construction in any particular locality. However, this initial experience was not good unit training for situations later encountered where intense tropical downpours set in at any time.

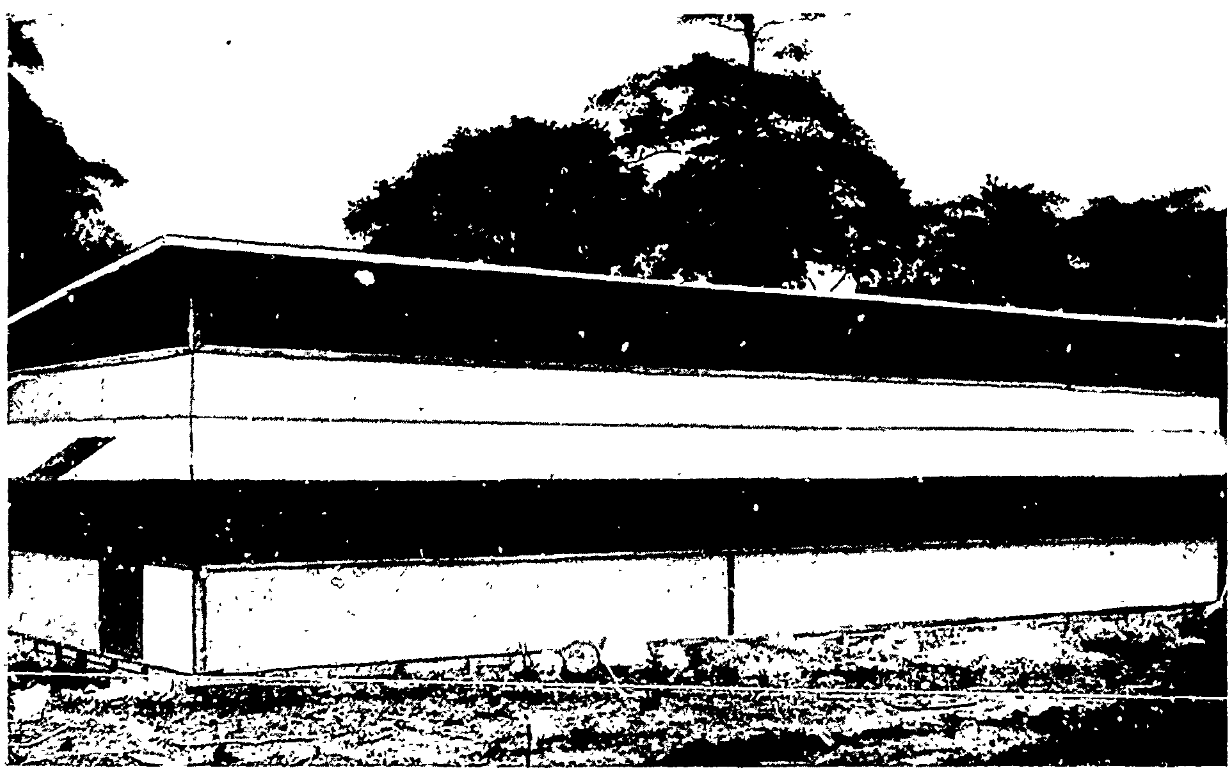
especially at Milne Bay. As it developed, these met the operating requirements of the Allied Air Forces with relatively few difficulties even during the first few days of intense rainfall. Engineers gradually improved and strengthened these lightly built fields as additional equipment and transportation became available, and, in the meantime, air operations were facilitated by the flexibility of operations which the availability of a maximum number of airdromes afforded. Furthermore, before the advent of the rainy season, some dry-weather fields had already been abandoned in keeping with the rapidly changing air strategy within the Theater. Accomplishment of the engineer mission for the Allied Air Forces, according to engineer plans, therefore, paid excellent dividends. Adherence to the original plan not only provided adequate support to the air forces, but materially reduced the expenditure of the limited engineer potential.

While for the most part coordination of air and engineer plans worked to the mutual advantage of both, there were, unfortunately, occasions when coordination wavered. On 20 November 1942 the commanding general, USASOS, issued a bulletin which outlined Theater construction policy and served as a guide for the scope of construction projects incidental to the maintenance and housing of U. S. troops in the Southwest Pacific Area. This construction policy was issued with the approval of the Commander in Chief, GHQ, SWPA, and covered the preparation of building schedules for all Theater projects with the purpose of holding all construction to a minimum. Specifications promulgated were to apply with equal force to installations of any branch of the U. S. Army whether Air Forces, Ordnance, Signal, Quartermaster, or Engineer. Despite this policy, certain U. S. Army Air Forces elements on occasions succeeded in having exceptions made in their favor, and critical engineer materials continued to arrive at airdromes under consignment to some air unit to the detriment of the over-all construction program for which the engineer of a base section was technically responsible (see Map No. 4). These construction refinements for U. S. Army Air Forces elements, which also later entered into construction in forward areas, consumed time, labor, and valuable construction materials and equipment besides affecting adversely the morale of troops not so indulged.

Igloo Arch

Such instances could not, of course, be allowed to adversely influence the engineers' primary construction mission of support to the Allied Air Forces. To this end every conceivable effort was dedicated. In the early days of the war the Allied Air Forces did not have the air superiority necessary for an air offensive which would have provided the best defense. Instead, they were driven to extreme measures in trying to protect the limited aircraft available while on the ground. Camouflaged airplane recesses had not been provided on many of the new airfields in SWPA, yet in time of war, and especially prior to attainment of air superiority, these should have been provided on equal priority with corresponding runway construction. On Royal Australian Air Force airfields, blastproof plane pens requiring a large expenditure of equipment, materials, and labor were being constructed in open areas visible to the enemy. Although such pens provided a moderate degree of protection from bombing operations other than a direct or near hit, aircraft located therein were very vulnerable to strafing attack. Conversely, an aircraft which could not be seen, had less probability of being hit. Moreover dispersed camouflage concealment would effect a major dissipation of enemy air effort. Therefore, an early provision of camouflaged airplane recesses which could be established more expeditiously within limitations of labor and equipment merited immediate consideration. If necessary, they could ultimately be expanded to provide interior blastproof revetments.

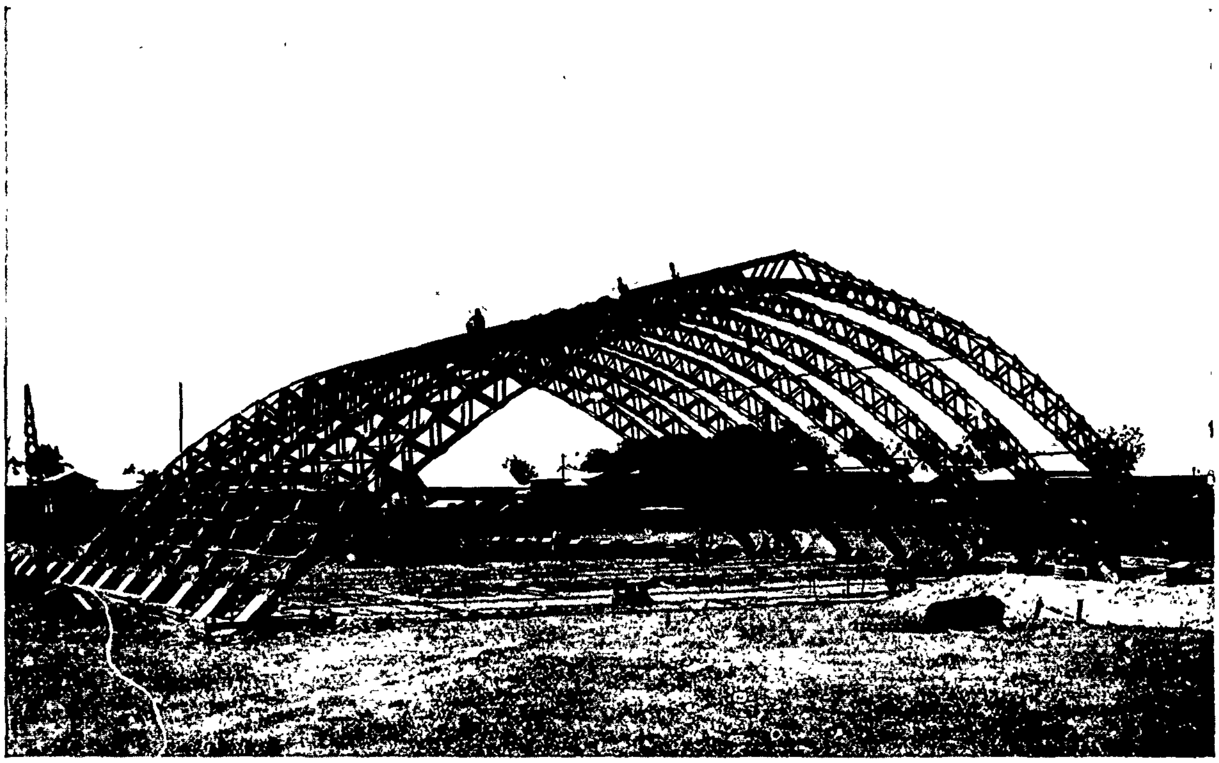
Native-style headquarters structure established through maximum use of local supplies and a minimum expenditure of troop labor.



In the same general area as the structure above, a modern, temporary headquarters structure which required imported supplies and considerable expenditure of troop labor.

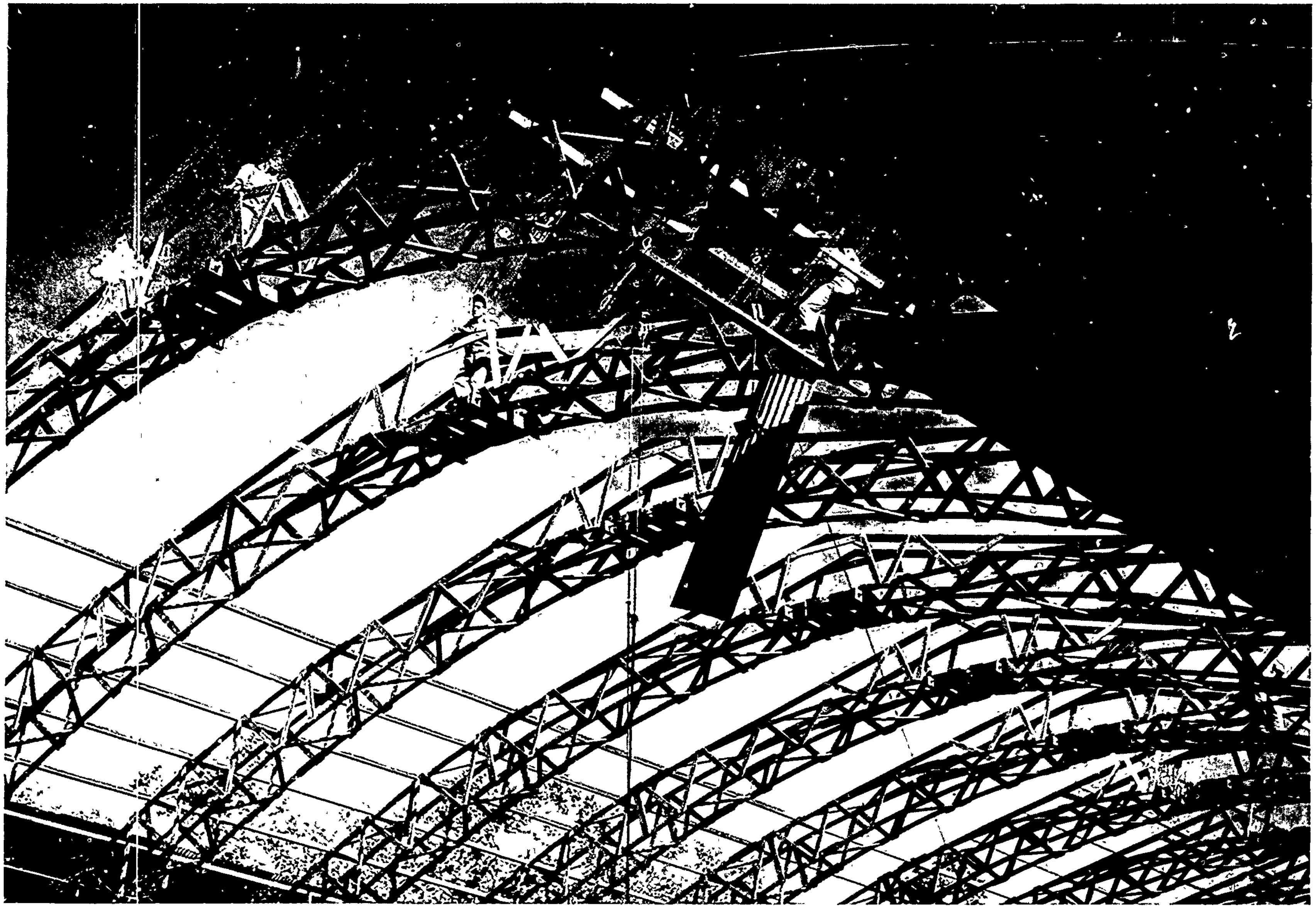
Plane pen construction which required large expenditures of engineer equipment, materials, and manpower.

Close-up view of a partially concealed plane pen, or earth revetment.



Igloo frame prior to addition of hideout camouflage or hangar roofing.

Completed Igloo-type aircraft hangar at an airdrome in Australia.



Close-up view of Igloo frame consisting of box-type arch girders fabricated from scrap lumber economically and rapidly.

Something had to be improvised, within the means available, something simple yet practical in forward areas, to provide dispersal, camouflage, and revetments for grounded aircraft. To meet this condition the *Igloo arch* was developed by an Australian engineer, a French engineer, and the Chief Engineer, GHQ, SWPA. This arch was made up of small pieces of scrap-size lumber, principally 1 by 3 inches, and, with subsequent addition of a corrugated iron roof, provided a form of covered storage which 30 semiskilled men could erect in about 9 to 12 days. Designed initially as a frame for camouflage cover, this igloo-type construction was also subsequently used extensively for warehouses and hangars and was illustrative of adjusting designs to conform with local limitations of materials and manpower.[9]

Engineer Administration vs. Command Channels

Adjustment and adaptability seemed to be the key words for engineer operations following General MacArthur's arrival in Australia and the subsequent change in tactical plans. Restricted in manpower, hopelessly underequipped, and desperately short of materials, the engineers could permit no potential medium of improving efficiency to remain unexploited. During this early period preparatory to initiation of the Allied offensive in the Southwest Pacific, all U. S. Army Engineer units in Australia, except for the combat battalions organic to infantry divisions, had been assigned to Headquarters, USASOS (initially designated USAFIA). Individual units, in turn, had been reassigned by USASOS to one of its seven base sections in Australia (see Map No. 4) for the performance of engineer work. Because of the extreme shortage of construction units, particularly engineer general service regiments, and the closely integrated engineering effort required in the development of the forward areas, this consolidation of control of engineer units was a sound Theater policy. Despite considerable pressure from Allied Air Forces to secure engineer units under their direct control, adherence to this policy of consolidated control was the only possible means of accomplishing over-all engineer responsibilities throughout the widespread area of operations with the limited engineer troop strength available. A definite problem affecting the orderly progress of the accelerated development work, however, was interposed by the Services of Supply (later Army Service Forces), War Department, doctrine of the command responsibility of the base section commander.

The base section commander was the immediate and responsible superior of the base section engineer who, in turn, in addition to other established engineer duties, was responsible for active supervision of construction work within the geographical limitations of the base section. The base section commander reported to the commanding general, USASOS. Within the general staff supervision of G–4, USASOS, the Chief Engineer, USASOS, was responsible for all construction, but did not command the engineer units nor procure directly any of the materials needed. He likewise had no authority over shipments of equipment or materials. Except for a close technical relationship with the Chief Engineer, GHQ, SWPA, he was, in fact, isolated from the Theater planning staff by submergence beneath two intervening organizational layers of staff and command.

Had the base section commanders been properly indoctrinated in the importance of construction and its problems, difficulties would have been lessened. But, unfortunately, some were not sufficiently trained in this phase of their command responsibility. Prewar policies throughout the various arms and services had generally confined the training and activities of officers to their own particular branches. The various officers' knowledge of the policies and procedures

[9] *Editor's note: See* Vol VI, *Airfield and Base Development,* this series, for Igloo design details.

observed by other branches than their own was, therefore, more or less superficial. Under the circumstances, the lack of understanding on engineer matters by some personnel on the higher echelons of staff and command was only normal.

Further, the base section commanders were subject to much shrewdly applied pressure for special construction work on *pet* projects. In some instances battalion-months of engineer effort were diverted from top-priority essential construction to such projects, or wasted on essential projects because of poor site locations insisted on through command channels. The cures were obvious, but probably unpalatable: the establishment of a construction command independent of the supply and housekeeping functions for which base section commanders were responsible, and for which purpose base sections were really established, or the proper education and disciplining of senior officers of all arms and services, or both.

Already adapted to problems of unprecedented scope, however, the U. S. Engineers in the Theater were not long deterred by complexities of command in their own limited forces. These could be, and were, short-cut by personal factors. Mutual acquaintance, loyalty, and confidence proved a ready match for any cumbrous confinements of command. The Chief Engineer, GHQ, SWPA, was on the staff of the Commander in Chief, and in a position to be more fully informed than any other Engineer officer of the plans and policies of the Theater commander. In emergencies he issued instructions in the name of the Commander in Chief with full assurance of subsequent confirmation. He frequently inspected construction in all sectors and suggested the most practical engineer procedures to the base section commanders for construction of their requirements. Even the majority of these non-engineer base section commanders recognized the fact that although these suggestions were in no sense orders, they nevertheless reflected opinions based on knowledge of top-level plans for the future, and that, if necessary, such suggestions could be processed and promulgated as orders. The coordination of policies thus achieved by such personal contact conserved considerable engineer effort and time, the least expendable elements available during this trying period in Australia.

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CHAPTER III

Papuan Campaign

July 1942–January 1943

The Engineer Situation

While the Allies were consolidating their forces within a newly formed system of Australian bases in readiness for their first aggressive move in the Southwest Pacific, the Japanese had opened a new offensive in New Guinea that threatened Port Moresby and Milne Bay. Initial enemy landings in the Buna area on 21 July 1942 had been followed by troop reinforcements during August. Although prevented from developing a major operating base at Buna by U. S. air attacks, and repulsed by Allied ground action at Milne Bay, the Japanese steadily built up their forces on the Kokoda Trail and continued to push overland toward Port Moresby. (See Map No. 5, "Orientation Map, Papua and Northeast New Guinea, 1942," and Chronology.)[1]

The resultant Allied counteroffensive necessitated a concentration of troops in the southeastern end of New Guinea which strained shipping resources and supply services to the utmost. Base installations in Papua, such as port facilities for heavy shipping, roads for the distribution of supplies to depots, and buildings for hospitals and the protection of supplies against the extreme heat and rain, were still inadequate at Port Moresby, virtually only initiated at Milne Bay, and entirely lacking in all other Allied-held forward areas. These facilities had to be developed concurrently with the counteroffensive. However, the movement forward of engineer construction supplies proved a limiting factor, particularly in the early days of the campaign. The shortage of available shipping in the Theater restricted major space allocations to tactical units and supplies urgently required for combat operations in New Guinea. The inadequacies of unloading docks and facilities in the forward areas, on the other hand, retarded unloading and turnaround of shipping and further taxed transport resources.

Under conditions which demanded a greater proportion of service troops than normal, there was actually a critical shortage. As late as December 1942, when Allied combat operations had progressed to the point of centering on the capture of Buna,[2] U. S. Engineer units in that

[1] *Editor's note: See also* Map No. 14, "Original Japanese Landings, Milne Bay, 25 August 1942," and Map No. 15, "Principal U. S. Combat Engineer Operations Prior to the Attack on Buna, New Guinea, September–December 1942," Vol I, this series.

[2] *Editor's note: See* Map No. 16, "The Capture of Buna, 15 December 1942–3 January 1943," Vol I, this series.

general operational area comprised only the 114th Engineer Combat Battalion (divisional engineers, 32d Division), two companies of the 43d Engineer General Service Regiment, one company of the 46th Engineer General Service Regiment, and one company of the 116th Engineer Combat Battalion (divisional engineers, 41st Division) attached to a regimental combat team. These units were all that could be spared from other vital engineer operations elsewhere.

Reconnaissance and Planning

Development of bases, such as were required in New Guinea, should receive months of methodical engineer planning. All essential details, such as itemizing the actual loading and scheduling the arrival of engineer supplies into the operational area, should be definitely developed and adapted to the proposed order of subsequent engineer operations. However, the Allies were so short on time that even advance information on ground conditions to be encountered, the basic element upon which such plans are formed, was either too generalized or entirely lacking. Neither the United States nor its Allies had undertaken an adequate peacetime program for the gathering of this information. Therefore, the engineer information and intelligence available was found to be inadequate for the proper orientation of Engineer officers unaccustomed to the terrain and climatic conditions in New Guinea. Similarly, practically no detailed data were available on spot areas which were projected to become the sites for large base developments. To overcome this handicap, particularly in the preliminary planning stages, engineer intelligence personnel extracted pertinent information from reports of individuals personally familiar with the areas under study. Meteorological records and governmental and commercial data were scanned. Although this material assisted in the preliminary planning phase, it was generally insufficient for detailed engineer planning. Actual ground reconnaissance, supplemented by prior aerial reconnaissance where possible, therefore, remained the only important source of engineer intelligence during this early period of the war.

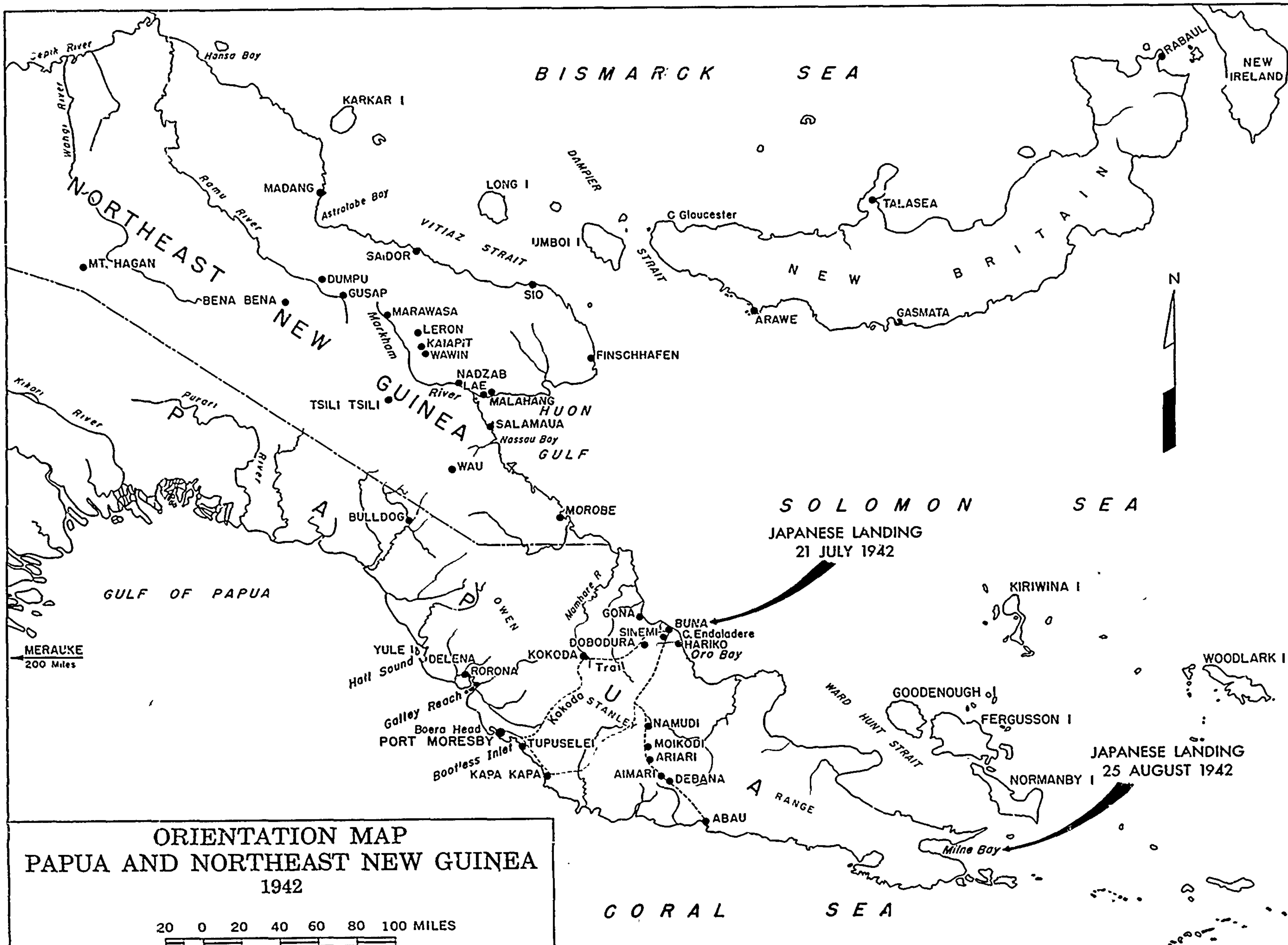
Notwithstanding the scarcity of experienced Engineer officers in Papua capable of accomplishing thorough ground reconnaissance, immediate and extensive investigations to determine the practicability of both base development and the support of combat operations in Papua had to be initiated. Data obtained from ground reconnaissance provided detailed information sorely needed for the location of airdromes, air dropping grounds, and trails, as well as for base development. Unfortunately, the limited signal communication facilities and lack of engineer authority over water transportation handicapped the revision of shipping arrangements for adaptability to such newly determined terrain conditions. As a result, some projects could not be constructed in complete conformance with the latest revised plans.

The actual execution of engineer ground reconnaissance was hampered by the incomplete coverage of maps supplied initially and the ruggedness of the country. The Australian preliminary 4-mile strategic map of the Buna–Milne Bay area had no tactical value. The hastily compiled larger scale photomaps proved to be excellent, although important trails and place names were, perforce, incomplete or not indicated on the maps. Whenever possible, to remedy such omissions, aerial photography was supplemented by ground reconnaissance and information from natives.[3]

Investigation of the Abau Area

An example of the strategic value of engineer ground reconnaissance in Papua was the investigation of the proposed access road from Abau to

[3] *Editor's note:* One very important trail for supply and evacuation leading inland from the Cape Endaiadere–Buna area to Sinemi Plantation was located only through information from natives. Its use reduced the distance over which supplies had to be transported by at least 7 miles.



ORIENTATION MAP
PAPUA AND NORTHEAST NEW GUINEA
1942

SOURCE: OCE, GHQ, AFPAC (Historical).

MAP NO. 5

U. S. Engineer Reconnaissance Patrol with Native Carriers, New Guinea, 1942.

An Engineer returns to Abau, New Guinea, after reconnaissance into the interior, 1942.

Namudi at a time when overland movement of U. S. troops was being considered to stem the enemy thrust from the Gona–Buna area across the Owen Stanley Range to Port Moresby (see Map No. 5). This reconnaissance, following a trail map of an obviously mythical route through creek beds full of boulders first to Debana, a distance of 25 to 26 miles, determined that this section of the route was absolutely impractical for construction of a motor transport road. But sufficient topographic notes were taken to allow for an aerial relocation survey of this first section; a ground survey would have taken months. The section of the trail from Debana to Aimari ran across the Owen Stanley Range, nearly 5,000 feet high; it was evident that development of a mule track here was possible but building a motor transport road would have required more time than was available. Construction of a motor transport road on the Aimari to Ariari (Mai-Oki) section was considered impossible and relocation plus a great deal of work necessary for even a mule track. The final section, Ariari to Namudi, varied between creek beds and 90 percent grades as far as Moikodi. This part of the trail was considered almost impossible for marching troops, let alone for a motor transport road; it would have required extensive operations to establish even a mule track. However, the remainder of the section, from Moikodi to Namudi, was found adaptable to relocation, although it still would have necessitated crossing wide rivers. Rapid construction of an adequate road from Abau to Namudi was obviously impossible.

The timely receipt of this terrain intelligence facilitated high-level planning. Further consideration of such overland movement for the concentration of U. S. troops north of the Owen Stanley Range was abandoned. Allied strategy had shifted from defense to counterattack, and movement of troops had to be effected without loss of time. Moreover, marching the tactical units across mountain trails, as exhausting as indicated by the reconnaissance, would have dissipated their strength. Transport by air to the seacoast south of Buna, was, therefore, substituted instead, and a wide envelopment of the enemy from the east initiated.

Initial Planning of Port Moresby

While engineer reconnaissance directly influenced high-level planning, it was having (due to its own inadequacy and lack of consideration by commanders) less favorable and continuing influence on detailed plans for base facilities in these expansive forward areas. Unstudied local command decisions considerably increased the engineer mission. Port Moresby, although partially destroyed after the evacuation of all civilians, was the one place in New Guinea where some facilities of civilization existed. The valleys between the ranges close to Port Moresby were adaptable to development for airfields and dispersal areas. With more port facilities and a road net, a most effective air force could be based and supported there. However, early base development under Australian control placed all installations like beads on a string along the Port Moresby–Jackson Drome–Rouna–Seventeen Mile Road, the only good road in the Port Moresby area. (See Map No. 6, "Location Map, Port Moresby, New Guinea.") Traffic on this road was heavy, and there was constant danger of isolation should it be cut. The main water supply line also generally followed the road, contributing even more to the density of population and to the vulnerability of the system. In fact, the water supply line not only followed the road, but crossed the end of Jackson Drome and paralleled it partially on two sides. Aircraft dispersed along the road in the vicinity of the drome became a magnet for Japanese bombers, and the water line, adjacent to the road, became an alternate easy target. Supplementary improvement had to be effected. Jackson and Kila airfields required considerable improvement and expansion. (See Map No. 6.) Under study it also became apparent that additional airfields together with essential taxiways and blast pens had to be built in advance of other essential construction in order to obtain local air cover. With air protection for subsequent construction provided, piers, a POL system, a loop road, and an alternate water supply line, all necessary for ultimate exploitation of the area, were then given top priority. Hospitals, refrigeration plants, and repair hangars were fitted in as their particular need became acute.

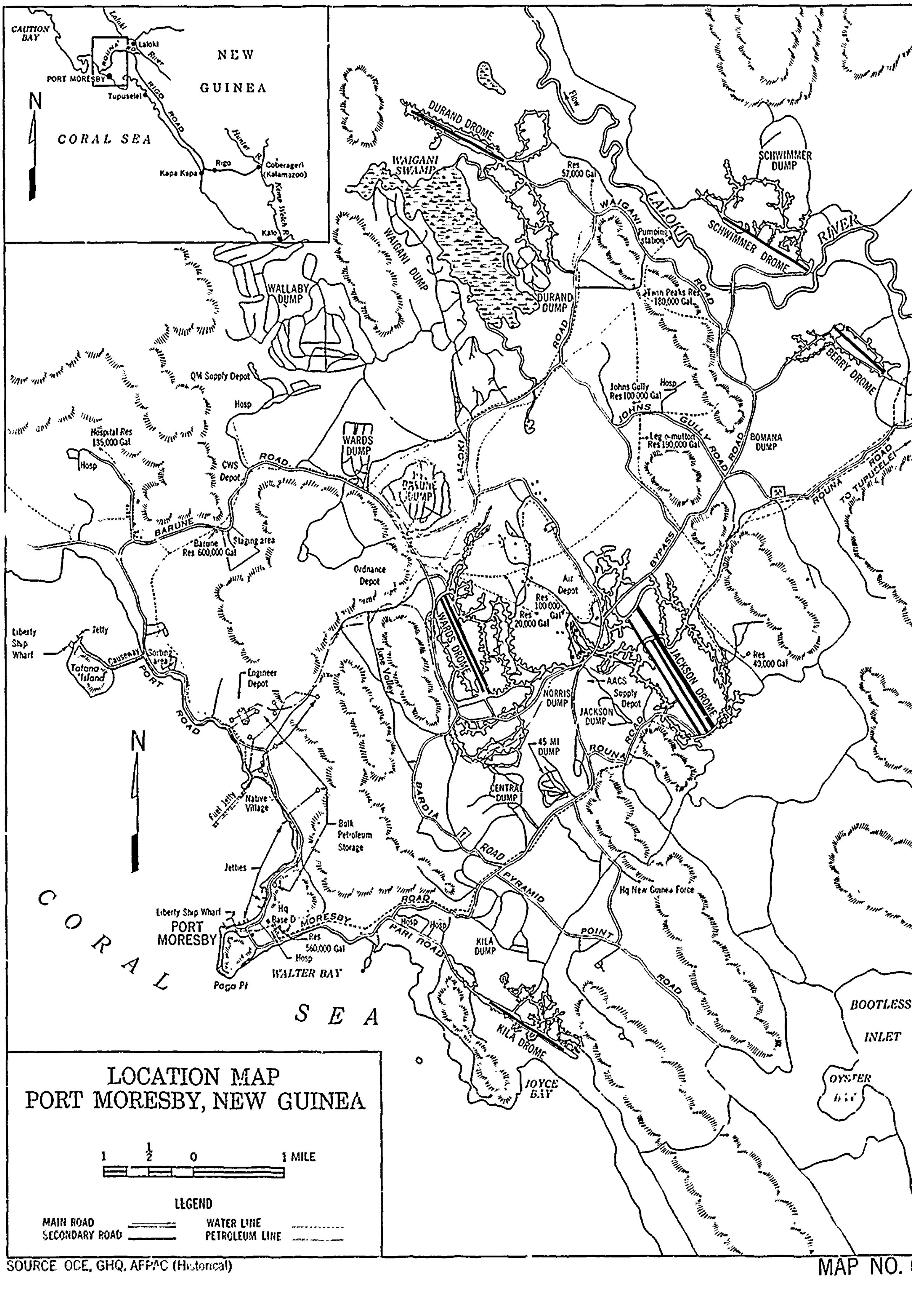
Development at Rorona

Another instance of a command decision based on lack of regard for adequate engineer reconnaissance occurred when the local command at Port Moresby diverted approximately one-third of the entire engineer troop strength in that area to the unprofitable venture of developing the plains in the vicinity of Rorona, northwest of Galley Reach, as an air base. Galley Reach is a long estuary opening into New Guinea from the Gulf of Papua about 40 miles northwest of Port Moresby. (See Map No. 5.) It is a mile or more wide, 12 or 14 miles long, and of fair depth. The terrain between Galley Reach and Port Moresby is largely mangrove swamp bordering the mouths of the many streams which flow into the Reach from the vicinity of Port Moresby. The northwest shore of the Reach is also mangrove swamp, but inland the terrain soon opens up into wide, gently rolling plains, which are quite easy to develop into airfields. The entrance to Galley Reach is blocked by a wide coral reef which is navigable only through a narrow, tortuous channel about 2 miles in length and 6 feet in depth at low tide.

The development of these plains as an air base for any considerable force would have required provisions for supply by deep-draft vessels, or by truck transportation from Port Moresby. Opening an adequate channel through the entrance reef would have involved a major job of underwater drilling, blasting, and excavation requiring use of the heaviest types of floating plant. A substitute harbor could have been constructed on the shore some 1 or 2 miles northwest of the mouth of the Reach, but this would have required a large amount of heavy floating equipment for dredging and the construction of sheet pile bulkheads and breakwaters. Overland supply from Port Moresby would have required the construction of approximately 75 miles of road, mostly through swamp and across several major streams, plus a detour around the eastern end of the estuary.

The supply difficulties, manifest even before the inception of this project, were so great that the construction operations were materially handicapped. As the end result of 6 months' work, the small and ill-equipped engineer force, assisted by a large number of Papuan native laborers, had only constructed a pier near the head of the Reach, 11 miles of gravel-surfaced road from the pier, a gravel runway surfaced with steel mat, and had made some provision for aircraft dispersal.

Preceded by proper reconnaissance, this same amount of applied effort would have been more productive at either of two other sites—Delena or Boera Head. (See Map No. 5.) Ground reconnaissance of the Delena area had not been made, but air reconnaissance indicated that, a few miles southwest of Delena, airdromes could have been constructed with the same ease as at Rorona. This location could have been supplied by deepwater ships unloading at piers which could have been constructed at Delena on Hall Sound in a roadstead sheltered by the coast and by Yule Island. On the other hand, Boera Head is a fairly flat point on the coast of New Guinea, about 10 miles north of the upper end of Port Moresby Harbor. The construction of a road connecting this site with the road net of Port Moresby would have presented no major difficulties; overland supply from Port Moresby piers and supply installations would have been relatively simple. A runway of Boera Head would have afforded excellent landing and take-off conditions inasmuch as approach zones would have been over water and completely unobstructed.



LOCATION MAP
PORT MORESBY, NEW GUINEA

SOURCE OCE, GHQ, AFPAC (Historical)

MAP NO. 6

Looking southwest from Kila hilltop over Port Moresby, Pago Point, and Tamraguba Hill; note mountainous terrain and rugged coast line.

Unloading problems in 1942 at U. S. Advanced Base, Port Moresby, New Guinea, requiring handling supplies from ship to barge to shore.

Expansion at Port Moresby

In sharp contrast, when it was obvious that additional deepwater berths were vital at Port Moresby, planning did pause for reconnaissance—with excellent results. The two most important factors governing the constru .on of deepwater berths were a shortage of long piling and the unusual hydrography of the harbor. The approach to Bootless Inlet was mined, shallow, narrow, unmarked, and twisting; this site was the least suitable.[1] Extension of the existing deepwater wharf, the two smaller jetties nearby, or the seaplane ramp to deep water would have required long piling, concentrated vessels in one area, and increased the already complicated truck traffic problems. There were two spots in Port Moresby Harbor, out of the town area, where deep water lay close to the shore. The largest of these was on the northwest side of Tatana Island located about a half mile off the town side of the harbor, and about 4 miles northwest of the town. (See Map No. 6.) A reef lay between the shore and the island. It appeared practicable to construct a causeway to the island, a road connecting the causeway to a floating pier location, and a road connecting the mainland end of the causeway to the town. All materials were either on hand or readily obtainable. The final decision was deferred, however, until a proper reconnaissance could be made across the reef to determine the feasibility of the proposed connecting causeway, and, if feasible, the proper location. No boats were obtainable, and the final decision and location were based on a survey made by wading to the island during a king low tide late in September. Construction started on 5 October, and the first ship berthed, less than 1 month later, on 3 November. A road over Barune Pass to Wards Drome was completed later, and this end of the harbor eventually developed.

[1] *Editor's note:* Not only the approach to Bootless Inlet, but most of the land fronting on the sea at Port Moresby, and inland too, was mined. Moreover, many of these mines had been broadcast without plotting their locations. Under the circumstances, some were unexpectedly set off on occasion with resultant casualties to personnel and equipment.

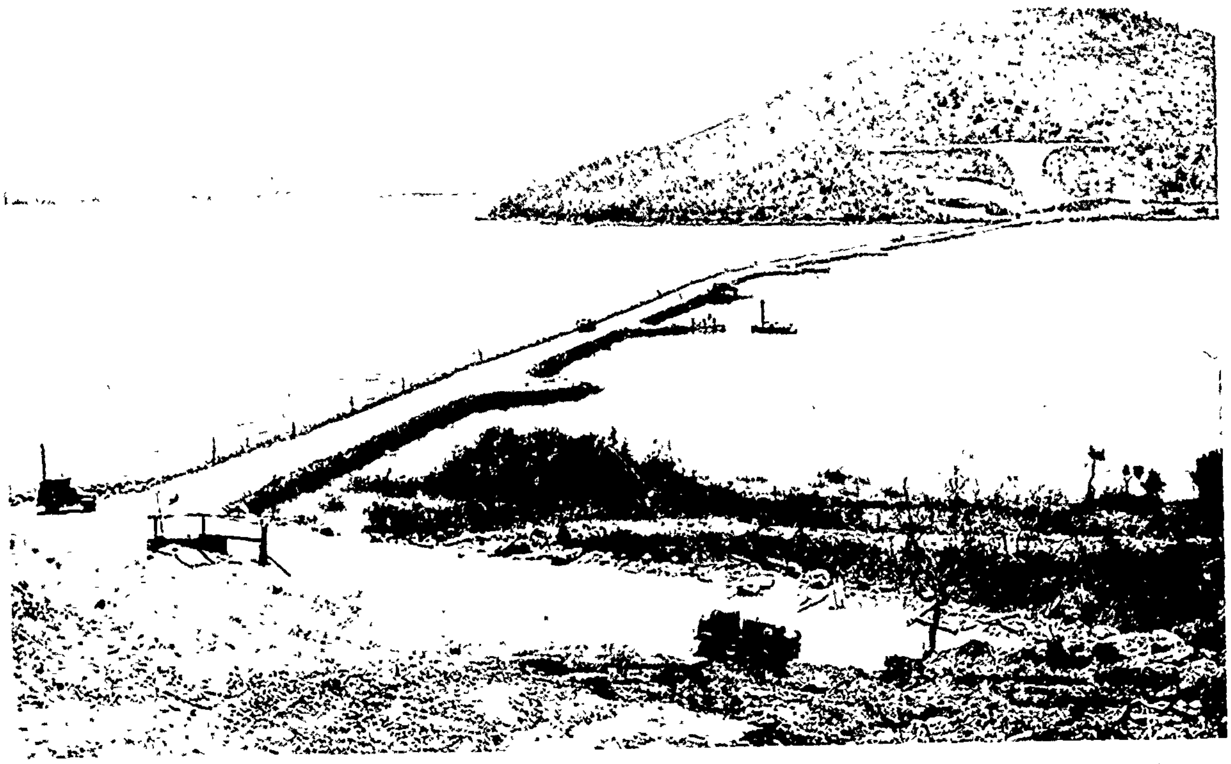
These and similar experiences emphasized the fundamental need to base initial plans and command decisions on detailed analyses of soils, geology, ground water, and meteorological conditions. Such engineer intelligence, however, must be available well before operations are planned, and its timely preparation can only be effected by the provision of engineer reconnaissance parties of properly trained engineers and scientific consultants immediately upon the initial manning of a theater of operations.

Engineer Operations

Equipped basically to engage in the type of warfare encountered in the European Theater of Operations with accepted facilities of civilization readily available, engineer units in Papua found themselves fighting an "Engineers' War" in a tropical wilderness. Everything had to be built, and the densest jungle had to be cleared for space in which to build it. The engineer equipment originally issued was not heavy enough nor available in sufficient quantity for efficiency in this type of work. Locating, clearing, grading, paving, and sealing of runways, roads, and hardstandings, were primary requisites. Wharves and bridges of heavy timber and pile construction also constituted an important element of the engineer construction work from the standpoints both of priority and battalion-months of expended effort. Another major element was light building construction, including use of prefabricated and locally fabricated structures, as well as provision of related services such as water, power, and fuel, and execution of harbor work.

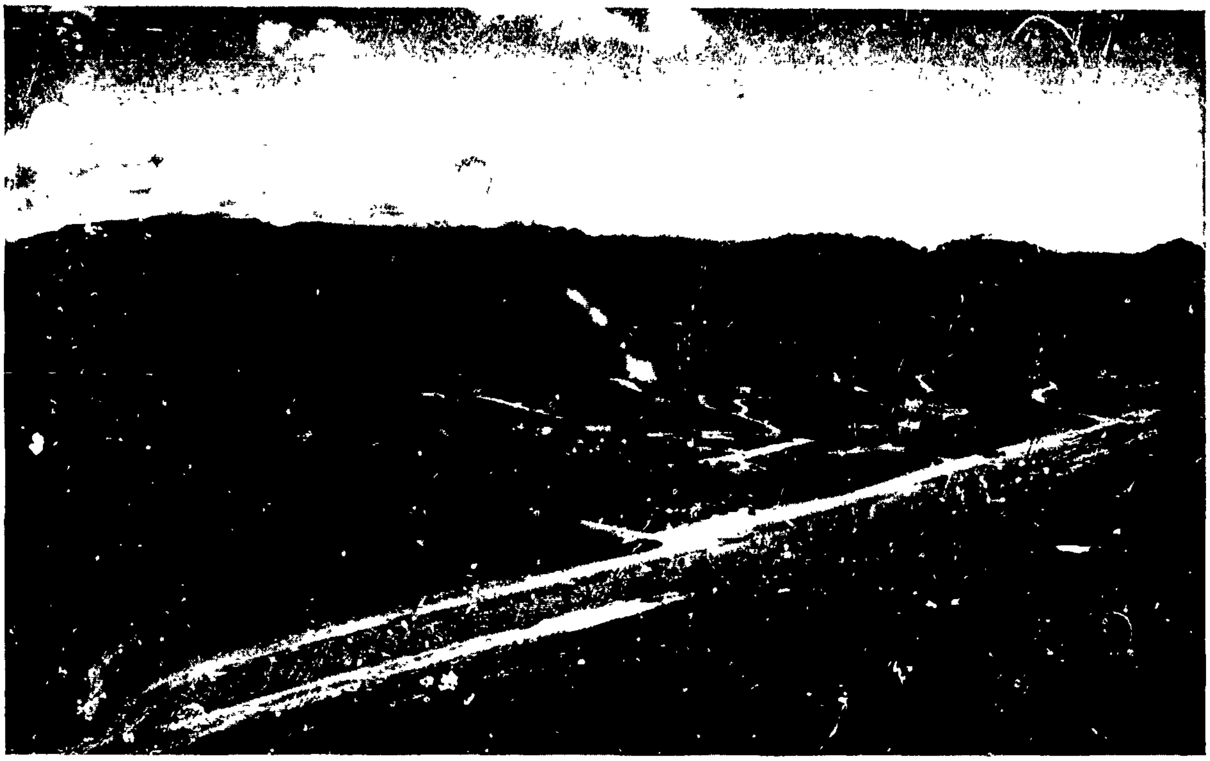
Corduroy Roads

Since much of the terrain was low and swampy, supplies had to be hauled considerable distances over soft ground. For that reason, corduroy road construction methods were used extensively. Engineer troops upon arrival in Papua, however, were not well trained in basic military road construction techniques or in the limiting



Engineer-built causeway connecting unloading piers at Tatana Island with mainland at Port Moresby, New Guinea.

Unloading piers at Tatana Island constructed by U. S. Army Engineers.



Looking northeast from Kila hilltop over the Kila Airdrome with its runway, taxiways, and surrounding dispersal areas.

Engineer-constructed road in the Port Moresby area to facilitate expansion of base facilities.

factors for its effective application under the conditions existing there. Hasty placement of layers of brush and poles to get one or two light motor vehicles through miry patches was worse than useless for the passage of continual foot and wheeled traffic. On a number of occasions the Chief Engineer, General Headquarters, Southwest Pacific Area, had to indicate log corduroy road construction deficiencies to both U. S. and Australian Engineer units to insure emplacement of well supported and properly bedded longitudinal sleepers, with decking securely pegged or spiked down and a curb rail firmly secured to the ends of the decking logs and poles. Too often there was a tendency to omit sleepers or to place sleepers above ground. This gave poor stability to the decking, particularly in extremely muddy sections, and necessitated the use of a great number of cross bearers to bolster the road. Where buried sleepers were used, good bearing with a minimum of maintenance problems resulted. It was found that, even with the high working stress capabilities of tropical timber, the decking logs used in the bottom layer should be at least 6 inches in diameter.

Such work kept large forces engaged in clearing and ditching of rights-of-way and in the felling, cutting, hauling, and placing of timber. It also involved the use of large quantities of drift bolts, heavy spikes, and wire which were almost always in short supply. Similarly, a considerable amount of fill was necessary in the innumerable low, swampy places. In view of the shortage of both engineer troops and supplies, it was recommended that corduroy road construction should be undertaken only as a last resort when dozers and graders to provide an adequate roadbed could not be obtained without considerable delay.

Corduroy road construction was discontinued during later phases of operations in Papua in favor of a more standard type of road construction with satisfactory results. For example, in the Dobodura–Buna–Oro Bay area (see Map No. 5) excessive miring of vehicles was experienced on some tracks and trails which had been only hastily improved during ground combat. Subsequent investigation disclosed that this whole area was a great gravel delta, overlain by silt and muck varying from 6 inches to 10 feet in depth. By test pits it was possible to correlate appearance of standing vegetation with depth of muck. A very satisfactory road was then staked out by observation of the vegetation. The primary construction effort consisted of peeling off the 6-inch-deep surface muck with a road grader which left a firm, well-drained subgrade, ready for surfacing.

Clearing and Drainage of Sites

The width of clearing for roads and airfields varied, not with the tactical need for concealment, but with the anticipated amount of rainfall and the height of bordering trees. Although tropical downpours were tremendous, they were frequently of but short duration, except during the rainy season. And the blazing tropical sun, wherever it penetrated, soon dried the soil. As a consequence, where heavy rains were frequent, it was customary to clear the site of the work to such width that the rays of the sun could reach the entire working surface. The higher the vertical jungle growth, the wider the clearing had to be. Rainfalls frequently exceeding an inch per hour required not only wide clearings to let the sun in, but also extremely large ditches to facilitate run-off. Such ditching had to be accomplished immediately after clearing so that the surface and subsurface of the right-of-way would dry simultaneously. As soon as the down timber from clearing operations was dragged off the site, the stakes for ditch grades and alinements were established, and the heaviest equipment put to work. Available ditching machines, however, were too light and too slow for this work. So, too, was the D–12 road grader, although it was made to serve by abusing it. Apparently the best combination was a heavy-duty rooter towed by two D–8 tractors, followed by a heavy-duty tow grader, drawn by one, and sometimes even two, D–8 tractors.

Borrow Pits

In the Port Moresby area, borrow material consisted of decomposed shale lying in slanting strata well up the hillsides. For maximum utilization of such material under the existing shortage of large power shovels, development of borrow pits with loading chutes was necessary. However, much more efficient use could have been made of the limited equipment available through better planning of the work. A common fault during these early operations was that of not opening borrow pits with a correct idea of the total yardage to be excavated. Initial stripping of all overburden and subsequent plans for over-all development were needed. Usually, only material at the chute entrance was used first, and grades soon developed in the pit which were too steep for subsequent dozer operations. In some cases, digging was such as to render one or more chutes completely unusable after several weeks of operation. Shovel operations in borrow pits were also on occasion poorly planned and executed. Here a not uncommon tendency was to dig the shovel into a circular basin too narrow for truck spotting rather than to keep digging parallel to the truck road in narrow successive escarpments or to open a wide crescent for alternate spotting of trucks close to either side of the shovel. Truck spotting was frequently such as to require a 180° swing of the shovel.

Field Expedients

Largely because of the shortage of engineer supplies, field expedients were depended upon for an important role in these early engineer operations. They included the use of certain types of tree bark for lashings, and adoption of the native method of sinking piles and H-frames by hand manipulation in the sand. It would have been impossible to bridge the many small streams along the Papuan coast without such expedients, many of which were learned from natives in the area. In such jungle country, reference books published in large quantity by the Office of the Chief Engineer, GHQ, SWPA, on the properties of native timber proved indispensable to engineer working parties, especially when backed up by the guidance of at least one native who was familiar with the location and properties of the various trees and barks and other local resources, and who knew native construction methods.

On occasion, however, improvisation solved one supply problem only by augmenting another. Such an instance occurred at Dobodura where a requisition for 28,000 feet of culvert pipe was filled with less than 4,000 feet. Welded gasoline drums were promptly substituted and some 15,000 feet of pipe were so improvised and installed. Unfortunately, however, higher authority at that time was confronted with, and trying to overcome, a shortage of drums. This naturally necessitated a restriction on any further unconventional use of this item. As a result airfield and road drainage in this particular area still faced a frustrating, though somewhat relieved, pipe shortage.

Field expedients, however, played an important role in situations other than relieving pressing engineer supply problems. At Port Moresby it was soon evident that the immediate availability of one-man stone for rapid repairs to bomb craters in roads and airfields was essential to make a damaged facility operational in the shortest possible time. Piles of such material around an airfield, however, while handy for repairs, constituted a hazard to taxying aircraft. Moreover, such material had to be hand or power loaded into trucks for transportation to craters. The expedient providing a solution to this problem was to keep a chute from the quarry face filled with one-man stone. Upon the sounding of the red alert, dump trucks were driven under this chute and loaded up, then held for subsequent dispatch orders to required destinations. This procedure materially reduced the nonoperational period ordinarily involved in repairing damaged facilities.

A particularly successful combat expedient was the improvisation of a special grenade when the

Recruited native labor assisting engineer construction of corduroy road through dense jungles of New Guinea.

Wide clearing operations essential to good drainage.

114th Engineer Combat Battalion, in the advance on Buna,[5] ran into Japanese bunkers and dugouts so well constructed that they were comparatively impervious to normal hand and rifle grenades and mortar fire. It was necessary to devise a special grenade to destroy enemy personnel occupying these strong positions, and the method suggested by the unit engineer was adopted and improved upon. The ordinary Australian rifle grenade (same as hand grenade except that it had a flat plate on the bottom) was used, but to it were tied 2 pounds of ammonal in 1-pound blocks. When thrown into dugouts through an entrance way the added high-explosive charge provided the blast effect needed to destroy the enemy therein; the grenade was not used in an effort to blow in the roof or sides of the dugout. Some of the first grenades improvised were made with gelignite, but later ammonal was substituted in order to prevent accidental detonation by gun fire while the grenade was still in the pocket of its user. It would be impossible to overstress the tenacity with which the enemy clung to their prepared positions. There were instances, and not isolated ones, wherein dugouts were grenaded inside, covered with gasoline and burned, and then sealed with dirt and sand, only to yield 2 or 3 days later Japanese who came out fighting. One souvenir hunter entered a sealed dugout 4 days after the battle and was chased out by a Japanese officer wielding a sword. Some of the instances in which the enemy lived on in these positions through burning and detonation, in filth and gore, when severely wounded themselves, were almost incredible.

Combat

Among the various engineer operations in Papua, one bore special significance. It dramatically demonstrated that engineers must be prepared and trained to fight as well as build. The Japanese landed near Rabi Mission on the north shore of Milne Bay, just 3 miles east of one of the airfields being constructed by the 2d Battalion (less Company E) of the 43d Engineer General Service Regiment. When the enemy advance threatened to cross No. 3 Airstrip, these engineers were diverted from their construction mission and in the emergency found themselves holding key positions in the newly established front line.[6] The total strength of the defending force along the airfield never exceeded 350 men, including Australian infantry units and U. S. Army antiaircraft troops which made up the greater proportion of the defenders. The total strength of the Japanese reaching the airfield probably did not exceed 300 men, but at least 150 dead were counted after the enemy had finally withdrawn. Of these, approximately 130 were killed directly opposite the position occupied by the engineers. Outside of the Philippines, this was the first incident of ground combat by any U. S. troops in the newly formed Southwest Pacific Theater of Operations, and, typical of the inconsistencies of modern war, not combat but service engineer troops were engaged. The chatter of machine guns in this first encounter had typed an inexorable doctrine: all engineers, regardless of their mission, must be disciplined men at arms, prepared for all emergencies.

Utilization of Native Labor

The success of engineer operations in this campaign was due, in no small way, to the loyal, wholehearted, and tireless efforts of natives assigned to this work. Their numbers varied in accordance with the situation. Best results were obtained when those assigned to any one project were all of the same tribe. After a little experience, one soldier could efficiently handle about 20 natives, and in some cases one noncommissioned officer handled as many as fifty. It was found that more work could be accomplished by marking out the day's work and instructing the natives as to the limit of their task. There were several instances, such as at Bena Bena and Mt.

[5] *Editor's note: See* Map No. 16, Vol I, this series.

[6] *Editor's note: See* Map No. 14, Vol I, this series.

Hagen (see Map No. 5), where virtually all airfield construction was performed by natives under the direct supervision of an Australian officer from the Office of the Chief Engineer, GHQ, SWPA.

In assigning natives to tasks it was well to remember that tribes whose villages were located in low swampy areas must know something about stream crossings, and were, therefore, the best bridge builders. In the same way, those whose villages were on high ground knew something about traversing hills and were, therefore, the best trail and road builders. All of them proved a ready source of information when consulted in the manner of selecting trees, bark, and vines to be used in construction projects.

Native Papuans, however, were subject to certain physical limitations and characteristic peculiarities. The average male Papuan was clumsy and physically weak in his lifting muscles. While native women could lift very well, a group of several husky young males would strive mightily to lift one case of small arms ammunition. The male could, however, carry things that were placed on him, and while he handled a hatchet or machete very well, he could not effectively use a two-handed tool such as a pick, shovel, or an axe unless he had previously worked extensively with the white man.

Supply Problems

Shipping Allocations

Staff policies, based on the logistic tables compiled after World War I and modified by Army Service Forces, War Department, for general application to shipments from the United States during the early part of World War II, allotted approximately 14 percent of the available cargo space to engineer supplies. This allocation was not adequate even for civilized theaters of operations with modern facilities readily available. It was grossly inadequate for development of Southwest Pacific jungle terrain into ports and staging areas of unprecedented scope. In the first 3 months of development of any new base under such conditions, the cargo space allotted to engineer materiel should have averaged between 30 and 50 percent.

In addition to the restrictive 14-percent space allotment, engineer needs were often further intensified by imprudent interpretation of logistic tables in the Theater and the inclination of base commanders, accentuated by undue stress of certain special staff sections, to give precedence to their own particular needs. As a result, overall benefits were frequently neutralized. For instance, on occasion an advance base would have from 180 to 240 days of rations, ammunition, POL, bombs, and telephone poles ashore, with an additional 90 days supply of these items aboard ships awaiting actual discharge or call forward. Yet, while overstocked with rations and tactical supplies, this same advance base would be laboring under serious engineer shortages of cement, nails, piling, tankage, pipe, pumps, lumber, dock hardware, construction equipment, and spare parts. And these engineer materials and equipment in short supply were, ironically, more often than not the vital key to the successful handling, protection from the elements, storage, and distribution of those items accorded excessive priorities.

Aircraft Availability

In the Theater, engineer requirements for aerial transportation of emergency items such as spare parts, special tools and materials, and key personnel were entirely dependent upon operations of the Allied Air Forces. But those forces had their own pressing problems and their own needs were far in excess of available aircraft. As a consequence, only limited air transport could be provided to relieve engineer emergencies. Moreover, the engineer need for aircraft was not restricted to supply operations alone. Engineer reconnaissance of potential construction sites and rapid inspection of work in progress could be best accomplished by use of aircraft.

Mapping of large, projected operational areas could be accomplished only by aerial photography. It was evident that doctrines of the future should provide the engineers either with their own aircraft, or with proper priority on service support from air forces.

Hand Tools

The inherent necessity for hand tool resupply in jungle operations was evidenced throughout the Papuan Campaign, particularly during the attack on Buna by the 128th Regimental Combat Team (RCT), 32d Division. The company of the 114th Engineer Combat Battalion which supported the 128th RCT in this operation had moved into the objective area by air transport, by rigorous foot travel overland, and by inadequate local small water craft.[7] The equipage of these engineers had necessarily been confined to bare essentials by the various stages of movement. Improvements of jeep trails and stream crossing expedients for foot troops, therefore, had to be effected by use of the limited hand tools originally carried by these engineers. A few additional tools, including block and tackle and tree climbers, plus a limited amount of engineer fortification supplies such as barbed wire, antitank mines, and explosives would have increased the value of engineer support in this operation. However, these engineers had no other supplies and equipment at the time, nor replacements for any of the limited hand tools available. Consequently the few tools with which they were equipped were indispensable for the simple but essential pioneer construction possible under the circumstances, and for the utilization of local materials to the maximum. Resupply of these essential tools, therefore, became a serious consideration as operations progressed. Moreover, with dependence on native hand labor, particularly in view of the inability to bring along heavy engineer mechanical equipment, the resupply of hand tools in this area became a major factor affecting engineer support.[8] The immediate and substantial benefit derived by the engineer platoon working at Hariko from a small number of axes, shovels, and picks which arrived by lugger definitely manifested the productiveness of hand tools and the indispensable requirement for their resupply in jungle operations, prior to the arrival of mechanical equipment.

It was obvious that a great surplus of machetes should always be provided in terrain of the type encountered. This particular accouterment proved to be the most important jungle tool for all services. Yet, the commanding officer, 128th RCT, reported that there were only 55 machetes in his entire regiment, whereas he really needed one for every other man and officer. Surprisingly, some machine-gun squads moved up to the front lines with no shovels with which to dig their emplacements. In at least one instance, the Engineer, 32d Division, saved the day by issuing Japanese entrenching shovels which his men had salvaged along the line of advance.

The most important hand tools were axes, machetes, and shovels. Picks were not so important because the ground was sandy and soft. Nevertheless, handles for tools were frequently broken. The average soldier was not particularly skilled in wielding such tools, and the supply of handles for axes, shovels, sledges, hammers, and hatchets never met the demand despite the original shortage of the tools themselves.

Motor Transportation

The initial lack of 1/4-ton trucks, essential to movement of engineer tools and supplies across hastily constructed jungle trails, was one of the greatest handicaps to resupply. However, inasmuch as the 128th RCT's move on Buna had been initiated by air, the normal, early issue of 1/4-ton trucks to engineer elements was impossible. As a consequence provision by the usual,

[7] *Editor's note: See* Map No. 15, Vol I, this series.

[8] *Editor's note:* Stocking sufficient one-handed tools for issue to natives who are unaccustomed to the use of two-handed tools should receive commensurate consideration with the supply of two-handed tools for issue to troops.

steady, forward displacement of resupply quantities of tools by motor transport was impossible. Yet as original allowances were expended or lost the urgency for such a provision became critical. Hand tools were almost traditionally short-lived in the hands of natives; engineer troops, carrying their tools on their backs in addition to their usual pack and arms, were sometimes tempted to abandon the tools to lighten their loads.[9]

Under the circumstances supply and evacuation were effected by carriers during the combat phase of the operation and to a limited degree by use of small boats (10–100 ton capacity each), and by air transport. Had ¼-ton trucks been available for operations along reaches of the coast, their use could have considerably expedited these services. Before bridges were provided by engineer units, these trucks could have been spotted between unfordable streams and operated as relay teams in conjunction with small craft or aerial cableways to quickly transfer loads across such streams. When ¼-ton trucks were subsequently delivered by water transport and employed in general coastal areas of limited trails and jungle, their use immeasurably improved supply and evacuation.

The initial shortage of transportation facilities involved a further disadvantage. It resulted in the expenditure of considerable native labor for hauling timber to bridge and corduroy road construction sites where logs were not immediately available. Although the maximum haul in the Buna area rarely exceeded 1 mile, time and manpower were critical and their conservation was effected by every means possible. The Engineer, 32d Division, for instance, evolved the scheme of borrowing, during hours of darkness, jeeps assigned to other units, and hauled logs to sites at that time. This procedure permitted construction operations to progress rapidly after daybreak.[10]

Over-all Supply Situation

Eventually, *distress cargo,* diverted from the Far East to Australia, provided a modicum of dozers, graders, carryalls, rooters, and sheepsfoot rollers, some power shovels, cranes, and dump trucks. However, even these supplies, loaded on ships in Australian ports were in many instances not unloaded in New Guinea until 3 months later because of a lack of port facilities and personnel in forward areas. Cargoes originating in the United States, because of transfers and redistribution along the extended supply line and the inadequacy of forward ports, were aboard various vessels from 4 to 8 months. Tires for wheeled equipment, spare parts for all equipment, shop trucks, pipe, pumps, nails, dock hardware, and welding supplies were all too often *not available.* Ever present were dire engineer shortages in everything essential—men, time, equipment, materials, facilities, weapons.

Troops and Training

Engineer effectiveness in the Papuan Campaign was handicapped by other factors besides the extremely small and decimated engineer troop strength present and the inadequacies of engineer supplies and equipment. The suddenness and nature of the Japanese threat considerably restricted any measures for conservation of engineers and their proper assignment to engineer missions as well as interfering with continuance of their unit training in forward areas under divisional control. There was not time available, for example, to consult the Engineer, 32d Division, regarding recommendations for the disposition of divisional engineers (114th Engineer Combat Battalion) until the Papuan Campaign

[9] *Editor's note:* Economy of resupply could possibly be effected by some consideration being given to reducing the weight of tools used in jungle warfare. Relatively, the 114th Engineers participating in this campaign reported that in mountainous, jungle terrain the carbine was found to be more useful than the heavier M–1 rifle.

[10] *Editor's note:* The 114th Engineers in their report on the Papuan Campaign pointed out that procurement of timber for corduroy and bridges could have been speeded up had gas-operated saws been available.

Understrength combat engineers, with inadequate equipment, open up a section of supply route between Oro Bay and Dobodura, New Guinea.

Supply convoy crosses a timber bridge along the newly constructed Oro Bay–Dobodura Road in New Guinea.

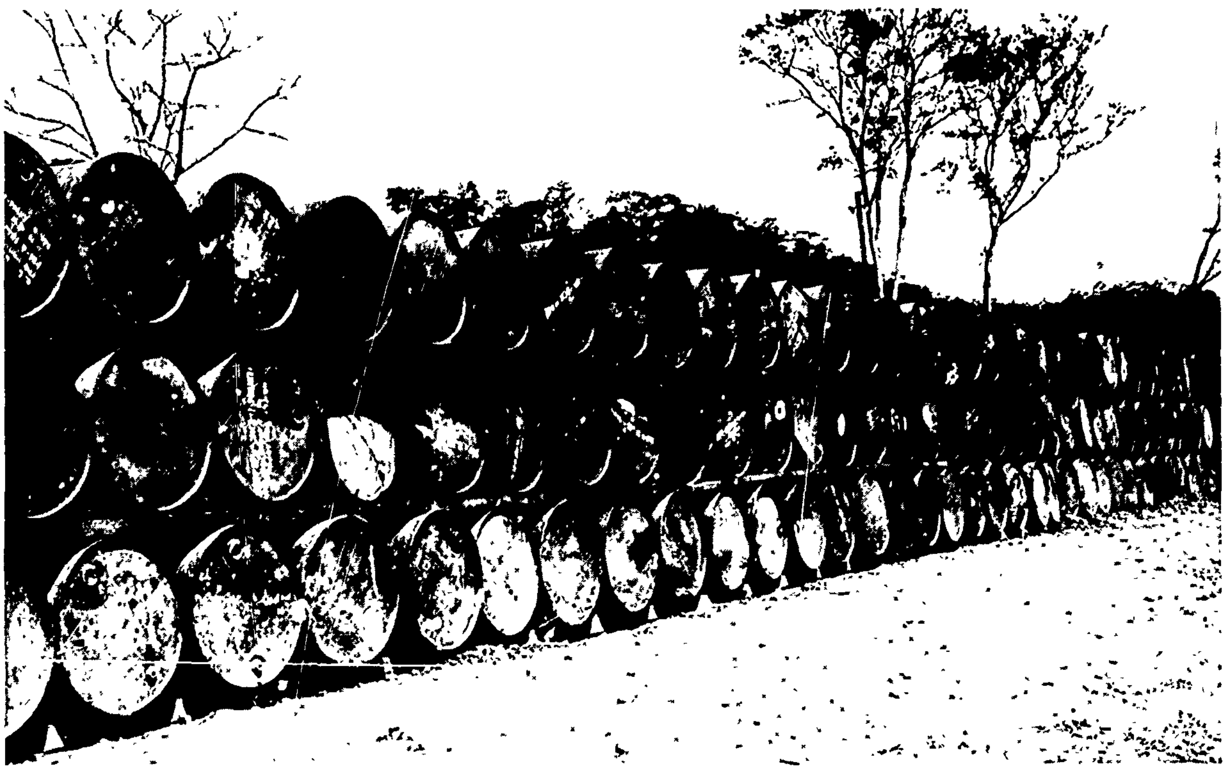
Engineer open storage, Oro Bay, New Guinea, adequate for pipe stock piles but accelerating the deterioration of wire mesh.

Insufficient depot personnel and covered storage for protection of Engineer supplies, Oro Bay.

Another resultant of insufficient Engineer depot personnel and covered storage, Oro Bay, New Guinea.

Engineer spare parts, at Milne Bay, inadequately protected and cataloged due to lack of covered storage and depot personnel.

Indiscriminate storage in river bed and broken drums of tar and asphalt products at Engineer Depot, Base A, Milne Bay, New Guinea.



Same supplies as above after sufficient personnel became available for sorting and restacking on higher ground.

Unsatisfactory arrangement of rounds, sheets, bars, beams, and channels in steel stock area, Engineer Depot, Base A, Milne Bay, New Guinea.

A portion of the same steel stock area after materials have been segregated, rebundled, and restacked by type and length.

Unsatisfactory condition of storage area for component parts of prefabricated buildings, Engineer Depot, Base A, Milne Bay, New Guinea.

Same supplies as above, after personnel became available for sorting, recrating, and movement to a new area.

Unsatisfactory condition of lumber stocks, Engineer Depot, Base A, Milne Bay, New Guinea.

Same area as above after adequate depot personnel became available.

was well under way. In fact, the campaign had been in progress under Australian command fully a month before command procedures in the emergency could be sufficiently organized to issue orders for the Division Engineer to proceed from Australia to Port Moresby. Shortly after his arrival in Papua, he was confronted with the problem of reassembling and operating a two company battalion without a battalion headquarters. Engineer administration continued, perforce, under this handicapped organization for about 2 months after the Division Engineer's arrival.

Throughout the Papuan Campaign there was a constant demand for more and more engineers. The manifold tasks assigned to elements of the 114th Engineers, supporting their division's widely spaced combat teams, would have kept a full strength engineer combat regiment constantly busy.[11] The use of engineers for carrying parties, handling supplies for other services as well as for their own, burying the dead, and evacuating wounded at Dobodura and Hariko (see Map No. 5) definitely reduced their capabilities for maintaining all-important supply and communication routes over the many miles of jeep trails for which the battalion was responsible. By 1 January 1943, this engineer unit was greatly depleted in strength, particularly through illness. The average company strength of the 114th Engineers at this time was only 70, whereas it had been 170 when these companies arrived in New Guinea during the previous September and October.

In no case was an advance base furnished an adequate over-all service force consisting of port companies, truck companies, and depot troops. After shipping availability gradually improved the engineer supply situation, this inadequacy of service troops, including engineers, was the limiting critical factor in the development and operation of installations in the combat zone. Troops in Australia could load supply ships faster than the inadequate personnel at ports in the operational areas could unload them. At these latter ports cargo could be unloaded from ships faster than it could be trucked away from the docks. Supplies could be trucked away from the docks faster than the trucks could be unloaded and their contents properly stacked in the dumps. As a consequence, engineer construction units were frequently diverted by advance base commanders from first priority construction work to unload ships, operate trucks, and manage dumps.

The morale and effectiveness of these limited engineer troops in Papua almost invariably reflected the example set by their immediate superiors. Subsequent notes of observers emphasized that junior Engineer officers, besides being physically fit and well trained, should be capable of cheerful and resolute endurance. In this connection it is believed that psychological preconditioning by some experienced senior officer is most effective. Junior officers should be told the seriousness of the operation, the type of resistance to be encountered, the emotions they will experience, the inevitable fear that accompanies all troops, and their inalterable duty to lead their men. At the same time they must never let their own apprehension (if any) be apparent, however insuperable it may seem. Down-to-earth training for junior Engineer officers and a complete understanding of the dangers and pitfalls of combat are essential to good leadership on the combat front. However, the shortage of units and equipment and the urgency of engineer missions, which required units to work their personnel on a multishift, round-the-clock basis, allowed little opportunity for combat training of either officers or troops. There was only limited time for essential equipment repair and maintenance and virtually no chance for recreation. That the engineers proved themselves equal to the task in spite of the handicaps was a tribute to their ingenuity and resourcefulness.

[11] *Editor's note:* These diverse duties converged upon the engineers inasmuch as the 32d Division had no grave registration detachment, no ordnance company, no medical regiment. In short, service elements necessary for independent action of a division were represented only by the engineers.

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CHAPTER IV

Northeast New Guinea and Bismarck Archipelago Operations

January 1943–January 1944

The Elkton Plan

By the time all Japanese resistance in Papua had collapsed, preliminary Allied plans for future operations were already being revised. The final plan, Elkton III, was completed and issued in May 1943. The strategy decided upon still held to the long planned main tactical concept of enveloping advances over land and water from two directions. Under General Douglas MacArthur's over-all strategic command, Southwest Pacific Area (SWPA) forces were to continue up the New Guinea coast and capture Lae, Finschhafen, and Madang, while the South Pacific Force was to attack and capture the New Georgia Group in the Solomons. Both would then combine in a final assault on Rabaul, New Britain.[1]

General MacArthur directed Alamo Force (U. S. Sixth Army) to undertake initial operations under the Elkton III Plan by seizing Woodlark and Kiriwina Islands while the New Guinea Force was to push against Salamaua and Lae. However, just as designated units were loading out for the opening operations under the Elkton III Plan against Woodlark and Kiriwina, the U. S. 41st Division, moving along the New Guinea coast north of Buna towards Salamaua and Lae, was engaged in maneuvering around a stubborn enemy line of resistance. An amphibious landing at Nassau Bay to flank the enemy was, therefore, carried out by units of the 41st Division while the task force scheduled for the initial operation under the Elkton III Plan was just approaching Woodlark and Kiriwina Islands, 450 miles away. Subsequent operations followed in quick order. While Salamaua was being approached by converging columns moving up from Nassau Bay and through the jungle from the southwest, Lae was taken by Australian troops supported by U. S. amphibian and airborne engineer units, and by U. S. paratroopers. Next came Finschhafen, also in New Guinea, and then the operations on New Britain with landings at Arawe and Cape Gloucester. These were quickly followed by the assault on Saidor, New Guinea, to prevent a successful enemy retreat from the Huon Peninsula. (See Map No. 7, "Principal Operations, 1 January 1943–2 January 1944," and Chronology.)

[1] *Editor's note: See* the lower of two operational pincer movements depicted on Map No. 8, "Allied Offensive Plans, 1943-1944," in the succeeding chapter.

Nassau Bay–Salamaua

29–30 June 1943

Implementing the western arm of the pincer movement under the Elkton Plan [2] after the fall of Sanananda, the U. S. 41st Division in the coastal areas and the Australian forces in the interior were slowly advancing northward through the Papuan jungle towards Salamaua and Lae against strong enemy opposition. In conjunction with a planned overland attack against heavy enemy opposition, the 41st Division sent the 162d Regimental Combat Team (RCT), known as the "MacKechnie Force," to land at Nassau Bay, Northeast New Guinea, behind the Japanese left flank. The mission of this force was to effect the reduction of enemy concentrations in the Cape Dinga–Nassau Bay area, to open a line of communication to the Australian forces inland, and to generally expedite the taking of Salamaua. On the night of 29–30 June just as the main task force elements in the Woodlark–Kiriwina operation were approaching their goals 450 miles to the southeast, this force effected its landing at Nassau Bay. (See Map No. 7 and Chronology.)

Amphibian Engineer Operations

Shore-to-Shore Movement. Staging from Mageri Point, just north of Morobe, about midway up the coast between Buna and Salamaua, a battalion landing team from the MacKechnie Force boarded 2d Engineer Special Brigade (ESB) landing craft manned by boat crews of a boat and shore combat team from the 532d Engineer Boat and Shore Regiment (EBSR) and set out for the initial landing behind the enemy lines at Nassau Bay, about 10 miles south of Salamaua.[3] Escorted by only three PT boats, the convoy inched northward a few miles off the enemy-held coast under cover of darkness and into increasingly heavy rain, wind, and seas. Natives who had lived in the vicinity for years said later that the storm on that particular night was the worst within their memory. Its violence prevented sighting of guide lights previously located on two small islands along the course as navigation check points. The PT boats were too fast even at their lowest speed for the convoy and could not effectively guide it. They cruised at 25 knots; ESB craft at 8. One wave of landing craft containing the artillery got off the course entirely and went beyond the objective beach. The main group of boats, however, finally located the landing beach by aid of recognition signals flashed by an Australian patrol which had infiltrated through the Japanese lines to the objective beach. It was obvious that the boats could not land successfully in the surf which was running 10 to 12 feet high, but orders were to land that night, and so, bouncing in all directions, the small task force went in to hit the beach in two assault waves separated by an interval of several minutes. Although large quantities of equipment, weapons, and ammunition were lost, the engineer boat company landed 740 men without a casualty. Most of the boats were unable to retract and many of them were left swamped where the violent surf pounded them into distorted shapes within a few minutes. The third wave, without the aid of a PT boat, arrived off the beachhead several hours after the first two waves had landed. The wave leader, upon learning that the first two waves had beached but that most of the boats were swamped, wisely decided that he would not land at that time as his boats, too, would inevitably swamp under the same conditions. He, therefore, did not attempt to beach his craft until daylight when he succeeded in landing his entire party under abated weather conditions and in retracting all but two of his boats.[4]

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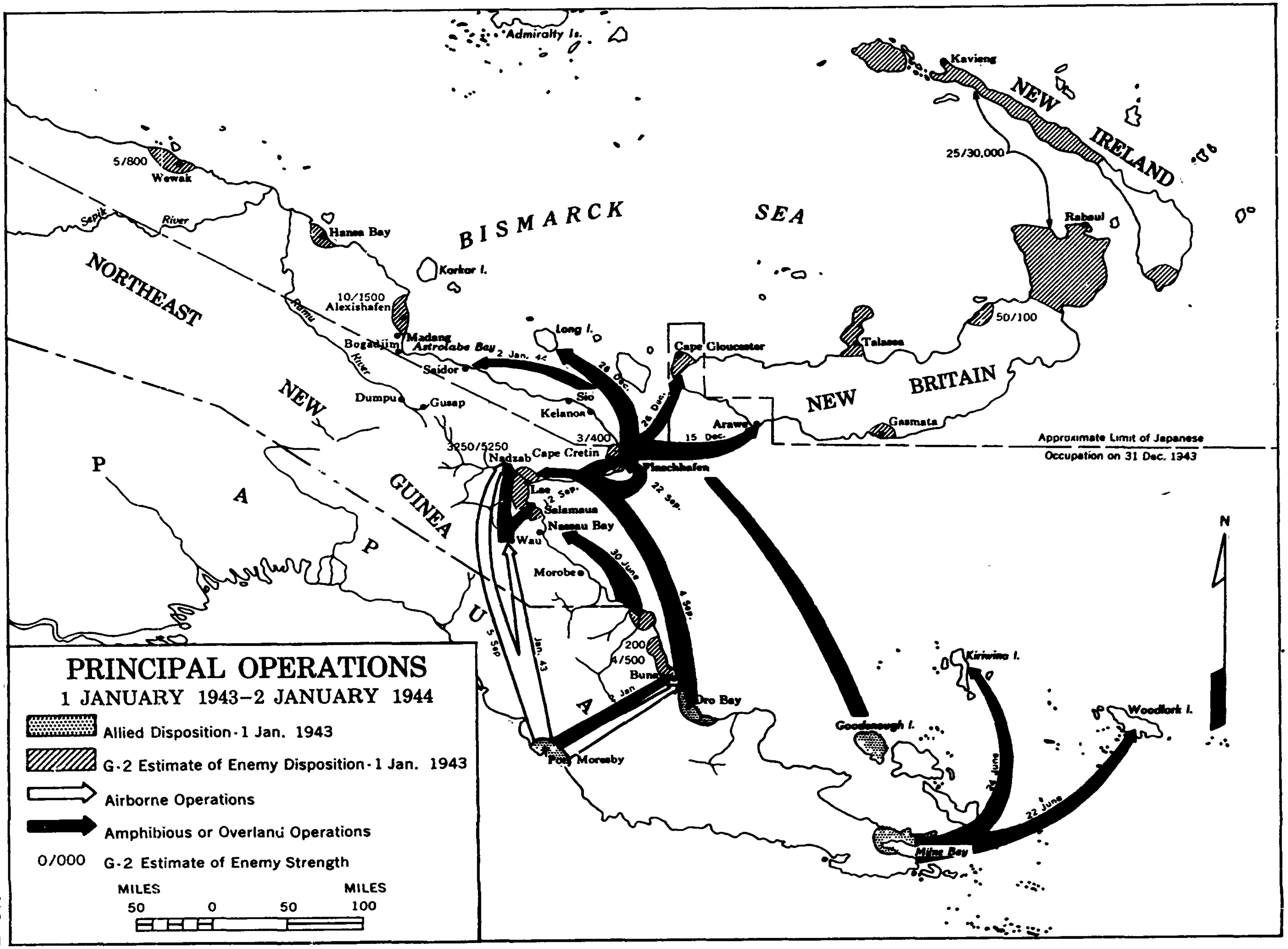
[2] *Editor's note: See* Map No. 8, in the succeeding chapter.

[3] *Editor's note: See* Map No. 19, "Nassau Bay–Salamaua Operations," Vol I, this series.

[4] *Editor's note:* It is fortunate that the wave leader made this decision, as these boats, together with one operational boat remaining from the first two waves, were at that time the only boats available for resupply.



MAP NO. 7

SOURCE: OCE, GHQ, SWPA, Annual Report, Operations, 1943.

The need for giving greater consideration to weather and surf as factors in determining a particular D Day was evidenced not only in the loss of landing craft, but also by the subsequent moderation of the weather itself. On the following night not more than a 6-foot surf was running, while on the second subsequent night the surf had diminished to only about 3 feet. A 24-hour delay in this landing might have obviated the loss of any craft, over and above the more vital factor of ensuring a successful landing. Since it was obvious that the severe weather conditions seriously threatened the possibility of landing at all, and that incidental heavy losses of craft would curtail future operations on the far shore, the judicious selection of time for landing was emphasized in lessons learned at Nassau Bay. Subsequent reports recommended that, if at all consistent with the tactical plan, authority be extended to future task force commanders to postpone operations 1 to 3 days when dictated by atmospheric conditions.

Another point particularly stressed was that one wave of landing craft should not consist of more than nine boats. Six to eight in a wave were considered preferable from the standpoint of control, particularly in night operations. However, two of the landing waves at Nassau Bay consisted of twelve boats which proved too great a number for one wave leader to control at night.[5]

Salvage. From a total of 29 LCVP's, 2 Japanese barges, and 1 LCM making the initial assault, only 1 LCVP from the two original waves and 5 LCVP's and 1 Japanese barge from the third wave survived the storm and surf for a return to Mageri Point. Yet, despite the extreme conditions encountered, probably 6 to 8 of the broached craft could have been salvaged had the earlier recommendations of the engineer boat and shore combat team commander for salvage craft been heeded. Established ESB doctrine published in standing operating procedures (SOP's) called for at least 2 salvage boats per boat company. Preferably there should have been 4 or 5, but in any case, not less than 2. Nevertheless, all landing craft were used as carriers by order of the task force commander and none was made available for salvage purposes. This proved to be poor economy. Salvage craft would have paid for themselves many times over in safeguarding landing craft from complete wreckage in the surf besides providing additional lifesaving facilities had the occasion arisen.

However, salvage of swamped boats and equipment was begun immediately by boat crews while the infantry pushed rapidly inland. The coordinated support of the engineer shore party at this time would have been invaluable, but the shore party was still on the near shore. It had been retained there in favor of carrying a maximum of combat troops for the initial assault, and was not scheduled to arrive until D plus 3. The efforts of the boat crews were, therefore, necessarily divided. While salvage of the boats required immediate attention, some organization of the beachhead was equally as urgent. These twofold operations were vigorously continued throughout the night of 29–30 June, and by morning practically all salvage possible under the circumstances was completed.

This lack of essential salvage boats and the absence of immediate support of an engineer shore party on the far shore strongly emphasized the advisability of instructing all task force commanders to adhere to ESB SOP's in the conduct of shore-to-shore operations insofar as the tactical situation permits. To overcome the effects of possible inexperience in amphibian operations on the part of tactical commanders, the orientation thus required would insure that principles established through careful study of previous ESB experiences were employed to full advantage.

Combat Employment of Boat Crews. Despite their combat strength in the area, the enemy re-

[5] *Editor's note:* Night assault landings subsequent to the Woodlark, Kiriwina, and Nassau Bay operations, after more adequate air cover had been established, were discontinued and all future initial landings were made during daylight hours.

frained from counterattacking until the evening of D plus 1. The roar of motors as boats tried to retract from the beach during the landing had confused the Japanese. They believed tanks were being landed and did not attack until convinced that the task force was small and without armor. However, the MacKechnie Force fully expected an enemy reaction to the landing. Even boat crews were organized into a platoon of 2 officers and 66 enlisted men upon completion of salvage operations and, armed with rifles and machine guns salvaged from abandoned boats, were assigned a place in the defense perimeter of the beachhead. Only sporadic Japanese small-arms fire was encountered by these boatmen during daylight on 30 June. But at dusk this platoon was reassigned to dig in and stop any Japanese counterattack on the left flank of the beach, while all combat reserves were committed on the right flank. That night, faced with a counterattack by a Japanese force estimated to be over 300 strong, these 68 men engaged in a mission considerably remote from the operation of engineer landing craft. With no previous experience in wily Japanese tactics, the amphibian engineers somehow managed to resist successfully all enemy ruses. They maintained their fox holes despite deceptive orders given in perfect English. They were not confused by the enemy's surprising identification of their unit, voiced from the brush close by with threats to "get" them. During the banzai charge just before dawn the enemy did "get" seven engineers and wounded eight others, but the ensuing hand-to-hand fighting with knife and bayonet vibrated with many a shrill squeal as the fighting engineers tallied up their score against the fanatic enemy. In the morning the beachhead was still intact. Over thirty Japanese casualties littered the engineers' defense area.

This relatively small but critically important incident, following the commitment of an engineer construction unit to combat at Milne Bay, reiterated the fact that any engineer troops, regardless of designation, might be required at any time to fight as infantrymen. With particular reference to ESB boat crews, this incident demonstrated the necessity for keeping rifles and bayonets in good condition and readily available at all times despite continued service close to corrosive salt water.

Resupply Missions. Subsequent support by ESB boat crews involved resupply missions run daily from Morobe to Nassau Bay despite enemy artillery barrages and mortar fire directed on the forward beaches. During the middle of July a new forward beach (Coane Beach) was established just south of Tambu Bay and considerable artillery and ammunition were transported there by ESB craft. From Coane Beach these movements were repeated as new beaches were opened up to keep the infantry supplied on its northward advance along the coast. Despite casualties and boat losses inflicted by enemy fire, resupply missions were run nightly—often in defiance of enemy observation. At no time was the advancing infantry held up through shortages of supplies or ammunition, transportation of which would otherwise have been most difficult over the unimproved jungle terrain traversed. A new technique was paying dividends. The close, continued overwater support to ground forces on the move provided the successful transfer north of between 110 and 150 tons of supplies and personnel nightly despite the fact that friendly forces did not control these sea areas or the air overhead. Because of the nature of these close support and resupply operations, an efficient and foolproof dispatch system of movement to and disembarkation at forward beaches was developed. Working on the trial and error method, by application of tentative procedures to actual ESB operations, a system was finally established that worked equally well for tactical or resupply missions.[6]

Shag Boat. The invaluable use of a "shag" boat was demonstrated in these early engineer

[6] *Editor's note: See* appendix, "Operation of an ESB Boat Pool in Tactical and Resupply Missions," Vol IV, *Amphibian Engineer Operations,* this series.

Engineers unloading a 37-mm. gun from their landing craft at Tambu Bay, New Guinea, during the drive up the coast against Salamaua.

Engineer bulldozer carving a supply road up Roosevelt Ridge to keep pace with the advance troops attacking Salamaua, New Guinea.

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Two Engineer tractors haul an antiaircraft gun toward Salamaua over the newly constructed road along Roosevelt Ridge near Tambu Bay.

Brigadier General Ralph Coane, 41st Division Artillery Commander, uses map to interpret tactical situation on 7 August 1943, preceding seizure of Salamaua, New Guinea.

resupply operations. The shag boat brought up the rear of a formation of boats, and, except in an emergency, carried only its crew. It policed the column for stragglers, and boats out of formation. In case of the mechanical breakdown of a boat, it would signal the lead boat half speed, take the disabled boat in tow, put its mechanic aboard, and proceed in the formation with the towed boat. When repairs were completed, the shag boat signaled the lead boat, and full speed was resumed. When boats went in to a landing beach, the shag boat stood offshore, ready to get a line quickly to any disabled boat.

Signaling. An obvious weakness in signaling during these early operations brought about the recommendation that all boat personnel, men and officers, should be qualified signalmen and should maintain their proficiency. Although accurate blinker signaling is essential in all boat operations, inter-boat and boat-to-shore communications in these operations were carried on exclusively by semaphore. This was due, no doubt, to the fact that personnel were much more proficient with semiphoric devices than with blinkers. Aldis lamps were discarded for flashlights, and fixed signals for column control were established.[7]

Shore Party Employment. The type of mission assigned to the shore party of the boat and shore combat team from the 542d EBSR, which relieved the 532d EBSR units, was not considered a proper use of technical troops.[8] The sole task assigned was the loading and unloading of supplies. It was backbreaking work, and monotonous. The use of a good engineer unit, made up of highly trained specialists, for stevedore work and carrying parties was illogical. Sergeants and corporals, who usually superintended such activities, were instead personally assigned to fill out these details as only a minimum of supervisors and a maximum of workers were required. These shore engineers were used for carrying parties as far as 7 miles inland. It was a colorless, thankless task, but the men put all their energy into doing an efficient job, and it was done in a superior fashion. However, it was apparent that the exhausting efforts of these few men, working under pressure for weeks, could have been duplicated with much less physical punishment per man and greater over-all efficiency if unloading parties had come entirely from reserve combat units, which were idle anyhow. The shore company could then have been used for the operation and improvement of the initial beachhead and the supplementary resupply beachheads when established farther forward. Such tasks were more in accord with engineer shore party training and the urgent needs existing.

Ordinarily shore engineers should have been fully occupied on the beach, or, over a short distance inland, establishing dumps, preparing the beachhead and access routes, and protecting flanks of the beachhead. A shore company cannot be a combination engineer and stevedore and carrying party unit. In assuming responsibility for unloading of supplies on the far shore ESB elements (not being provided in extravagant strength) were undertaking liability for something they could not deliver by themselves, since they had no authority to arbitrarily requisition working parties from the combat troops. The responsibility for assigning all available manpower in a beach area to stevedoring should have been assumed by the commander controlling the reserve combat units. Engineer shore company responsibility should not have extended beyond supervision of working parties made up largely from reserve combat elements.

Landing Craft Maintenance. It was apparent that certain deficiencies existed in the methods used for the maintenance of landing craft. The

[7] *Editor's note:* One flash indicated *Full Speed,* two flashes, *Half Speed,* and three *Stop.* Distress signals were a series of *E's* for motor trouble and a repeated *SOS* for aground or on a reef.

[8] *Editor's note:* On 14 August the combat team of the 532d EBSR was relieved by similar units from the 542d EBSR so that the 532d could reorganize its units in preparation for the Lae operation. The new force, made up of 542d units, was known as Combat Team III.

maintenance organization supporting the boat and shore combat team (Combat Team III) from the 542d EBSR consisted of a maintenance section from Company C, 542d EBSR, and a heavy maintenance platoon of Company B, 562d Engineer Boat Maintenance Battalion, at Nassau Bay, and the 562d Engineers, less detachments, at Morobe. (See Map No. 7.) Major repairs, requiring complete shop facilities, were to be returned to Morobe where control of marine spare parts was centralized. Requests for such parts, however, were not filled or, if filled, were subject to considerable delay. This lag in the flow of parts forced the combat team maintenance detachment to resort to considerable improvisation. In the face of these difficulties boats were kept going, though at times bailing wire was literally used. Wrecked boats from the initial landings at Nassau Bay were thoroughly stripped. Two complete LCVP's plus three serviceable Gray marine motors were assembled from salvaged materials. Various and sundry parts were collected, sorted, and cleaned. Time spent on this "scavenger hunt" was definitely worth while. Because of the time and personnel involved in salvage, however, preventive maintenance was not adequate. It was performed, but not with the thoroughness and system that might otherwise have been applied.

Other deficiencies existed in the heavy maintenance setup. Company B, 562d Engineers, was split three ways—the platoon in direct support of the boat and shore combat team at Nassau Bay, a detachment at Oro Bay, and a detachment at Morobe under control of the brigade maintenance officer, 2d ESB. The equipment of one maintenance company is not sufficient for a three-way division. Also, by splitting the personnel into three elements, no one element had sufficient men to do its work satisfactorily. Another maintenance defect was created by the method of command. The platoon supporting the combat team was naturally placed directly under the command of the combat team commander. In spite of this, there were repeated instances when the brigade maintenance officer gave orders direct to this platoon involving movement of men, equipment, and boats. This situation made it impossible for the combat team commander to depend upon his only means of direct maintenance support. On a number of occasions he called upon the platoon's personnel or equipment for a required task only to find that they had been dispatched on some special job by the brigade maintenance officer.

Task Force Engineer Operations

Company A, 116th Engineer Combat Battalion, was attached to the MacKechnie Force immediately after completion of a difficult portion of the Oro Bay–Dobodura Road (see Map No. 5), and elements of the company participated in the initial landings at Nassau Bay. The close support rendered under fire by these combat engineers won enthusiastic commendation from the task force commander. One platoon participated in the initial assault by promptly establishing beach exits for the attacking infantry battalion with the use of landing strip and Sommerfeld mats. They moved supplies from the beachhead to dumps, increasing their transfer capacity by the improvisation of a sled made from native materials. When the beachhead was attacked from inland, this platoon, participating in the perimeter defense, helped to repulse the attack.[9]

After its consolidation on the far shore, this engineer company constructed 7½ miles of jeep tracks. Many small streams required bridging, and the engineers, using native materials, spanned them in their stride. Several miles of trails constructed under fire by these engineers expedited the carrying of rations and other sup-

[9] *Editor's note:* Two heavy equipment operators manning a machine gun during the engagement were responsible for the annihilation of a squad of Japanese attacking along the beach. The platoon lost three men in the skirmish, one killed and two seriously wounded. When the enemy was successfully driven back, the platoon reorganized and joined the remainder of Company A which had subsequently arrived at Nassau Bay.

plies over the mountains, and considerably facilitated support of the combat troops. An outstanding engineer achievement was the movement of the guns of an artillery battery over 8 miles of a mountain range rising to elevations of 3,000 feet. These guns had to be disassembled and hauled over sheer precipices by ropes.

In close support to the final attacks on Salamaua, this company of combat engineers arrived in the Tambu Bay area [10] where they initiated construction of roads, trails, and hospitals, and effected installation of water supply units. Japanese-manned pillboxes harassed operations here, but despite the intensity of enemy rifle and machine-gun fire ten engineer volunteers promptly blasted them out of existence. Five and one-half miles of two-way road were constructed in the Tambu Bay area. Access up Roosevelt Ridge with maximum grade of 33 percent was made possible by 900 yards of jeep track built under constant fire. Miraculously only two engineers were wounded. By August and September the company had added to its accomplishments the provision of a 300-yard landing strip for artillery reconnaissance planes, and a 550-foot bridge over the Francisco River plus roads, beach road nets, and water supply points.

In substance, the performance of the company of combat engineers attached to the MacKechnie Force was a superb example of engineer close support to a regimental combat team.

Woodlark and Kiriwina Islands

30 June 1943

Woodlark and Kiriwina Islands, lying off the east coast of New Guinea, were strategically situated for the establishment of airdromes from which fighter aircraft could support task forces operating along the New Guinea coast. Air operations against Rabaul and other enemy concentrations could also be advanced by eliminating the loss of unescorted bombers through establishment of fighter fields closer to target areas. The advance of the fighter line was beginning. Woodlark and Kiriwina illustrated the pattern from which the 7,000-mile air, sea, and land offensive to victory was cut. The CHRONICLE Operation against these islands was carried out during late June by the 158th RCT on Kiriwina and the 112th RCT on Woodlark. Despite the large enemy air potential based too conveniently close at Rabaul and virtual Japanese possession of the Bismarck Sea and the waters north of Milne Bay, no enemy opposition developed to the initial landings. The Japanese were caught by surprise, and contributing considerably to the success of these operations was one of the noteworthy engineer feats of the war.

Almost 2 months before the landing by combat troops, two small reconnaissance parties, headed by the Deputy Engineer, Sixth Army, surveyed the islands and provided detailed advance terrain information, supplementing native reports and aerial reconnaissances. This information proved invaluable to Army field planning for these operations, and in furtherance of these plans, the same men, with reinforcements, returned again to the islands a week prior to the combat landings. Risking possibilities of Japanese ambush if the natives had betrayed the original reconnaissance, they returned with the mission of paving the way for what was expected to be a race against time for completing airdromes. The threat of Japanese bombers from Rabaul could not be ignored. Undetected preparation of landing facilities, egress roads, bivouacs, and water supply was essential. Woodlark had a good beach, but it ran into a coral cliff, several hundred feet high, which was covered with heavy rain forest. Kiriwina was completely surrounded by a jagged coral reef, 300 yards to 3 miles wide, through which the advance party made their way in boats launched from an APD (destroyer). After navigating high seas in utter darkness through a 5-mile channel studded with

[10] *Editor's note: See* Map No. 19, Vol I, this series.

jagged reefs, these boats landed at a previously reconnoitered point where beaching was possible only along 200 yards of the shoreline. These reconnaissance troops had no way of knowing whether Japanese guns were awaiting their arrival. With few tools and no heavy equipment, they crossed to the opposite shore of the island 14 miles to the north and, using native help to carry coral in baskets, they built a coral causeway 7 feet high and 300 yards long across the reef and above the tide on the north coast. Scheduled combat landings a week later were successfully effected here under cover of night, wholly undetected by the enemy. (See Map No. 7.)

Amphibian Engineer Operations

Elements of the 59th Engineer Combat Company comprised the shore party of the advance echelon for Kiriwina Island while troops of the 112th Cavalry Regiment, supplemented by heavy dozers and operators from the 20th Naval Construction Battalion, constituted the shore party at Woodlark. No engineer special brigade landing craft or boat personnel were employed by Sixth Army in the CHRONICLE landings, but the 2d Engineer Special Brigade did furnish trained shore party officers and noncommissioned officers to supervise and assist in the establishment of a beachhead on each island. These men, performing their first mission since training days, and that under particularly adverse weather conditions, received exceptionally favorable comments from both the U. S. Navy and Australian observers.

Staging Area Problems. Plans were made for staging all elements of the Kiriwina landing force from U. S. Advanced Sub-Base A, Milne Bay, New Guinea, in areas previously reconnoitered by Sixth Army staff officers. Establishment of this force, arriving from various scattered locations in Australia from Townsville (Base Section 2) to Sydney (Base Section 7), in a forward area with limited unloading facilities presented somewhat of a problem. Roads from unloading points to staging areas were still generally undeveloped and some of these troops and supplies had to be moved 15 to 18 miles by barge even after their debarkation at Milne Bay. Units were, therefore, immediately employed in unloading ships and in the performance of other tasks in connection with base development which considerably limited their opportunity to train for the CHRONICLE Operation.

Subsequent outloading operations evidenced the need for early preparation of loading points with adjacent parking areas on the near shore, and the establishment of a road system interconnecting these loading points with staging areas. A measure of the scope of such preparations was indicated by the necessity, during this operation, for a team of ten men with sandbags, logs, beach roadway material, and a D–4 or D–6 bulldozer (in the absence of critical D–7 and D–8 dozers) simply for construction of a ramp seat and provision of road maintenance at each individual LST loading point.

The type of cargo stowed aboard task force shipping for both Woodlark and Kiriwina evidenced laxity in preparation of loading plans. All APD's and LCI's were excessively loaded with tentage and Chemical Warfare Service supplies. Many late requests were made for transport of special items not originally listed. These items completely filled enclosures between bridge and bow on LCI's, while more important equipment crowded the troop compartments. Troops assigned to the initial landing should have carried only a minimum of urgently needed equipment and supplies; cots, refrigerators, and refreshments could not conceivably be classified under this category. Furthermore, authorized cargo should not have exceeded the standard load for the craft and with the shortage of shipping prevalent during the CHRONICLE Operation, only equipment and supplies necessary to the mission should have been specified by the task force in detailed loading plans prior to embarkation. Rigid inspection by representatives of the task force commander at loading points would have insured that only authorized equipment and supplies were loaded.

Loading plans were subject to further criticism because adequate precautions against losses through air or naval attack had not been made by sufficient dispersal of types of personnel and supplies aboard craft. All medical officers for the Woodlark landing force were loaded in one LCI. All 90-mm. antiaircraft guns for the Kiriwina landing force were in one group of LCT's.

Shore Party Activities. While every effort was made to equip and train shore parties, including preparation of an SOP by the Engineer Section, Sixth Army, the training time available for this operation was inadequate, particularly under the stress of added work responsibilities at Milne Bay. This was true of the entire landing force destined for Kiriwina, and subsequent unloading of landing craft by its shore party organization clearly reflected lack of training. The landing force scheduled for Woodlark, having received satisfactory training at Townsville, Australia, executed its mission in a far smoother manner—on more favorable beach and inland terrain, however, than was encountered at Kiriwina.

At Kiriwina, infantry units attached to augment the shore party were particularly ineffective. As soon as debarked, they immediately moved inland and had to be rounded up the next day. This was due to the lack of realistic training, which, in turn, was due to the fact that neither time nor amphibious craft were available, particularly at Milne Bay, to permit this training.

It was evident that future training should be conducted jointly, with participation by Army, Navy, and Air Force components. It was also apparent that thorough tests of engineer special brigade weapons and equipment could only be effected by practicing amphibious operations under realistic conditions requiring landing over coral reefs and narrow beaches with unfavorable and difficult landward ingress despite some expense of equipment. The relatively good landing beaches used for training in Australia were not at all typical of conditions to be encountered in later operational areas.

For the Kiriwina landing it had been recommended that not less than 2 weeks or 3 complete "dry runs" be required of the shore party. However, not even 1 hour was devoted to it. This was due to the fact that naval landing craft arrived in the staging area 20 days late. Under orders of higher authority occasioned by the critical port unloading situation, these boats had been made available to United States Army Services of Supply (USASOS) for unloading troops and supplies rather than for training purposes. Nevertheless, even if the shore party had trained as then prescribed, the physical effect of encountering coral ledge for the first time in an actual operation undoubtedly would have proved beyond their capabilities.

At Woodlark Island normal beach marking was dispensed with in order to show a minimum of lights. A red light was shown in the center of the beach and single lights were displayed on arrival of LST's at beaching points selected for them. The use of a few luminous signs on the beach to mark beach exits, beach and shore party headquarters, and guide posts would have eliminated some confusion. Shore party personnel were difficult to recognize in darkness, and lights of a distinctive color or other suitable identification should have been furnished them to facilitate recognition.

Unloading activities on the far shore soon reflected the disadvantages of loading on the near shore without first establishing a complete loading plan and indicating definite cargo priorities to insure that the most important supplies would arrive first. When overloaded LST's had difficulty in beaching close to shore, material required to extend the beach roadway was as yet unavailable. Similarly, when trailers were disembarked from landing craft, sufficient tractors or prime movers were not yet unloaded and available to move them from the beach before congestion ensued.

In this unopposed landing, logistic and engineering considerations far outweighed the tactical. It was constantly necessary to divert large numbers of engineer and combat troops and considerable engineer equipment to road construction and ship landing facilities from the primary mission of establishing airdrome facilities on the islands. Where this was not done or was delayed, roads quickly became impassable, some to the point of abandonment, and landing points deteriorated to such an extent as to delay unloading seriously. The principal lesson learned was that amphibious operations will be jeopardized, if not defeated, by repeated verbal acquiescence to, but inadequate understanding of, the importance of logistics by tactical planners, and through failure of service commands and supply planners to insist on certain minimums of supporting facilities before an operation is scheduled.

Task Force Engineer Operations

The 59th Engineer Combat Company and the 46th Engineer General Service Regiment provided engineer support to the 158th RCT on Kiriwina. On Woodlark, U. S. Army Engineers consisted only of the 404th Engineer Combat Company in support of the 112th RCT. The balance of engineer support was provided, during these operations, by the 60th Naval Construction Battalion and elements of the 20th Naval Construction Battalion.

Plans for engineer construction on both islands were disrupted from time to time by frequent changes in requirements and further complicated by the fact that some Royal Australian Air Force (RAAF) units were included in the U. S. Fifth Air Force organization planned for Kiriwina. Building design to accommodate RAAF units was considerably different from that required for U. S. military air units and was more pretentious. It did not conform to standard building designs nor did it permit adherence to the tenet of providing bare essential facilities. The necessary changes involved in these requirements made it difficult to estimate labor and materials required, and to plan other developments such as road, dump, and bivouac areas.

Supplies and Equipment. Task force engineer supply was complicated by the fact that no engineer depot personnel were made available for Kiriwina Island. Inasmuch as only one engineer depot company had been assigned to the entire Theater, General Headquarters, Southwest Pacific Area (GHQ, SWPA), directed USASOS to form a provisional depot platoon when troop requirements for the operation were established. In turn, USASOS directed the 46th Engineers, then under USASOS control at Port Moresby but about to be assigned to this operation, to provide one officer and twenty-three men from its complement to make up this detachment. As a consequence, engineer troop requirements, though nominally filled, were met only by depleting the strength and effectiveness of one of the major engineer components assigned to the task force. And specifically detrimental to engineer task force supply was the assignment of this detachment, untrained in depot operations, to responsibility for this vitally important supply function.

The imposition of radio silence on both Woodlark and Kiriwina Islands was a further handicap to engineer supply. Only supplies of a combat nature, such as hand tools and explosives, had accompanied the troops in the initial landings. Resupply was to come from Milne Bay. However, the greater part of engineer resupply requirements could not be anticipated because of shipping limitations and had to be requisitioned after specific needs developed in the objective area.[11] Radio silence lasted for 20 days during

[11] *Editor's note:* Only LST's could be used for resupply because cargo vessels were not permitted to enter objective areas in early operations until airdromes were completed. The limited number of LST's available, however, had to be unloaded in 4 to 6 hours on Navy insistence, and the unloading of heavy, unwieldy engineer cargo, in view of a lack of crane working space on this type of craft, was a slow process. Loading plans for resupply, therefore, accorded priority of space allotments to types of cargo which could be mobile loaded, and most engineer resupply requirements, therefore, had to be requisitioned after essential engineer needs were determined in the objective area.

which time task force engineer reports and requisitions were dependent on safe hand transmittal by LST's returning to Townsville, Australia. Frequently, delays of a week or more were involved before reports and requisitions were received at Milne Bay through this means of transmission. Subsequent reports of the operation pointed out that resupply during early days of radio silence could have been expedited by stationing a Sixth Army engineer supply representative at Townsville, and planning resupply shipments direct from Base Section 2 headquarters there. Such assignments of engineer representatives were later made to all major USASOS installations involved in Sixth Army supply, despite seriously reducing the number of personnel assigned to the already small Engineer Section, Sixth Army. Even so, without radio communication, too much valuable time would have been lost in requisitioning the numerous emergency requirements which arose to permit timely action.

Air shipment of Sixth Army emergency supplies from Australia was completely controlled by Allied Air Forces (AAF), and aircraft frequently arrived in forward areas with inaccurate manifests or none at all. Cargo would be off-loaded with AAF supplies at any one of the hundreds of hardstandings on airdromes at Port Moresby, Milne Bay, Dobodura, or Goodenough Island, and it was often impossible to trace shipments.

Much engineer equipment used in the CHRONICLE Operation had had over 5,000 hours of severe usage prior to the landings and was over 18 months old. Such vehicles and equipment were soon deadlined because of the shortage of spare parts and construction was correspondingly delayed. Reserves of spare parts as ordinarily allotted to equipment in the United States and the mainland of Australia were entirely inadequate in these forward operational areas; they should have been at least tripled.

At Woodlark Island the naval construction battalions brought in considerable quantities of construction materials for their own camp construction. While these supplies were later helpful, they forcibly presented the disparity in housing standards of the ground and naval construction forces, and their transport markedly reduced cargo space that could have been used to more advantage for more important operational construction needs.

Engineer improvisation contributed to the saving of some critical supplies. Kiriwina and Woodlark road and runway construction was of coral which caused a high rate of wear on tires. The sharp particles cut tires and greatly reduced their life, particularly when coral was picked up in between the dual wheels with resultant damage to the side walls of tires. The 46th Engineers effectively solved this problem by improvising a metal bar welded with a hinge joint to the frame of the carryall over each set of dual wheels. The lower end of the bar, resting against the drum between the dual wheels, removed the rocks and coral before they became tightly wedged between the tires.

Construction. Construction progress on the Kiriwina Island airdrome was delayed initially by heavy rains, unexpected difficulties with roads, relatively slow arrival of heavy construction equipment, and the increase in scope of engineer construction. Most of the available construction equipment, because of its required use on roads, could not be placed on the airdrome project until D plus 10 although clearing for the runway had already been underway. This was a typical example evidencing that construction plans should include provision of a supporting road net in advance of or simultaneously with an airdrome; otherwise the lack of such a road net inevitably delayed construction of the airdrome itself.

The need for speed of construction and for revision in designs to meet existing operational requirements as well as to conserve construction effort influenced all engineer considerations at this time. Airdrome design was undergoing continuous revision. During this critical period of limited aircraft availabilities, for example, AAF required hardstandings to be both dispersed and revetted. The extreme vulnerability of airdromes to attack by the enemy, particularly in view of the fact that aircraft replacements were not available, motivated defense-mindedness.[12] At Kiriwina, therefore, in accord with existing construction policies, keyhole type hardstandings of different sizes for fighters and bombers were constructed. It was observed, however, that many of these, particularly in the remote portion of dispersal loops, were seldom used inasmuch as pilots frequently placed assorted aircraft in the hardstandings located near the runway. Standardization in design and size of hardstandings was stimulated as a result, and all hardstandings were subsequently designed to accommodate either a heavy bomber, 2 medium bombers, or from 3 to 5 fighters. In later operations standard construction of a single type hardstanding resulted in saving much construction effort.

Operational factors continually prompted revision in designs. The vast distances to be covered, exceeding the range for which available aircraft were designed, necessitated the overloading of planes with fuel and bombs. This tended to decrease the angle of ascent on take-offs. At the same time, partially trained pilots required the entire runway in taking off, while crippled aircraft returning from combat similarly required an extended approach zone. The glide angle for runways was revised accordingly, and gradually decreased from a ratio of 40 feet of clearing to 1 foot of altitude, as provided on Woodlark and Kiriwina, to 60 to 1.

The Woodlark Island airdrome was provided at the request of the South Pacific Force for U. S. Navy use and constructed by naval construction battalions. A 150-foot runway width was, therefore, necessarily specified, although U. S. Army specifications, in the interest of conservation of construction effort, limited all Theater runway widths to 100 feet. No Allied offensive air strikes were ever scheduled which included fighter strength based on Woodlark, and from the time the original construction request was received from Headquarters, South Pacific Force, early in May, the Navy displayed a decreasing interest in Woodlark Island. The exact opposite was the case at Kiriwina. These airdromes were occupied by fighter groups on 12 October, and from dawn to dusk Kiriwina-based P–38's rendezvoused 20,000 feet overhead with fleets of B–17's and B–24's en route for successive air strikes on Rabaul, the powerful Japanese anchor in the Southwest Pacific. This fighter escort, plus the provision of an intermediate landing field, saved an untold number of bombers and crews.

Although the location of docks in these early operations was normally influenced by heavy sea action during certain seasons, in some cases the danger from weather had to be risked because of other considerations. Under existing needs for speedy construction, proximity of proposed docks to work and depot sites and the availability of access roads outweighed considerations of seasonal tides. At Kiriwina, therefore, though a sheltered site for the dock was available at Boli Point, the dock was built at Muiau Bay in the interest of the time and effort which could be saved by reduced access road construction at the latter site. This proved a correct decision; before the seasonal winds started to pound this area, the bulk of supplies had already been landed over the dock and the operation was largely completed.

Lae–Nadzab

4 September 1943

Under cover of the Salamaua operation, the Allies were forestalling Japanese reinforcement of Lae, and draining its reserves. Meanwhile plans for a three-pronged, closely coordinated

[12] *Editor's note:* Airdromes on Kiriwina were bombed while still under construction. Besides damage to equipment and installations, casualties were suffered by personnel of the 46th Engineers working on the runways at the time.

amphibious, airborne, and ground offensive were being completed to effect the capture of the Japanese base at Lae and the airfields in the Lae–Markham Valley area of New Guinea. A large force consisting of two Australian divisions, the U. S. 503d Infantry (Parachute), and Task Force 76 from the Seventh Amphibious Force, U. S. Navy, including 2d Engineer Special Brigade elements, had been assembled at Port Moresby and Milne Bay for this mission. Preliminary air strikes to neutralize Japanese air power, based in the vicinity of Wewak and threatening the success of any move against Lae, were to be carried out by the Fifth Air Force. The 9th Australian Division was to make a landing on beaches east of Lae and then move along the coast to Lae. Simultaneously, the 503d Infantry and the 7th Australian Division in airborne operations were to land at Nadzab in the Markham Valley, drive down the valley, and attack Lae from the northwest. Ground forces consisting of the 5th Australian Division and the U. S. 41st Division, after successful attacks at Salamaua, were to push northward along the coast to Lae. (See Map No. 7.)

Amphibian Engineer Operations

The 2d ESB elements to be attached initially to Task Force 76, Seventh Amphibious Force, but to revert to control of the 9th Australian Division after landing, had been hastily organized from far-flung and scattered units of the 532d Engineer Boat and Shore Regiment into an engineer boat and shore combat team. Approximately 1,300 men had been assembled for this team, consisting of a reinforced boat company and boat control section, a shore battalion, a medical company plus one medical detachment, an amphibian scout detail, and a headquarters detachment.

Utilizing their own craft, and transporting only ESB troops and equipment, this combat team left Morobe and joined the naval convoy off Natter Bay at 2030, 3 September 1943, for the run across Huon Gulf to the landing beaches east of Lae.[13]

Amphibian Scouts. On 4 September 1943, specially trained amphibian scouts of the combat team, wearing Australian uniforms, were landed with Australian infantry in the first wave of LCVP's discharged from an APD. These scouts, consisting of two officers and eight enlisted men for Red Beach (division beachhead just east of the Buso River) and one officer and four enlisted men for Yellow Beach (flank protection east of the Bulu River) were to make a quick reconnaissance, ascertaining enemy positions as well as adaptability of the terrain, and promptly mark the beaches. Plans had been made for small detachments of the assault infantry company to be assigned to each flank of the beach to protect these scouts during their activities. Actually, however, upon hitting the beach, every Australian infantryman in the first wave pursued his original direction and disappeared into the jungle, leaving the scouts to provide flank security for their own activities. Erection of beach markers was, therefore, accomplished by using one of the few scouts available to provide flank protection for the work of the rest of the detail. This token of security proved adequate only because there were no Japanese on the flanks of the beach.

The scouts then signaled back to the ships offshore that enemy opposition was negligible, called the LCI's in to land, radioed messages controlling movement of craft, and assisted in clearing the beach of initial casualties.

Shore Party Activities. Engineer shore battalion personnel began work as soon as their landing craft touched the beach. They set up beach defenses and promptly initiated unloading by using the hand-to-hand chain method of passing supplies.[14] The assistance of labor details

[13] *Editor's note: See* Map No. 19, "Nassau–Salamaua Operations," and Map No. 20, "Lae–Finschhafen Operations," Vol I, this series.

[14] *Editor's note:* For this purpose loads should not exceed 75 pounds nor should they be so small as to require too many items for handling. Weights should preferably be 50 to 75 pounds.

from the 9th Australian Division, however, proved unsatisfactory. Far too few Australian troops were available for labor on beach roads and for unloading. The few labor details furnished the shore party did not nearly approach the number ordered by the division. Requests for more troops to assist in the urgent unloading were initiated through Australian liaison officers but disorganization among their units just back of the beach was so great that despite ali efforts only a relatively few Australians were pressed into service. This threw much more work on the shore battalion than had been planned, but the unloading schedule was met except for the delayed discharge of the last seven LCT's.[15] Subsequent Theater-level study of the amphibious phase of the Lae operation elicited the following conclusions:[16]

The landing force commander should be made responsible for the entire operation to include both tactical and logistical phases thereof. The tactical phase cannot succeed unless the logistical phase succeeds. The situation will determine what portion of the total force should be used for tactical exploitation and what portion should initially be used for unloading and handling of supplies on shore.

To maintain and progressively adjust during the operation a proper balance between the number of troops used in supply operations and those used on the tactical missions, preliminary training is essential. All troops employed initially should be capable of performing either beach supply or tactical operations as the situation may demand. Control should be flexible to permit immediate adjustments in units engaged on the different phases of the operation. The particular situation confronted dictates the measures to be employed and the method of their employment. It is considered, therefore, that combat landing teams should be organized into 3 components, namely: tactical, logistical, and support. The support component could be utilized either in support of unloading operations or in support of tactical operations, dependent on the situation, and should be capable of being readily diverted from one operation to the other as may be necessary.

Further difficulties were encountered. Attempts to construct a ramp surfaced with ARC mesh to each grounded LST caused considerable delay in unloading. Traffic over these wire mats before they were properly staked down resulted in loss of mats and time.[17] Similar mats for a lateral beach roadway were laid too close to the water line, and required constant repair and maintenance. Construction of the main beach exit road was delayed by swampy conditions caused by recent heavy rains, and as a result a congestion of vehicles and off-loaded supplies along the lateral beach roadway promptly accumulated. Labor details available, however, were not sufficient to disperse these supplies by hand. Movement of combat troops inland to assembly points after the initial landing was poorly executed. Large numbers of these troops congregated on the beach, adding to the over-all congestion and interfering with traffic and organization of the beachhead. Just beyond the narrow, open beach area, tracks were cut too close together through planned dump areas by some Australian troops. This later resulted in improper segregation of off-loaded supplies. Ammunition and gasoline dumps were separated by a distance of only 20 yards and situated about the same distance inland under poor cover. The first 3 days were particularly hectic for the shore party. Yet despite performance of unloading responsibilities punctuated by enemy air attacks, concurrent organization of the beachhead was not neglected. A double lateral road was constructed on the beach; a road was built from the beach to Buso Village; beach dumps for off-loaded LST cargo were constructed, and the ammunition dump, initially established too close to the gasoline dumps by the Australians, was moved to a new location farther inland.

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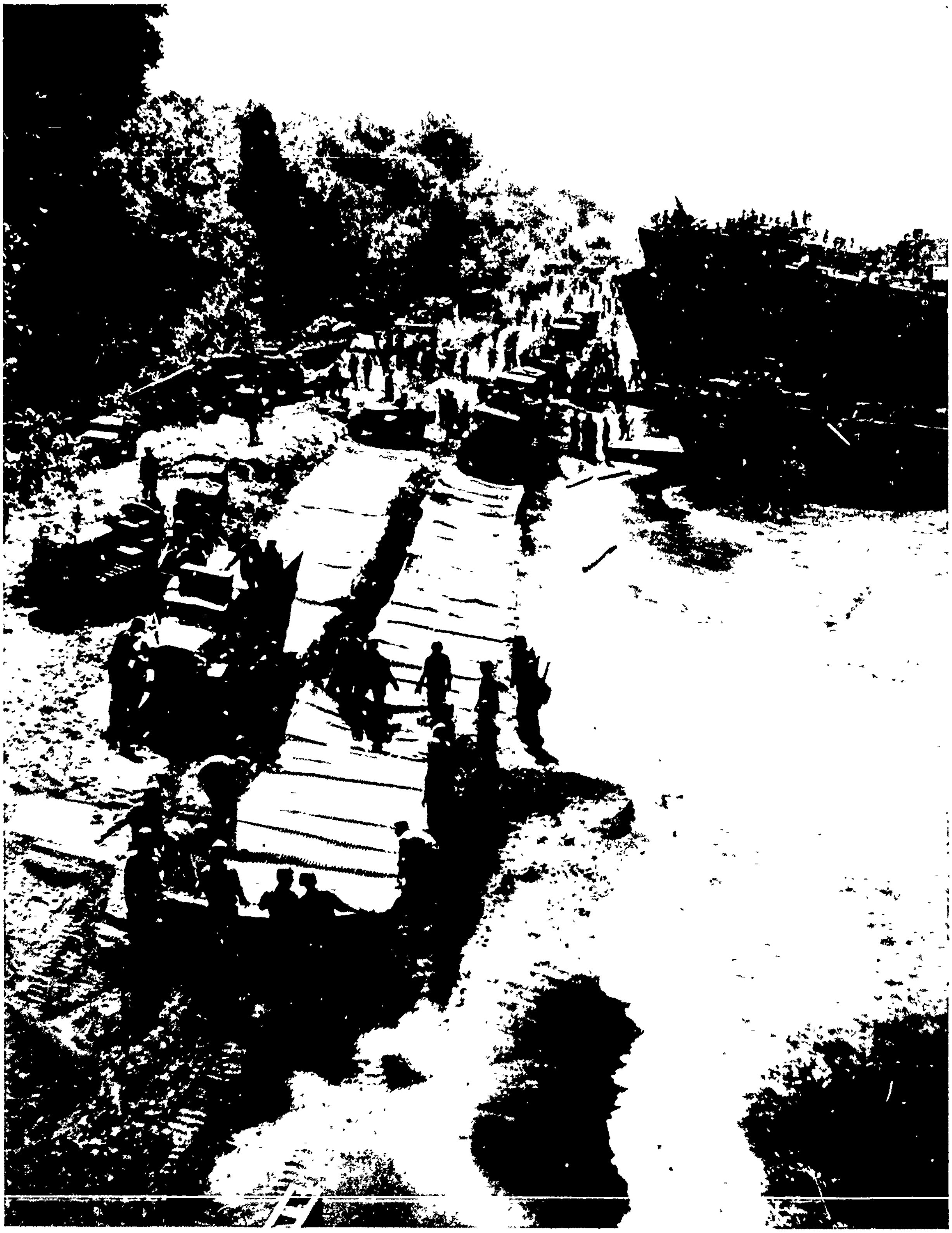
[15] *Editor's note:* These LCT's were to have been unloaded entirely by labor details furnished by the division. Approximately 60 percent of them had to be unloaded by the shore battalion after they had unloaded all the craft initially assigned to them.

[16] Check Sheet, OCE, GHQ, SWPA, to G-3, GHQ, SWPA, 24 Oct 43. In OCE, GHQ, SWPA.

[17] *Editor's note:* The most effective method of using ARC mesh and preventing its winding up in the treads of tractors or on the axles of trucks was by the introduction of a tensile stress, transverse to the direction of traffic. Requiring frequent and effective stakes and side poles, or cables, to keep the mesh stretched across the road, this method naturally involved much labor.

Engineer shore party bulldozers prepare sand ramps to LST's and exit roads on narrow beach near Lae, Northeast New Guinea, to facilitate unloading of heavy equipment and supplies.



Lateral beach roadway mats being laid too close to water line, near Lae, Northeast New Guinea.

An Engineer dump, Lae (U.S. Base E), New Guinea, affected by lack of covered storage and by inadequately experienced Supply personnel.

One of the few Engineer supply sheds subsequently provided at Lae for essential protection and segregation of construction materials and spare parts.

The importance and urgent need for using trained engineer shore personnel to organize the beachhead and assist in landing operations was definitely emphasized in the divergence of effort to less important tasks on the beach at Lae. This phase of an amphibious operation is apt to become the most critical period in an amphibian assault, yet it was the most often overlooked or its importance underestimated in task force planning. Fortunately, however, hostile opposition was limited to bombing and strafing. Had determined enemy ground resistance to the initial landing developed on the narrow beach, overloaded with troops and supplies, the ensuing casualties and confusion might have been critical to the success of the operation.

Lessons Learned Under Bombing. The larger naval ships were still unloading supplies when enemy bombers and fighters attacked in strength. Two LCI's were hit and disabled. Engineer special brigade landing craft were quickly dispersed offshore while beach installations and the shore party of approximately 1,000 men took the full impact of the bombing and strafing. During the enemy air attacks, which continued at intervals during day and night throughout the 12-day battle for Lae, beachhead fuel and ammunition dumps were hit and set afire, several small craft were lost, and the ESB combat team command post was bracketed by four 500-pound bombs. Direct hits were scored in the ESB medical detachment area where wounded were being attended. Throughout the almost constant hail of destruction, however, several things were obvious. Small landing craft made poor targets for attacking enemy planes. Larger vessels, such as the damaged LCI's of the naval task force, should have been accompanied by a salvage ship with hull repair equipment, fire-fighting equipment, and towing gear. However, the small ESB salvage boats, equipped primarily to handle LCM's and LCVP's, were all that was available. The importance of adequate defenses on the beach against land, sea, and air attack was also emphasized. Barrage balloons might have been used to advantage to prevent low-level air attacks.

Landing Craft Activities. The engineer boat company began tactical and resupply missions along the coast from the initial beachhead on 5 September, and continued these services until the fall of Lae, 11 days later. The transport of troops, guns, ammunition, supplies, and equipment by small ESB landing craft in support of ground elements advancing along the coast towards Lae constituted perhaps the most important role played by amphibian engineers in this operation.[18] On one occasion an LCVP ferried practically an entire infantry battalion across the unfordable and unbridged Busu River during daylight hours under continuous fire. The commanding general, 9th Australian Division, lauded the invaluable measure of their support: "Not for one hour has my advance on Lae been held up by failure of the 2d Engineer Special Brigade to deliver troops, supplies, or ammunition at the time and place needed.[19] The considerable support of ESB boats to ground forces, which was demonstrated here as well as at Nassau Bay, established a definite place in future planning for the assignment of engineer boat elements to the commander of the tactical landing force. The employment of such small craft on the far shore provided a water-borne support to the overland forces heretofore terminated by the return of the more vulnerable naval task force shipping to the near shore. The added mobility afforded ground forces through coastal tactical and resupply support by such craft under the senior ground commander in the objective area definitely deter-

[18] *Editor's note:* (1) *See* Map No. 20, Vol I, this series. (2) A force of 1,125 officers and men of the 2d ESB remained at Red Beach with their equipment, plus 2 LCS's, 10 LCM's, 10 LCVP's, and 1 salvage boat. Led by APC's, the balance of 34 boats had returned to Morobe, leaving Red Beach at 0910 on D Day and arriving at Morobe at 1700. All boats arrived intact after having made the entire round trip, a total distance of some 150 miles, under their own power. This run was, up to then, one of the longest shore-to-shore amphibious operations on record and far in excess of distances originally contemplated for amphibian engineers in small craft.

[19] Quoted in Brig Gen W. F. Heavey, "Amphibian Engineers in Action," *The Military Engineer,* XXXVI (May 1944), 148.

Australian troops cross the Markham River via a ponton bridge to join American paratroops in the assault against Nadzab Airstrip.

Engineer airborne equipment that reached Nadzab, New Guinea, by air transport for airfield construction.

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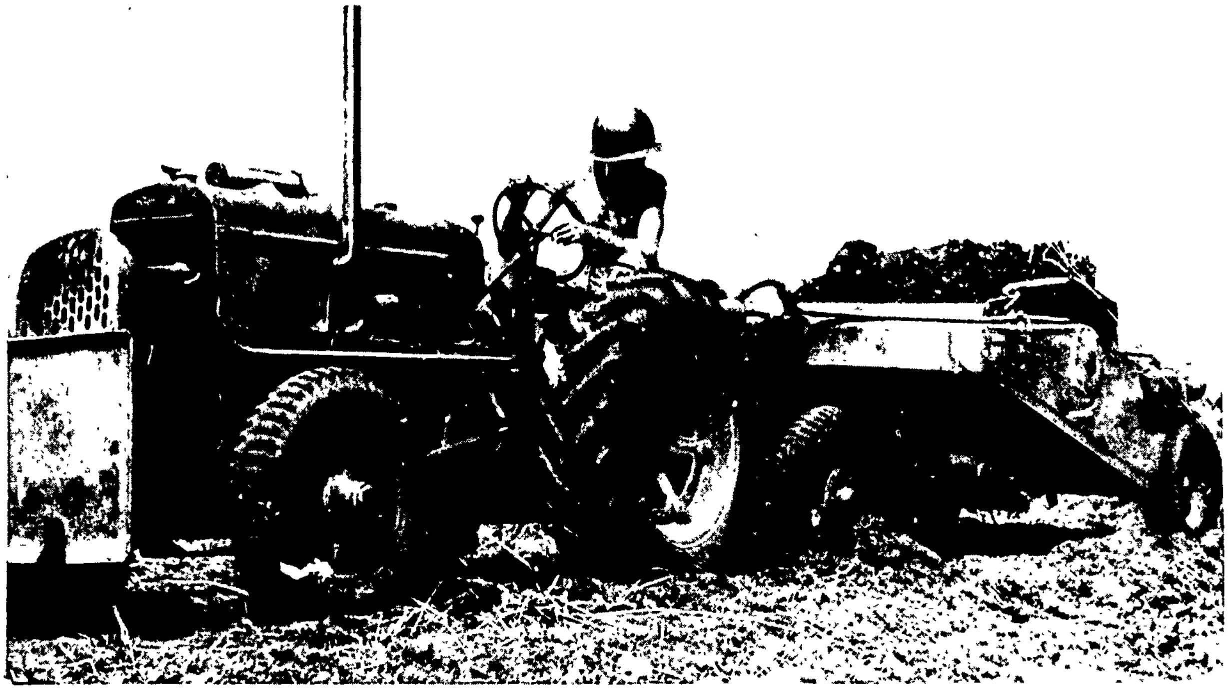


Engineer airborne equipment that reached Nadzab, New Guinea, by air transport for airfield construction.

Nadzab Airstrip rolled and compacted, and ready for placement of pierced-steel plank.

mined their assignment to future operations. The soundness of this decision was confirmed in the case of every subsequent landing made in the Southwest Pacific.

Task Force Engineer Operations

In a swift, perfectly synchronized movement on 5 September, paratroops were used extensively for the first time in the Pacific. Their capture of the Nadzab airstrip, located about 18 miles northwest of Lae, cleared the way for the 7th Australian Division's airborne landing and subsequent drive down the Markham Valley to attack Lae from the northwest. It assured the fall of Lae, threatened already on 4 September when the 9th Australian Division and attached troops in the amphibious phase of the operation had seized the beachheads east of Lae. (See Map No. 7.)

Airborne Engineers. In 1 minute and 10 seconds from the time the first parachute opened, 1,700 U. S. Army paratroops had dropped. After the preliminary bombing, no Japanese resistance was met. Paratroops rapidly established positions covering the airfield while an Australian pioneer battalion, which had moved overland from Wau (see Map No. 7) and crossed the Markham River, arrived to clear the old Nadzab airfield which was overgrown with tall kunai grass. Within 48 hours the leading brigade of the 7th Australian Division, to which units of the 871st Airborne Engineer Aviation Battalion were attached, had been landed in transport aircraft.

The operation evolved into two phases. The first was seizure of the Nadzab area and construction of a troop carrier landing strip, and the second, concentration by air movement of the 7th Australian Division at Nadzab for offensive operations against Lae as soon as a sufficient force became available. Immediately upon landing, elements of the 871st Engineers made a reconnaissance of the area and began work on a strip between the Erap River and the old Nadzab airfield. The over-all operational plan was based on seizure of successive areas at Nadzab which, from topographical studies, were considered to be possible sites for transport aircraft landing strips that could later be developed into tactical airfields. An essential part of the plan was to provide, on the ground, sufficient engineer troop strength to rapidly construct airstrips on these sites. Then, with landing facilities available, a concentration of combat troops could be flown into the area by transport planes.

To permit landing of the leading elements, the old Nadzab strip was reconstructed entirely with hand tools. Because of nonarrival of gliders which were to have carried light tractors, mowers, a wheeled rake, and other equipment and supplies for the preliminary work, Australian forces removed the grass by burning instead of by cutting. This dried and pulverized the ground surface, increasing disintegration in the early stages, and the resultant ash seriously inconvenienced operation of the strip. Subsequent reports of the operation recommended retention of grass to a height of about 3 inches for preservation of surface and reduction of attrition on fields where regrading was not required. It was also recommended for future operations of this nature that gliders carrying engineer personnel and mechanical equipment should be landed immediately after the area had been secured. Airfield maintenance requirements were high in the initial stages before surface improvements could be undertaken. Impact of aircraft upon landing produced undulations in the surface which required immediate attention.

Ensuing analyses of the operation indicated the necessity of making arrangements for the immediate provision and marking of unloading bays sited to suit the operation of aircraft and to facilitate unloading and removal of airborne supplies to dumps. At the same time the need for concurrent establishment of engineer supply dumps was obvious. It was also evident that each platoon of airborne aviation engineers should move complete and with sufficient basic tools and supplies to enable it to function immediately on landing. The advisability of engineer personnel accompanying engineer supplies on transport planes for unloading, or at least, supervision of unloading, was similarly apparent. Subsequent recommendations placed particular emphasis on such accompaniment for airborne mechanical equipment, early employment of which could best be insured by escort personnel specially trained in its unloading and reassembly. The loading of mechanical equipment on sleds was also advocated to facilitate unloading, such mounting permitting heavy components to be dragged to the assembly point by a light, wheeled tractor.

Airborne operations necessarily imply movement to a remote locality, largely inaccessible from the ground. The element of surprise to the enemy is usually of paramount importance. Limited facilities for prior reconnaissance, however, required considerable dependence on intelligence of doubtful reliability. The general plan was, therefore, liable to considerable change, especially in detail. Recommendations for the future, as a consequence, stressed that the engineer plan must be sufficiently flexible to meet sudden changes in demands in the planning stage, as well as future contingencies during the operation.

It was also recommended that shipment of supplies for operations of this type be planned with provisions to meet tactical requirements should delays be caused by changes of priorities in air transport. Distribution of particularly essential supplies among several aircraft rather than segregation was advocated to reduce the risk of nonarrival.

The differences between an operation of this type and one in which an existing airfield is captured are considerable. The major difference is the time lag between arrival of initial troops and landing of an effective force of supporting troops after preparation of landing areas. The rate of arrival of the latter is governed, in the early stages, almost entirely by capacity of the airstrip to accommodate transport aircraft. Therefore, the earliest possible construction of one airstrip, and the construction of additional strips concurrently or immediately afterwards is urgent. Because of the vital necessity of this engineer construction being carried out before the tactical operation could develop, reports of the Nadzab operation emphasized the advantages of effecting original air landings in areas not actively defended by the enemy.[20]

The final assault on Lae met little opposition. With overland supply lines cut by the Nadzab airborne operations, Salamaua and Lae both fell in rapid succession.

Finschhafen

22 September 1943

The capture of Salamaua and Lae in quick succession and Japanese losses in the defense of these areas paved the way for catching the enemy off balance by a quick amphibious strike at Finschhafen, Northeast New Guinea. Accordingly, on the day following the fall of Lae (16 September 1943) the 20th Australian Infantry Brigade, reinforced, was selected to make a landing approximately 7 miles north of Finschhafen on 22 September 1943. (See Map No. 7.) A naval task force and a boat and shore group of the 2d Engineer Special Brigade were assigned in support of the operation. As soon as occupied, Finschhafen was to be developed into a troop concentration point and staging area for projected operations and as an advance base for aircraft and light surface ships.

Amphibian Engineer Operations

The engineer boat and shore group consisting of 515 officers and men had as its basic unit a shore company, reinforced, with various service detachments attached. This group was to trans-

[20] *Editor's note:* At Nadzab the 871st Engineers had completed the first strip by 10 September, 5 days after the airfield had been secured by paratroops. By the 12th, a taxiway and 18 hardstandings were completed and work started on a parallel strip and taxiway.

port itself from Lae to Scarlet Beach north of Finschhafen, organize and defend the beachhead, and retain its boats (10 LCM's and 15 LCVP's) at Scarlet Beach for running resupply or assault missions required by the 20th Australian Brigade after the initial landing.[21]

Amphibian Scouts. A beach defense had been organized by the Japanese and the landing met short but stiff resistance. Amphibian engineer scouts, landing in the first assault wave, had to make their way cautiously along the beach. Despite direct exposure to enemy guns, however, they succeeded in installing range lights and flank markers, surveying the beach, and signaling the result of their reconnaissance to ships offshore. The remaining waves then came in according to their landing schedule. The absence of confusion as these waves beached under prepared enemy defenses confirmed once again the importance of assigning responsibility to one man on the beach (with designated replacement in the event of casualty) for turning beach lights on at the correct time and for directing incoming boats to their proper places on the beach.

Shore Party Activities. Japanese opposition on the beachhead was overcome after about a half hour's fighting. The engineer boat and shore group upon landing immediately set up beach defenses, and constructed a lateral beach roadway and beach exit roads. Communication equipment was quickly installed and the medical detachment was established. Exit roads were constructed so rapidly that at one time construction was going on in the most forward areas of the combat front. Unloading details, which were very much disorganized at Lae, worked like a well-coordinated machine at Finschhafen. The naval LCT's and LST's were unloaded rapidly and an appreciable reduction was effected in the time craft usually remained on the beach exposed to air attack. Everyone knew his job and did it.

This decrease in unloading time was the direct result of careful, advance planning. Each LST carried 100 men who were assigned exclusively for unloading and scheduled to return with the ship to the near shore after unloading. They were not part of the landing force. These men were able to clear ships by hand at an average of 50 tons and 20 vehicles per hour, a considerably faster rate than achieved heretofore. Faced with the probability of enemy air action, rate of discharge is a considerable factor. Experience in SWPA taught that, if at all possible, LST's and LCT's should not remain on the beach under threat of enemy aerial attacks for a period in excess of 3 hours. However, the employment of such details to expedite unloading can only be considered feasible for trips of short duration in instances where sufficient reserve manpower is temporarily available. The potential risk of their loss by enemy action must also be considered.

Personnel of the engineer boat and shore group initially bivouaced near the shore line. The disadvantage of selecting such a camp site was manifested daily by enemy air attacks on the beach. The group was forced to move further inland and to the north flank of the beach, not only for safety, but also as a means of support for the infantry units who were defending that flank.

The many occasions on which the enemy dive-bombed and strafed the landing beaches after dumps were established, inflicting considerable casualties and destroying supplies, once again indicated the early need for more antiaircraft protection of the beachhead area. The installation of barrage balloons here, as well as at Lae, might have been an effective means of keeping enemy aircraft higher, although the relative priorities of essential needs within the limited capacity of available shipping had to be considered.

Resupply Missions. For a few days after the initial landing, the tasks of boat engineers were relatively light and consisted primarily of defending themselves against enemy infiltration and almost daily air attacks. This lull in boat operations was due to initial resupply being ef-

[21] *Editor's note: See* Map No. 20, Vol I, this series.

fected overland. A road from Heldsbach Plantation to Finschhafen was already in existence while the intervening beaches from Scarlet Beach to Finschhafen were, for the most part, rocky and inaccessible to boats. However, when the infantry reached Finschhafen and later Langemak Bay, the landing craft came into their own. From then on they were constantly running resupply missions from the initial beachhead, as well as from Red Beach, Lae.[22]

Congressional Medal of Honor. The records for this operation contain little of a critique nature. Still they are almost unanimous in their descriptions of the combat incident which brought the Corps of Engineers, U. S. Army, their first Congressional Medal of Honor in World War II. It is unlikely that any engineer participating in the Southwest Pacific could mention Finschhafen without reference to Pvt. Nathan Van Noy, Jr. This 19-year-old amphibian engineer gallantly illustrated the highest tradition of the Corps of Engineers. Finschhafen had fallen and the 9th Australian Division had pursued the retreating enemy to Satelberg Heights. There on the mountains northwest of Finschhafen the Japanese were making a last stand in an old German Lutheran Mission which they had converted into a fortress. Unless they could retake Finschhafen, the Japanese knew they had lost control of the Huon Peninsula. They fought tenaciously and desperately. On 17 October a Japanese force in landing barges attempted a sneak counterattack on Scarlet Beach behind the advancing Australians. A surprise attack from the rear could possibly undermine the Allied gains. Ten barges set out for the beach, but only four endeavored to land. A U. S. Army sentry spotted these as they approached about one and a half hours before dawn, and alerted the Allied troops. While the enemy were quietly paddling their boats in for the landing, the men on the beach prepared to repel the invaders. Van Noy and his loader sat in their machine-gun pit about 15 yards from the water's edge, waiting. As the enemy approached shore, readied Bren and Bofors guns opened up from behind the beach. One enemy barge foundered, but the survivors jumped to the other barges. The Bofors had difficulty depressing enough to hit the barges. Other guns on the beach were sited so that their fire could not cover the landing area. But Van Noy's gun was directly opposite the point which the Japanese had selected for their landing. He, however, held his fire, waiting to ambush the approaching attack group at close range. A Japanese hurled a hand grenade. It was merely a lucky toss, inasmuch as Van Noy had not yet revealed his position by firing, but the missile dropped directly under Van Noy's gun. The shrapnel shattered one of Van Noy's legs and wounded the loader. Still these engineers lay in wait and held their fire. Their sergeant ordered them to abandon the gun and withdraw to a defensive line being formed 100 yards back from the beach on a bluff. They ignored him. Then the enemy craft hit the beach, and about 100 Japanese rushed ashore, blowing bugles, shooting, screaming. Two enemy officers rushed Van Noy's gun with a flame thrower, and now, finally, he swung his firing pin over and pressed the trigger. His gun spat angrily and fatally. The Japanese officers fell in their tracks, 4 yards from Van Noy's gun muzzle. The forces behind them dropped prone, firing rifles and tossing grenades wildly. It was a hundred men against two. These two, however, even managed to load a second belt with the enemy only a dozen feet away. Ignoring pain, Van Noy sprayed them with death until both of his legs were nearly torn off, until his lifeless hand, clenched on the trigger, had fired the last round from the gun

Japanese casualties littered the boats, the water, the beach. The enemy's rout was complete. When the fight subsided, the loader, alive but unconscious, lay with a dead Japanese sprawled across him. Van Noy, still gripping the trigger of his gun, was dead. He had not,

[22] *Editor's note: See* Map No. 20, Vol I, this series.

however, given his life cheaply. Australian troops, who had witnessed and participated in the action while Van Noy held off the Japanese landing force, credited him with at least 31 enemy dead.

Van Noy was awarded the Congressional Medal of Honor posthumously. His loader received the Silver Star. Back in the United States, the first engineer port repair ship to be developed and launched was named in Nathan Van Noy's honor.

4.5-Inch Barrage Rocket. For several days the Australians had unsuccessfully attempted frontal and flank attacks on Satelberg Heights. Then, for the first time in the Pacific, the amphibian engineers used the new 4.5-inch barrage rocket which, heretofore, had been withheld as a secret weapon. Rocket launchers were mounted on a ¾-ton weapons carrier. They were then driven several miles through the jungle and up a steep mountain to a point from where the amphibian engineers could fire on Satelberg Heights. Startled by this new type of projectile, the Japanese opened up their artillery in wild firing against the new and deadly weapon. Since their observers were unable to determine the source of the rockets, the only effect of their fire was to disclose their positions to Australian artillery and advancing Matilda tanks. Under the roar of the exploding rockets, the tanks were able to approach practically without detection, blast out pillboxes, and capture the Heights. In addition to the casualties caused by rocket fragments, other enemy dead without a scratch on them were victims of the concussion from the exploding projectiles.

Commendation. That the amphibian engineers *had gone on record* with the 9th Australian Division was evidenced in an article which appeared in an Australian newspaper.[23]

> The Lae and Finschhafen campaigns have provided a fine example of the effectiveness of Australian–American cooperation. In addition, the A. I. F. has been supplied by its "Navy," a fleet of barges manned by the 2d Engineer Special Brigade. Cooperation in the air is an impersonal detached matter. In an entirely different category is the active and man-to-man cooperation of the U. S. boys who man the supply barges. These Yanks have fought and some have died alongside Australians, and have done both so gamely as to win the respect and affection of the Diggers.

[23] Quoted in Brig Gen W. F. Heavey, *Down Ramp!* (Washington, D. C., 1947), p. 65.

Arawe
15 December 1943

While the offensive on New Guinea was still underway, the Alamo Force (Sixth Army) was assigned the objective of seizing control over western New Britain. This step, also in continuation of operations under the Elkton Plan, began with a landing at Arawe, New Britain, on 15 December 1943, by a task force composed of the 112th Cavalry Regiment; the 148th Field Artillery Battalion; Headquarters and Headquarters Battery, 236th Antiaircraft Artillery Searchlight Battalion; and Batteries C and D, 470th Antiaircraft Artillery Automatic Weapons Battalion and supporting elements. (See Map No. 7.) Engineer troops for combat and logistical support and the minor construction required at Arawe were limited to the 59th Engineer Combat Company which also constituted the shore party, and a boat task group from the 592d Engineer Boat and Shore Regiment (2d ESB), composed of 232 men and 29 craft, including the 2d ESB Support Battery (provisional) of 2 rocket DUKW's (rocket launchers mounted on amphibian trucks) and 1 LCVP.

Amphibian Engineer Operations

Ship-to-Shore Movement. Because of distances between staging and objective areas, a new problem confronted Theater engineers in planning the employment of engineer special brigade elements. Preceding operations against Lae and Finschhafen in New Guinea had been of the *shore-to-shore* classification. The projected assault at Arawe, however, represented the first *ship-to-shore* type of operation. How to get Army-controlled landing craft to the objective area for initial landing operations, vital patrolling, reconnaissance, and shore-to-shore operations between the many small islands in the Arawe area necessitated an unprecedented solution. The possibility of small ESB landing craft proceeding under their own power from Finschhafen, making the shortest possible crossing of open seas, and then moving close to an enemy-occupied shore to reach Arawe presented a hazard to the security of the operation. While passage by this means would be practical for reinforcing and resupply missions once a beachhead was established and the need for secrecy was no longer a consideration, at the time of the initial assault it would risk the danger of small craft being swamped in high seas or making emergency landings on enemy-occupied shores in possible bad weather with resultant disclosure of the operation to the enemy. Yet the need for Army-controlled landing craft during the assault phase influenced not only Army planning, but Allied naval operations as well. Included in the naval attack force were two vessels designed to transport naval landing craft in a ship-to-shore operation. These vessels, the *Westralia* and *Carter Hall,* however, were the only two such transports then available in the Theater, and, therefore, could not be hazarded rashly. The enemy cruiser squadron based at Rabaul was superior to the Allied covering surface force. Moreover, violent air reaction from heavy enemy concentrations at Rabaul was expected. Effecting the landing with organically self-sustaining Army-controlled boat units which could maintain themselves on the far shore after the withdrawal of the naval attack force, would permit these large naval transports to be out of the danger area with the least possible delay. An unorthodox solution was eventually found. Working in coordination with the Seventh Amphibious Force at Milne Bay, a boat detachment of the 592d EBSR, after many trials and rehearsals, established a procedure that was ultimately adopted not only in this operation but also for subsequent operations. Landing craft of both the U. S. Navy and the U. S. Army being of identical design, the Navy landing craft normally lifted by these naval transports were replaced by Army-controlled and Army-operated boats of the 592d EBSR to permit early withdrawal of the mother ships. This was a fortunate decision as the Arawe area consisted of a great many small islands, and their occupation required a number of shore-to-shore operations subsequent to the main landing.

The naval transports were loaded at Goodenough Island. Sixteen LCVP's and two LCM's of the boat task group were lifted by the *Westralia.* The *Carter Hall* carried the balance of the ESB craft, namely, two rocket DUKW's and one LCVP, as well as the LVT's which comprised the first echelon assault waves. Seven LCM's and one Halvorsen boat traveled to the far shore under their own power from Finschhafen with the naval LCT's of the second echelon.

At H minus 1 (0530), prior to any preliminary bombardment, a surprise landing was attempted by a troop of cavalry at Umtingalu (Blue Beach) to cut off any Japanese retreat along the coast from Cape Merkus (Orange Beach).[24] These rubber boats, launched from an APD, were repulsed by a terrific enemy cross fire which inflicted over 50 percent casualties. One destroyer moved in to shell the beach, but this action came too late to save the situation. At the same time, another cavalry troop landed successfully from rubber boats on Pilelo Island (Purple Beach). However, it was evident that despite all precautions, the enemy was aware of the convoy and prepared to resist the invasion. Moreover, even if secrecy had remained intact until the arrival of the convoy off the assault beaches, the surprise element would have been dissipated by the LVT's (Buffaloes and Alligators) noisily racing their motors as they discharged from the parent ship for the main assault against Cape

[24] *Editor's note: See* Map No. 21, "Arawe-Cape Gloucester Operations," Vol I, this series.

Merkus at about 0410.[25] This was more than an hour before time to move toward the line of departure, and the assault troops were cramped and exhausted by the unduly long wait in small and uncomfortable craft before landing. Fortunately, the seas were calm; had they been rough, many of the men undoubtedy would have become seasick. This early loading into landing craft did, however, allow the release and departure of the parent ships before dawn.

Employment of Mixed Landing Craft. Experience at Cape Merkus led to considerable doubt as to the advisability of using LVT's (amphibian tractors), DUKW's (amphibian trucks), and LCVP's (landing craft, vehicle and personnel) in successive waves of a landing. The varying speeds of these craft made control and coordination of the assault waves very difficult, especially under wind and current conditions prevailing in Pilelo Passage. The delay and confusion which resulted might have caused the landing to fail had a more determined opposition been met. In planning landing operations, care must be taken to assign craft of the same speed to assault waves to insure an orderly and uniform approach to the beach. In this operation, the leader of the second wave failed to maintain contact and to follow closely on the first wave. A 25-minute interval between the landings of the first and second waves resulted. This delay might easily have caused the defeat of the first wave on the beach before the arrival of supporting waves. Timing and coordination of assault waves must be diligently planned and rehearsed. Wave leaders must follow instructions, cross the line of departure on schedule, and maintain prescribed distances.

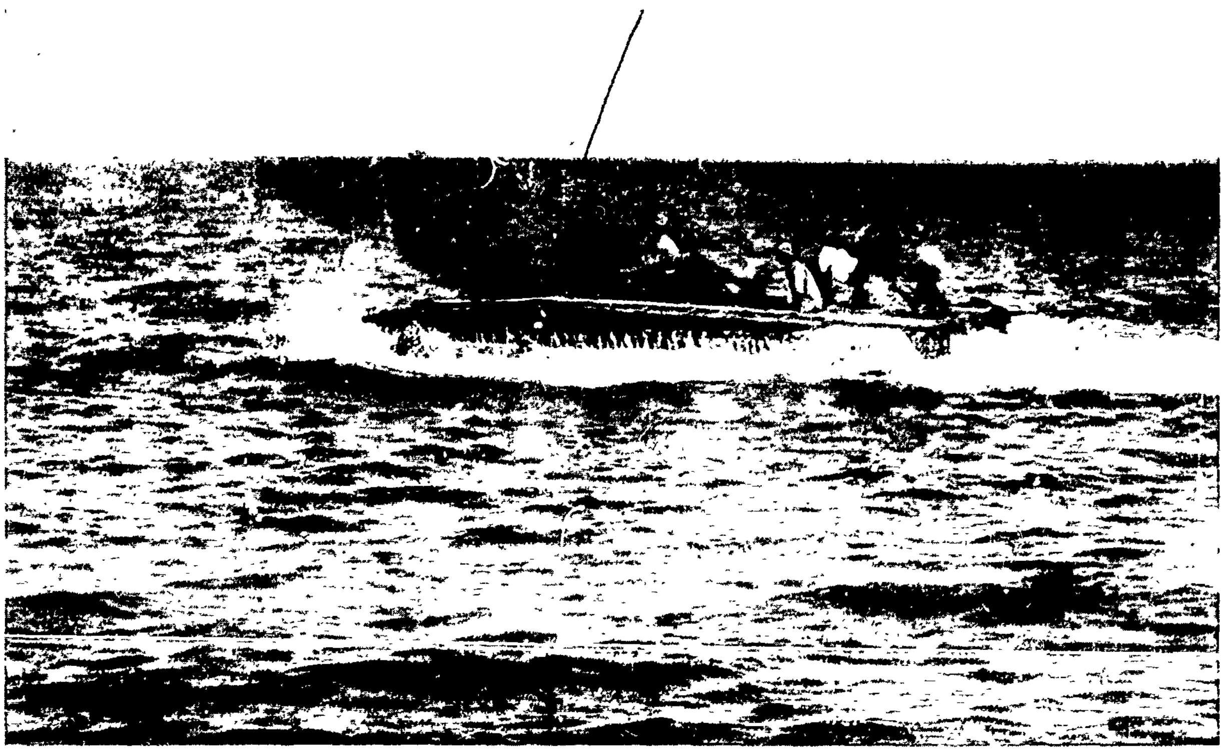
The LVT's were much slower than LCVP's in moving from the transport area to the beach during the landing, although they had considerably less difficulty in crossing reefs and approaching the beach. However, their susceptibility to swamping made them of dubious value in rough water. Their weight made it impracticable to hoist them over the side of a ship or to launch them from anything but an LSD or an LST. For these reasons, LVT's should have been used to land assault waves only at beaches where reefs precluded or limited the employment of other craft. The exclusive use of LCVP's (or LCM's if available) at Arawe would have resulted in a much more coordinated attack. Even if the second wave had kept closed up on the first wave of LVT's, wave six, consisting of the faster LCVP's, still would have had to stand to in order to retain its relative position in the rear of the fifth wave of slow moving LVT's. From the time of final approach off Cape Merkus, 1 hour and 45 minutes elapsed before wave five landed. By using LCVP's exclusively it was estimated the same force could have been landed in not over 45 minutes. Had serious enemy fire been encountered, uniform use of LCVP's would have resulted in an hour's less exposure to fire, much faster progress through exposed Pilelo Passage, and better coordination and control throughout.

ESB Support Battery. Experience in this landing indicated the value of an additional unit within the organization of an engineer special brigade, namely, a brigade support battery. This unit was not a part of the authorized organization of the brigades, and its evolution was only beginning as a result of experience gained in the Southwest Pacific. At the time of the Arawe landing, this battery was in the initial stages of gradual improvisation. It was assembled from the limited number of rocket projectors, guns, landing craft, and vehicles which could be furnished locally. Previous operations had indicated a particular need for supporting and neutralization fire while assault waves were nearing the beach during the time interval between

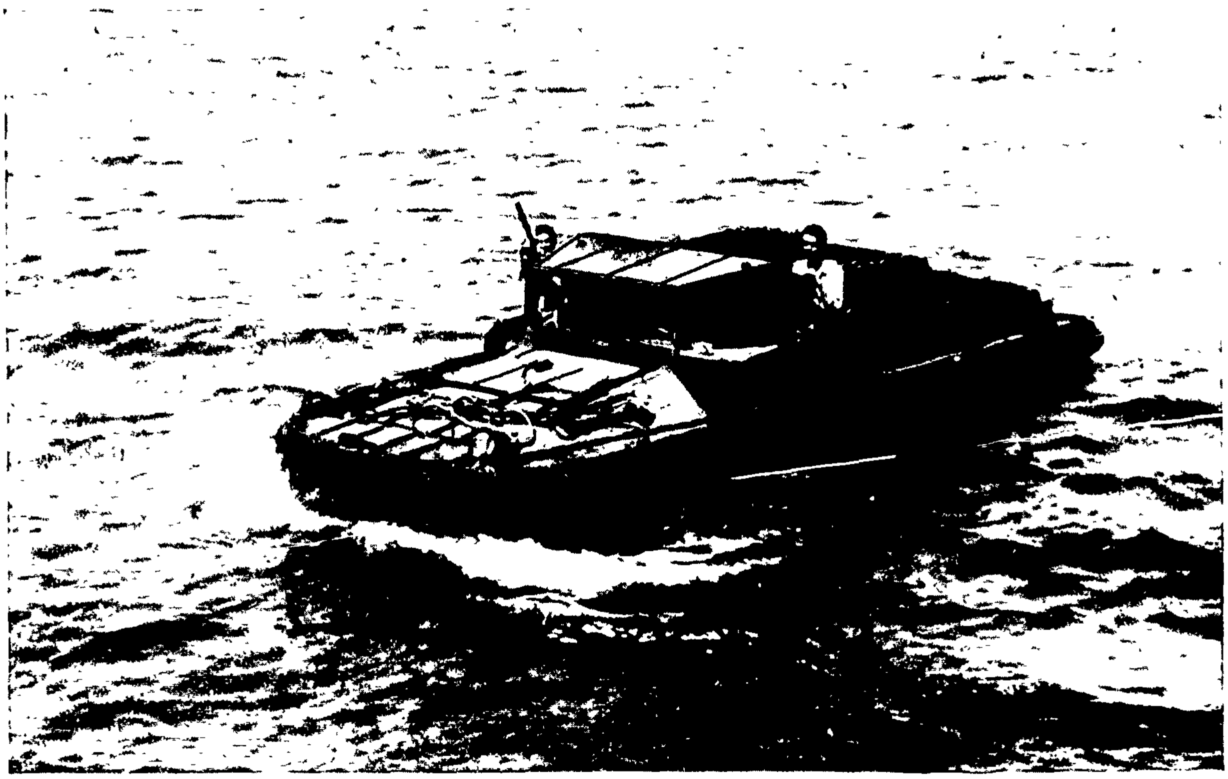
[25] *Editor's note:* The "Buffalo" is the trade name for the LVT(A) (2) [Armored] and the LVT(2) [Unarmored]. It is the result of improvement and further development of the old "Alligator" known as the LVT(1). The LVT (2) is superior to the LVT(1) primarily in its power plant, tracks, and suspension system. Experience in the Southwest Pacific with the Alligator showed that it lacked power to negotiate reefs and banks and was not reliable. The Buffalo not only was faster in water (4½ m.p.h. instead of 3) but also proved more capable of withstanding rough usage.

LVT's and LCVP's landing at Arawe, New Britain.

The Landing Vehicle, Tracked (LVT), sometimes called the "Alligator" or "Buffalo," is equally at home afloat or on land.



Afloat, the LVT cruises at a relatively slow speed.



Initial equipment of ESB Support Battery (prov.), the Engineer rocket DUKW, afloat. Note machine guns on either side and rocket launcher tubes just aft of pilot's compartment.

Engineer rocket DUKW emerging from the surf and negotiating the sandy beach; rocket launcher and machine guns are plainly visible.

cessation of naval gunfire and actual contact with the shore. Such support by a battery of this type was essential to the success of landing procedures developed. These prescribed, in addition to a preliminary aerial bombardment, a heavy naval barrage that necessarily ceased when landing craft were roughly 1,000 yards from an enemy-held beach. It usually required about 4 minutes for landing craft to traverse this distance, or 6 to 8 minutes if LVT's (amphibian tractors) were used. This critical time interval of 4 to 8 minutes between cessation of naval gunfire and beaching of landing craft allowed surviving enemy gunners to reman their guns. The purpose of the brigade support battery was to continue to cover the beach thoroughly with close support fire power until the leading wave of landing craft was only 100 to 150 yards from the beach. Here, at Arawe, following naval bombardment and aerial bombing and strafing, an ESB provisional support battery of two rocket DUKW's laid down an effective barrage, raking the length of Orange Beach while a submarine chaser covered Cape Merkus with a similar barrage. When their mission was completed, the rocket DUKW's moved away and came in with the third wave of amphibian tractors. This initial use of rockets in support of a combat landing in the Southwest Pacific was highly successful even though executed by only a small, improvised engineer boat detachment.

Amphibian Scouts. Although the first assault wave landed at 0710, up to 0820 there was no evidence of installed beach markers nor of location and marking of reefs and coral heads. Had amphibian scouts been included in plans for the operation, these all important missions would have been executed in time to facilitate considerably the initial landing activities.

Shore Party Activities. The inexperienced engineer shore party encountered considerable trouble in unloading LCT's on the beach and moving supplies inland to less vulnerable dump areas. As a result the beach became littered. Inclusion in the original plan of an ESB shore company with a boat control section would have eliminated much congestion.

Landing Craft Activities. The selection of good cover and concealment for ESB craft soon proved its effectiveness. Japanese pilots and bombardiers based at Rabaul knew Arawe well. Every day and night for 2 weeks they bombed U. S. troops and installations from the air. They obviously knew practically all positions but one: the location of the ESB landing craft which had been moved from Pilelo to a secluded anchorage on the north side of Angup Island where concealment from aerial observation was available.

The majority of the engineer boat missions in the Arawe area were of a reconnaissance nature with the primary purpose of collecting vital information. However, to prevent enemy sneak counterattacks from the sea, these on occasion developed into "naval" engagements with Japanese barges lying in ambush behind some of the numerous islands in the vicinity. On a mission to determine enemy troop strength near the mouth of the Itni River, engineer crews aboard two LCVP's typically demonstrated the versatility required of the fighting engineer when forced into one of these unexpected "naval" engagements. While attempting to conceal their boats during daylight hours, these engineers were trapped in an inlet by seven Japanese barges employing fire power superior to that provided on the ESB craft. Outnumbered, outgunned, and suffering four casualties, the engineers were forced to beach and abandon their damaged LCVP's in a mangrove swamp. Despite the urgency of the situation, these engineers first dismounted their machine guns and buried them together with their ammunition in the swamp. Then, taking only food and gear which could be gathered quickly, the boat crews moved overland. Although indoctrinated principally with over-water tactics and not trained in dodging enemy patrols and combating the elements in the jungle on foot, these engineers managed to return to Arawe through miles of impenetrable rain forests in less than a week.

Task Force Engineer Operations

Staging Area Problems. The 59th Engineers received orders on 27 November 1943 to move from Kiriwina Island to Goodenough Island. On 30 November the unit was informed that it would provide combat and service engineer support for the Arawe operation. By 11 December 1943 all unit equipment, which had been released piecemeal from a 24-hour-per-day operational basis, was loaded for the Arawe landing. Needless to say, the unit equipment available was not equal to the missions assigned. Constituted as a combat unit, the 59th was not organically provided with heavy equipment. However, additional equipment, including one D–7 tractor, one D–8 tractor, and one mobile air compressor, was obviously necessary. As the expected use of this equipment at Arawe was short, old machines were taken from the 477th Engineer Heavy Shop Company yard, and, by overhauling, reconditioned to an expected 30- to 60-day operational capacity. Actually, the tractors were to more than double the total operating hours during which they had been used previously. The main bearing inserts in the LeRoi engine of the air compressor were badly worn at the time of issue, and the compressor lasted only 3 weeks. Although the 59th was equipped with ten 1½-ton, 4 by 4, Chevrolet dump trucks, parts for them were unobtainable and three had to be cannibalized for parts. These were replaced by three used 2½-ton, 6 by 6, GMC trucks taken from the 856th Engineer Aviation Battalion for which Ordnance could supply parts. Circumstances such as these evidenced the desirability of allowing engineer units selected for the support of an operation sufficient time in staging areas for necessary rehabilitation of their equipment prior to embarkation with a task force.

Supplies and Equipment. Available LST's could not carry all the tonnage to be transported to the far shore. Consequently some items were eliminated without consideration for the required priority of their use on the far shore. Water supply equipment needed on D Day did not arrive at Arawe until D plus 3. Engineer reinforcing supplies were not loaded according to plan for their early availability. Other urgently needed items arrived as much as 2 weeks late. It was recommended that future loading officers follow priority listings of engineer supplies as submitted by the task force engineer. This would insure arrival of indispensable items should certain tonnages have to be left behind.

As far as engineer assault supplies were concerned, all items were adequate except barbed wire. The latter had to be flown in to construct double apron fences on the main line of resistance when the objective was reached sooner than expected. In the initial phase the only explosives required were for the construction of dugouts. No enemy obstacles existed and no enemy demolitions were encountered.

During the construction phase, difficulties of supply delayed construction programs, but taught much about improvisation. There was hardly a piece of machinery or heavy equipment on the Arawe peninsula that did not have some part salvaged from a boat, an airplane, a tank, or any readily available facility. When the cooler on back order for the D–7 tractor was not delivered, the tractor was made to operate efficiently with two D–2 oil coolers. Still, despite improvisation, considerable time was lost because of the lack of engineer heavy equipment parts. An electric arc welder and an oxyacetylene welding set, had they been available, could have been used to prevent many breakdowns and readily repair others. However, such equipment was not available at Arawe where its pressing need developed into a special recommendation by the combat engineers that no separate engineer unit move with a task force in the future without it.

Prior to the landing, the 59th Engineers received only 2 hours' training in procedures for the shore party portion of their mission. Their inexperience naturally impeded accomplishment of duties assigned in the initial stages of the operation. However, through previous experience this unit was well trained in construction, and, in the second phase of its mission, every man produced in an excellent and experienced fashion. It was estimated that the unit could even have doubled its production had supplies and adequate equipment been readily available.

Cape Gloucester
26 December 1943

Immediately following the landing at Arawe, the next Allied bid for extending control over western New Britain was made by the Backhander Task Force. Consisting of the 1st Marine Division and attached troops under command of the Alamo Force (Sixth Army), this task force executed landings on both the east and west coasts of Cape Gloucester with the objective of seizing and extending the airdrome facilities on New Britain. (See Map No. 7.) Supporting these landings was a boat task group from the 592d Engineer Boat and Shore Regiment (2d ESB) made up of a boat company, attached regimental headquarters, signal, embarkation, medical, and maintenance detachments, and the 2d ESB Support Battery (provisional).

Amphibian Engineer Operations

The Landing. The engineer boat task group was divided into two sections. One section was designated for patrol and resupply missions after the initial landing on the east coast (Yellow Beach), and the other was to land the initial assault waves on the west coast (Green Beach).[26] There had been substantial additions to the U. S. naval surface forces during the middle of December. Nevertheless, it was not considered advisable to risk either the *Westralia* or the *Carter Hall,* the transports which had carried 2d ESB landing craft to Arawe, north of Vitiaz Strait. It was, therefore, determined that the two LCVP's, 14 LCM's, and 2 rocket DUKW's of the engineer boat task group assigned to land the first assault troops on Green Beach must make the run of approximately 85 miles from Finschhafen, New Guinea, through the uncharted Dampier Strait, to Cape Gloucester under their own power. This move provided a more direct route for shallow-draft craft and enabled the slower LCM's, moving under naval escort with the LCT's, to reach their positions off Green Beach at the same time that the main amphibious force aboard deep-draft LST's, reached its position through Vitiaz Strait off Yellow Beach. It was not, however, considered desirable for the assault infantry battalion assigned to the landing at Green Beach to make the fatiguing trip through Dampier Strait in the LCM's designated to land them. Arrangements were made instead to carry these assault elements in LCI's which would accompany the main convoy destined for Yellow Beach northward as far as Sakar Island and would then turn off to rendezvous with the LCT's and LCM's off Green Beach. The movement was executed as planned; assault personnel on the LCI's were transferred to 12 LCM's in the rendezvous area and landed on Green Beach in three waves of four LCM's each at H Hour. Two LCM's carried the rocket DUKW's which bombarded the beach from each flank of the first wave.

The Yellow Beach element of the engineer boat task group embarked with the greater part of the task force from Cape Sudest, New Guinea, moved north through Vitiaz Strait, and maneuvered around the north coast of Umboi Island so as to approach the beach from the northeast. Twelve LCVP's of the engineer boat task group were davit-loaded on the LST's which comprised a part of the task force assault echelon. Nine LCM's loaded with boat unit organizational equipment and the balance of the boat group personnel were towed to the far shore by the LST's carrying task force reserve and supply echelons. The 12 LCVP's lifted did not participate in the initial waves, but were lowered later in the day and used principally to assist the beachmaster in controlling traffic into the beach and to evacuate

[26] *Editor's note: See* Map No. 21, "Arawe–Cape Gloucester Operations," Vol I, this series.

wounded. The LCM's arriving with reserve echelons on 27 December, immediately upon casting off from LST's and unloading, started to transport ammunition, rations, and medical supplies to forward Marine tactical units approaching the Cape Gloucester airfields to the north.

Preparatory to the landing on Green Beach, smoke and dust from the exploding shells of the initial bombardment, together with the rays of the rising sun topping the shoulder of Mt. Talawe, obscured the beach and very little could be seen through the haze. Allied Air Forces elements, which began their attack at 0732, were undoubtedly handicapped by these conditions and made two passes at the beach after the expiration of their allotted time. Although the rocket DUKW's of the 2d ESB Support Battery began their bombardment 1 minute late, these two off-schedule flights of B–25 bombers made their passes over the beach after the rocket DUKW's had opened fire and exposed their low-flying aircraft to hits by high trajectory rockets. The 2d ESB liaison officer to the naval task force had pointed out this danger during the planning phase and had asked that the last aircraft drop a flare to indicate that they were withdrawing, but AAF preferred to work strictly on a time basis. Fortunately no mishaps occurred. Reports of observers indicated that the rocket fire on Green Beach was very effective, although there was doubt as to whether there were many Japanese in the target area.

Shore Party Activities. No engineer shore party was assigned to this operation; it was assumed that the experience of the 1st Marine Division, veterans of Guadalcanal, would compensate for its absence. As very few supplies and not much equipment were landed at Green Beach, the absence of a shore party was not seriously felt. At Yellow Beach, however, unloading of the large quantities of supplies and equipment was greatly handicapped by the lack of an experienced shore party. The unloading of LST's, scheduled to retract at 1300, was so slow that a strong enemy air strike at 1400 caught the LST's still on the beach. The naval covering force had withdrawn, and only the four destroyers assigned to the convoy of the LST echelon were standing by off the beachhead. These destroyers received the whole weight of the enemy air attack which damaged three of them and sank the fourth. It was felt at Headquarters, Seventh Amphibious Force, that swifter unloading of LST's might have prevented this loss, and a strong recommendation that an engineer shore battalion be henceforth included in initial assault elements was made.

Combat Use of Engineer Equipment. At Cape Gloucester, an undetermined number of Japanese casualties were inflicted by the rocket DUKW's of the 2d ESB Support Battery which were used as effectively on land as afloat. In one case a pillbox located at a crossroads was delaying the advance. The DUKW's were brought up and, after firing 20 rounds, destroyed both the pillbox and its occupants. In another case, a Japanese strong point, located approximately 1,000 yards south of Airstrip No. 2, was holding up the advance of a Marine unit. The DUKW's laid a barrage on the strong point and completely demolished it. As at Finschhafen many Japanese dead were found without a mark on them, apparently killed by concussion alone.

In this operation even the unpretentious bulldozer reverted from an implement of construction to one of destruction. Unfamiliar with this large, versatile piece of equipment, the Japanese regarded the big tractor as America's secret weapon, and papers found at Cape Gloucester described it as a U. S. secret weapon able to do the work of three thousand coolies. It was indispensably useful. During an attack on a hill, for instance, it was necessary to cut down a 30-foot terrace so that tanks could move up to knock out enemy pillboxes. A D–6 dozer promptly climbed the bank, but immediately came under fire, and the operator was wounded. A second operator took over and, crouching on the footboards, operated the dozer under fire until the bank was cut down sufficiently for passage of the tanks. On another occasion, a D–6 dozer, in the face of continuous small-arms fire from 70 yards distance, crossed to the enemy side of a 45-foot stream and dozed a ramp to enable tanks to climb the bank. The tanks again got through. Similarly, spearheading the Marines' advance on the airfield, a D–6 dozer was clearing a path for tanks through heavy jungle. Breaking out into a clearing it came under automatic-weapon fire from a Japanese bunker. The operator raised his blade as a shield and continued forward, crushing the bunker under the dozer's tracks, and killing all occupants. He then backed off the bunker, bladed up a ton or two of earth, and advancing again, buried bunker and occupants. These operations were typical examples of the need for armored cabs on tractors of combat engineer units and dozer attachments on tanks, both of which were already under development and later utilized.

Diversionary Landing. On 27 February 1944 the first echelon of the 3d Engineer Special Brigade arrived at Cape Gloucester, followed by the remainder of the brigade on 3 March 1944. On 6 March, Companies A and F, 533d EBSR (3d ESB), together with Company C, 592d EBSR (2d ESB), transported and supported elements of the 1st Marine Division in a diversionary landing at Talasea, New Britain, a 120-mile jump towards Rabaul. (See Map No. 7.) This operation, immediately following the Arawe and Cape Gloucester landings on New Britain, was designed to confirm the Japanese impression that Rabaul, key to the enemy's defense system in the Solomon Islands and Bismarck Sea areas, was the Allies' next objective. The landing had a few innovations of interest. Marine pilots in low-flying Cub planes bombed the beach with light bombs and gasoline cans just before the leading wave hit the shore. While still at sea an engineer-operated LCM partly lowered its ramp to allow a Sherman tank, which was loaded on the LCM, sufficient field of fire to engage an enemy tank on shore. After firing only a few rounds a direct hit was scored. This was the first known instance of a tank firing from an LCM at sea and destroying an enemy tank on shore.[27]

Mixed ESB Elements in Same Area. The 2d ESB elements did not conclude operations with the Backhander Task Force at Cape Gloucester until April, when supply, patrol, and construction were entirely taken over by elements of the 3d ESB. Elements of the two brigades operating simultaneously in the same area presented conflicting boat maintenance problems, especially since elements of both were operating at Cape Gloucester, New Britain, and Saidor, New Guinea (where landings were made on 2 January 1944), and maintenance facilities of each were split. Yet, however undesirable, the assignment of elements of two engineer special brigades to one operational area often could not be avoided because of other limiting factors. Locations of various units in relation to operational areas, extremely heavy tonnages and unwieldiness of ESB equipment, and the limited availability of heavy amphibian shipping to lift such equipment virtually controlled assignments.

When operations in an area could be consolidated under one brigade, it was found most economical for the relieving unit to take over all craft in that area belonging to the unit relieved even though such craft might vary widely in amount of maintenance required and length of operating life. When the transition between two separate brigades took place at Cape Gloucester, however, the 2d ESB convoy of 24 LCM's and 4 LCVP's was backhauled to Finschhafen, New Guinea, instead of being retained at Cape Gloucester to augment the craft of the relieving 3d ESB elements.

Task Force Engineer Operations

Split Engineer Authority. The task force commander (commanding general, 1st Marine Division) for the Cape Gloucester operation first

[27] *Editor's note:* The design of landing ramps on LCM's might well take into consideration the height of tank turrets above the deck so as to permit the tank's weapons to fire forward while it is still afloat.

requested Alamo Force to furnish a task force engineer. Later he assigned this responsibility to the commanding officer of the division's organic engineer regiment. A member of the Engineer Section, Alamo Force, was designated as the Base Engineer. Planning was, therefore, hampered by lack of clarity as to the specific responsibilities for the engineer mission between the Task Force Engineer (Marine) and the Base Engineer (Army). Operations suffered as a result. The situation was partially alleviated by the Task Force Engineer (Marine) and his engineer regiment undertaking all combat engineer missions and all road and bridge construction, while the Base Engineer (Army), using three engineer aviation battalions, undertook all other construction.

The desirability of having one Engineer in charge of all engineer operations from start to finish, however, loomed large. The Task Force Engineer (Marine) placed roads with inadequate regard for the planned layouts of the Base Engineer (Army). Marines excavated in the approach zone at the east end of the airstrip, built one road through the middle of the crash strip, and another road through an area for taxiways, hardstandings, and drummed gasoline dump on the north side of the strip. The Task Force Engineer, who was not a graduate engineer, restricted the Base Engineer from logging in certain areas, did not permit taking gravel from beaches, and operated the pit at Red Hill in such a way that only a minimum of red ash, the nearest suitable base material for surfacing, could be delivered to the airdrome. As a result of this inadequate internal coordination and owing to dissipation of engineer authority, engineer construction missions suffered and thousands of man-hours were wasted relocating and reconstructing roads and bridges.

Supplies and Equipment. Each succeeding Southwest Pacific operation was furthering the proof that this was primarily a war of logistics, with heavy emphasis on supply, and the Cape Gloucester operation was no exception. Port congestion at Milne Bay, New Guinea, together with absence of balanced stocks and urgent commitments for other missions, made it impossible to meet delivery schedules at Cape Gloucester. Shipments to New Britain were often incomplete and unbalanced. Severe beach and surf conditions delayed both the disembarking of troops and the discharge of supplies at their destination. The arrival of dock materials, already critically short, was thus delayed, and the Liberty ship dock was not completed in time to meet peak unloading demands.

The difficulty of obtaining engineer spare parts necessitated excessive emergency field repairs on equipment. Even with maximum local effort, 50 to 60 trucks were usually deadlined within the three engineer aviation battalions. This meant that as much as one-third of the hauling capacity of the battalions was out of service during extended periods when it was direly needed. Radio messages requesting spare parts for deadlined equipment were withheld by the task force because of overloaded communication facilities and finally sent by mail. This naturally delayed their receipt. It was difficult to impress tactical commanders with the operational importance of supply and its direct relation to their primary tactical mission. A few parts were flown in and dropped by plane in the first 3 weeks, but this dribble of supply was not sufficient to keep equipment off deadline.

Nothing of value was salvaged from Japanese supplies. Practically all lumber for buildings and other structures was cut and sawed by engineer troops in the area. This amounted to more than one million board feet of lumber which was cut from trees heavily imbedded with shell fragments by preinvasion shelling and bombing at a considerable expenditure of saw teeth.

Additional difficulty resulted because task force and base engineer supplies were not consolidated for their most advantageous use in the engineer depot when it was established. This condition was further aggravated on occasion by delivery of engineer supplies direct to the 1st

Native laborers fell tree to be processed at an Engineer sawmill, Cape Gloucester, New Britain.

Stacking and shipping lumber, Cape Gloucester, New Britain.

Marine Division dump without notice to the Base Engineer supply officer.

Highlighting and exaggerating all these difficulties was the constant and excessive rainfall. Twenty-three days of the first twenty-five at Cape Gloucester were rainy. Yet, somehow, despite continuous downpours, loss of working hours through blackouts, air alerts, shortages, and lack of internal coordination, the engineers managed to have one airstrip ready for operation by 31 January 1944. Twice as much work could have been accomplished under normal conditions.

Saidor

2 January 1944

To eliminate the possibility of a successful Japanese withdrawal from the Huon Peninsula, existing operations instructions were extended by GHQ, SWPA, through a directive dated 17 December 1943, for the seizure of the Saidor area of New Guinea on or after 2 January 1944. (See Map No. 7.) This operation was contingent on a quick victory in New Britain, and Alamo Force (Sixth Army) immediately began organizing the Michaelmas Task Force for the operation. Field orders were issued and the first Alamo Force construction directive was prepared and made available to the Task Force on 26 December, just 4 days prior to the scheduled outloading of its Engineer Section. This directive was fairly complete in its general details, although it was not sufficiently definite as to light naval and dock facilities to be constructed. These deficiencies could probably have been corrected by conferences had there been sufficient time between the formation of the Task Force Engineer Section and its departure for the objective area. However, there was little time for planning and the operation opened on schedule.

At 0645, 2 January, Allied naval gunfire was directed on the flanks of the three adjoining objective beaches and gradually worked towards the center. Rocket fire from LCI's was provided. Aircraft (B–24's and A–20's) bombed and strafed the assault area. Landings were unopposed.[28] The assault echelon of the task force participating in the initial landings consisted of the 126th Regimental Combat Team, 32d Division; reinforced by the 121st Field Artillery Battalion; Headquarters and Headquarters Battery, 191st Field Artillery Group; Batteries B and D, 209th Coast Artillery Battalion, Automatic Weapons, Antiaircraft; Battery A, 236th Antiaircraft Artillery Searchlight Battalion (less 1 platoon); Headquarters, Headquarters Battery, and Batteries A and D, 743d Coast Artillery Battalion, Gun, Antiaircraft; and the Shore Battalion and a boat detachment of the 542d Engineer Boat and Shore Regiment (2d ESB). Engineer combat support was provided only by Company A, 114th Engineer Combat Battalion, organic to the 32d Division. Subsequent echelons included the 808th, 860th, and 863d Engineer Aviation Battalions; the 3d Platoon, 453d Engineer Depot Company; and a survey group from the 8th Engineer Squadron. On 19 January the Task Force was further augmented by the 128th Regimental Combat Team (less 1 battalion) from Alamo Force reserve elements to provide against any possible underestimate of enemy defensive strength in the area.

Amphibian Engineer Operations

Extensive ESB task group preparations had to be performed on very short notice. Immediately upon receipt of orders to form a task group, the Shore Battalion, 542d EBSR, left Lae, New Guinea, and 2 days later, on 27 December, arrived at Goodenough Island. Camp was established, troops were briefed, and the battalion, reinforced by elements of the 32d Division, loaded the LST's which moved out at 0800, 31 December, carrying a number of the shore battalion troops with them. By 1 January, the balance of the shore battalion aboard LCI's joined the convoy off Cape Cretin where the boat detachment had been staged.

[28] *Editor's note: See* Map No. 22, "Saidor Operations," Vol I, this series.

Although the ESB craft to be employed consisted of 12 LCM's, 12 LCVP's, 2 rocket DUKW's, and 1 Halvorsen boat, only 6 LCM's were taken in tow by the LST's for the initial assault, and joined by the Halvorsen boat moving under its own power. These LCM's carried 2 bulldozers and 2 rocket DUKW's, the latter loaded with 120 extra rounds of ammunition each in addition to the 120 rounds in the projectors. The remaining 6 LCM's were scheduled to move in a like manner on the following day (D Day) and the 12 LCVP's, davit-loaded on LST's, were to follow on subsequent days.[20]

Shore Party Activities. The advance detachment of the engineer shore party went ashore in the fifth wave (first LCI wave) to reconnoiter for beach roads and exits. LST's and the 2 LCM's carrying dozers followed. The dozers, together with beach matting, were promptly unloaded and the shore party immediately began organizing the beachhead. However, this engineer shore battalion was hampered by the fact that it had had very little time to plan and organize its activities. Only one company of this battalion had had previous combat experience. Only one-third of the officers and one-fourth of the enlisted men had had previous experience in landing operations. The battalion had been trained in overwater operation, but not with other troops. It had had training in building roads, bridges, and docks. However, the lack of operational experience on the part of the engineers was offset by the previous combat experience of infantry units. In addition, the Task Force units had undergone considerable amphibious training, had planned a previous operation that had not materialized, and, above all, understood shore party problems and cooperated to the utmost.

The first landing waves immediately encountered difficulties in off-loading vehicles. The beaches were composed of rounded pebbles 2 to 3 inches in diameter with no gradation. Because these stones had no solid subgrade, trucks in pulling up the fairly steep beach lost traction, merely churned their wheels, and dug in. Only the tracked tank destroyers could cross the beaches to the exits. The shore battalion, with dozers available from the LCM's towed to the assault area, requested the naval loading officer not to off-load vehicles from LST's until some roads were built. Apprehension that LST's would remain on the beach most of the day immediately obsessed all but the busy shore battalion. However, within 15 minutes, roads at each LST landing point had been constructed and vehicles were moving off the ships in a steady stream. These roadways were constructed with ARC mesh, and experience here again emphasized that this mesh must be pinned together or weighted down by piling gravel on top of the matting.

The Task Force had numerous small tractors, and one was stationed at each LST landing point where it performed invaluable work in assisting stalled vehicles. However, D–8's or D–7's, if available, could have been used more effectively.

Supplies were moved off the LST's with dispatch. The Task Force furnished 500 men to assist in the unloading; naval personnel also assisted. As a result the average unloading time for each LST was under 2 hours and 54 minutes, the fastest time to date in the Theater. This successful synchronization of unloading activity, even more emphatically than the disorganization encountered at Lae, was illustrative of the fact that a joint responsibility for the unloading of supplies must rest with commanders of reserve units not initially engaged. They should take the initiative in seeing that their men assist in unloading and not wait for requests from the shore party commander.

On D plus 1 six LST's came into the far shore area at about 0500 when it was still very dark. Friendly shore batteries immediately began to fire at them inasmuch as an order had gone out previously that 11 ships sighted off the beach

[20] *Editor's note:* Boat strength was gradually increased during January to 22 LCM's and 25 LCVP's.

were to be regarded as unfriendly. At daylight the LST's were recognized as an expected echelon arriving ahead of schedule, and a boat was dispatched to bring them in to the beach. To prevent recurrence of such an incident, orders were issued that no ships were to come into the area before daylight no matter when they arrived.

During January the engineer shore battalion unloaded 49 LST's carrying 6,775 tons of wheeled cargo and 20,040 tons of bulk supplies. The battalion constructed 8 miles of lateral roadway, 12 beach exit roads, 11 miles of dump roads, and cleared 7 dump areas. Five bridges and two culverts were built, and work was started on three other bridges. Eight LST ramps were built and paved with pierced plank. Troops of the shore battalion also operated a sawmill, and, with the aid of native loggers, cut about 70,000 board feet of lumber. They operated a water point, and devised and executed the beach defense plan. While manning their own guns they supervised the positioning of antiaircraft, antitank, and machine guns of other units defending the beach. Initially the shore battalion was charged with road building for most of the area, but this work was turned over to the 808th Engineers for execution with their heavier equipment in view of the conditions created by adverse weather.

Shore Battalion Equipage. These operations were not without problems. An unanticipated problem arose when the TNT failed to explode. The blocks with detonators went off, but adjacent blocks tied with primer cord failed to explode. This may have been due either to faulty manufacture or to the local climatic conditions under which moisture could have permeated the TNT. Gelignite gave fairly satisfactory service, but there was a tendency for the glycerin to separate from the earth in this tropical climate. The most satisfactory explosive during this operation was dynamite, 60 percent gelatin.

In general, heavier earth-moving equipment was needed on Theater projects than was customarily required in the United States. The first task assigned the shore battalion was to open an interior road parallel to the beaches. However, this task still had not been completed by D plus 24 because of the lack of heavy equipment. The unit should have had one more air compressor, and two more D–12 graders. The Galion, Model 101, gasoline, and the Galion, Model 101, Diesel, graders were too light and of little value for the work here.[30] One tow grader was needed. Four carryalls of 6 to 8 cubic yards capacity were also needed. The half cubic yard shovel which the unit had was inadequate. Three-quarter cubic yard shovels would have been more effective. The battalion had a Quickway crane mounted on a 4 by 4 chassis; it should have been on a 6 by 6 chassis. Water trailers had outlets so low that they dragged and broke off during the operation. Despite the necessity of a heavy maintenance shop to keep equipment in working order, the equipment provided by the Tables of Basic Allowances did not include even sufficient hand-repair tools.

Some of the personal and organizational equipage issued to engineer units in this operation was not beyond criticism. For instance, jungle boots had been supplied to the troops since parachute boots, which had given excellent service previously, were no longer available for issue. These proved injurious to the feet in the type of work required of the shore battalion. The unit was equipped with steel or iron cooking utensils which, because of heavy rainfall and tropical humidity, rusted overnight and were difficult to keep sanitary. All filters for the water purification unit were mildewed when received. W–130 assault wire, used for signal communications, was not rugged enough and contact was continually broken. Waterproof covers, essential in this climate and not issued, had to be improvised for radios.

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[30] *Editor's note:* The light Galion road graders, essentially patrol graders rather than construction equipment, would have been more useful retained in base supply for subsequent issue to maintenance gangs after roads were built. In addition, these graders were hydraulically operated and the breakage of tubing for which there were no replacement parts limited their usefulness in the Southwest Pacific.

On the other hand, some signal equipment was of such considerable merit that it warrants favorable mention. The EE–8–A field telephone and W–110 field wire gave excellent service. The SCR 300 (Walkie-Talkie) radio set was used from boat to shore with very good results. The range over which it was used here was only 3 miles, but on previous occasions it had been used efficiently to communicate with LST's 10 miles distant. Its BA–70 dry storage battery was also good for 20 to 25 hours in this climate. Satisfactory results were likewise achieved through the SCR 284 radio for code transmission on continuous wave for a distance of 50 miles. The SCR 188 radio, used for voice or code, had given satisfactory service at Nassau Bay for a distance of 700 miles, but there was no occasion for its use at Saidor.

Landing Craft Activities. All 542d EBSR craft employed at Saidor remained on the far shore under task force control. The 2d Engineer Special Brigade Support Battery was not engaged until 5 January when it was ordered to lay a rocket barrage on Biliau Village. The two rocket DUKW's were loaded on LCM's and transported to the target where 360 rounds of 4.5-inch ammunition destroyed the village and set off an enemy ammunition dump nearby.[31] Upon completion of this mission, the DUKW's returned to Cape Cretin. The balance of the ESB task group landing craft were engaged principally in transporting supplies and equipment for short distances up and down the coast in support of tactical units. These boats hauled 12,627 troops, 7,102 tons of supplies and equipment, and ran 361 missions for a total of 22,302 boat miles during their period of service with the Michaelmas Task Force.

This performance was exacted from the landing craft despite the fact that most had come directly from a heavy operational assignment with no opportunity for adequate maintenance. Moreover, the battalion maintenance equipment did not arrive until 2 weeks after D Day. As a result, only 3 of the original 12 LCM's were in operation a few days after the landing. The others had to be shipped back on LST's for repairs that could have been done locally if the maintenance equipment had been available.

Deficiencies in the armor of the engineer landing craft were manifest during the operation. The two .30-caliber light machine guns carried by LCVP's were not effective against enemy strafers. LCVP's equipped with .50-caliber machine guns would have been more adequately armed. Corrosion of ammunition on the boats was a serious problem. The Heintz Mount M–39 was too heavy and bulky. The mount itself is topheavy, and in a rough sea tore itself out of the fastenings. The armored shield seriously reduced the field of vision; a larger opening in the shield would have corrected this fault. Some of the boats were equipped with the Naval Mount M–31. This mount was too light in construction; the tubular steel on which the machine gun was mounted corroded and bent so that it was impossible to work the mount. The Truck Mount M–24 is not standard equipment, but gave better results than the other two. Rifles were wrapped in ponchos to prevent corrosion, but a waterproof cover should have been provided.[32]

Identification of small landing craft proved a problem to Allied airmen. To the amphibian engineers, this uncertainty constituted a considerable hazard. Dummy barges were moored near Saidor by the engineers in an attempt to attract the enemy. They proved so realistic that Fifth Air Force elements were baited into strafing them. Unfortunately, however, this error was not confined only to dummy barges. Although the air force was furnished limits in which the engineers operated, on at least two other occasions, their pilots shot up boats.

[31] *Editor's note: See* Map No. 22, Vol I, this series.

[32] *Editor's note:* The corrosion of armament is a very serious problem. Manufacturing rifles and all their component parts of a noncorrosive material could eliminate all possibilities of such deterioration.

The airmen claimed that identification marks were of no value since they could not be seen in time, and, further, that from the air American barges resembled Japanese barges. Two LCM's, washed ashore at Saidor by heavy seas, were also shot up by two P–39's before the seas abated sufficiently to permit getting them off the beach. One barge was left a complete loss, and the other in need of extensive repairs.

On 10 February 1944 the Saidor operation was closed. While the boat detachment remained at Saidor, the Shore Battalion of the 542d EBSR (2d ESB) left aboard LST's on 26 February. Companies C, D, E, and headquarters detachments of the 1st and 2d Battalions, 533d EBSR, and part of Company A, 563d Engineer Boat Maintenance Battalion (all of the 3d ESB), assumed operation of the beachhead on 27 February. As at Cape Gloucester, this left elements of two brigades concurrently in the same operational area with the maintenance facilities of both split between two operations. The incidental conflict led to but one conclusion: the integrity of units must be preserved wherever possible.

Task Force Engineer Operations

Formation of Engineer Section. The initial formation of the Michaelmas Task Force for the Saidor operation was begun only 2 weeks prior to D Day. This limited time element seriously affected adequate engineer planning, and necessitated hasty formation of a Task Force Engineer Section from the most readily available personnel of various organizations. As a result, most engineer personnel had never seen each other prior to assignment to the task force, and, therefore, were unfamiliar with each other's capabilities and limitations. Consequently, the deficiencies of the Engineer Section were numerous. None of the officers had had any prior experience on an amphibian operation. Only one had had any Theater airdrome construction experience despite the fact that one of the primary missions of the task force presumably was the construction of an air base. Definite responsibilities could not be assigned to each officer and to key enlisted men concerned since their capabilities were as yet unknown. By the time their abilities were recognized, they had drifted into the assumption of particular duties irrespective of their qualifications.

There was inadequate time for consultation by the Task Force Engineer with commanders of engineer units. In fact, the Task Force Engineer never saw these unit commanders prior to their arrival at Saidor with reinforcing echelons, because the 863d Engineers were at Oro Bay and the 808th Engineers were partly at Finschhafen and partly at Lae. To offset this condition, an officer representative from each unit was requested to report to the Task Force Engineer at Goodenough Island. These representatives on arrival submitted a list of their unit's organizational equipment. However, the lack of time prohibited any attempt to obtain additional equipment. The only arrangements possible were with the 114th Engineers for its company which was going in on D Day with the combat team to bring a D–8 bulldozer from battalion headquarters, and commandeering a jeep from this same company for the Task Force Engineer Section inasmuch as the section had not been provided with any transportation.

Engineer Supervisory Staff. It is obvious that the restricted time for engineer planning allowed little opportunity for checking the adequacy and qualifications of the engineer supervisory staff for this operation. When considering the specific responsibilities of a supervisory staff, however adequate, it is also evident that time was a controlling factor in the efficient discharge of their duties. This staff should, in the period prior to an operation, inspect the engineer units assigned to the subsequent task force missions to insure that officers and men are adequately trained for the type of construction they will be called upon to perform. They should analyze the over-all project to determine the requirements of the job in hand, initiate and supervise the necessary engineer reconnaissance, determine and analyze the resources available, plan and lay out the work, including the most efficient over-all allocation of units and plant, and supervise efficient execution by continuous personal inspection. Theirs is also the responsibility for checking the provision of sufficient construction equipment and its maintenance and proper operation. They are responsible for choice of suitable materials and balanced effort in construction methods, for adequacy of drainage, elimination of bottlenecks, and technical supervision of the training of officers and men within their units. A deficiency in staff, even though representing an insignificant percentage of the total engineer force, may result in a major percentage of deficiency in the execution of the engineer mission. Operations at Saidor proved a concrete example of the necessity for an adequate supervisory staff.

Outloading Split Units. Upon loading out, Company A, 114th Engineers, was loaded in accordance with plans prepared by the S–3 Section of the combat team to which it was assigned. The company was broken down into individual squads for the initial wave of LCVP's. Parts of the truck echelons were loaded into all of the LST's so that the loss of one LST would not cripple the engineer effort. However, upon arrival, this company experienced considerable difficulty in trying to assemble the various squads of the platoons. When loading engineers, their units should not have been split into anything smaller than a platoon, or similar group commanded by an officer, unless a very definite and specialized squad assault mission was anticipated. An individual engineer squad is unable to provide adequate engineer support for any sizable combat unit.

Engineer Responsibilities by Operational Phases. The limited engineer planning possible during the short preparatory period before the operation was too restricted to permit well-defined assignment of initial responsibilities to engineer units on the far shore. The projected operation was not broken down into engineer phases of "Assault" (direct support of tactical operation, usually by organic or attached combat and amphibian engineers), "Reinforcement" (initial minimum road and bridge work to dumps and around the perimeter of the first-priority airstrip, and support of tactical operations where required), and "Base Construction" (dock work, provision of aviation gasoline facilities, and construction of airdrome, access roads, and buildings for servicing the airdrome and base). These phases should have been well planned and coordinated to prevent futile activity. However, under stress of hasty preparations, it was assumed that when the "Assault" phase of engineer responsibility had been accomplished and locations established, the "Base Construction" phase would be definitely resolved. Meanwhile all units were left to determine their own responsibilities for initiating operations during the intervening "Reinforcement" phase.

This method of approach probably would have been satisfactory had the area back of the beach required less effort in clearing undergrowth to make it suitable for parking of vehicles and storage of supplies. However, the heavy rain forest backing up the beach presented an immediate obstacle even to the movement of troops and truck transportation. A remedy for the situation had to be improvised on the spot. The Task Force Engineer Section immediately assembled small groups of engineer and infantry bulldozers, which appeared to have no special task at the time, and initiated a definite project of breaking through to the kunai grass areas. Considerable effort could have been saved, however, had sufficient importance been placed on planned procedures normally entered into with the provost marshal for traffic direction and control to provide the most efficient operation of traffic with the minimum expenditure of engineer effort. When landings were contemplated on beaches backed up by New Guinea rain forests, a definite plan for clearing the forests or of cutting through to open inland areas should have been prepared prior to the operation. Previous experiences conclusively indicated the type of landing areas to be expected. With the possible exception of Lae and Salamaua, practically all former landings had been made across marshy shores to beaches hemmed in almost to the water line by brush, forests, and jungle. Even at the exceptions, hills and swamps immediately adjacent to the beach had initially restricted operations. The opening of passages to the hinterland and clearing of areas definitely controlled not only logistical support but tactical progress in every landing as well. At Saidor all engineer units included in the task force should have been assigned definite responsibilities for this phase of the operation. Furthermore, they should have been prepared to proceed with their missions after landing without additional orders since suitable communication between task force command echelons and engineer units was often unavoidably lost for brief periods in the initial stages of a landing.

Allocation of Unit Areas. Individual engineer units selected bivouacs close to their assigned tasks. Without coordination of bivouac plans on the task force staff level, considerable confusion resulted. The bivouac selected for the 808th Engineers was off to one side of the airstrip while the 863d Engineers' was on the other side. Elements of the 808th, however, were not able to go into their assigned area until initial development of their camp location had been completed. In the meantime, as a temporary expedient, they bivouaced on a portion of the kunai grass area which was to be used eventually for hardstanding areas. But, as a result, the 860th Engineers coming in later found their assigned area quite crowded, and their several companies had to be placed in separate locations. The 542d EBSR units were originally bivouaced in the rear of Red, White, and Blue Beaches. Without prior approval of the Task Force Engineer, they moved to a new location in the rear of Wilwilan Beach where, at the time, there was but a single-lane track. In moving, they made the error of locating the camp, kitchen, headquarters, and various temporary shelters immediately adjacent to both sides of this track and delayed its improvement to a two-lane road until they were relocated.

Similarly, considerable difficulty was experienced with the antiaircraft artillery. The original location of their guns would have seriously interfered with construction work had they been allowed to remain in the particular areas selected. Since these were tactical troops, coordination with them prior to the landing had been considered unnecessary. It had been assumed that they would be able to move readily when required by the various construction necessities. However, the antiaircraft defense plan is closely interrelated with base construction, particularly airdrome and dock installations. The location of all batteries of antiaircraft, therefore, should be coordinated by the task force engineer and the antiaircraft commander prior to the various phases of construction and prior to the location and establishment of any of the antiaircraft batteries.

These incidents demonstrated most emphatically the need for basing layouts of assigned unit and depot areas on studies of available terrain data and analyses of requirements to avoid later conflict and resultant confusion in the operational area.[33] Allocation of areas should be prepared by the task force engineer section after consultation with all concerned and presented to the task force commander for approval. Then the allocations should be well publicized to all subordi-

[33] *Editor's note:* The terrain data available in these early operations unfortunately were too often limited to inadequate aerial photography interpreted by untrained men. When photography was provided, the forest cover was usually so dense, the ground could not be seen on the photograph; where it could, the grass was so thick and tall, it prevented proper evaluation of the open ground. What looked like an open, grassy stretch might prove to be a swamp covered with undergrowth 15 feet high. Even after landing it was extremely difficult to get proper information on the characteristics of such terrain inasmuch as this could only be accomplished through exhausting and hazardous reconnaissances on foot. Treacherous swamps and dud parachute bombs often lay concealed under the towering grass. Accurate *advance* knowledge of the type of terrain encountered in New Guinea could not very readily be obtained *after* occupation by the enemy.

nate commands to insure that each is informed of its designated area as well as its location in relation to other sites. No deviation from such allocations should be countenanced except in the light of changed conditions found, and then only after the approval of the task force commander.

Night Operations Under Air Attacks. Enemy activity did not interfere with the prosecution of work except for delays during red alerts at night when it was necessary that all lights be turned out and work halted. On three such occasions enemy bombing damaged engineer equipment. As a result of one bombing two carryalls and two D–7 tractors were deadlined, one man in the 860th Engineers was killed, and one tractor operator in the 808th Engineers was seriously injured. Another bomb, which landed in the 860th's area, deadlined a grader, completely demolished a jeep, and damaged tents and equipment. On another occasion bombs landing in the 114th Engineer area damaged considerable camp equipment, killed 20 men and wounded 37 others. It was learned the hard way that good liaison must be maintained between the air warning system and the engineer equipment operators on night construction work to insure lights being turned out immediately upon receipt of a red alert. Delay of as little as a minute resulted in bombs being dropped within lighted engineer work areas.

A subsequent recommendation stressed "plenty of Walkie-Talkies and at least one powered siren" [34] for each engineer battalion. It was pointed out that the noise of Diesel equipment, both road graders and dozers, is so great, normal sound warning of an air raid was not readily detected by the operators. At night, the sudden extinguishing of all lights naturally attracted the individual operator's attention and alerted him. During the day, however, even the sound of rifle shots did not affect an equipment operator whose hearing had been deadened by many hours of exposure to the roar of a Diesel engine. Under the circumstances, an effective air-raid warning system to prevent casualties to the men and damage to equipment was an obvious requirement.

Construction. Difficulties encountered on airdrome work at Saidor were numerous. Requirements were gradually increased until 232 hardstandings were required by 15 April. This was a local impossibility considering the means available, weather prevailing, and quality specified. In an effort to meet this schedule, particularly under pressure of the local air engineer's demands to permit occupancy before the hardstandings were ready, the Task Force Engineer attempted to speed up progress by working even in the rain. As a result, when the rains increased in intensity, the downpours caught a good deal of work open without adequate provision for drainage. Even so, charges of unnecessarily delaying completion of construction were made because 50-foot graveled shoulders were provided on the airstrip. However, considering the mud encountered and the heedless driving of AAF trucks over wet and uncompleted work, satisfactory shoulders could not have been built in any other way. A relatively inexperienced engineer organization, meanwhile, besides opening up too much work at one time, constructed the initial hardstandings too small and with inadequate drainage and compaction. This resulted in a complaint by the Air Engineer, Fifth Air Force, that drainage and compaction were poor, hardstandings were small, and that Sixth Army was not using sound engineering principles in construction of airdromes. For these and other reasons a new task force engineer was designated on 15 March 1944. By that time, many of the difficulties had already been solved, including drainage correction and compaction. Changing all of the small hardstandings on the south side to the slot type had been started. This corrective work was far more difficult than original construction and required much more gravel which

[34] Pers Ltr, Col A. G. Matthews, USA (Ret) (formerly Chief, MID, OCE, WD) to Editor, 10 Nov 49. In OCE, GHQ, FEC (Hist).

was frequently a bottleneck. Furthermore, keeping AAF trucks off the work was next to impossible and, as a result, much new work had to be redone. This traveling over and occupying of new work before it was released continued throughout the operation and was responsible for much of the delay in completion of construction.

In the latter part of the project the main difficulty was to impress on some engineer troops that drainage comes first, and that drying gravel by blading was locally impractical. This, too, occasioned a duplication of effort where correction was required on some projects, but finally these inexperienced engineer troops learned how to secure their work against the rain and to expeditiously apply bitumen during the few dry days available. However, another repetition of effort was necessary when some soft spots developed in the runway and had to be corrected. These were occasioned largely by previous indiscriminate running of wheeled vehicles across open work. Large quantities of mud had been introduced into the various courses of runway construction by such vehicles and had resulted in areas where insufficient bond existed between the bitumen when it was applied and the gravel surface. As a consequence the impact of landing aircraft on such areas caused rapid deterioration of the pavement in certain spots.

Many of these difficulties could have been avoided if the task force staff and Allied Air Forces representatives had had sufficient time to go over the general layout and procedure of construction prior to the operation. A procedure should have been established whereby air and ground troops would move over the airdrome and hardstanding areas as little as possible. A service road skirting the airdrome, with service squadron hardstandings connecting it with the adjacent taxiway, should have been given high priority. Alert aprons adjacent to the end taxiways, rather than the end of the strip, would have been preferable because such location would have provided better dispersion, earlier use, and more safety from crash landings.

The main difficulties of dock construction were caused by poorly suited equipment, inexperienced construction crews, heavy surge from ground swell, and poor seamanship. Available pile drivers with 2,000-pound hammers were unsuitable for heavy dock work.[35] The crews were inexperienced and had to be broken of such poor practices as batting the piles around with the leads and wasting time. Tying the clusters was very difficult for them at first and, as a result, the clusters were not adequately secured. Heavy seas necessitated fairly constant maintenance on the jetties and the roll of ships in heavy swells caused considerable damage to adjacent docks. One night in a very heavy swell a Liberty ship completely pulled out a seven-pile stern line cluster and a four-pile fender cluster, and broke two heavy additional breast line and spring line chains. Poor seamanship was evidenced mostly at the small docks. This consisted mainly of unauthorized tying of large vessels and heavy barges to small docks and leaving them tied in heavy seas until the guard piles were beaten to pieces. When areas of relatively minor operational importance like Saidor are entered, a Navy "can" dock, if available, would provide almost immediate pier facilities, but, of course, only under normal or unexposed conditions.[36] For later developments, if they should be required, a heavy port construction unit could be employed to provide them. Otherwise, aviation battalions, if assigned to dock constr tion, should be issued special heavier equipm t than that issued under

[35] *Editor's note:* These little pile drivers were really half-yard shovels refitted as pile drivers with 2,000-pound hammers. They were not sufficiently counterweighted to permit the lifting of a pile into position even with the boom almost vertical. Unless improvised counterbalances and preventer cables were attached, this rig would tip forward upon attempting to raise a pile into position and the complete plant would topple into the water.

[36] *Editor's note:* On subsequent operations as equipment became available, several self-powered "can" docks, together with one or more small but powerful tugs, and some seamules with barges, or self-powered barges, brought in with the first reinforcement echelon reduced pile driving to the minimum required for mooring and fender piles for the "can" docks, and gave the possibility of proper lighterage in the harbor at the same time.

the existing Tables of Organization and Equipment.[37]

Most of the roads at Saidor had to be built in mud while traffic ran over the construction in both wet and dry weather. Drainage was inadequate initially but was finally solved by use of extremely deep ditches. Building roads under constant traffic also required far more gravel than for normal road construction; many sections of the main roads at Saidor received 2 feet of gravel. Moreover, construction of roads was a continuing process. This situation would have been materially improved by roughly laying out the location of the various installations before the operation and planning the roads to serve them in priority of use. Engineer units should have been grouped as closely as possible in an area providing the most immediate access to their work and the main supply roads. Camps for AAF elements should have been compact and placed on the main artery to the airstrip in order of the units' arrival, with the service group closest to the airstrip. The crash strip–hospital road should have had high priority and early provision should have been made for an access road from the hospital to the main road. Both commanders and staff engineers should have recognized more fully the need to make certain allocations of equipment initially to road construction, particularly since early availability of roads actually accelerated completion of the primarily urgent airstrip construction.

The major problem encountered in hospital construction was occasioned by delivery of materials. Such necessities as a suitable pump, pipe and fittings, nails, hinges, and plumbing and electrical supplies arrived in dribbles and materially delayed the work. Here again, the time and effort required for this heavy type of construction to support relatively minor tactical requirements could have been saved by increasing field hospital facilities.[38]

The original layout of the engineer supply dump on a city street plan was elaborate and unsound. Initially, a simple solid loop road would have sufficed. No large amount of equipment could be allocated to its construction and as it was opened up with excessive dispersion, it soon became a disorderly quagmire extending over a large area. A major drainage and construction project had to be initiated to make it sufficiently passable to collect engineer supplies and equipment which had been thoroughly scattered throughout the area.

Supplies and Equipment. Initial engineer supply for Saidor labored under a disadvantage from the start because of the short period available for planning prior to the operation. This was remedied to some extent, but the usually critical items of spare parts, oxygen, acetylene, nails, hardware, cable, cable clamps, plumbing and electrical supplies, and cement arrived in small and sporadic deliveries and their need remained crucial. In spite of requisitions, signals, and officers sent to obtain acetylene, only one shipment of empty bottles was received during the 5- to 6-week period of heaviest work. The only local

[37] *Editor's note:* Over and above special issues of extra heavy equipment for specific missions, engineer aviation battalions and general service regiments required heavier equipment than that which was organically issued. Such units always need the biggest, heaviest, most powerful, and fastest-moving earth and mechanical tools that can be transported in the field. The little rock crushers issued, for instance, produced 10 to 15 cubic yards of rock an hour. This quantity was so hopelessly inadequate for existing requirements, the rock crusher issued was considered of little value.

[38] *Editor's note:* A suggested procedure, where feasible, to conserve engineer construction effort in establishing temporary installations, was to place facilities on barges. Three or four properly equipped, large barges with quarters, for instance, could provide a fairly adequate temporary hospital or port headquarters if they could be towed to the objective area and established in a sheltered location. Similarly, 15 or 20 barges with proper warehouse type deck houses could provide the housing for most of the smaller and more perishable items of supply. A certain amount of additional pier work would, of course, be involved in providing access to the floating installations from land. Since most of this would be occasioned by provision of floating bridges, however, the major effort required would be in placing mooring anchors or piles to hold the bridges in place and constructing roads to them. Such a procedure would not, of course, eliminate the very considerable amount of work necessary to provide airfields, hardstandings, and dispersal points as well as access roads to such facilities. Still it could eliminate the large proportion of effort diverted to subordinate structures.

materials available were water, mediocre gravel, lumber, and short piling, and these were used freely. Spare parts requisitions were seldom filled completely and deadlined equipment increased proportionately. Most units had to cannibalize at least one deadlined piece of equipment for parts to keep the others running. One of the major reasons for the inadequacy of engineer supplies at Saidor was the disproportionate allocation of shipping space to large levels of ammunition, rations, and gasoline at the expense of providing space for even a minimum of engineer requirements. This was a logistical error that cannot be overstressed and which should be corrected with realistic regard for priority of needs by the officers controlling the loading and the calling forward of shipping.

Another significant fault in engineer supply was demonstrated when a report of excess paper work, noncooperative supply officers, and general inefficiency at a specific base was submitted by an Engineer officer who made the trip back to supply bases to expedite shipment of construction supplies to Saidor. When this report reached the Chief Engineer, GHQ, SWPA, he directed that an immediate study be made throughout all engineer supply echelons for the purposes of streamlining and standardizing administrative procedures. The fundamental reasons behind the reported weaknesses were soon revealed by the information accumulated. Paper work depended naturally upon the number of depots involved in filling requisitions, since each warehouse of every depot had to prepare tally-outs for proper maintenance of records. The few cases of noncooperative supply officers were obviously the result of the tendency to assign junior officers as Engineer supply officers at bases instead of capable, senior officers seasoned in working under stress and wresting results even from incompetents. The alleged inefficiencies at the base criticized in the original report were readily understandable when it was pointed out that the depot company at that base consisted of new and untrained Negro troops with a poor clerical section and 17-percent illiteracy of personnel, and that the company had been further handicapped by the addition of 100 untrained replacements immediately prior to embarkation for the Southwest Pacific. Obviously, the reason for task forces not receiving essential, and sometimes available, supplies, except through special processing of requisitions and services of expeditors, was the shortage and caliber of personnel assigned to these important duties. The reported faulty procedures, noncooperativeness, and inefficiency were largely reflections of the basic weakness: the desperate need for additional qualified personnel.

Over-all Engineer Problems

Engineer problems and difficulties were not confined only to individual operations. Behind the engineers involved in each task force, higher echelons responsible for engineer support throughout the Theater constantly struggled under exigencies. Providing each task force with adequate engineer means for the assigned mission from widely scattered and all too few engineer units at the time and place needed was their responsibility. This responsibility was continuous, and involved highly diversified problems. Plans had to be kept abreast of rapidly changing strategical concepts. A wide range of intelligence activities had to be initiated and constantly studied. Liaison with Allied agencies to develop every possible facet of support had to be maintained. Standing operating procedures and Tables of Organization developed in peacetime had to be continually revised to meet wartime conditions in unprecedented climate and terrain. Administrative problems incidental to securing authorizations for such changes had to be resolved with the War Department. Some of the difficulties encountered in these activities during the period January 1943 to January 1944 merit recording for possible assistance in any future conflict. They are presented briefly for consideration.

Planning

Staff Plans. Individual operations were planned under a constantly increasing tempo. Considerable pressure developed, both at GHQ, SWPA, and Sixth Army levels, for the speedy preparation of operations instructions and field orders and for their distribution down to the task force level. The requirement for secrecy in selecting areas for projected amphibious operations, the sudden subsequent changes from the areas initially selected for operations, and the frequent advancing of operational dates from those originally planned, made it essential that engineer sections develop a particular flexibility of engineer operations. Full development of this characteristic depended largely upon: (1) maintenance of Theater engineer reserve stocks (a factor not favorably considered by Army Service Forces, War Department); (2) maintenance of a close technical channel relationship between the Engineer Section, GHQ, SWPA, and engineer sections of subordinate headquarters; and (3) maintenance of active, energetic, and coordinated engineer intelligence and engineer planning systems.

Engineer intelligence operations at the Engineer Section, GHQ, SWPA, level, were concerned with the preparation of data on all potential operational areas, with special concentration of effort on those considered most likely to soon become operational. The requirement for secrecy in selecting areas, however, placed engineer intelligence and planning personnel within the Engineer Section, in the position of having to continually anticipate the plans of the General Staff Sections, GHQ, SWPA. This involved making all possible surveys and studies of every one of the most likely areas to be selected to insure compilation of sufficient data on the one finally designated in time to meet the requirements of staffs and units responsible for detailed planning and execution of an operation. Formal and timely dissemination of complete planning data to subordinate commands, however, was often impossible. Although the data to determine the feasibility of a proposed operation from the engineer standpoint were normally always on hand at the Engineer Section, GHQ, SWPA, level, often the assembly of this information into an engineer annex and preparation of the final terrain study could not be completed in sufficient time for distribution to subordinate staffs and units as aids in their detailed planning. As a partial solution, however, interim reports containing the portions of the studies which had been completed were dispatched to affected echelons. These interim reports contributed information essential to initial planning by subordinate staffs even though compilation of complete data was delayed by reasons of: (1) the small staff available for production of engineer studies in the Engineer Section, GHQ, SWPA; or (2) the rapidly changing strategic and tactical concepts; or both. Delays in dissemination, on the other hand, often occurred through the delays or failure of the tactical headquarters, charged with over-all responsibility for the execution of the operation, to distribute the studies, even when made available, to lower echelons because of time and distances involved. Whatever the cause of nonreceipt of this critically important information, it was then that maintenance of close technical channels between various staffs and unit engineers proved its worth. Conferences and correspondence initiated through these channels promptly bridged the gap between Theater-wide and subordinate engineer staffs during the planning phase, and forestalled much confusion and wasted effort.

The factors of secrecy in planning, rapid changes in plans, and speed-up of operations also at times appreciably hindered the coordinated action of general and special staffs within subordinate headquarters themselves. For example, some field orders were published by a G–3 section of a headquarters before the special staff of the headquarters had had an opportunity to study and submit recommendations on the proposed plan. Adequate consideration of a plan by an entire staff would naturally retard the publication of field orders. However, this disadvantage should be weighed against the advantages of a well-coordinated plan which would insure a minimum of subsequent handicaps and delays, and obviate any uneconomical use of time, manpower, and materiel.

The Engineer Section, Sixth Army, for example, sometimes encountered difficulty in obtaining early information from the General Staff Sections, Sixth Army, with which to anticipate engineer requirements and to perform adequate advance planning for operations. Such instances, of course, precluded a thorough engineer analysis and production of a sound engineer plan. Further, the ensuing delay in preparation of the engineer plan circumvented all possibility of its coordination with, or influence on the makeup of, staff plans as a whole. So at times, hasty engineer estimates resulted although the Engineer, Sixth Army, was, nevertheless, held completely responsible for the soundness of subsequent engineer operations. In some such instances, hasty preliminary staff conferences, based only on a brief verbal presentation of plans by the G-3 Section, Sixth Army, however, served to prevent crystallization of a logistically unfeasible plan. In this connection the Engineer, Sixth Army, basing his remarks on his understanding of the Sixth Army policy that preparation of a field order was the preparation of a plan, "because a field order *is* a plan," commented: [39]

> . . . an estimate of the situation involving the analysis of one or more alternate plans by the entire Staff is prerequisite to the selection and formulation of a sound and well coordinated plan. This is true whether or not the expression of that plan is by a field order. Time is necessary for that process, or the plan becomes a travesty on the usefulness of a Staff over and above the G-3 Section.

Shore Party Support Requirements. Conferences for the exchange of experiences between U. S. Army, Navy, and Marine personnel regarding solutions employed to problems of shore party organization in the various task forces produced helpful conclusions for future consideration. For example, it was determined that the provision of one engineer combat company, as normally constituted, for performance of shore party functions on a one-battalion landing beach was inadequate for the assigned mission. Considered on the basis of a list of grades and ratings, but excluding the 1st sergeant, clerks, cooks, messengers, and automobile mechanics, the available manpower for handling of supplies would be only 5 officers and 128 enlisted men out of a total strength of 5 officers and 171 enlisted men. Further, not all of the 128 enlisted men could be considered available for actual handling of supplies. Some would be engaged in preparation and improvement of beach roads, operation of bulldozers, and performance of other functions. Clearly the need for initial employment of cooks, clerks, and the like, as hatch crews and for possible augmentation on the beaches was evident. It was, therefore, concluded that, with careful selection and proper training for the tasks, such personnel could be made available for unloading activities until approximately H plus 48. However, the number of personnel required on the beach to handle supplies varied with factors found to be quite different in one operation from those present in another. This made it impossible to establish a standard shore party strength per battalion landing team, regimental combat team, or division. The first consideration was the time in which it was considered essential that the transports be unloaded. Ship unloading machinery and small landing craft, more often than not, were capable of unloading supplies more rapidly than the largest shore party practicable could accommodate.[40] The required size of a

[39] Memo, Engr, Sixth Army, for CofS, Sixth Army, 19 Apr 44, sub: Preparation of Field Orders. In Sixth Army files.

[40] *Editor's note:* Experiences of Marine officers at Guadalcanal and Navy officers in the Rendova and New Georgia operations indicated that one man could handle a half ton of supplies per hour. Assuming the average tonnage per APA to be 1,000 tons, a fair estimate for weight of personnel and vehicles would be 400 tons. This would leave 600 tons of supplies to be handled. At a half ton per man per hour, it would take 120 longshoremen 10 hours to unload supplies from an average APA.

shore party was modified considerably by characteristics of the beach and its adjacent terrain which varied in each operation as to distances and obstacles over which supplies had to be handled. The scale of equipment and supplies *combat loaded* with the troops, and those *combat loaded* in AKA's, had a direct bearing. The extent to which supplies could be palletized on sled pallets greatly influenced the number of longshoremen required on beaches.[41] The amount of labor necessary was also affected by the availability of 2½-ton amphibian trucks (DUKW's) and the ratio of their practicable use over certain tropical beaches.[42] Another very important factor was the type of landing craft employed in the unloading. The type of operation characterized by a long sea voyage in which all supplies were combat loaded and unloaded by LCVP's and LCM's carried by the transport group was altogether different, logistically, from the type in which most of the supplies were transported by LST's and LCT's, either operating from a near shore or transferring cargo from transports. The latter type of operation, involving unloading of larger craft, naturally imposed a far greater burden on the shore party.

All factors considered, it was concluded that the most desirable solution was the initial use of elements of the combat team to support the shore party in unloading. As determined after study of the Lae operation, if combat teams were organized into integral forces for tactical, logistical, and support activities, the support component would be available either for unloading operations or tactical support as dictated by the particular situation, and could be readily diverted from one operation to the other as necessary. It was pointed out time and again that the landing force commander should thoroughly understand and accept the fact that unloading of supplies and their movement across the beach to properly located dumps was as much his responsibility (and a major one) as the tactical phase of the operation. With the provision of certain total means to carry out his over-all responsibility, tactical and logistical, he should be charged with the proper employment and constant effective operation of all. Tactical success without adequate logistical support was an impossibility. Protection against excessive boat losses on the beaches required expeditious unloading; otherwise such losses, resulting in a shortage of supplies at the critical time when needed, could jeopardize the entire operation. To reach the combat troops in time for effective use, these supplies had to be moved off beaches vulnerable to enemy fire. It could not be done by depleting the logistical support on the beaches for the purpose of augmenting sketchily equipped combat troops with additional logistically unsupported men.

Forward Movement of Engineer Units. The availability of engineer personnel and their movement forward to operational areas presented considerable difficulties to formation of engineer components for task forces during this early period of operations. Many engineer units arriving from the United States were shipped to ports of debarkation in continental Australia. In general, these units and their equipment arrived on a number of different ships. Equipment for some units arrived at varying times on as many as 18 separate ships. With the northward advance of operations and further development of port facilities in advanced areas, troop shipments to Australia were no longer required or desirable. It was stressed to higher authority that all units and their equipment be shipped directly to the port nearest the location at which the unit would be initially employed, that all equipment for the unit should be shipped, insofar as practicable, to the same port as the unit itself, and, if possible, on the same ship or in a minimum of ships.

[41] *Editor's note:* Technical disadvantages discouraged extensive use of sled pallets at this time. Shore conditions had to be suitable for their use, and tractors or suitable prime movers were required for their utilization.

[42] *Editor's note:* On some islands where the jungle extended right to the beach line, tropical growth and the absence of trails precluded the use of DUKW's. They appeared better adapted for resupply missions from larger craft rather than initial landing operations.

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Owing to the necessity of waiting for arrival of equipment and transshipment of both personnel and equipment from Australia to the forward areas, delays and consequent waste of construction effort were considerable. It was requested that information as to the expected availability of new units for shipment from the United States be furnished the Theater as far in advance as possible to permit periodic recommendations of ports of debarkation in accordance with Theater operational plans.

Mapping Operations

Maps for ground forces were produced by various mapping agencies, with each assigned certain areas of responsibility, subject to revision as operations progressed. Interchange of data between engineer mapping agencies and direct contact between personnel of all mapping agencies were encouraged, however. For example, the Australian Survey Directorate and the Base Map Plant (648th Engineer Topographic Battalion) cooperated with the Royal Australian Air Force by performing a major portion of its reproduction work. The 648th Engineers furnished manuscript to the Royal Australian Navy for its hydrographic chart compilations. But during 1943 map production had reached its peak output within the resources available. Continuance or increase of this level of production could be maintained only by an increase of mapping personnel and suitable photographic aircraft. However, through November 1943 the 8th Photographic Reconnaissance Squadron, at only part operational strength, had been the only Allied Air Forces unit to furnish mapping photography of operational areas in the Theater. This unit had furnished, in addition to extensive reconnaissance photography for the Fifth Air Force, 75,000 square miles of mapping photography, although its facilities were often limited to three or four operating aircraft, and, at momentary peaks, a maximum of fifteen P–38's and one converted B–17. The range of the P–38's was not sufficient for the wide mapping coverage required in the Theater; more long-range photographic aircraft were necessary to fill mapping requirements well in adance of operations. However, replacement aircraft which had been requested for shipment on high priority were continually delayed in their arrival.

Similarly, facilities for printing large quantities of aerial photographs were limited. Yet the great distances existing between the various headquarters and reproduction units augmented the urgent need in the Theater for additional negative duplicating and printing equipment which was on order but not yet available. Operational needs required negatives to be promptly available to the Allied Air Forces in forward areas for tactical use as well as at engineer mapping agencies further to the rear for map production. Because of the existing shortage of negative duplicating equipment in forward areas, the dissemination of photographic information to engineer map reproduction agencies was ofttimes seriously delayed.

Engineer Equipment and Supply

Spare Parts. From the beginning of operations in the Theater the shortage of parts for engineer mechanical equipment was a serious problem. Practically all construction plant in the forward areas was operated 20 hours per day, 7 days per week. The existing echelon system of parts supply for repair of this equipment, however, could have worked only under a completely improbable and ideal set of conditions.[43] In this Theater of slow and uncertain deliveries, the system proved impractical and entirely academic in its basic conception. The replacement rate in SWPA exceeded established factors of supply. Maintenance and heavy shop personnel and facilities were unavailable initially. There were too few trained parts supply personnel in the Theater for operation of a parts depot, and engineer troop units continued to arrive without

[43] *Editor's note: See* pp. 71–72 and Appendix IX, "Supply and Procurement of Spare Parts for Engineer Equipment, 22 March 1943," *Engineer Supply*, Vol VII, this series.

organizational echelon sets until the end of 1943. Under such conditions an excessive proportion of deadlined equipment was "SOP" with widely dispersed engineer battalions and regiments carving bases out of primitive jungle before depots and repair and maintenance shops could be established. Until April 1943 when the first maintenance company and heavy shop company, long on requisition, arrived in the Theater and limited units of that type became available over the following year, all echelons of engineer maintenance had to be performed by unit mechanics. In the meantime shipments of parts from the United States were very slow to arrive until the end of 1943 and distribution of available parts within the Theater was restricted because of limited shipping and the unavailability of parts supply personnel. The ensuing short supply of parts in many instances resulted in cannibalization of equipment as a necessary expedient to keep a unit operating.[44] This, in turn, aggravated the already critical equipment shortage.

There was an improvement in shipment of parts from the United States towards the end of 1943. Still the storage and issue problem within the Theater was acute because of the shortage of trained parts supply personnel. Beginning in February 1943 efforts had been made to obtain a spare parts company. The Commander in Chief, SWPA, had made a formal request to the War Department by radio dated 16 April, and dispatched another radio requesting status on 24 July. The War Department radioed in reply on 1 August that no spare parts company would be made available during 1943. Continuous efforts were made to obtain personnel who were experienced in spare parts work either from replacements or from other units for operation of a parts depot at a forward base. It was eventually necessary to place an additional burden on a heavy shop company, and the situation was still far from satisfactory. The dilemma could only be solved by detaching experienced men from operating units where they were urgently needed or permitting a chaotic condition to develop in the spare parts depot. Even a platoon or small detachment of trained spare parts personnel dispatched to the Theater promptly would have been of inestimable value.

Another problem which assumed alarming proportions was the supply of spare parts to the engineer special brigades for marine engines and appurtenances. These marine spare parts were to be supplied through U. S. Navy channels, but to the end of 1943 the Service Force, Seventh Fleet, had been totally unable to meet requirements of the 2d ESB. As a result, the brigade's maintenance problems increased considerably. In tropical waters generators and starters deteriorated rapidly and intensive combat operations resulted in extensive damage to propellers and shafts. Hundreds of craft were disabled, and prospects for obtaining needed parts from the Navy were not promising. This situation was personally and forcefully presented to War and Navy Department representatives in Washington in January 1944, by the Chief Engineer, GHQ, SWPA, and material improvements were gradually attained.

Construction Equipment. Throughout this entire period of operations in the Southwest Pacific, there existed a dire shortage of construction equipment. In 1942 and continuing into 1943, it was necessary to requisition any type of used heavy-duty construction plant available in Australia. The limited number of engineer units available performing the extensive amount of construction work required had to be augmented with equipment far in excess of that nor-

[44] *Editor's note:* Despite the considerable weight of spare parts, a subsequent suggestion for the future urged that each engineer unit's organizational supply should include a year's stock of spare parts, boxed and shipped with its equipment. If necessary, it was pointed out that organizational motor transport could be increased to carry such parts. It was further recommended that all engineer units, down to and including the company, should contain maintenance personnel in their organization, with 1st and 2d echelon repairs provided by the company, and 3d and 4th echelon repairs provided within the battalion or regiment. Significantly reminiscent of experiences at Arawe, special emphasis was given to provision of personnel and equipment for arc and gas welding within each engineer company.

mally authorized in Tables of Equipment. Further, there was a definite need to establish a Theater stock pile in order to meet contingencies such as prompt replacement of plant damaged by enemy action or lost by sinking of vessels, and for supplemental provision to task forces charged with major engineer construction responsibilities. The build-up of such a stock pile was constantly deferred because of the need to immediately dispatch each piece of plant received to various engineer units already short of equipment for performance of tasks on which they were employed. In desperation requests went forward to higher authority even for overhauled plant previously employed on the national defense construction program in the United States to help meet requirements.

Theater Class II supplies were authorized on a 90-day operating level plus a 90-day reserve. The ideal condition, therefore, was for the supplies to fluctuate between a 90- and 180-day level. Engineer supplies never remotely approached the levels prescribed. Shipments from the United States were not sufficient to keep pace with the rate of expenditure and increase in troop strength. Nonetheless it was frequently necessary, as previously indicated, to equip units in excess of their Tables of Equipment so as to meet project target dates with the limited number of engineer units available. The equipment problem was further handicapped by the inability, in most instances, to recover special equipment once it had been temporarily issued to a unit because of the critical shipping situation and the isolated location of units.

The advent of engineer special brigades presented supply problems other than the filling of their additional marine requirements. Experience in amphibious operations in the Theater demonstrated conclusively the usefulness of the engineer special brigades. However, over and above the mission for which the brigades were established, it was apparent that great advantage could be derived by training and equipping shore battalions for immediate initiation of heavy engineer construction on hostile shores to supplement the limited construction forces in the Theater. Landing points were narrow, isolated beaches fringed by dense jungle. Such terrain obstructed dispersal of troops, delayed establishment of dumps and medical clearing stations, retarded unloading of ships, and otherwise rendered difficult the organization of the beachhead. Following the establishment of the beachhead and the initial advance of the landing forces, full exploitation of the landing required the rapid development of port facilities and airstrips, establishment of a road net and communications, and construction of utilities, storage, and shelter. Conditions encountered in initial landings and in subsequent development of operational areas strongly indicated the necessity for the early landing of engineer troops with heavy construction equipment. The engineer special brigade, having the organic transportation equipment and training for accompanying the amphibious assault forces, appeared to be the logical organization to initiate the engineer mission except that it lacked the required construction equipment. Issue of such equipment to the brigades would not only permit their employment for initiation of heavy engineer construction on the far shore, but would also permit a desperately needed increase in the Theater equipment stocks.

For these reasons a recommendation was made to the War Department that a supplemental set of equipment be issued to the engineer special brigades. The recommendation was approved, but it was directed that issue be made from Class IV requisitions previously submitted by the Theater. These Class IV requisitions were based on other requirements of the Theater, and, as previously indicated, stocks were already wholly inadequate without providing supplemental equipment to the brigades. The War Department was advised that additional Class IV requisitions would be submitted and was requested to approve and ship them at the earliest possible moment; otherwise the effort to derive additional benefits from the brigades would adversely affect the supply of equipment to other engineer units. This action was finally approved by the War Department.[45]

The year 1943 also revealed the necessity for equipping airborne engineer aviation battalions with a complete set of standard equipment which could be broken down for air shipment in place of their special light equipment. Experience under jungle conditions proved the light equipment short-lived, and economical for use only during such period until heavier equipment could be delivered to and reassembled at the site. Some experimentation on the preparation of heavy plant and trucks for air transport resulted.

General. The combat zone of the Theater was almost entirely undeveloped and all installations for the staging of troops and support of operations were, and continued to be, built from the ground in virgin territory. This included harbor and dock facilities, roads, water supply installations, power generation, hospitals, covered storage, camps, gasoline and oil storage, and pipe lines, over and above the major engineer task of building airdromes. In these tropical jungle areas, covered storage for supplies was required to a greater degree than in temperate zones. In fact, it was estimated that covered storage had to be provided for about one-third of all classes of supplies for all services. Mere tarpaulin or roofing-paper cover for protection from the rain, which was originally attempted, resulted in damage and losses because of the high humidity and scorching heat which built up under such shelter. Ventilation and insulation against tropical heat had to be provided in this climate. Provision of suitable covered storage, therefore, added that much more to the heavy engineer burden and increased the demand for construction materials, particularly roofing.

Another point not fully appreciated in the United States was the time which lapsed from the initiation of a requisition until the equipment was in the hands of a unit. Theater experience demonstrated this *time lag* to be 300 days, 120 of which were consumed in transshipment from Australian ports to New Guinea, and in movement between bases in New Guinea.

Under these conditions, engineer supplies were in a precarious position during this period. Little or no reserves of critical items were available and the loss of a single ship or destruction of any considerable quantity of supplies on the ground would have been a serious blow. In the light of impending engineer commitments, the situation was cause for grave concern.

However, further aggravating this situation was the small regard sometimes evidenced within the Theater for the proper distribution even of such supplies as were available. Certain commanders of base sections responsible for supply showed a definite inclination to expend supplies urgently needed in forward areas for developing the facilities of their own bases. Base section engineers were responsible only to their respective base commanders, and the discharge of their duties, affecting the whole engineer effort, became confused with the base commanders' concept of their mission. It was evident that some base section engineers were not executing their full supply responsibilities; even the engineer supplies and equipment available in the Theater were failing to reach the forward areas in sufficient quantities. The situation was so critical that the Chief Engineer, GHQ, SWPA, had to devote a major part of his inspection time at forward areas to matters of supply essential to the construction program rather than upon details of that program and other operational problems.

Troops and Training

Shortages. During this phase of operations the same desperate shortage of engineer person-

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[45] *Editor's note:* Subsequent to arrival of the 3d and 4th Engineer Special Brigades in the Theater, a Standard Special List of Equipment (as Class II equipment) was approved to authorize supplementary heavy equipment to each of the shore battalions of the 2d, 3d, and 4th Brigades. The standard SLOE authorized a lesser quantity of equipment than that originally requested and shipped as Class IV equipment. Elements of the brigades other than shore battalions were authorized SLOE equipment, but in general not items of heavy construction equipment.

nel existed which had prevailed from the beginning of hostilities in this Theater. The allotment of personnel of all arms and services to the Southwest Pacific Area was limited and controlled not only by the availabilities of replacement units, but by shipping availability. As a consequence the available proportion of engineer units scheduled for the Theater was restricted. Yet, difficulty was experienced in securing even this reduced number from the United States. Certain specific types of direly needed engineer units necessary for balanced support were not available because they had not been set up in the War Department troop basis. Therefore, the over-all engineer shortage, coupled with the insufficient variety of engineer units being supplied the Theater, often resulted in inadequate and unbalanced engineer support to operations.

There was a serious lack of Engineer officers with extensive experience in construction. Many of the Engineer officers being provided were from officer candidate schools. Although these officers were of great value for direct handling of troops and execution of projects already laid out, their actual construction and engineering experience was either entirely nonexistent or very limited at best. The critical need for at least a moderate number of experienced construction personnel was pointed out to higher authority, and in view of the curtailment and near completion of the large military construction program in the United States, an urgent request was made for early assignment to the Theater of any experienced officers that could possibly be released from the Zone of Interior.

Tables of Organization (T/O), such as for engineer general service regiments, were based largely on peacetime operational conditions which were materially altered by wartime needs. As has been previously indicated, during operations in the Southwest Pacific a considerably greater quantity of construction equipment was necessarily assigned to these units and its operation on a two- to three-shift basis required a commensurately increased proportion of trained operators and experienced foremen for supervision. An adequate provision of grades and ratings was, therefore, necessary in the unit T/O. This need was amply substantiated by the disparity of ratings between U. S. Navy construction battalions and comparable U. S. Army Engineer units. Hence, it was recommended to higher authority that grades and ratings be added to engineer units, particularly to engineer general service regiments. If this should prove impracticable, it was requested that consideration be given to converting existing general service regiments to special service regiments. It was further recommended to the Chief of Engineers, War Department, that provision of at least two qualified operators for each piece of heavy engineer equipment issued to units be taken up with the War Department and that adjustment of T/O and provision of trained operators be effected as soon as approval could be obtained.

Internal Engineer Administration. Although ESB task groups were temporarily attached to and under the command of task force commanders, clarification was still needed at this time on the matter of internal administration. In one case a task force commander assumed control of all promotions in a small ESB unit attached to his command. This was promptly reported to higher authority, however, and for the purpose of better control, it was pointed out that all matters of internal administration in ESB units should be handled in the future through brigade headquarters direct instead of through the task force commander.

Training Materials. The direct interest of engineers from the top level downward was demonstrated to each incoming engineer unit upon debarkation in the Theater. In compliance with directives of the Chief Engineer, GHQ, SWPA, close supervision was exercised to insure that packages of appropriate maps, terrain references, technical memoranda, and standing operating procedures, as prepared in the Theater, were actually made available to even the smallest engineer unit upon arrival. Such distribution, aside from evidencing a gesture of *esprit de corps,* promoted early orientation of units, and properly coordinated their unit planning and training with Theater policies without loss of time.

However, direct distribution of information on developments, lessons, new equipment, and training aids disseminated by Engineer offices in the United States was irregular and unreliable in many instances. Receipt of deliveries from the United States by units in the Theater was uncertain because of frequent changes in unit location and the precariousness of overseas shipment. It was, therefore, requested that copies of all new engineer information be sent to the Chief Engineer, GHQ, SWPA, in triplicate, together with information copies of all technical manuals, maintenance circulars, maintenance manuals, and other new or revised engineer publications. At the same time it was specified that these copies be accompanied by data as to quantity, date, and destination of bulk shipment for Theater distribution. Rather than continuing the practice of direct distribution from the Chief of Engineers, War Department, or installations under his control, to individual units in the Theater, it was suggested that such bulk shipments be made to the Chief Engineer, USASOS. The Chief Engineer, GHQ, SWPA, could then, through continuing close liaison with the Chief Engineer, USASOS, ensure that distribution had actually been made to the units for which the publications were intended.

Prompt and definite receipt of information on the latest and most up-to-date engineer developments and doctrines had to be assured. It was compulsory that the limited engineer potential available to this Theater achieve the greatest proficiency possible. For it was forcibly evident that this was to an important degree an "Engineers' War." Not only the progress of advance, but ultimate victory, depended in a large measure upon rapid engineer establishment of bases, communications, and airfields—upon the abilities of the engineers as builders, soldiers of service, fighters, and seamen.

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CHAPTER V

Admiralty Islands and Netherlands New Guinea Operations

February 1944–October 1944

The Strategic Situation

The capture of Saidor completed Allied domination of the Huon Peninsula and at the same time assured control of the strategic Vitiaz Strait. From two directions Allied forces under General Douglas MacArthur's over-all strategic command had relentlessly spread around enemy concentrations and encompassed them in either of two offensive pincers. The left jaw of the first pincers, set in motion by forces of the Southwest Pacific Area (SWPA), had curved up from Papua, enveloping Nassau Bay, Salamaua, all of the Huon Peninsula of Northeast New Guinea, and the western end of New Britain. In coordination, the right jaw of these pincers, set in motion by the South Pacific Force under Admiral William F. Halsey, had swept up through the Solomon Islands, bypassed two Japanese concentrations in the Bougainville area, established a strong base on Bougainville Island at Empress Augusta Bay, and occupied Nissan Island between New Ireland and Bougainville, only 125 miles due east of Rabaul. Allied air activities had already somewhat lessened the threat of enemy concentrations at Rabaul on the northeast corner of New Britain and the menace of the Japanese staging base at Truk, 800 miles north in the Caroline Islands. The seizure of Nissan Island, however, put Allied forces in a position to command Rabaul's northern approaches. The actual taking of Rabaul was no longer of prime importance and instead it was appropriate to start the movement of the second pincers. On the day following the capture of Nissan, U. S. naval elements in the Central Pacific delivered another crippling raid on Truk. Meanwhile Allied forces in New Guinea had begun to move northwestward along the coast after their successes at Saidor. The scene was perfectly set for squeezing the second pincers shut around the Bismarck Sea by seizing the Admiralty Islands and establishing thereon a major naval and air base to support a drive west along the northern coast of Netherlands New Guinea. (See Map No. 8, "Allied Offensive Plans, 1943–1944.")

The Admiralty Islands
29 February 1944

With control of the Huon Peninsula in Allied hands, the Japanese expected their base at Rabaul, New Britain, to be the objective of the next Allied offensive step. They were, therefore, caught off guard when Alamo Force (U. S. Sixth Army) elements consisting of brigade combat teams of the 1st Cavalry Division (Brewer Task Force) assaulted the Admiralty Islands, 300 miles to the north.

Original plans had designated Seeadler Harbor on the west coast of Los Negros Island as the initial area for invasion and 1 April as the target date. During February, however, intelligence estimates indicated that enemy defense capabilities in the Admiralties could rely on little air or naval support from nearby bases. General MacArthur thereupon changed his plans. In place of the assault scheduled for 1 April, an immediate reconnaissance in force would be made. The Brewer Reconnaissance Force, consisting of the 2d Squadron, 5th Cavalry Regiment, reinforced, with a small detachment of divisional engineers (8th Engineer Squadron) but no amphibian engineers attached, would land at Hyane Harbor near Momote airstrip on the eastern coast of Los Negros. D Day was designated as 29 February, and General MacArthur himself accompanied the reconnaissance force to determine how far initial successes would be exploited.

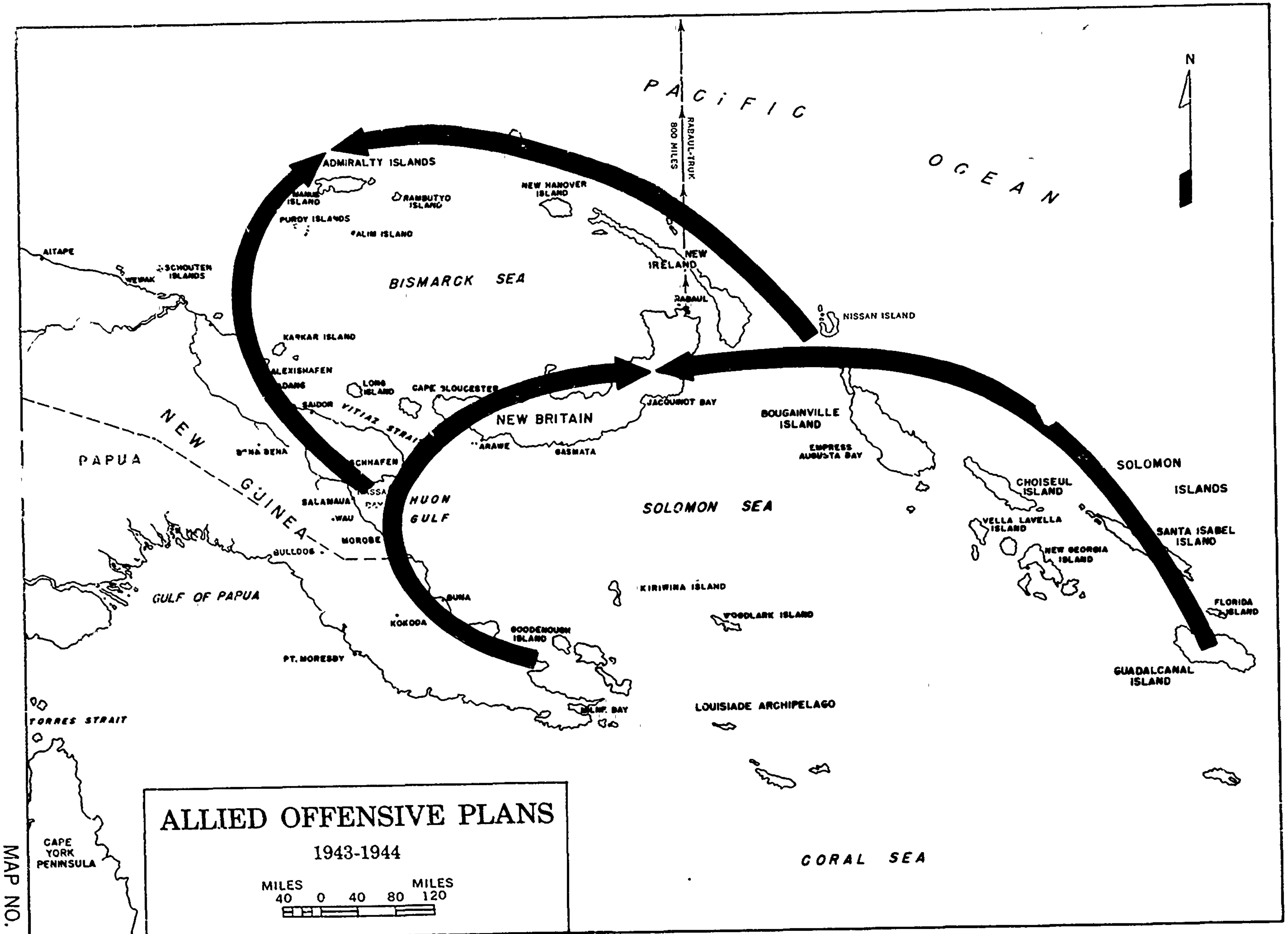
The moment and place of the landing took the defending enemy garrison by surprise, and more than one thousand men were landed against light Japanese resistance. Successful establishment of initial positions was aided by evident confusion in enemy intelligence reports and lack of coordination between enemy units, which resulted in Japanese failure to concentrate their forces at once against the newly established beachhead. Thus, reconnaissance was transformed into invasion, in accord with General MacArthur's expectations. The Brewer Support Force, consisting of 5th Cavalry reinforcements with one platoon of divisional engineers, a provisional task group from the 2d Engineer Special Brigade (ESB) (a reinforced shore company of the 592d Engineer Boat and Shore Regiment (EBSR)), and the 40th Naval Construction Battalion (Seabees), arrived on D plus 2. The area was further secured, and work was begun on repair of the airstrip for fighter operations.

Subsequently, integrated landings of the Brewer Task Force were made at Salami Plantation, Papitalai, and Lombrum Point on Los Negros, the Lorengau area of Manus Island, and Hauwei, Pityilu, Ndrilo, Koruniat, and the Butjo Luo Islands. (See Map No. 9, "Admiralties, Plan of Battle.")

Amphibian Engineer Operations

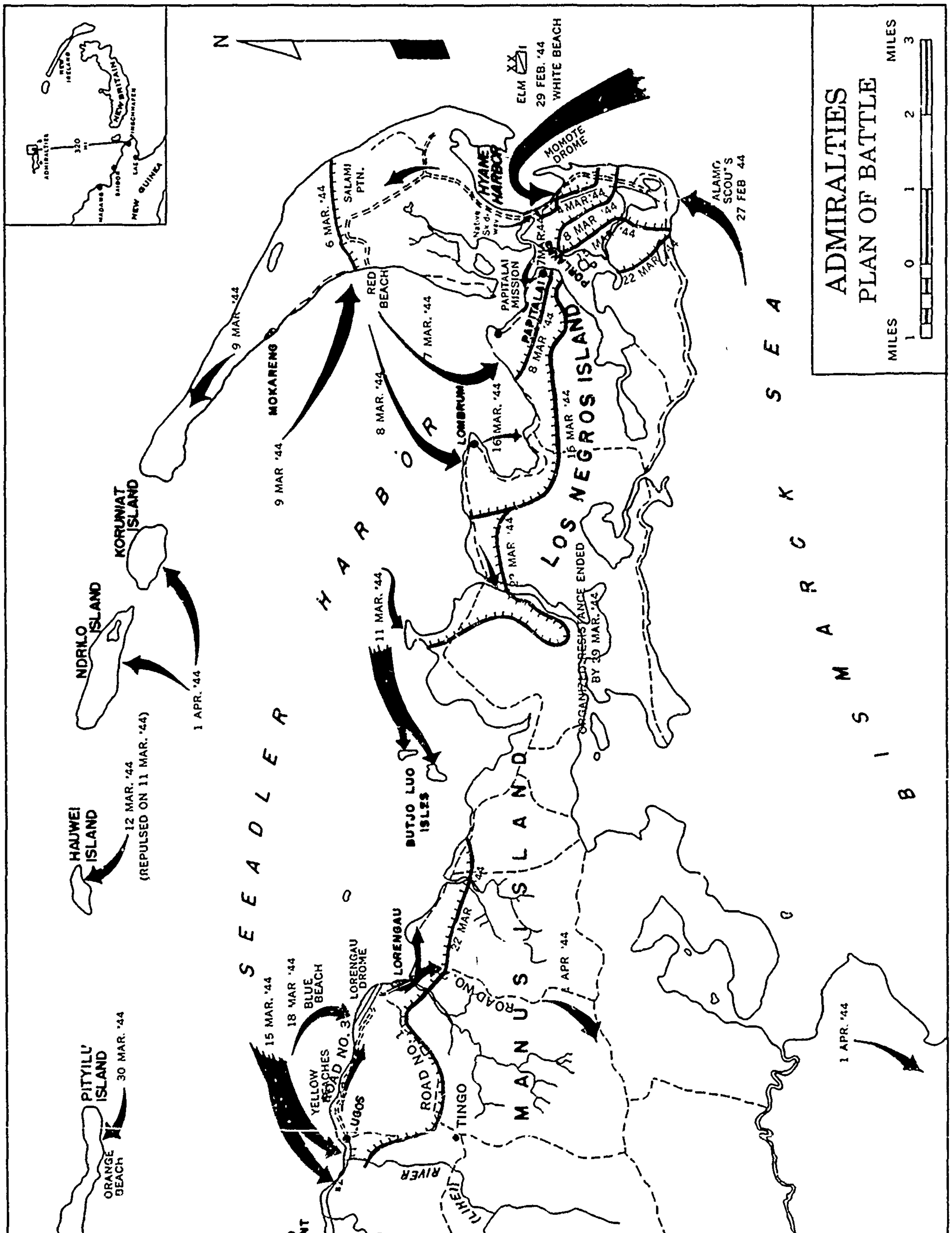
Just 2 days prior to D Day for the Brewer Reconnaissance Force, the 592d EBSR at Buna Anchorage near Cape Sudest, New Guinea, was alerted to prepare certain units of the regiment for a landing with the Brewer Support Force. This force was to land on Los Negros at Hyane Harbor on D plus 2. A company from the shore battalion was promptly selected as the nucleus of the provisional engineer boat and shore task group for amphibian engineer support to this landing. Six LCVP's and six LCM's from one of the boat companies were attached, and the group was reinforced by medical, communications, weapons, and embarkation detachments. Subsequent to its landing on D plus 2, this provisional engineer boat and shore task group was gradually increased until it consisted of an engineer shore battalion, an engineer boat group operating 40 LCM's and 23 LCVP's, and an ESB support battery group operating 1 flak LCM, 2 rocket LCVP's, 1 combat Buffalo (LVT—amphibian tractor), and 8 troop-carrying Buffaloes.

Shore Party Activities. This operation, confirming previous experiences, emphasized that amphibian engineers to be used in an operation should be attached to a task force in time to be included in its preliminary training and rehearsals prior to D Day. The Admiralty landings were made before the date scheduled for the first rehearsal, and, primarily for this reason, initial beach operations were not executed as efficiently as others. The original assault elements of the Brewer Reconnaissance Force had estab-



MAP NO. 8

SOURCE: OCE, GHQ, AFPAC (Historical)


ADMIRALTIES
PLAN OF BATTLE
MILES
SEEADLER HARBOR
BISMARCK SEA
MANUS ISLAND
LOS NEGROS ISLAND
HYANE HARBOR
MOMOTE DROME
29 FEB. '44
WHITE BEACH
ALAMO SCOUTS
27 FEB 44
SALAMI PTN.
RED BEACH
PAPITALAI MISSION
PAPITALAI
LOMBRUM
MOKARENG
KORUNIAT ISLAND
NDRILO ISLAND
HAUWEI ISLAND
12 MAR. '44
(REPULSED ON 11 MAR. '44)
PITYILU ISLAND
30 MAR. '44
ORANGE BEACH
BUTJO LUO ISLES
LORENGAU
LORENGAU DROME
BLUE BEACH
YELLOW BEACHES
ROAD NO. 3
ROAD NO. 1
ROAD NO. 2
LUGOS
TINGO
BUNDO POINT
RIVER
LIHEI
LIEI
ORGANIZED RESISTANCE ENDED BY 29 MAR. '44
1 APR. '44
9 MAR '44
8 MAR. '44
7 MAR. '44
6 MAR. '44
11 MAR. '44
15 MAR. '44
16 MAR. '44
18 MAR '44
22 MAR. '44
NEW GUINEA
NEW BRITAIN
NEW IRELAND
ADMIRALTIES
SOURCE: OCE, GHQ, AFPAC (Historical).

MAP NO. 9

lished a beachhead from 50 to 300 yards in depth with the front lines along the eastern side of Momote airstrip. There had been very little organization of this beachhead, and it was necessary for the engineer shore company, arriving on D plus 2 with the Brewer Support Force, to construct temporary ramps to landing craft and exit roads from the beach. The airstrip itself was a "no man's land" with the Japanese located along the western side only 50 yards beyond the strip. Machine-gun fire and mortar shells were directed on LST's and the unloading area as soon as landings were effected. Firing was continuous and the tactical situation made it impossible to set up extensive dump areas inland. Because of the limited depth of the beachhead and the close proximity of the front lines, supplies were necessarily crowded onto the immediate shore area available and congestion ensued. Subsequent reports of this initial landing stressed the need for adequate beach exits to avoid congestion. And if reconnaissance disclosed that the beach was narrow, the terrain immediately behind it swampy or, for other reasons, difficult to penetrate, it was recommended that the time interval between landings of successive waves be lengthened to permit early preparation of such exits.

Shore engineers were assisted in unloading bulk supplies by 100 cavalrymen on each of 3 LST's and by Seabees on the other 3 LST's which carried Seabee equipment. Despite these reinforcements, however, subsequent reports claimed that unloading could have been completed 2 hours earlier except for two factors. These were the delayed return to ships of attached troops which were detained ashore on the possibility of their being needed for immediate tactical employment, and the slowdown of unloading activities every time Allied aircraft came over to bomb enemy positions across the adjoining airstrip. As a result, one LST, with 20 to 30 truckloads of supplies still aboard, was forced to leave the shore at dusk to avoid exposure to possible concerted enemy night attacks.

The expected enemy ground attack, following the precedent set on the two previous nights, developed after dark on D plus 2 and contributed to the sleeplessness of all. Fortunately, it was not as severe as expected. The perimeter defense, through considerable engineer effort, had been extended to obtain adequate dispersal, and there had been some apprehension that this increased frontage would exceed defensive capabilities. The enemy's principal effort, however, was to push machine-gun crews and infiltrating patrols through the north and northwest sectors of the beachhead. Communication lines were cut, radio equipment slightly damaged, and a few Japanese penetrated even as far as artillery positions. However, the new perimeter held. The perimeter established on the following night also held against the enemy's heaviest counterattack, but only through the combined combat employment of every man on the beach—Cavalrymen, Seabees, Engineers, and the ESB boat crews who joined them in their fox holes.

Landing Craft Activities. This operation completely confirmed the ESB doctrine, often debated by others, that LCM's could be towed over long distances satisfactorily. The six LCM's used in the initial landing were towed by LST's all the way from Cape Sudest, New Guinea, to the Admiralty Islands.[1] Transported in this manner, these craft traversed a distance of 500 miles. Moreover, they did so under conditions which thoroughly tested the mettle not only of the craft but of the crews as well. The journey was made through high seas in a tropical downpour but these crews successfully manned their small, storm-tossed, wildly swinging craft and arrived in readiness for immediate operation.[2]

And the LCM proved more efficient during this operation than any other type of landing craft employed. Its "work horse" utility in the

[1] *Editor's note:* LCVP's attached for this landing on D plus 2 had been slung on davits.

[2] *Editor's note:* Unfortunately, tow lines on two of the LCM's were broken by chafing of the Navy ⅞-inch cable and these craft had to return to Cape Cretin under their own power. For future long hauls in rough seas, an LST using stern anchor cable (1½-inch) shackled to the 1-inch pennant of the LCM was recommended.

Admiralties evidenced the desirability of attaching an adequate number of LCM's to future task forces and of arranging for at least one craft to be assigned for reconnaissance purposes to each tactical unit making a subsidiary landing. The lack of sufficient small landing craft not only slowed up, but even postponed some subsidiary operations.

Similarly, following the major D Day landings, the use of the ESB support battery's Buffaloes (amphibian tractors) in the Admiralty Islands operations was extensive. Immediately upon the arrival of the Buffaloes on 6 March they were attached to the 1st Cavalry Brigade, and reported the following day to the 12th Cavalry Regiment at Salami Plantation for a planned landing at Papitalai Mission. This type of vehicle was required for landing the 12th Cavalry troops because other types of landing craft could not be navigated over a coral reef which existed on the far shore. Subsequently, three cargo Buffaloes and one combat Buffalo participated in the landing at Lombrum Plantation. At Hauwei Island where an attempted landing by an LCVP and a PT boat had failed, three cargo Buffaloes were towed by LCM's to a point 2,500 yards off the far shore on the following day and succeeded in landing troops. (See Map No. 9.) These and other landings in the Admiralties demonstrated forcibly the effectiveness of using Buffaloes in the initial assault waves of a landing where coral reefs were obstacles to other landing craft. Their ability to cross coral reefs, to reach dry land regardless of the slope of the beach, and to advance inland, coupled with the low silhouette target they presented while in the water and the fire power with which they could cover their own advance, combined to make them an essential part of amphibian forces.

However, because of the Buffaloes' slow speed, other landing craft had to be considered superior where beach conditions were suitable to their employment. As discussed in earlier operations, it was still not advisable to mix Buffaloes and other types of landing craft as troop transport elements in the same landing. Such a combination always presented the risk of the slow Buffaloes impeding the scheduled progress of the faster craft. All the same, at the conclusion of the Admiralty operation, it was recommended by those participating that a minimum of 20 Buffaloes should be made available to every sizable ESB task group to assure the landing of assault waves and their drive beyond the beach. Buffaloes could provide considerable support by directing their automatic fire ahead of and to the flanks of assault waves when LCV's and LCM's were employed. They could be used to transport heavy weapons ashore and maintain their ammunition resupply. Their availability would insure that Class I, III, V, and medical supplies got ashore. They could assist in neutralizing bunkers in the beachhead area and evacuating the wounded.

Reports of amphibian engineer operations in the Admiralties also pointed out the advantages obtained through employment of the 4.5-inch rocket which not only proved devastating to the enemy, but also had a salutary effect upon the morale of friendly troops. The critical stage in any landing is running the last 500 to 1,000 yards to shore after the lifting of the naval barrage. With the cessation of naval fire, every possible support must be given to this final phase, and use of the 4.5-inch rocket by the ESB support battery provided the most effective cover. The Buffaloes ferrying cavalry troops to Papitalai Mission were credited with about 30 enemy casualties while covering their own landings with such fire. Twelve Japanese, killed without a scratch, were found in a bunker; their eyes only had been blown out of their sockets by the concussion of the rocket barrage. In the landing at Lombrum Plantation, 8 days after D Day, the combat Buffalo and flak LCM of the ESB support battery bombarded the beach with forty-eight 4.5-inch rockets and heavy automatic weapons. This barrage destroyed one machine-gun emplacement and a medical supply dump. It set fire to several shacks, neutralized enemy fire, and dispersed the Japanese to high ground. Cavalry troops reported that 28 enemy dead were later discovered in one trench and 8 more were found inside a bunker, all killed by rocket fire.

By the end of March the 1st Cavalry Division was mopping up in the Admiralties. The 2d ESB elements meanwhile had figured in 16 tactical operations including 9 major landings, as well as numerous reconnaissance patrols to small islands and isolated areas. More than 19,000 tons of equipment and supplies and 27,000 passengers had been carried in Admiralty Islands waters during March 1944. To transport them, ESB craft had traveled 13,000 boat miles.

Task Force Engineer Operations

Split Engineer Authority. Originally the Admiralty Islands operation was planned as one in which Sixth Army would seize and secure the islands, providing a suitable location at which Allied Naval Forces (ANF) could construct a major naval and air base. Initial Army construction responsibility under General Headquarters (GHQ), SWPA, operations instructions was to be limited to provision of an airstrip for three Royal Australian Air Force (RAAF) fighter squadrons whose operations would provide security until naval facilities, including airfields for heavy bombers, became operable. Allied Naval Forces was to detail a naval base commander with appropriate staff to Army for construction of naval base facilities until the tactical situation would permit transferring this responsibility to ANF for completion.

Accordingly, with the understanding that the initial Army engineer mission in the Admiralties was to be solely tactical, all Army plans for engineer supply of construction materials, equipment, and units were being concentrated on the major Hollandia operations scheduled for late April 1944. For the Admiralties, such planning was to be assumed by ANF which was to undertake heavy construction in that area and furnish engineer supply for it. However, ANF had not stepped up the tempo of its supply preparations sufficiently to meet the advance in D Day. When, shortly after D Day, Army was assigned the additional construction mission of providing two heavy bomber fields with supporting facilities, the available naval construction forces and supplies in the objective area, only nominally under Army control, were already committed to naval construction. Army engineer units, equipment, and supplies were, of course, not immediately available, since this increase in the scope of Army construction responsibility after D Day had not been anticipated in the planning stage. General Headquarters, SWPA, in an endeavor to augment construction forces in the objective area, had dispatched an additional naval construction battalion at the time the additional construction was directed with the understanding that in the meantime all construction forces available would be committed to construction of air facilities. However, chain of command, set up for naval construction, placed Sixth Army at considerable disadvantage in meeting its revised and increased responsibilities. The Task Force Engineer, an Army officer, was required to send all instructions to naval construction battalions through a naval construction regimental headquarters. This indirect control was inefficient, and instructions were frequently delayed or not passed on at all. Additional difficulties were encountered because of the tendency of the naval construction battalions to give first priority to establishment of their own camp facilities upon arrival before initiating authorized construction. Lacking direct control, the Task Force Engineer was handicapped in getting these battalions to speed up operations and to undertake an immediate 24-hour-per-day work schedule. On 10 April 1944, the local naval base commander, cooperating with an Army recommendation for more efficient utilization of naval construction battalions, eliminated the naval construction regimental headquarters from the chain of command. The work potential of these battalions immediately increased.

Responsibility for construction of the naval base facilities could not be turned over to ANF until 18 May 1944. In the meantime, despite difficulties encountered by the joint construction forces and failure to meet some of the target dates, adequate facilities for the operation of Allied Air Forces were provided. The progress on airdromes was attained, however, by almost completely sacrificing construction of the naval base until the airdromes were essentially complete.

These interservice difficulties, bearing close similarity to those experienced at Cape Gloucester, New Britain, manifested an irrefutable doctrine for the future. They evidenced that control of any joint engineer operations should be retained by a single responsible head, and most particularly during the active tactical phases of such task force operations.

Supplies and Equipment. Immediately preceding and during the planning phase of these operations, constructive steps had been taken to improve supply services. An exhaustive study of the additional engineer equipment needed by engineer units in the Theater, based on actual operational experiences, had been made by the Chief Engineer, GHQ, SWPA. As a result of this analysis, Special Lists of Equipment (SLOE's) for each type of engineer unit had been made by the Theater commander and published as a Theater allowance.[3]

Another progressive step in engineer supply planning at this time was the compilation and publication of a list of engineer supplies approved for issue to alerted regimental combat teams (RCT's). Eventually known as the block of "Assault and Pioneer Supplies," it was used as the basis for equipping RCT's for the Admiralties and subsequent operations.[4]

Further, when Army construction responsibilities expanded after D Day, the Engineer, Sixth Army, immediately coordinated the activities of the task force engineer units for accomplishment of design, layout, and construction of the required installations and initiated steps to move in necessary engineer construction supplies and equipment. In view of the target dates for completion of this construction, dependence could not be placed on naval construction supplies which could not be expected to arrive for a considerable time. It was during this phase that the first block-loaded engineer supply ship reached the Theater, and from it came the critical items needed.

Despite these progressive steps, supply shortages still affected all engineer activity in the Admiralties. In planning for the operation originally scheduled for 1 April, detailed estimates of engineer supplies and materials for a 15- to 30-day operation had been made. These had been set up under two priorities: first priority, those supplies to accompany the two engineer troops attached to the cavalry brigade combat teams; and second priority, those to follow with the remainder of the 8th Engineer Squadron. However, the decision to attempt a reconnaissance in force that might be exploited required the preparation of an alternate plan. The engineer squadron staff was allowed 2 days in which to make the necessary revisions. The final plan called for the 8th Engineers to move in six echelons, corresponding to the successive movement of elements

[3] *Editor's note:* It would have been of great assistance had all engineer units been equipped with this additional engineer equipment prior to departure from the United States. However, these SLOE's were not approved by the War Department until July 1944, and furnishing this equipment from Theater stocks put an undue strain on limited resources, already too small to supply other vital needs. An allied problem was the training of operators for this additional equipment. The 8th Engineers were a fortunate exception in having a large part of its equipment authorized prior to its departure from the United States, and in having an opportunity to train in its use and maintenance. This was supplemented by a further period of training after arrival in SWPA. All additional heavy equipment authorized the 8th Engineers was used during some phase of the occupation of Los Negros and Manus Islands. The lack of all means of land communications, the necessity of clearing camp sites in virgin jungle, and the need for malaria control measures, made additional equipment even more necessary after combat ceased. Those Engineer officers consulted were emphatic in their statements that no division could hope to sustain itself in operations of the type in SWPA with only a divisional engineer combat battalion equipped with the basic engineer equipment allowed by previously authorized Tables of Equipment.

[4] *Editor's note:* The reader is referred to Vol VII, this series, Appendix XI, "Engineer Plan for the Hollandia Operation, 5 April 1944," which lists assault supplies for RCT's participating in the operation which followed seizure of the Admiralties.

of the 1st Cavalry Division. Original priorities on engineer supplies and materials were discarded. Instead supplies were broken down into those needed to accompany each echelon, and in view of the abrupt change of plans, detailed diagrams for loading of engineer equipment on LST's could not be prepared. The 1st Platoon, Troop A, was assigned space in three different LST's. This was also true of the remainder of Troop A and all of Troop C for their respective moves. As at Saidor, this split loading definitely limited engineer support upon landing in the objective area. Insofar as practicable, all equipment and supplies were loaded in vehicles to facilitate mobile unloading. However, the quantity of equipment and supplies accompanying the leading engineer echelons was governed entirely by an inadequate space allocation. As a consequence engineer equipment and supplies were inadequate until D plus 16.

So, owing to some men arriving without equipment because of inadequate shipping space and the original lack of a clear understanding as to who was to build what and when, engineer supply for the most part was short in the Admiralties operations. A typical illustration was the short shipment of timber and piling ordered for dock construction. The shortage in this instance delayed completion of the wharf, which in turn delayed the unloading of ships, and resulted in retarded construction of other projects.

Combat Use of Engineer Equipment. Despite scarcities, the importance of the supporting role of engineer equipment was again demonstrated in the Admiralties. The bulldozer in particular was a noteworthy example. Once again it became a weapon of offense as well as an instrument of construction. Its use to help in organizing the beach, to destroy enemy bunkers, to clear fields of fire in advance of the front lines, and to accompany and occasionally precede advancing tanks made it the most important single piece of engineer equipment in the assault waves of amphibian operations in the Southwest Pacific.

Typical of the support provided by this particular piece of equipment was its performance on Manus Island. Landings at Yellow Beaches 1 and 2 on Manus were effected by the 2d Brigade, 1st Cavalry Division. Elements of one of the attacking regiments split into two forces with one force advancing east along the coast on Road No. 3 to Lorengau, while the other swept south along an inland trail to Tingo, and then along Road No. 1 from Tingo toward Lorengau (see Map No. 9). In this operation the cavalry regiments of the 2d Brigade were supported by Troop C, 8th Engineer Squadron. These engineers, working under heavy enemy fire, materially assisted the advance of the first 2 days by clearing the way for the movement of tanks and improving roads to make them passable to wheeled vehicles. It was generally conceded that tanks would have been totally ineffective had it not been for the ever present bulldozers which not only pulled them out when mired in jungle swamps, but quickly completed the destruction of Japanese bunkers neutralized by the tanks. More than once these machines buried struggling Japanese alive in pillboxes as they pursued their principal mission of patching up the muddy tracks leading into Lorengau. Excerpts taken from an Army Ground Forces Board report based on interviews and observations of these operations provide interesting details on tactical employment of bulldozers: [5]

> From 15 March to 19 March 1944 on Manus Island, Admiralty Group, in the vicinity of Lorengau Mission, tanks were needed in the forward area to assist in the neutralization of Japanese bunkers. Due to the steep sided ridge and dense jungle growth over which the tanks had to proceed they were unable to do so under their own power. It was necessary to dispatch a D–7 bulldozer and operator to precede the tanks and prepare the way so that the tanks could get forward. An additional tactical use of the bulldozer was to demolish and fill in the Japanese bunkers in order to prevent their reoccupation at night by the enemy as was his practice. On at least one occasion the track was blown from the bulldozer by a Japanese anti-tank mine.
>
> On 16 March 1944 on Manus Island . . ., Private Webster J. Ough, 12067202, Troop C, 8th Engineer

[5] AGF Board, SWPA, 16 May 44, Report No. 49, Tactical Employment of Tractor Bulldozers in the Admiralty Islands. In Records Section, GHQ, SWPA.

Squadron, was operating a D-7 tractor-bulldozer on a trail near a Japanese fortified position. Two medium tanks and one light tank operating against the position became mired in the underbrush and marsh about 200 yards to Private Ough's front. Heavy machine gun fire was directed by the enemy in a bunker at the tanks and the bulldozer. Seeing that the tanks were in no position to return the fire, Private Ough raised his bulldozer blade and drove his machine in front of the most advanced tank, hooked his tow cable to the front of the tank and pulled it to within 25 yards directly in front of the Japanese bunker. Several bursts of mortar fire exploded within 15 yards of the bulldozer and continuous machine gun fire was directed by the enemy against the blade of the bulldozer which acted as a shield. Private Ough then unhooked his bulldozer from the front of the tank and returned to bring forward the other two tanks. The leading tank succeeded in reducing the bunker.

It is believed that this tactical combination of bulldozer and tank to overcome stubborn enemy resistance from fortified positions is unique in modern warfare. Brigadier General V. D. Mudge, the commander of the cavalry force engaged in the operation, stated that the combined action of the bulldozer and tank was one of the most effective means yet discovered to cope with the problem.

While unarmored bulldozers were effectively employed under circumstances justified by the tactical situation, their habitual employment in this manner is not contemplated, as damage or destruction of the equipment would too often result. A limited number of armored cabs for tractors have arrived in the theater and will be of value in protecting operators from the effects of enemy fire when the nature of the terrain requires that bulldozers pave the way for other transportation before battlefield mobility can be attained.

Combat Engineer Operations. Distinguished service was not restricted to amphibian engineers; divisional engineers also displayed conspicuous devotion to duty, courage and daring. During the night of D plus 1 the engineer detachment with the Brewer Reconnaissance Force on Los Negros dug in within 15 yards of an abandoned enemy bunker. In the dark, ten Japanese, armed with grenades and one .25-caliber light machine gun, infiltrated and reoccupied the bunker. Early in the morning the Japanese in the bunker opened fire, killing one news correspondent and seriously wounding the brigade communications officer. Attempts to neutralize this bunker by small-arms fire and grenades, proved ineffective. A noncommissioned officer in a nearby fox hole under fire considered the situation, and applying his engineer training, evolved a plan of action which merited him the Silver Star. He prepared a satchel charge of TNT bound with friction tape and attached a fuse just long enough to hold the fuse lighter. He then crawled within 5 yards of the bunker, pulled the fuse lighter, jumped up, ran to the bunker, threw the charge in the slit, and sprinted for cover. The immediate blast which followed blew the top off the bunker and killed most of the Japanese; survivors were disposed of as they crawled out.

In another of the many instances of engineer gallantry, an engineer detachment was laying a double band of antipersonnel mines across the narrow skidway area on Los Negros, 200 yards beyond the Momote perimeter defense. (See Map No. 9.) Security for the laying party was furnished by two squads of cavalry. The job was only half completed, when a sniper in a concealed fox hole fired on the working party. The engineer sergeant of the laying party advanced single-handed and killed the sniper. After all mines were buried, the security detachment withdrew before mines were armed to prevent accidental discharge. Increased enemy fire on the laying party immediately followed withdrawal of the covering force and all but the sergeant were driven away. He, however, continued to work alone, under this hail of bullets, and finished arming the mines.

At times, improvisation prevented seemingly unavoidable delays in combat engineer support. The main engineer operations on Los Negros Island during the period D plus 7 to D plus 14 were the construction of a road through the swamp east of Red Beach (Salami Plantation) and of one running along the beach south of the swamp. Corduroy mattresses made of 10- to 12-inch coconut logs were laid and a coral road was built on these mattresses. The difficulty in handling these coconut logs in the swamp slowed work considerably until an improvised boom 10 feet long was placed on the front of a 2½-ton winch truck. This boom proved invaluable in placing logs. A grizzly for the handling of road material was constructed on top of an abandoned enemy bunker, and, through use of these improvisations, both roads were made capable of carrying sustained heavy traffic by 15 March.

Similarly, improvisation stepped up the tempo of engineer support during the 5th Cavalry advance along the south shore of Los Negros. The advance was so rapid, road construction could not keep pace. The 1st and 3d Platoons, Troop A, 8th Engineer Squadron, therefore, supported the 5th Cavalry by water from the western end of the road, using a raft constructed of two 6-ton pneumatic floats and 1 LCR decked with 1-inch timbers and propelled by a 22-hp. outboard motor. This raft averaged six trips per day and supplied three cavalry troops. The original raft was later replaced by one constructed of 6 half boats from infantry assault raft equipment lashed together and stiffened by two timbers secured across the bow and the stern. In place of decking, pierced planks were placed in the bottoms of the boats and cargo transported. This raft was capable of carrying a load of 5 to 6 tons with an 8- to 10-inch freeboard at a sustained speed of 3 knots.

These were only a few of the operations of divisional engineers on the Admiralty Islands, but they clearly demonstrated the great need for employment of divisional engineers in close support of assault troops. Moreover, the dependence of tactical troops on such support had increased proportionately with the mechanization of forces. Evidencing this fact was the recommendation of the 1st Cavalry Division that a minimum of two battalions of combat engineers be attached to properly support a division.[6]

Hollandia, New Guinea
22 April 1944

The capture of the Admiralty Islands virtually isolated Japanese concentrations in New Britain; Rabaul was so effectively neutralized that it could be bypassed. (See Map No. 8.) Allied operations now concentrated on a westward drive towards the Philippines. This drive along the northern coast of Netherlands New Guinea was initiated by simultaneous landings, executed by I Corps, Sixth Army, at Humboldt and Tanahmerah Bays, Netherlands New Guinea, and at Aitape, Northeast New Guinea, approximately 115 miles to the southeast. In pursuance of General MacArthur's bypassing tactics, enemy troop concentrations at Madang, Hansa Bay, and Wewak were isolated by these operations. Unlike the early days at Nassau Bay when two PT boats escorted the convoy, one of the largest naval task forces in the Pacific backed up the 22 April invasions with battleships, aircraft carriers, cruisers, and destroyers. Instead of an infantry battalion going ashore initially, elements of two divisions were used. The 41st Division (less 163d RCT), supported by the 532d Engineer Boat and Shore Regiment (2d ESB) and elements of the 239th, 79th, and 116th Engineer Combat Battalions, comprised the Letterpress Landing Force committed to the assault at Humboldt Bay. At Tanahmerah Bay, landings were made by the Noiseless Landing Force composed of the 24th Division (less 34th RCT), supported by the 542d Engineer Boat and Shore Regiment (2d ESB), the 3d Engineer Combat Battalion, elements of the 239th Engineer Combat Battalion, and the 339th Engineer General Service Regiment. These two forces made up the Reckless Task Force which was assigned the mission of seizing the Hollandia area for establishment of an advance base. The 163d RCT was assigned to the Persecution Task Force for the occupation of Aitape. The 34th RCT was held in I Corps reserve.

The convoy carrying the respective forces rendezvoused in the vicinity of the Admiralty Islands, headed almost due north for 200 miles in what was regarded by the Japanese as a move against Truk or Palau, and then doubled back on its tracks. Then the convoy moved in the general direction of Hollandia and the Persecution

[6] *Editor's note:* This need for a regiment of engineers as an integral component of either an infantry or cavalry division was confirmed in every operation throughout this Theater, where forces of a division or larger were engaged.

Task Force separated from the main convoy, proceeding to its objective at Aitape. The Reckless Task Force convoy continued to move to the Hollandia area and divided; the Letterpress Landing Force proceeded southeastward toward Humboldt Bay, and the Noiseless Landing Force southwestward toward Tanahmerah Bay. (See Map No. 10, "Orientation Map, Hollandia–Aitape Operations.") Air cover during the voyage was provided by carrier-based fighter aircraft. Following a carefully coordinated naval gun fire support plan, cruisers and destroyers shelled designated land areas in the vicinity of Humboldt and Tanahmerah Bays in preparation for the landing of assault waves.

Little opposition was encountered by the landing forces. Times had really changed. Practically no infiltration tactics were employed by the Japanese at Hollandia. They realized they had been outmaneuvered, and many of them retreated to the hill areas which afforded greater defensive capabilities to their scattered forces.

Forty-one percent of the total scheduled troop strengths provided by original plans for the Hollandia and Aitape operations respectively were engineer troops. No previous operation had attained such a high engineer strength. The realization of the importance of assigning sufficient engineers to an operation had been growing with each operation. The complete lack of existing facilities and the vital need for speedy development of bases and airdromes could lead only to the conclusion that it was, to a large degree, an "Engineers' War."

By D plus 4 all three airdromes in the Hollandia area had been secured and the divisions had joined. (See Map No. 11, "Hollandia, Plan of Battle.") Subsequent tactical operations took the form of pursuit and destruction of the surviving Japanese in the area.

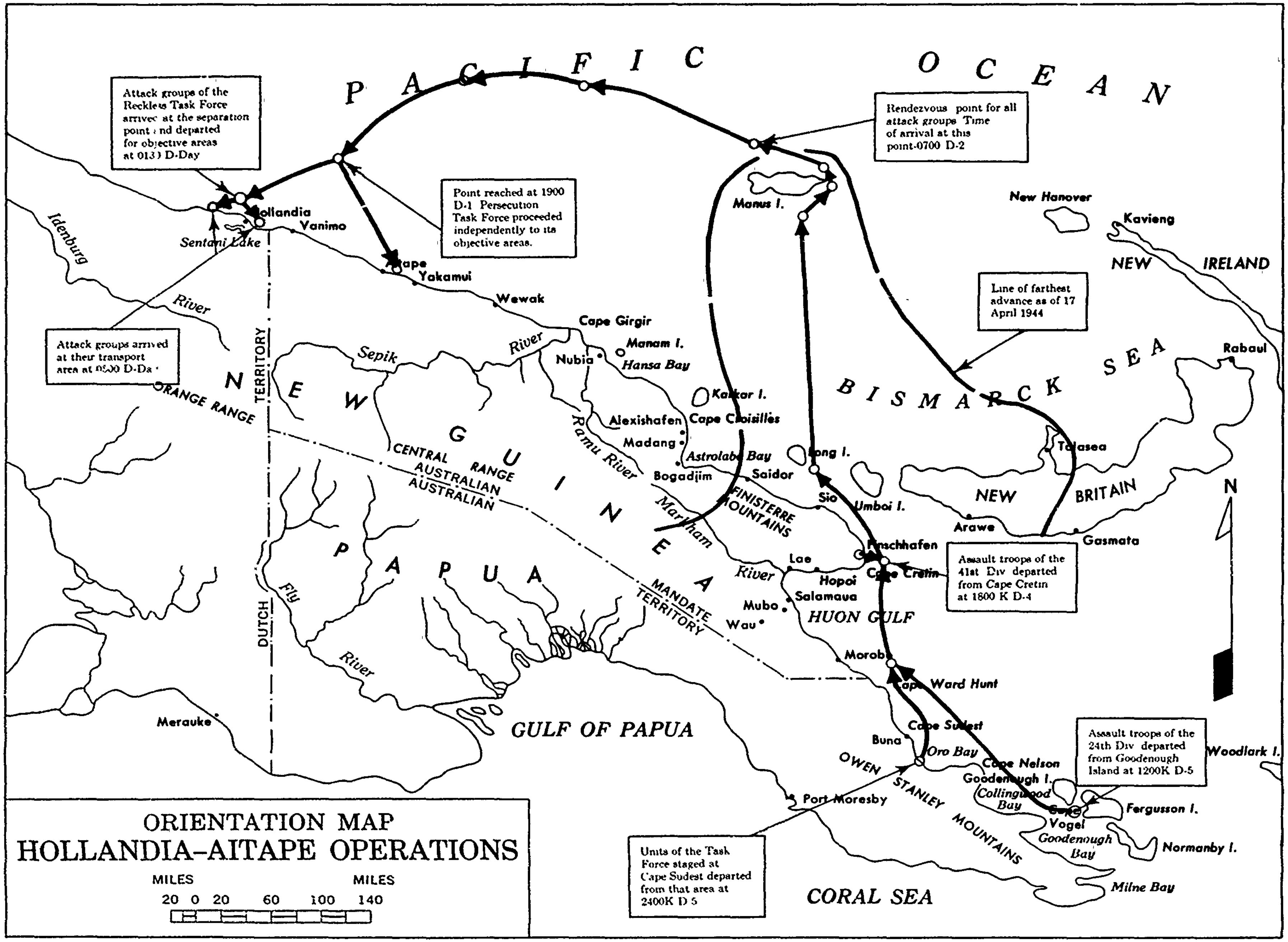
Amphibian Engineer Operations

The landings at Humboldt Bay (White Beaches) began at 0700, 22 April. Engineer special brigade units participating were comprised of a shore battalion, a boat group consisting of 25 LCVP's, 40 LCM's, 1 LCS, 1 J-boat, 2 LCP(L)'s, and an ESB support battery group consisting of 2 rocket LCVP's, 2 rocket DUKW's, 1 flak LCM, 2 combat Buffaloes (LVT's), and 27 troop-carrying Buffaloes (12 attached from 41st Division).

At Tanahmerah Bay (Red Beaches) landings were effected at 0708, 22 April. Engineer special brigade units employed in these landings were made up of a shore battalion, a boat group of 82 LCVP's, 57 LCM's, 3 LCS's, and an ESB support battery group of 2 rocket LCVP's, 2 rocket DUKW's, 1 flak LCM, 1 combat Buffalo (LVT), and 16 troop-carrying Buffaloes.

Principles established in successive operations from Nassau Bay to Cape Gloucester were, for the first time, fully exploited. Distances to objective areas were prohibitive to independent movement of ESB craft, and these, together with their crews, were lifted by naval transports.[7] Upon arrival at the far shore these engineer craft and crews transported assault personnel from ship to shore, unloaded the transports which had carried them, and lightered equipment and supplies to the beach. Except for the AKA's, all amphibious shipping departed from the objective area before dark on D Day. The engineer landing craft remained on the far shore for unloading AKA's and heavy shipping of the resupply echelons, and for tactical and supply missions up and down the coast. In each landing, the engineer shore battalion, unloading supplies and equipment on the beach, was reinforced by service troops from the division landing team. Coordination of boat and shore operations was the responsibility of the regimental headquarters of the engineer boat and shore regiment. The efficient execution of these landings confirmed the correct-

[7] *Editor's note:* The participating divisions were not only staged 300 miles apart, but the landing force scheduled for Humboldt Bay was 700 miles from its objective, while the landing force for Tanahmerah Bay had to cover more than 1,000 miles.

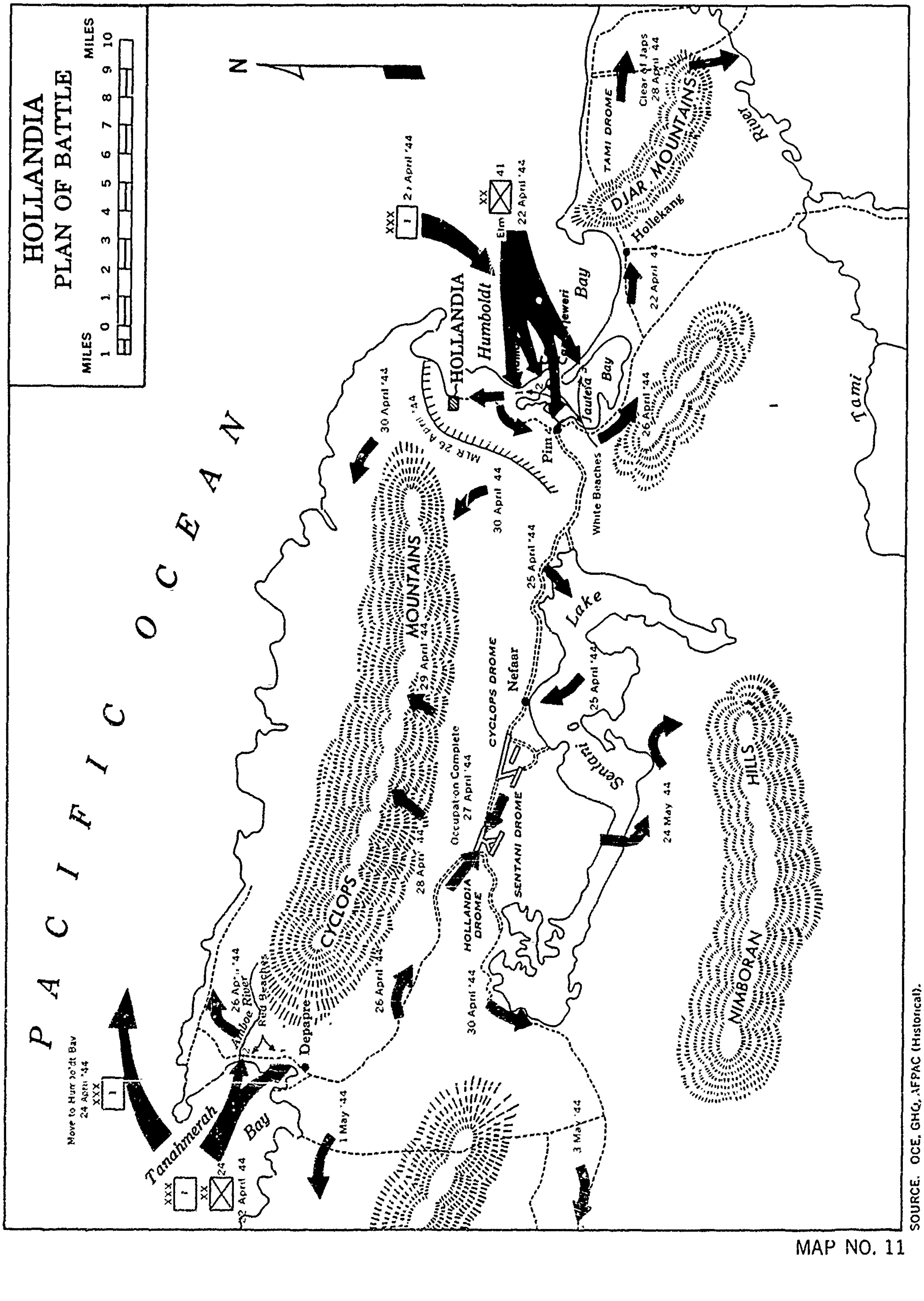


ORIENTATION MAP
HOLLANDIA–AITAPE OPERATIONS

MILES 20 0 20 60 100 140 MILES

SOURCE: Hq, I Corps, Reckless Task Force, History of the Hollandia Operation

MAP NO. 10



HOLLANDIA
PLAN OF BATTLE
MILES 1 0 1 2 3 4 5 6 7 8 9 10 MILES
N
PACIFIC OCEAN
HOLLANDIA
Humboldt
Bay
Hollekang
DJAR MOUNTAINS
TAMI DROME
Clear of Japs 28 April '44
River
Tami
Jautefa Bay
Pim
White Beaches
MLR 26 April '44
30 April '44
22 April '44
26 April '44
Elm
CYCLOPS MOUNTAINS
CYCLOPS DROME
Nefaar
Sentani Lake
25 April '44
29 April '44
28 April '44
Occupation Complete 27 April '44
SENTANI DROME
HOLLANDIA DROME
24 May 44
NIMBORAN HILLS
26 April '44
30 April '44
Depapre
Red Beaches
Tanahmerah Bay
1 May '44
3 May '44
22 April 44
24
SOURCE: OCE, GHQ, AFPAC (Historical).

MAP NO. 11

ness of deductions drawn from the experiences of earlier operations.[8]

ESB Support Battery. Rocket fire of the 2d ESB Support Battery (provisional) supplemented naval barrages during these landings. Key points in the Depapre area during the Tanahmerah Bay landings were covered with an effective barrage of rockets, and 20-mm. and 50-caliber fire. Even more extensive use was made of 4.5-inch rocket launchers mounted on landing craft, DUKW's, and LVT's at Humboldt Bay. The battery engaged in tactical support of two infantry battalions and other troops, firing more than 600 rounds of barrage rocket ammunition in active support of combat landings. It strafed and neutralized enemy barges and sank one 150-foot tanker. It gave logistic support to infantry combat teams and engaged in reconnaissance and evacuation of wounded.

In both landing areas the use of Buffaloes (LVT's) proved the great value of this type of craft. The Buffaloes were used to carry assault elements into tactically advantageous positions which were inaccessible to other types of landing craft or vehicles. At Depapre during the landing of the 24th Division, other landing craft were unable to reach the beach at low tide. Troop-carrying Buffaloes which had landed over the coral reefs were, therefore, employed in a shuttle service for 7 days until a channel was blasted to the beach. When the 41st Division landed at Humboldt Bay, the infantry struck out for the three enemy airstrips north of Lake Sentani, high in the hills, some 15 miles from the beach. They fought their way against scattered enemy opposition along a narrow, boggy trail, the only access to the airstrips from the east. Buffalo tractors of the 2d ESB Support Battery moved the initial troops and kept them supplied. These were the only vehicles able to get through the terrain. On the fourth day the advance was stalled at the eastern end of Lake Sentani where the trail led along steep cliffs. The Japanese had taken advantage of the terrain by blowing out bridges and throwing up road blocks. Further progress over land was impossible. But the Buffaloes were not restricted to travel over land only; they could proceed over water, and the lake flanked the Japanese forward defense lines. Troops were loaded into the amphibian tractors. Rocket-equipped 2d ESB Support Battery craft forged ahead, blasting enemy shore batteries which were now laying down a heavy barrage of mortar and 90-mm. antiaircraft fire in an effort to prevent a landing. Engineers ferrying the troops followed close behind the rocket-equipped craft. After an approximate advance of 10 miles along the lake's shore, the support battery landed the assault troops at a point flanking the Japanese positions near the airstrips. (See Map No. 11.) The next day other similar flanking movements were carried out along the lake. Japanese troops defending the ridge road were cut off and effectively bottled. The infantry closed in and mopped up.

Influence of Outloading on Far Shore Activities. Unloading of LST's on the far shore met with numerous difficulties. The origin of some setbacks was on the far shore; others could have been anticipated and eliminated during the outloading phase on the near shore. Details of service troops from the divisional landing teams sent on LST's to assist in the unloading frequently consisted of improvised units. Officers and noncommissioned officers did not know each other or their men, and, as a result, the details were not well controlled. Additional confusion was caused by subordinate task force officers disregarding channels of command and occasionally giving orders direct to noncommissioned officers and men of the engineer shore party. These were the difficulties occasioned by the usual stress of initial far shore unloading activities during establishment of a beachhead. The actual mechanics of unloading, however, were impeded by obstacles which should have been foreseen when

[8] *Editor's note:* Under the procedures thus established, the theory was developed that an engineer special brigade, originally set up to land the assault elements of a division landing team, was capable, if properly coordinated with a naval amphibious force, of supporting the landing of a corps of three divisions.

loading out for the operation. Some trucks, and especially jeeps, had trailers so heavily overloaded they were immobilized as soon as they approached any difficult terrain. These caused serious traffic jams on crowded beaches. Even on an ordinary beach a jeep can pull a loaded 1-ton trailer or a full 250-gallon water trailer only with great difficulty. Many vehicles were not equipped with tire chains. Some vehicles were without tow lines. Heavy trucks should have been equipped with grousers. A few vehicles were out of gasoline soon after landing. Several vehicles with run-down batteries had to be towed off LST's. As some near-shore-to-far-shore trips last several days, portable battery chargers should have been made available or spare batteries carried. The operating condition of a few vehicles was so poor, they could not be started when the time came to unload.

Much heavy equipment, apparently not needed on D Day or D plus 1, arrived in early echelons. None of the K–36, K–37, and K–38 trailers, asphalt mixers and spreaders, or ditch-digging and rock-crushing equipment was employed for several days after being landed. This type of heavy equipment, owing to its poor maneuverability, caused considerable congestion ashore during initial attempts to organize the beachhead. On the other hand, equipment needed immediately on the far shore was not available because some engineer units were prohibited from loading cranes and similar equipment on early transports at the staging area.

Landing Craft Activities. The month of April 1944 proved to be the most extensive operational period up to that time for the 2d Engineer Special Brigade. During the month they operated 515 craft, traveled over 120,000 boat miles, handled 95,000 passengers, and moved 75,000 tons of cargo in their own craft. However, at Hollandia, brigade elements had great difficulty in keeping their craft in operation through circumstances beyond their control. First, a totally inadequate strength of initial elements of their boat maintenance battalion was lifted to the far shore. In one ESB unit the first boat maintenance equipment was not lifted from the near shore until D plus 8 although scheduled originally for delivery on the far shore by D plus 2. By D plus 28, only two relatively small boat maintenance units got forward to Hollandia. The shortage of LST's affected not only ESB maintenance, but all amphibian engineer operations. Secondly, long delays in forward transport of rear echelons of engineer boat and shore regiments when task groups moved forward undermined ESB support. The 532d EBSR, for instance, had two-thirds of its organization in the forward area while the other third was left in the rear area for several weeks. This split the administrative, supply, and boat maintenance facilities and impeded coordinated and efficient operations. While much of this was due to the shortage of transportation, at the same time it was also obvious that during the planning phase neither the Reckless Task Force nor Sixth Army had fully appreciated the effect of such a situation.

A more immediate setback to efficient operations of the engineer landing craft available on the far shore was the previously mentioned tendency of subordinate task force officers to give direct but unauthorized orders to boat crews as well as shore party troops. Some officers often commandeered boats without notice, seemingly unaware that the boats were controlled by the Boat Control Section on each beach. Boatmen, explaining that their orders were supposed to come through the Boat Control Section, were threatened on a few occasions by these commandeering officers with courts martial for disobedience of *orders.* This commandeering of craft frequently resulted in delaying the movement of important supplies. It strongly emphasized the need for all personnel to be impressed with the requirement of following designated channels of command.

Despite all difficulties, however, the available boats and their crews, pressed for time and operating at the maximum possible capacity, often succeeded in distinguishing themselves by exceptional service beyond the normal requirements of their missions. During one of the first Japanese bombing raids, the dump area at White Beach No. 1 (Humboldt Bay) was hit and raging fires ensued. The spreading flames engulfed piles of ammunition which exploded in all directions. A number of men working in the area were injured; others were trapped on a small section of the beach, their exit cut off by fire and exploding bombs and shells. The crew of an LCVP operating nearby saw their predicament and immediately set out to reach them. Undeterred by explosions which were raking the whole area and shrapnel spraying the water all around, they managed to beach the craft and evacuate the men. Throughout the night these and other amphibian engineers removed wounded from the danger zone.

First Aid Activities. Fortunately medical elements of the 2d ESB were present on White Beach No. 1 that night. Litter bearers of the Collecting Platoon, Company B, 262d Medical Battalion, moved continuously through the holocaust of burning dumps and devastating explosions. Again and again they returned to the inferno to rescue the injured while the remainder of the personnel stayed in the aid station to treat the wounded. Many lives were saved by the effective care so efficiently provided. The Presidential Unit Citation, highest award that can be attained by any military organization, was bestowed on this platoon on 22 September 1944.

However, medical elements provided for White Beach No. 3, congested with scattered detachments from various arms and services, were wholly insufficient. As many as 50 diverse units were dependent upon the medical detachment with the 532d EBSR for a period of approximately 2 weeks. As many as 200 patients were treated in 1 day in a single aid station operated by 1 medical officer and 4 enlisted men.

Provision should also have been made for the independent medical treatment of natives. As many as 40 to 50 natives came to the boat battalion aid station for treatment. This interfered with the proper care of unit personnel and exhausted essential medical supplies.

A Lesson in Logistics. Illuminated against the background of disaster and heroism during the inferno on White Beach No. 1 was a significant lesson in logistics. This lesson was impressively interpreted by a brigade observer aboard an LST waiting to land at White Beach:[9]

> The holocaust on White Beach as viewed from the sea was so awesome and terrifying as almost to defy description. Great billowing black clouds of smoke were flung thousands of feet into the air from exploding drums of gasoline, while the oil, lubricants, rations, vehicles, and hundreds of tons of miscellaneous stores and gear burned below it in a solid, hideous, frightening wall of flame five hundred feet in the air for a mile and a half along the beach. Through this dense pall of smoke and flame all kinds of ammunition set up a pyrotechnic display to end all boyhood impressions of Fourth of July fireworks. The spitting, vicious crackle of millions of rounds of small-arms ammunition, grenades, and engineer explosives permeated with increasing waves of sound the shattering, crashing, crumbling roar and rumble of barrage after barrage of heavy artillery shells. In all directions, in all colors of the rainbow, rockets, signal flares, and white phosphorus shells sprayed out like all . . . let loose. The fierce, eerie glare made faces look green in the half light. Shortly after the 2d ESB working and rescuing parties evacuated the beach due to the tremendous heat and danger of exploding projectiles of all kinds, the raging fire reached its maximum intensity in an intensity of destruction that made everyone gasp. None who saw it will ever forget the White Beach fire at Hollandia set off by one unlucky Jap bomb. Among the "lessons learned the hard way by all ranks was 'Do not pile more supplies on a beach than the shore working parties can handle efficiently'."

The disastrous fire at White Beach (Humboldt Bay) could as readily have happened at Red Beach (Tanahmerah Bay). Planned D Day unloading at Red Beach amounted to 5,700 tons over a beach known to be extremely limited in area with no natural exits. This tremendous shipment of vehicles and supplies on LST's was scheduled to land an hour after the leading wave had beached and had been protested by the 2d ESB. Considering the tonnage to be moved, there was practically no allowance of time for

[9] Quoted in *History of the Second Engineer Special Brigade, United States Army, World War II* (Harrisburg, Pa., 1946), p. 77.

engineer preparation of beach exits and dispersed hardstandings.

In this connection, during the planning phase too few combat commanders seemed to realize the importance of balancing tactical plans against tonnages that could be delivered. The excessive amount of shipping being brought into the harbor at Hollandia under the terrain and lighterage conditions prevailing there was also protested by the Engineer, Sixth Army. This protest was substantiated by preparation of a tabular analysis showing conclusively the danger of the GHQ, SWPA, resupply plan. (See Chart No. 2, "Port Capacity Analysis Sheet.")[10] However, during the planning phase, the risk so illustrated was minimized by the anticipation that the enemy would be even harder pressed. Prolonged exposure of shipping to Japanese air attack, inadequate supply of increasing troop strength ashore, and subsequent shortage of ship tonnage needed for other SWPA operations which could result from failure to unload ships in any objective area were considered unlikely possibilities.

During the actual operation, however, resupply for this task force of two divisions, greatly reinforced with service troops and air elements, was suddenly limited almost entirely to approximately 100 tons per day over Pim Jetty (see Map No. 11) for a period of a week, and only slowly increased for some time after that.[11] Unloaded cargo in the harbor grew in excess of 180,000 tons before the daily discharge capacity began to surpass the arrival of tonnage in Humboldt Bay. The bombing of White Beach No. 1 resulted in the destruction of thousands of tons of equipment, vehicles, and vital supplies which accompanied troops by LST. Offsetting this was only a mere trickle of resupply over Pim Jetty.

Loaded ships remained in the harbor day after day while additional shipping continued to arrive as scheduled. What little tonnage got over Pim Jetty had to be hauled some 17 miles over the only existing, almost impassable, track up in the jungle hills to Lake Sentani. From here supplies had to be moved by a circuitous trail along steep cliffs around the east shore of the lake to the complex of the Hollandia, Sentani, and Cyclops Dromes north of it. (See Map No. 11.) The operation of fighter aircraft for the protection of the congested shipping in the harbor was dependent upon use of these dromes. However, even if aviation gasoline could have been discharged across the suddenly disorganized landing beaches, no appreciable delivery could have been effected to the dromes over the inaccessible terrain. Therefore, as soon as an engineer battalion had hacked its way to the dromes and put one of them in roughly operable condition, aviation gasoline

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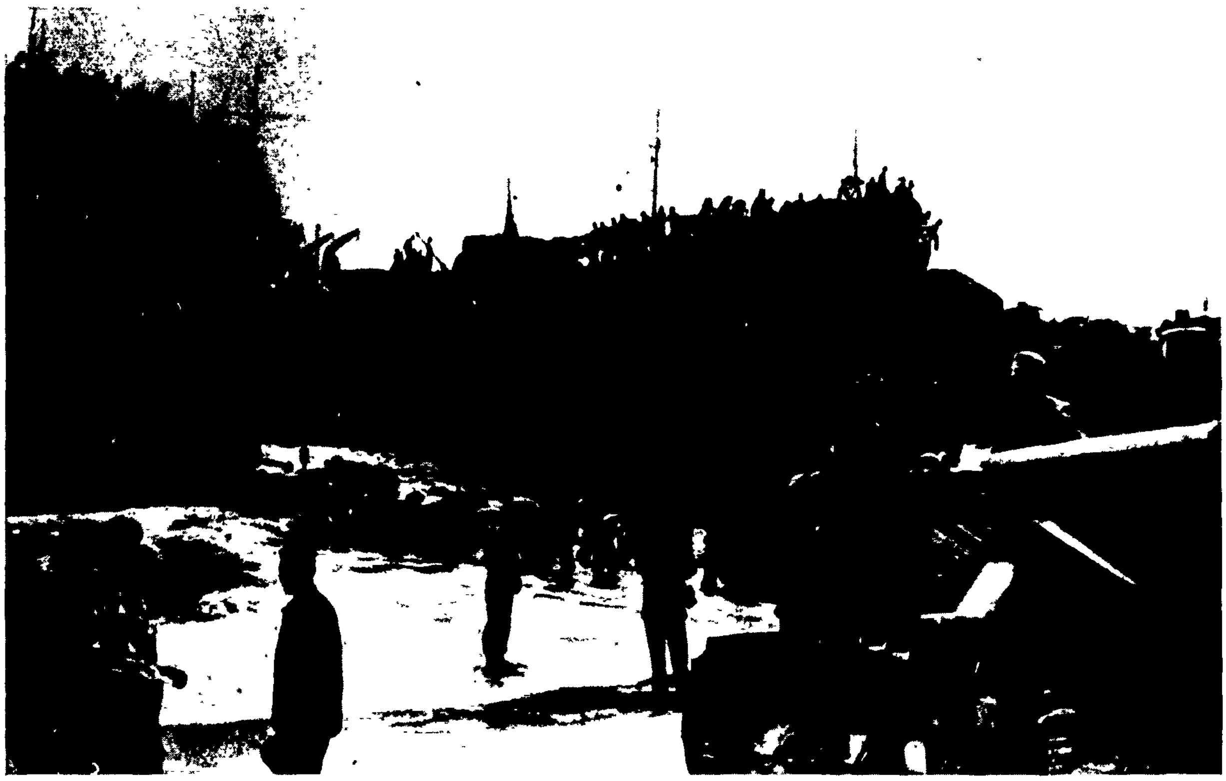
[10] *Editor's note:* This method of analysis was found exceptionally accurate in all subsequent operations.

[11] *Editor's note:* All landing beaches proved more difficult than interpretations from aerial photography had indicated. All were known to be narrow, but the difficulties of providing exits from the beaches and the lack of dispersal areas had not been fully anticipated. At Tanahmerah Bay, photo interpretations of the main landing beach (Red Beach No. 2) indicated a stream 10 to 20 yards wide behind the beach running parallel to the sea. This actually proved to be a sago swamp, armpit deep, beginning 30 yards from the shore and extending inland from 100 to 400 yards. It occupied nearly all of the area planned for the dispersal of supplies and for bivouacs. A road net initiated through the swamp to the hinterland behind had to be abandoned as impossible, and supplies piled 6 to 8 feet high soon greatly congested the narrow beach. To relieve the situation personnel and equipment were shuttled to Red Beach No. 1. This latter beach, although backed by a more adaptable hinterland, was restricted by a coral barrier and could only be approached at high tide through a narrow channel leading into a shallow inlet which could accommodate only two landing craft abreast. Because of the lack of space on the two beaches at Tanahmerah Bay for the unloading and storage of large stocks of supplies, the D plus 2 echelon of LST's previously scheduled to land in that area was diverted to White Beaches Nos. 1 and 2. Here, again, unexpected difficulties manifested themselves. The bombing of White Beach No. 1 on D plus 1 and the resultant fire spreading across White Beach No. 2 caused the diversion of LST's to White Beach No. 3 which was unsuitable for their beaching and necessitated wet landings. During the week following the bombing, while the results of the fire were being cleared away and White Beach No. 3 was handling all of the unloading, there was much activity at White Beach No. 4 (Pim Jetty). Across this jetty ran the life line to the troops pursuing the tactical mission inland. Reinforcements and resupply materials loaded in LVT's poured over this pier to the limit of its capacity.

White Beach No. 2, Humboldt Bay, Hollandia, Netherlands New Guinea, on D Day—Engineer bulldozers on the move to prepare sand ramps to beached landing craft.

White Beach No. 2, Humboldt Bay, Hollandia, Netherlands New Guinea—Satisfactory landings by LST's and limited dispersal areas ashore.

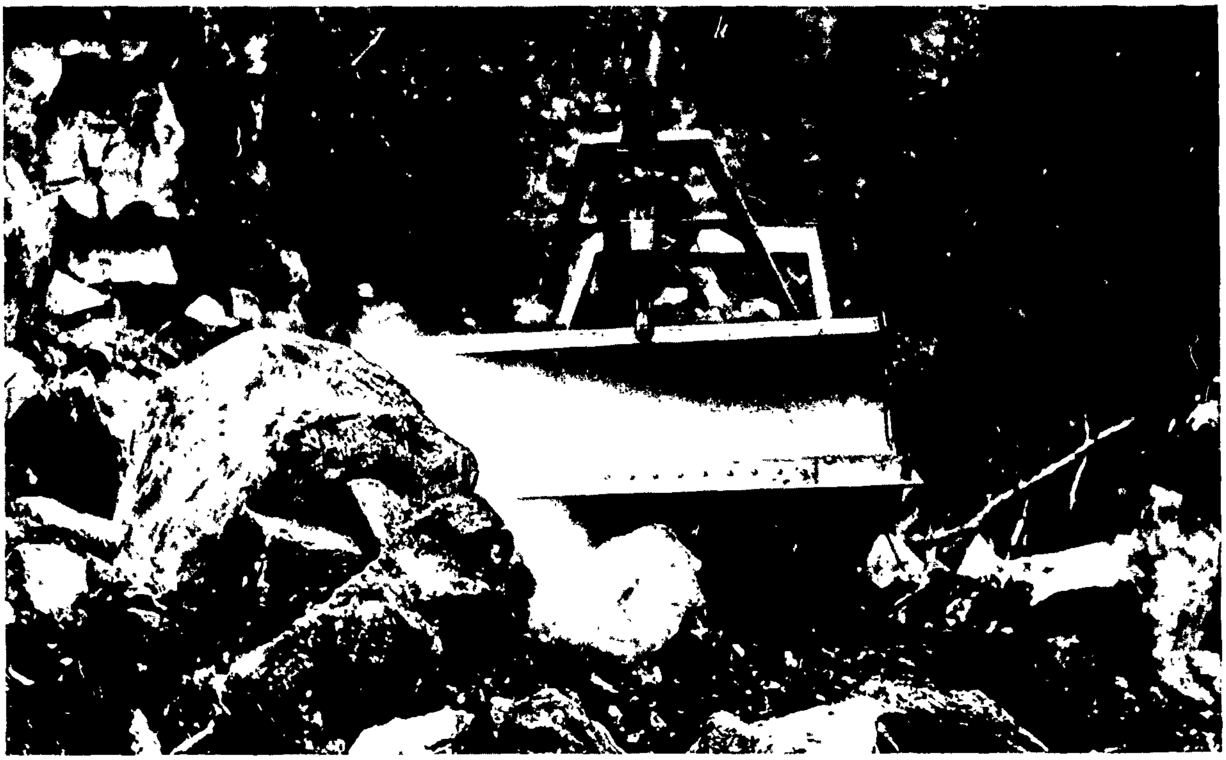


Unsatisfactory landings by LST's diverted to White Beach No. 3 after enemy bombings and fires at White Beaches Nos. 1 and 2.

Another view of White Beach No. 3, where some equipment became completely submerged during early off-loading operations.

Engineer landing craft carrying diverted troops and supplies to White Beach No. 4, Pim Jetty, Hollandia, Netherlands New Guinea.

White Beach No. 4, Pim Jetty, Hollandia, Netherlands New Guinea—Restricted beach dump and mountainous terrain.



One of many road construction problems between Humboldt Bay and airstrip sites located inland.

Engineers using a D–8 bulldozer and road scraper to improve the new road from the Hollandia beaches to the inland airstrips.

was flown first from Finschhafen (500 miles), then Aitape (115 miles), and finally from Tami Drome in the immediate objective area. The latter was a swampy Japanese strip, hastily reconstructed on the isolated southeastern edge of Humboldt Bay in order to initiate and sustain local fighter operations in the Hollandia area. This considerably burdened the Theater air transport capacity, but with all the vulnerable shipping in the harbor, it was a *must* operation to insure local fighter defense. Strenuous and exceedingly uneconomical logistical efforts had to be resorted to for maintenance of fighter aircraft to protect the accumulated shipping in the anchorage. Some ships loaded with drums of aviation gasoline were even sent 115 miles back to Aitape from Hollandia in order to discharge for air transport from there to Hollandia Drome.

The shipping congestion resulted from several factors. Unloading areas on the beaches were limited in size. There was little storage space in the rough and swampy areas in the immediate vicinity of these beaches. Beach exit roads to the hinterland were nonexistent. The necessity for concentrating the only available engineer troops on airdrome construction for the support of the next operation prevented timely and adequate development of the Pim–Hollandia Drome road over which all traffic had to pass to reach any extensive storage areas suitable for development. (See Map No. 11.) The beaches were so crowded with troops that storage space there was an impossibility, and no dispersal for offloaded cargo was available. All these factors, plus lighterage capacity, had been taken into consideration by the tabular analysis. Its predictions were distressingly justified when radio messages from GHQ, SWPA, began arriving in the objective area criticizing the retention of shipping at Hollandia and demanding that extraordinary measures be taken to expedite the discharge of ships.

The best expedient seemed the opening up of such limited storage areas as were available in the rear of Pim Jetty and along the Pim–Hollandia Drome road. However, the immediate engineer mission was the improvement of Hollandia Drome, and the number of engineers available was insufficient to divert an adequate force to clear potential storage areas and build access roads to them. Although the original plan had made adequate provision for engineer support, various engineer units, originally scheduled for early arrival, had not yet been moved forward from staging areas and uncertainty existed as to when they could be moved because of the shipping situation. Strict adherence to airdrome construction priorities, therefore, prevented diversion of engineer effort to roads. The lack of roads to storage areas caused a bottleneck in unloading. The resulting lack of turnaround shipping prevented the shipment of additional, urgently needed engineer units. The situation had resolved itself into a vicious circle. The solution, naturally, resulted in curtailment of the program for the Hollandia base.

The lesson here was obvious: greater weight would have to be given logistical considerations in future planning. The amount of equipment and supplies not essential to early phases of an operation would have to be drastically reduced in the initial assault waves of a landing where beach and hinterland conditions were extremely adverse. The risk of resupply shipping failing to meet later requirements would not be as great as attempting the defense of a disorganized beachhead while urgently needed initial supplies were inaccessible because they could not be unloaded from comparatively defenseless shipping immediately offshore. Such exposure to hostile air attack could result not only in the destruction of supplies still afloat, but of those on vulnerable beaches as well.

Signal Communication Restrictions. The radio contact prohibition imposed by Sixth Army on direct communications between Headquarters, 2d ESB, and subordinate boat and shore groups attached to task forces had a limiting effect on the efficiency of amphibian engineer operations. Although the Lae operation with the 9th

Australian Division was by no means comparable in size to the Hollandia operation, forward ESB units in that area sent an average of 5 to 10 messages back to regimental and brigade headquarters daily. On at least three occasions the task force commander and GHQ, SWPA, had resorted to the ESB net when their own nets failed to operate. However, during the Hollandia operation, initiation of an important 2d ESB inquiry, through Sixth Army to I Corps, and receipt of a reply by the brigade headquarters, routed back through Sixth Army, took 5 days; the inquiry concerned boat maintenance parts for which shipping space was available the day following origin of the query. By the time reply was received, the shipping space had, of course, been allocated to others. When informed of the naval plan to tow 23 LCM's from Hollandia to the next operation, 2d ESB sent a *Confidential Priority* message to Sixth Army asking how many LCM towing bridles and slings could be made available in the forward area. No reply was ever received. In the early part of May it was learned that the second projected operation would require a maximum of Buffaloes. This amphibian tractor type of craft invariably needed a great deal of maintenance and a large replacement of marine spare parts. Had 2d ESB headquarters had direct radio communication with its boat and shore groups at Hollandia, all information as to parts needed and special maintenance personnel required would have been on hand at brigade headquarters even before the operation was contemplated; constant efforts were normally made to foresee needs for special personnel and spare parts rather than wait until the last moment. However, the commander of ESB elements at Hollandia did not have free use of the radio net to brigade headquarters and could not make his requirements known. It was necessary for brigade headquarters to appeal to the designated task force commander of the ensuing operation to have a special message put through for this information. By the time it was received, considerable apprehension arose as to whether or not all of these spare parts could be forwarded in time for installation in the Buffaloes prior to the next operation.

Lifting of this restriction would in no way have interfered with the radio net of the Reckless Task Force; the ESB radio net would have been restricted to technical needs such as boat maintenance parts and special personnel. Many of these messages required the listing of spare parts numbers and other descriptive data, and were very long. Tactical commanders, naturally, could not allow their nets to become overloaded with such detailed messages. The importance of rapid and direct communication on such technical matters which vitally affect engineer operations cannot be overstressed.

Task Force Engineer Operations

Planning of Task Force Engineer Component. All engineer units were placed under the direct command of the Reckless Task Force Engineer with the exception of divisional engineers and engineer units attached initially in direct support of divisional engineers. Eventually, the units attached to divisional engineers were to revert to direct Task Force Engineer command at a time to be specified, but tentatively fixed as the time of initiation of airdrome construction.

Actual command of the base to be established at Hollandia (Base G) was to be exercised by the commanding general, Reckless Task Force, until D plus 45 when the base was to pass from Sixth Army to United States Army Services of Supply (USASOS) control. To insure continuity of construction effort, it was decided that the Task Force Engineer and his staff (less the Engineer Section, I Corps) would also pass to USASOS control on D plus 45, and the Task Force Engineer would become Engineer, Base G. The Task Force Engineer and the major portion of his staff were, therefore, drawn from personnel and units normally assigned to USASOS to eliminate as much confusion as possible in the change-over. The Engineer Section, I Corps, was to be temporarily absorbed into this staff for the period prior to the change-over.

Inasmuch as the Task Force Engineer staff was composed of personnel from various headquarters, many staff officers had to familiarize themselves with the plans for engineer work while the operation was in progress. Much smoother engineer staff work and elimination of considerable misunderstanding between all staff sections could have been effected had all key personnel, designated for assignment to the Task Force Engineer staff, participated in the preparation of the original plans.

In estimating the number of engineer units required on the various projects, the Task Force Engineer staff had little to assist it except past experience in the Southwest Pacific. Some logistical data had been compiled for reference but required considerable breakdown before a comparison of unit capacities could be effected and battalion-months estimated. In making such comparisons when units were manifestly not equipped to perform work similar to an engineer aviation battalion (the unit used as a common denominator for calculating construction capacity), a comparison of capacities to produce the type of work for which units were equipped had to be made. The major factor, therefore, was not strength but equipment, and before even an approximation could be reached, the staff was forced to go through a detailed process of calculating the capacity for work of each type of unit from a careful study not only of its personnel, but its equipment as well. In evaluating personnel potentialities of each unit, the staff had to draw on civilian as well as military experience.

Estimates of the construction supplies needed were made. Typical designs for some of the structures with bills of materials were furnished the Task Force Engineer staff. These, however, had to be adapted to expected conditions, and the adaptation frequently called for new bills of materials. Where no typical design was available, a complete design and bill of material had to be prepared. Construction supplies called for, up to and including D plus 120, totaled approximately 98,973 DWT, or 132,990 ship tons, an equivalent of 12 Liberty ships of engineer construction supplies alone.

Approximately 1,958 tons of engineer assault and reinforcing supplies were loaded in a number of ships of the initial convoy to reduce the hazard of loss of all of the supplies. This split loading practice, however, later required a considerable expenditure of effort to locate and transport these supplies to a central dump.

Supplies and Equipment. Engineer units involved in task force operations should have been allowed adequate time in staging areas to completely overhaul and repair their equipment. The continued shortage of engineer troops, however, and the heavy tasks imposed on alerted units in rear areas almost until embarkation time seldom permitted advance relief. This employment of engineer equipment on near shore projects until outloading resulted in frequent breakdowns during initial operations on the far shore. Landing operations under any circumstances impose a greater wear and tear on equipment than is normal, and some breakdowns are inevitable. Therefore, only equipment that is well serviced and mechanically perfect should be assigned to such operations.

Task Force Engineer reports of the operation, as those of ESB units, pointed out that although certain heavy engineer equipment was essential and had to be landed on D Day, there were certain other pieces that could be brought in on later echelons. Specifically recommended for subsequent shipment were 8-ton low-bed trailers, 16-ton flat-bed trailers, and 2½-ton two-wheel pole-type trailers. However, the landing of the engineer motorized shop, all tractors with angledozers, the 4-ton wrecker, and the air compressor was considered essential on D Day.

Spare parts for engineer equipment were again a serious problem. This was especially true of tractor parts. A complete supply of second echelon parts should have been issued to all engineer units prior to embarkation.

A shortage of demolition materials in some cases caused serious delays in carrying out engineer missions, and emergency attempts to relieve the situation by use of captured enemy explosives resulted on occasion in dangerous misfires. All engineer units should have carried an ample supply of mobile-loaded demolition materials.

The initial demand for potable water exceeded the supply of water purification chemicals initially brought ashore by engineer units. One engineer battalion was unable to secure even the normal supply of water purification chemicals prior to embarkation. This could have resulted in a serious situation had the unit been unable to obtain these vital supplies from other engineer units. It was evident that large quantities of water supply chemicals should always be brought in initially by engineer units. Also, all operators of engineer water supply purification units should be most thoroughly instructed in the proper use and conservation of such chemicals.

The Combination Section A 10-ton van or semitrailer issued to the engineer topographic company (corps) proved impractical for amphibious operations. The extreme height of the van caused considerable difficulty in loading it on and unloading it from an LST, and tractors had to be used to aid in both operations. This was particularly true in disembarking on a sand beach. In this operation it was necessary to tow the van a distance of 3 miles before ground was reached where it could operate under its own power. The Motorized Camera and Motorized Press Sections were considered far superior for amphibious operations.

Engineer Troop Units. The performance of the 3d Engineer Combat Battalion in support of its division was noteworthy. This battalion and the 116th Engineer Combat Battalion (less one company) were employed in close support of the forward elements of their divisions (24th and 41st Divisions respectively), performing such engineer work as required by the divisions. No road existed across the ridge between Tanahmerah Bay, where the 3d Engineers had landed in support of the 24th Division, and the three airdromes in the Lake Sentani area. (See Map No. 11.) The 3d Engineers were, therefore, immediately employed in construction of a jeep road to these dromes. The work was accomplished under the most adverse and rigorous conditions. In addition to the difficulties presented by the impenetrable terrain, the intensity of the tactical situation was such that the road was not completed until after the dromes were captured. During the interim the division had to be supplied principally by air and by carrying parties. However, the support of the 3d Engineers was not limited to road construction alone; this battalion, hacking its way across the ridge, accounted for approximately 82 enemy dead and 29 prisoners of war.

During the Hollandia operations, the survey platoon of the engineer topographic company (corps) proved very useful in assisting artillery units to establish base lines and sound range control. However, upon completion of this mission, such survey personnel should have been released immediately from division and Corps control to assist with the great amount of other survey work required for layout and construction activities and to check maps made and issued prior to the landings.

Two of the engineer battalions engaged in construction activities during these operations were seriously handicapped by an insufficiency of trained equipment operators. The shortage of experienced operators for multishift operations was a recurring handicap to engineer operations throughout the Theater.

Construction. The directive for the Hollandia operation called for the establishment of a base (Base G) to furnish logistic support for 200,000 troops, and a staging area for future operations. This would have entailed construction of 6 airdromes, involving the building of 10 runways, an air depot, and approximately 200 miles of road to serve the installations. The base was to cover approximately 8,012 acres. After the landings were made, development was modified and reduced to essential requirements for logistic support of 140,000, including only 3 air-

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dromes, no air depot, 1,204,210 square feet of covered facilities other than storage, and 2,906,960 square feet of covered storage.

Terrain difficulties and the necessity of supervising all engineer agencies within the Reckless Task Force restricted the ability of the Task Force Engineer and his staff to give construction the intimate attention required. The Hollandia area was divided, therefore, into sectors with sector engineers and staffs established in the interest of the close supervision necessary. Each sector was given complete control of the work assigned to it, and this decentralization was effected into five sectors, namely: Hollandia, Sentani, Tanahmerah, Tami, and Dock Sector.

The most arduous aspect of construction under the Reckless Task Force was the need for speed of operations. Airdromes had to be operable for transport and fighter aircraft at the earliest possible date. Yet, the existing supply route connecting Humboldt Bay and the dromes was, in places, little more than a jungle trail, totally incapable of handling more than jeep traffic, and that only barely and intermittently. This inadequate road deteriorated quickly, and keeping traffic moving over it while developing it into an all-weather road presented a major problem. However, there was no alternate route which could be selected for development, while heavily loaded vehicles necessarily traversed the trail to supply accelerated construction demands on the dromes. Passing road machinery, trucks loaded with gasoline, oil, rations, ammunition, and construction supplies, and vehicles carrying personnel hampered development of the road to such an extent that construction time was doubled. It took about 2 weeks to construct approximately 20 miles of road capable of carrying the traffic 90 percent of the time. This, in turn, of course, delayed construction operations on the dromes and elsewhere.

Despite initial retarded progress caused by limitations of terrain and ports and delayed arrival of engineer units and supplies, over-all engineer progress was considered good. Eventual construction included 5 docks and 1 floating dock, hospital facilities for approximately 7,000 beds, 3 airdromes with total dispersed hardstandings for 364 aircraft and connecting taxiways, and storage installations for 94,000 barrels of aviation gasoline, 79,250 barrels of motor fuel, and 25,250 barrels of automotive Diesel fuel. Hollandia, under a vigorous engineer program, became Base G, a major link in the persuasive chain of logistics relentlessly tightening around the widespread enemy.

Aitape

22 April 1944

The seizure of Aitape, Northeast New Guinea, was executed simultaneously with initial Allied offensive operations in Netherlands New Guinea against Hollandia. Striking approximately 115 miles to the southeast, the smaller force at Aitape provided flank protection to operations of the larger Reckless Task Force at Hollandia. Designated as the Persecution Task Force and made up of the 163d Regimental Combat Team of the 41st Division with attached troops, this smaller force was supported in its initial combat phase at Aitape by an unprecedented proportion of engineer troops. As previously indicated, 41 percent of each of the respective forces assigned to operations at Hollandia and Aitape were engineers. However, while the initial engineer support on D Day at Hollandia amounted to only 19 percent, at Aitape, this figure was raised to 30 percent of the landing force. This initial engineer strength consisted of a boat company and the Shore Battalion, 593d Engineer Boat and Shore Regiment (3d ESB), a company of the 116th Engineer Combat Battalion, the 27th Engineer Combat Battalion, and a RAAF mobile works squadron.

The establishment of the Aitape beachhead, integrated with those of the Reckless Task Force in the Hollandia area, not only extended the bombing range of Allied aircraft over all enemy-held New Guinea, but the flank protection it afforded the larger force could interrupt any Japa-

Engineer Shore Party troops form a human chain to expedite unloading of rations and ammunition from a landing barge on Aitape beach.

Engineer bulldozer unloads cargo net of ammunition from landing craft at Aitape.

Engineer Shore Party bulldozer assists a 2½-ton truck over the ramp of an LST that has just beached at Aitape, New Guinea.

By D plus 2, Allied aircraft were operating from Aitape.

Vehicles, on their way to the front lines, cross an Engineer ponton bridge near Aitape, New Guinea.

Engineers spanned the Drinumor River with this rubber ponton bridge not far from the Aitape beach in New Guinea.

nese northwestward attack which might be launched by enemy concentrations in the Wewak area. (See Map No. 10.) By D plus 2, however, this threat was offset; Allied aircraft were using the Tadji Airfield near Aitape, completing the strategic plan for containing the Japanese *18th Army* at Wewak.

Amphibian Engineer Operations

The amphibian task force destined for Aitape, as previously indicated, made up part of the huge Reckless Task Force convoy, largest ever assembled up to that date in the Theater. This armada rendezvoused near the Admiralties, and proceeded to the coordinated attacks at Hollandia and Aitape. (See Map No. 10.)

The actual Aitape landing, spearheaded by a boat company from the 593d EBSR, encountered light resistance only. The first assault wave was met merely by desultory rifle fire. Some distance inland, light machine-gun fire from an enemy emplacement was quickly silenced by one of the tanks carried to the beach aboard engineer LCM's.

Shore Party Activities. Beach work was performed by the Shore Battalion, 593d EBSR, with the regimental commander in the capacity of shore party commander exercising undivided control of the beach area. Perhaps the outstanding engineering achievement of initial operations was the rapid construction of seven 40-foot jetties, closing the water gap between the beach and large naval landing craft grounded in 4 feet of water. These jetties were completed within 1 hour through well-coordinated use of bulldozers, steel matting, and trained engineer manpower.

Inasmuch as the initial landing was effected approximately 1,000 yards east of the intended assault area, an adjustment in the disposition of assault troops had been necessary. This, of course, increased the distance from the beached LST's to delivery points at forward dumps. The increased haul retarded the return of empty vehicles, and a 1- to 2-hour delay in off-loading bulk supplies from LST's ensued.

Contributing to unloading difficulties was a shortage of trucks. Although as many as 60 trucks were attached to the shore battalion from other units, there still were not enough. And as these trucks arrived in small increments from many organizations, control proved difficult. Trying to locate trucks after each trip to a dump became a problem. Everybody seemed to commandeer any empty truck in sight. This was partially solved subsequently by applying special numerals and markings to these attached trucks, and by employing military police to assist in their roundup. Arrangements in the staging areas for a windshield sticker or driver's pass, however, would have made control much easier. These extra trucks also caused a severe drain on the ESB motor pool maintenance facilities, and their maintenance requirements were met with difficulty.

The Task Force provost marshal at Aitape operated under the shore party commander from the outset. This was a very desirable system as it assured undivided control of traffic, but subsequent reports of the operation indicated that more military police should have been on the beach. Access roads to the airfield should also have been more rigidly policed to prevent unnecessary traffic interfering with construction activities.

No mobile cranes were taken ashore early in the operation. At least two, of 3- to 5-ton capacity, would have been invaluable in the dump areas, which in themselves were open to criticism as well as enemy observation. These dump areas consisted simply of indiscriminate clearing of areas: all trees were chopped down and the ground roughly leveled by dozers. A lesson could well have been taken from the construction of enemy dumps where concealment was effected by retention of all possible natural overhead and ground textures. Conservation of trees would also have been of assistance to the wire section by permitting the stringing of lines overhead and eliminating one of the most frequent interruptions to telephone service: the tearing out of ground lines by tracked vehicles. The danger of fires spreading from explosions in dumps could have been circumvented by scooping out hasty, but well-located, ditches either by dozers or graders in the early phases as required. In any case, more importance should have been attached to location and segregation of dumps.

Property responsibility was very lax and casual appropriations very common. In one company of shore engineers at least 70 percent of the troops had lost their mess kits by D plus 3. Such occurrences could have been minimized by the establishment of a temporary personnel equipment dump for shore engineers where they could have left their equipment under guard immediately upon landing. Such equipment could then have been picked up easily and without loss of time when D Day assignments were completed.

After a month's work spent in consolidating the Aitape beachhead, the 593d was relieved by the 533d Engineer Boat and Shore Regiment. This regiment took over in time for its weapons section and heavy engineer equipment to be of considerable assistance to the combat troops in establishing defensive positions during an attempt to regain the beachhead by elements of the Japanese *18th Army*. The weapons section manned pillboxes and occupied a portion of the main defense line. They broke down 37-mm. guns and transported them piece by piece to pillboxes where they then stood guard in the damp jungle, subsisting only on cold C rations. In the succeeding 5-month period the 533d unloaded 153,506 tons of cargo with a daily average of approximately 1,200 tons for the entire period. These high figures were achieved despite comparatively poor beach conditions, and the regiment unconditionally merited the commendation received from the commanding general, 32d Division, for their fine work.

Landing Craft Activities. A further measure of the support rendered the Persecution Task Force by the 3d Engineer Special Brigade was evidenced by the boat operations of the 533d Engineer Boat and Shore Regiment. The LCMG's (LCM's converted into gunboats) of this regiment supported infantry missions along the coast and kept combat patrols supplied with food and ammunition as well as evacuating wounded and prisoners to Aitape. In the performance of such missions during the week of 14–20 August, these LCMG's were credited with killing 148 Japanese by strafing enemy movements paralleling the shore line.

Task Force Engineer Operations

Engineer Command Authority. In preparation for this operation the Persecution Task Force Engineer staff was organized on or about 14 March 1944 and consisted principally of RAAF personnel with a RAAF officer as Task Force Engineer. Economical employment of engineer troops was made possible by placing all engineer units of the task force directly under the command of the Task Force Engineer. (See Chart No. 3, "Engineer Order of Battle, Aitape, Northeast New Guinea.") This gave the Persecution Task Force Engineer even greater command responsibilities than those accorded the Reckless Task Force Engineer for the landings at Hollandia, and facilitated effective employment of engineer units. The Task Force Engineer at all times had direct command authority to allocate missions to any one of his units in accordance with their location, capabilities, and equipment. Interchange of equipment between units to conform to their tasks was thus made possible.[12] The one difficulty in the execution of command was the lack of an engineer radio net. Only the boat and shore regiment was adequately equipped in this regard.

Early Availability of Intelligence. Engineer estimates and layouts based on interpretation of aerial photography proved extremely accurate for the Aitape operation. Early availability of aerial photographs permitted the production of the preoccupational area layout plan showing

[12] *Editor's note:* Interchange of equipment, while undesirable if avoidable, is, nevertheless, sometimes essential, and can only be amicably effected when units, as in this instance, are united under one command.

unit areas, dumps, the road system (both existing and projected), and topographical features during a period of relative quiet rather than under the stress immediately following an operational landing. The value of aerial photographs to the task force engineer staff and engineer unit commanders in planning phases of an operation cannot be overemphasized.[13] Security measures which delay unduly the dissemination of basic plans, maps, and aerial photographs to the engineers may be overstressed. Safeguarding information to the extent of deterring good lower level planning can actually threaten the success of projected operations.

Engineer Loading Plan. All in all, advance engineer planning and estimating very nearly met all basic requirements on the far shore. The loading plan for engineer units, however, did not provide combat engineer detachments in direct support of early waves of assault troops. Engineers did not land in any strength until the seventh wave at H plus 75 minutes, though this wave was scheduled to beach at H plus 45 minutes. The omission of detachments of combat engineers in initial waves created a condition which, under many other circumstances, could have jeopardized the initial progress of assault troops and the movement of their guns, tanks, and heavy equipment to cover beyond the beach. Apart from this criticism, the loading plan for engineer units was considered sound. Each LST contained a detachment of the shore battalion responsible for its off-loading. Also a good dispersion of engineer troops was effected throughout the LST's on the seventh wave. The build-up of engineer troops in the forward area after D Day was considered very satisfactory.

However, engineer planning for the provision of bridging equipment was open to criticism. There was a tendency to underestimate requirements for bridging materials and to overemphasize the value of other supplies at the expense of standard bridging equipment. Yet, this equipment was invaluable to combat engineer units, and in stream-traversed terrain earned its shipping space by early provision of communication routes. Whether or not standard bridging equipment is taken ashore, at least one mobile pile driver, and preferably two, should be landed on D Day or D plus 1. In this operation two sets were brought ashore on D plus 8. The lack of both pile driving equipment and floating bridging until this date was particularly regrettable. Without it the early crossing of the Raihu River [14] was precluded and access thus denied to the only workable deposits of coral and limestone suitable for road and airstrip surfacing.

Economical Employment of Engineers. Not only was the percentage of engineers assigned to this operation and united under one command adequate, but, in compliance with the Task Force field order, economical employment of the engineers available was specifically adhered to by the various tactical units. During the initial assault phase, tactical units were employed to the maximum for establishment of their own defenses, and engineer effort was conserved for specific engineer tasks. The importance of economical employment of engineer troops and the ultimate effectiveness of such a policy was categorically confirmed at Aitape where the fighter strip was operational in 44 hours after being cleared of the enemy through practice of such conservation. In significant comparison was the delayed construction of the bomber strip in the days that followed occasioned by the emergency commitment of two battalions of airborne aviation engineers when furious Japanese assaults developed from the Wewak area.

Supplies and Equipment. Engineer equipment, for the most part, was provided on a generous scale, and its early availability on the beachhead paid big dividends. Between 50 and 60 percent of the mechanical equipment and motor transportation of engineer units was taken

[13] *Editor's note:* During this planning phase the vectorgraph was particularly recommended as a simple and rapid means of studying terrain without the trouble and time involved in setting up a stereoscope and training personnel to use it.

[14] *Editor's note: See* Map No. 29, "Aitape, Plan of Battle," Vol I, this series.

ENGINEER ORDER OF BATTLE, AITAPE, NORTHEAST NEW GUINEA

- Task Force Engineer (RAAF)
  - Under Command for Operation (US Units)
    - Detachment Operations Section
    - 875th Airborne Engineer Aviation Battalion
    - 874th Airborne Engineer Aviation Battalion (Had not arrived by D plus 12)
    - 872d Airborne Engineer Aviation Battalion
    - 27th Engineer Combat Battalion
    - Company A, 116th Engineer Combat Battalion
    - One Boat Company, 593d Engineer Boat and Shore Regiment
    - Shore Battalion, 593d Engineer Boat and Shore Regiment
  - Headquarters, 62d Works Wing (RAAF)
    - Attachments for Operation (RAAF)
      - Detachment Signals
      - Mobile Dental Unit
      - Detachment Postal Unit
      - Base Depot Squadrons
      - 22d Medical Clearing Station
    - Normal Works Wing Units (RAAF)
      - 13th Australian Survey and Design Unit
      - 10th Australian Works Supply Unit
      - Detachment, 4th Australian Works Maintenance Unit
      - 7th Australian Mobile Works Squadron
      - 6th Australian Mobile Works Squadron
      - 5th Australian Mobile Works Squadron

Source: Annex 9, Engineer Order of Battle, to Rpt, Maj R. M. Little, SORE, 1 Aust Corps, AMF, 15 May 44, Report on Engineer Operations at Hollandia, Netherlands New Guinea, 22 April–2 May 1944, and Aitape, Northeast New Guinea, 22 April–6 May 1944.

CHART NO. 3

ashore on D Day, and this figure rose to 80 percent by D plus 12. With few exceptions it was the maximum that could be operated on a 3-shift basis owing to the limited supply of trained operators. The spare parts situation, however, was difficult, and much deadlined plant resulted. Parts were requested by air transportation from rear depots and service was prompt in all cases where spares were available.

Machetes were very noticeably in short supply in the early stages of the Aitape operation, and could have been doubled without risk of surplus. The supply of acetylene was also critical.

The early installation of the sawmill, taken ashore on D Day, resulted in saving shipping space which would have been required for timber. To 15 June, 12,180 lineal feet of piling and 267,000 board feet of lumber were produced.

Subsequent reports of the operation classified the D–7 and D–8 dozers as "star performers," with particular emphasis on the D–7 because of the ease in waterproofing it.

The ⅝- to ¾-cubic yard capacity power shovel was considered the most suitable for general purpose use. Those taken ashore in the early stages at Aitape were ⅜- to ½-cubic yard capacity, and the limited output of these small shovels resulted in light loading and uneconomical use of trucks which lined up waiting for loads. Where time and ground permitted construction of a "chinaman," [15] the larger size shovel was not of such importance, but when airfield facilities had to be provided immediately after landing, the supply of an adequate shovel proved of major importance.

Construction. During accomplishment of re- quired construction, hydrographic surveys of the Aitape shore line indicated that construction of a dock for Liberty ships was impracticable because shallow water continued for a considerable distance out from the shore line. It would have been necessary to build out some 700 to 900 feet from the shore to obtain the necessary depth. Instead, a small lighter dock was constructed by using two of the pontoon rafts brought in on the sides of LST's. Piles were driven on both sides and flat-topped barges were brought in alongside. This was satisfactory in fair weather, but any strong surf carried away the piles. It was obvious that lighter docks of this type were excellent for fair weather unloading or in sheltered waters, but in unsheltered locations, they were impractical. Inexperienced lighter crews invariably wrecked them when mooring barges to them in rough weather, and dock hardware replacements were difficult to obtain. Another lighter dock was subsequently constructed by using local rock revetted with piling and timber sheeting.

Airfield construction at Aitape, as elsewhere, encountered traffic interference across work sites. It appeared that an airfield under construction had a magnetic attraction for much unnecessary vehicular traffic which was a definite hindrance to the engineer effort and a menace to aircraft. As previously pointed out, access roads should have been more rigidly policed, and bypass roads should have been constructed at the earliest opportunity. Emergency landings also reduced airfield construction progress.

Before proper drainage, grading, reasonable compaction and stabilization had been effected, steel matting was hastily placed on the fighter strip at RAAF insistence. The difference in time of availability would have been very small if these precautions had been taken. Instead, the strip was characterized by immediate usability but poor quality, and the maintenance and repair required so much effort that less total progress was effected than could have been expected with the means available.[16]

[15] *Editor's note:* A chinaman was a hillside structure used for overhead loading of trucks. It was built flush with the top of a hill and so constructed that trucks could be driven under it and quickly loaded by means of dozers pushing material from the hill onto the top, or grizzly, of the chinaman through which it then funneled into the waiting trucks.

[16] *Editor's note:* In extenuation, it should be pointed out that the majority of assigned engineer units had already performed 16 months of arduous tropical service in the Theater without any leave. Energy and effectiveness are not quite up to par under such conditions.

The recurrent problem of drainage had assumed significant proportions. Inadequate appreciation for early and efficient drainage provision had become all too obvious, and culminated in necessitating remedial action from the highest staff level. After numerous personal inspections had evidenced the prevalent underestimation of the importance of this primary phase of construction, the Chief Engineer, GHQ, SWPA, issued the following special technical memorandum to all engineer unit commanders and staff engineers directing corrective action.

GENERAL HEADQUARTERS
SOUTHWEST PACIFIC AREA
OFFICE OF THE CHIEF ENGINEER

SPECIAL TECHNICAL MEMORANDUM
NO 1 APO 500
CE 616 (7 JUN 44) E 7 June 1944

MEMORANDUM FOR: Engineer Unit and Staff Commanders

SUBJECT: Drainage

1. Although the problem of drainage has been repeatedly stressed, it is apparent from personal observation on numerous recent inspections that the importance of drainage is not adequately appreciated nor understood by many engineer headquarters and units.

2. FAILURE TO PROVIDE ADEQUATE DRAINAGE AS ONE OF THE EARLIEST FEATURES OF ANY CONSTRUCTION PROJECT INDICATES A BASIC LACK OF ENGINEERING KNOWLEDGE.

3. When roads, storage areas, airdromes or related construction are to be located in areas of high water table or subject to potential or intermittent flooding, *IMMEDIATE* measures must be taken to analyze the drainage situation and to improve it.

4. It is a hopeless task to try to build up roads and dromes on a bed of muck requiring countless days of manpower and equipment, with still unsatisfactory results. Every effort must be made in the earliest stages of construction to find the best potential drainage channels and to initiate as first priority effort the opening up and cleaning out of such drainage channels, side ditches, etc., to permit easy run-off and maximum possible draining of sub-base.

5. In almost every case, it is far easier to pull the water surface and ground water table down by a foot or more by adequate drainage than it is to haul in and place thousands to hundreds of thousands of cubic yards of selected materials to build up the roads, airdromes and hardstanding areas on a soft and unstable foundation above the water table. Relatively little effort spent on such drainage relief will effect major savings not only in the overall initial construction, but also in subsequent maintenance.

6. The need for *CONTINUING* drainage *MAINTENANCE* cannot be overstressed.

7. The necessity for early provision of drainage on all engineer construction must be completely understood by *ALL* members of *EVERY* engineer unit. It is the responsibility of all engineer headquarters and unit commanders to see that the principles and effectiveness of drainage are thoroughly understood by all members of their commands—and that it is promptly and energetically exercised in the earliest stages of all construction projects.

8. All engineer headquarters should on all inspections of the various construction projects under their jurisdiction check specifically that adequate drainage is provided.

9. It is desired that fullest possible dissemination be given to this communication, to include *ALL* officers and NCOs of *ALL* engineer units engaged on construction activities.

/s/ Hugh J. Casey
/t/ HUGH J. CASEY
Major General, USA
Chief Engineer

The fighter strip at Aitape was a concrete example of the ultimate wasted effort involved in nonadherence to such basic principles of construction. By 12 July this strip was declared unserviceable as a result of the failure to properly drain and compact it, and it was subsequently converted into a crash strip after the steel matting had been removed. Fortunately, however, by that time, despite delays occasioned by diversion of engineer aviation battalions to tactical missions, the separate bomber strip was available for the operation of three fighter squadrons, two light bomber squadrons, and two troop carrier squadrons.

Wakde Islands—Sarmi, New Guinea 17 May 1944

While a beachhead was being organized by ESB personnel at Aitape, Northeast New Guinea, in April, other U. S. amphibian engineer units attached to the 9th Australian Division, and later the 5th Australian Division, spearheaded the Allied advance from Saidor to Madang, and subsequently to Alexishafen. Contained between Allied forces at Madang and at Aitape, the Japanese, with no other alternative, retreated hurriedly to Wewak. (See Chronology.)

The success of such encirclement and the growing strength of Allied forces in the Southwest Pacific motivated an increase in the tempo of General MacArthur's leapfrogging activities. Thus, the Wakde Islands (Insoemoar and Insoemanai) situated just opposite the Arara–Sarmi area on the mainland of Netherlands New Guinea now constituted the target for the next Allied move westward. Operations instructions called for a double operation. The Hurricane Task Force, assigned the over-all tactical mission, was divided into two components: the Tornado Task Force was to seize, hold, and develop the airdrome on Insoemoar (commonly known as, and hereinafter referred to as, Wakde Island); the Cyclone Task Force was to make a landing on the mainland in the vicinity of Sarmi, and seize airfield sites for development and use. Both forces committed were to be subsequently reassembled under one command. On 8 May, however, instructions were received changing the entire plan. The Sarmi landing by the Cyclone Task Force was eliminated because engineer intelligence indicated the area unsuitable for airfield construction. The over-all operation was limited to seizing a 3-mile strip of coast on the mainland opposite Wakde Island, embracing the towns of Arara and Toem, and to the capture and development of the Wakde Drome.[17] This task was assigned to the Tornado Task Force.

The basic combat unit of the Tornado Task Force was the 163d Regimental Combat Team of the 41st Division. Supporting this RCT and participating in the operation, engineer components consisted of the Shore Battalion, 593d Engineer Boat and Shore Regiment (3d ESB), Company A, Boat Battalion, 542d Engineer Boat and Shore Regiment (2d ESB), Company A, 116th Engineer Combat Battalion, the 27th Engineer Combat and 836th Engineer Aviation Battalions, the 617th Engineer Base Equipment Company, and a detachment of the 650th Engineer Topographic Battalion.

Amphibian Engineer Operations

Limited Organization Time. Because of a last-minute change in plans, the Shore Battalion, 593d EBSR, was given only 8 hours notice of its impending move from Aitape with the principal elements of the task force for the Wakde landings. The unit originally scheduled for the operation, the 533d EBSR, had not been called forward by Sixth Army until D minus 2, and was inadvertently delayed in its arrival at Aitape. This unit had been loaded aboard a ship which instead of taking it to Aitape, had taken it to Hollandia. Because of the ensuing delay of transshipment, the 593d was substituted for the operation on short notice with the understanding that its duties at Aitape would be assumed by the 533d upon that unit's arrival at the staging area. In the 8 hours allotted, the 593d had to load its unit equipment as well as continue outloading the Task Force. Bulldozers were necessarily worked until the last minute before being loaded.

Detailed plans for the operation had not been issued even a week before D Day, and combat engineer planning had consisted primarily of briefing the Task Force Engineer staff on the characteristics of the far shore to determine what special engineering problems might be encountered. A definite necessity was evidenced for future operational instructions and field orders to be more specific in establishing the responsibilities of assigned ESB units. It was again confirmed that ESB staff officers should be present during the planning phases of an operation to more fully familiarize themselves with requirements and not have to organize and operate on such short notice.

Ship-to-Shore Movement. The landing on the New Guinea mainland was executed on 17 May after heavy shelling and bombing of the area extending from Toem to Sarmi by naval vessels and Fifth Air Force bombers. The waves of small craft went in with precision-like orderliness, but had to beach some 50 feet offshore because of

[17] *Editor's note: See* Map No. 30, "Wakde, Plan of Battle, Engineer Construction," Vol I, this series.

a shallow backwash shelf, and disembarking troops were forced to wade ashore through waist-high surf. The LCI's grounded farther out on the reef, and troops unloading from these craft experienced even greater difficulty as they struggled through depths of 5 to 6 feet and slipped underwater into numerous shellholes. Fortunately, there was no enemy resistance, and a beachhead was quickly established between the Tor and Tementoe Rivers. The LST's were signaled in, and again the shallow beach shelf made disembarkation difficult.

Shore Party Activities. Because of the absence of portable ramps on the LST's, D–7 and D–8 dozers were required to immediately build ramps out to the grounded craft while shore engineers hand-placed sandbags along these improvised jetties to prevent them from being washed away by the heavy surf. Other dozers went to work on the shore road which was a one-way, small track, paralleling the shore line on a 10- to 15-foot embankment. Ramps to LST's had to be cut below this road level. Meanwhile, additional dozers cut roads to the interior to expedite unloading and traffic circulation.

This operation proved conclusively the need for an increased number of D–7 and D–8 dozers in initial landings unless portable ramps were carried ashore aboard each LST. Two dozers were required for the construction of each ramp. Extending the ramp to any desired length, especially in a heavy surf which retarded rapid construction, consumed considerable operating time of these dozers which could have been profitably applied to other urgent requirements. The assignment of additional equipment would have speeded essential clearing of roads and dump areas, but its transport would have meant sacrificing vital assault equipment space. The more reasonable solution would have been to place aboard each LST a portable ramp, employment of which would have released dozers more rapidly for other missions.

Contested Occupation of Wakde. By noon, Wakde Island was under bombardment by Allied artillery which had established positions on the New Guinea mainland opposite the island. Later in the day a small party which had taken Insoemanai Island set up machine-gun posts in that area and trained their guns on Wakde. On the day following, 18 May, the 1st Battalion, 163d Infantry, left the mainland, transported by Company A, 542d EBSR (2d ESB), and made the initial assault on Wakde. As the landing waves were formed, Wakde took a terrific pounding from the land, sea, and air. The LCI's moved close to shore, laying a heavy rocket barrage along the beach and inland. The terrific and deafening curtain of fire laid on Wakde diverted the usual preinvasion apprehension of the assault troops to emotions more allied with sympathy for those on the receiving end. But enemy opposition soon manifested itself. Japanese resistance was heralded by an explosion aboard an LCI. A magazine was hit by an enemy shell causing several casualties. Despite the intensity of the naval barrage, the Japanese had managed to bring up light weapons with which they opened fire on the small craft nearing the shore. Infantrymen, huddled down behind the armor of the landing craft, suffered few casualties, but gunners and coxswains on the ESB boats had to face intensive fire in exposed positions above the armor plate.

These amphibian engineers, running the gauntlet of enemy fire, suffered severe casualties that morning. When a coxswain was hit another member of the crew quickly took his place. Not a single boat hesitated for a moment as they moved shoreward into the ever increasing barrage. All boats reached the beach although six of them were riddled with bullets and leaking badly. The engineer boat company sustained casualties of 5 killed and 30 wounded out of 120 boatmen involved.

Snipers picked men off as the assault waves landed. The sudden shock of stiff opposition kept the men pinned down to the beach for a half hour. In the first hour and a half, four of the five company commanders were among the

Assault troops of the 41st Division hit the beach from Engineer landing craft during the invasion of the Wakde Islands.

Another view of assault troops landing from LCVP's at Wakde.

Engineer bulldozers had extended sand ramps out to grounded LST's on Wakde beachhead.

Engineer Shore Party typical white coral road construction on Wakde. Note communication wire strung along shattered tree trunks for protection from wheeled and tracked vehicles.

Japanese pillbox on Wakde.

Another formerly concealed Japanese pillbox on Wakde.

casualties. The enemy was putting to good use their new .307-caliber automatic rifle and smokeless ammunition which defied detection.

Reorganization was slow among these men imbued with the false security gained from the comparatively easy Hollandia operation and the unopposed landing of the day previous. Noncommissioned officers, at first confused by the loss of their officers, soon took the initiative, reorganized their men, and led them into battle. The men followed, but in many cases undertook to solve the problem themselves, which undoubtedly caused more casualties than there would have been. LST's, carrying personnel and equipment of various air and ground service units, landed while the assault troops were still trying to establish their initial positions, and added to the confusion on the extremely small and congested beachhead.

Fully realizing the seriousness of the situation, the men fought desperately, advancing inland despite casualties. They fought something they could neither see nor find. They shot up tree tops only to find the Japanese buried in slit trenches covered by palm fronds, or sometimes huddled under their own dead. They advanced from stump to stump, crater to crater, taking advantage of whatever concealment offered itself. They no longer hesitated, and the enemy finally retreated to the north corner of the island. However, many infiltrated back to the beachhead area, and as late as 1600 were still sniping at personnel on ramps of LST's.

Actual unloading of ships at Wakde Island was executed very efficiently considering the congestion of the extremely small beachhead and the harassing fire from Japanese snipers. Congestion was primarily due, of course, to the fact that service units and supplies arrived before the beach could be properly organized. Engineers simultaneously worked and fought, mopping up enemy positions missed by the infantry in the midst of unloading activities, maintaining a perimeter defense, and evacuating casualties brought to the beach. Before the beachhead could be appreciably enlarged, still other units and supplies were landed on D plus 2, and considerable losses in personnel, equipment, and supplies were avoided only through the enemy's failure to make a more substantial ground or air attack during this interval.

Schedules of landing units should have been more flexible, and should have been regulated to conform with the tactical situation and beach conditions. In this case these units were landed at the time originally scheduled, although the tactical situation was considerably different from what had been anticipated. There should have been more coordination between Task Force elements on the island and naval shipping offshore in order to make adjustments in landings consistent with the adverse tactical situation and beach conditions.

Shore Moorings for LCM's. During the period of resupply, the method devised at Toem, New Guinea, of holding LCM's on beaches to reduce the wear on marine engines is noteworthy. This was an exposed beach, usually with considerable surf. Ten-foot piles were spaced at 40-foot intervals along the beach and then driven 6 feet into the ground at points about 3 feet back of the high-water mark. Two lengths of wire cable, each approximately 70 feet long with bights at each end, were fastened to each pile. (Manila rope, 2 inches or 1½ inches, was suggested as easier to handle and more suitable for this purpose if available.) The LCM's beached between two piles, and cables from each were then fastened to the stern bits of the LCM. Then LCM's could stop their engines and remain in position on the beach without broaching while bulk supplies were being unloaded. This method of shore moorings for LCM's was particularly beneficial because silty water was not running through the cooling pumps while the LCM was beached for periods that sometimes consumed a period of 3 or 4 hours. Shore moorings were not used if the LCM's were mobile loaded and remained on the beach only a short time. Similar shore moorings were used effectively for holding ponton barges and LCT's in position while trucks were in contact to receive off-loaded supplies.

Task Force Engineer Operations

Planning. Operations were progressing with considerable rapidity. By the time directives were received, it was too late for Sixth Army to thoroughly review, complete its plans, and prepare the necessary directives for methodical study by the Task Force Engineer. As an expedient, when time permitted, the Task Force Engineer staff was assembled at Headquarters, Sixth Army, for briefing and preliminary study of the situation prior to undertaking the detailed planning for an operation. Although this resulted usually in temporary absence of the staff from the Task Force during initial planning stages, there was no alternative which could insure the availability of essential basic data to planning agencies in sufficient time for detailed planning. In commenting upon this situation, the Engineer, Sixth Army, stressed the necessity for operational information being furnished by GHQ, SWPA, to a task force headquarters through Headquarters, Sixth Army, at least 30 days in advance of an operation. In the meantime, the Chief Engineer, GHQ, SWPA, also had been pressing continuously for the early release of planning information to subordinate headquarters, and was, through technical channels, furnishing such advance information as could be released in keeping with requirements of security and a rapidly changing tactical situation.

A few days prior to D Day for the Tornado Task Force, however, sudden revisions were made affecting both the tactical plan and the troop list, with the result that information relative to the size and disposition of the Task Force was insufficient for engineer planning. Initial construction planning, therefore, was limited principally to the airstrip and pertinent airdrome facilities which were to be developed on Wakde (Insoemoar) Island. Plans for the New Guinea mainland area were confined to the necessary minimum facilities to supply and bivouac the Task Force; no definite instructions were available for planning a resupply point and staging area for future operations. As a consequence subsequent engineer activities were adversely affected by the necessarily restricted planning.

Supplementing the endeavors and recommendations of engineers in higher echelons, the Task Force Engineer, in his report of the operation, stressed that more comprehensive directives should be made available prior to detailed planning by the Task Force Engineer staff. Moreover, to the participants it was evident that a task force engineer staff should be organized and located with the task force headquarters as far ahead of actual operations as possible. Usually the Task Force Engineer was more or less a stranger to the Task Force Commander who had little opportunity to determine the capabilities of his Engineer, or to take him into his confidence as far as the initial combat planning was concerned, and to benefit by any worth while recommendations which the Engineer might be able to offer. From the very beginning the Task Force Commander had his G-1, G-2, G-3, and G-4 participate in his planning. Unless the Task Force Engineer could similarly be made available early enough to share in initial preparations, it would be only natural for the Task Force Commander to turn to his Division Engineer (who might not be designated as Task Force Engineer) for engineering advice. As a result, deviation from a uniform type of planning and unified system of control desired by higher headquarters could readily occur.

Another recommendation resulting from the Wakde Islands–Sarmi operations restressed the need to release units scheduled for an operation from USASOS control in sufficient time between receipt of orders and date of actual operation for adequate preparation. Unit commanders should have sufficient information concerning the operation prior to loading out, particularly as to the type of mission that will be assigned to the unit and order of landing. However, during the planning phase of the Wakde operations there

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was not even time to establish liaison with the 836th Engineer Aviation Battalion, and the commander of this unit had to depend on the meager information he could obtain from the local base commander in the staging area. This left him at a disadvantage because adequate briefing necessary to the proper employment of his unit on this operation was necessarily delayed until his arrival in the objective area.

Preparations for adequate unit equipment were also necessarily conditioned by time available prior to the operation. In several instances engineer units were released to Sixth Army control by USASOS only a few days prior to the start of operations. Although every effort was made by Sixth Army to completely equip these units, the time element was often too limited to permit a positive check on the status of unit equipment and to take the necessary corrective action. Furthermore, units involved in this operation were widely separated during the planning phase, and it was impossible to assemble equipment scattered throughout various rear echelons to insure its timely arrival in the objective area. It was necessary to depend entirely upon the engineer of each of the different bases to see that these units were properly equipped. Some equipment not needed on prior operations of these units, but essential to this operation, was unfortunately, therefore, left behind. Time was even inadequate to insure that units going into the operation were properly equipped with allowances authorized by Tables of Equipment and of Basic Allowances. The result was that many units in the objective area were incapable of performing at full, normal efficiency.

Ships' Manifests. The importance of ships' manifests in expediting unloading was again forcibly evidenced. Construction materials, other than any diverted shipping, were loaded at Theater bases from requisitions submitted by the Task Force Engineer. These requisitioned supplies were loaded on one small ship and one Liberty ship and routed forward without accurate manifests of the materials aboard either ship. The only means for locating certain materials was dependent upon the memory of crew members who participated in the loading. In a number of cases this was not reliable and low-priority materials had to be unloaded while searching for critical items. A definite loading plan submitted by the Task Force Engineer, if adhered to, could conceivably have eliminated much time-consuming guesswork even without a manifest. However, in this hastily directed operation, where the Task Force Engineer could not determine in advance the respective bases at which certain categories of supplies would be loaded, it was impossible to prepare an accurate loading plan. Had such information been available for preparation of a definite loading plan and supplies loaded aboard ships in a systematic manner according to the plan, the unloading of urgently needed supplies could have been considerably expedited, particularly if accompanied by specific manifests.

Area Allocations. Prior to D Day, a detailed layout for the location of service units in the objective area should have been developed by concurrent planning between the officer designated for assignment as Air Engineer and the Task Force Engineer. Together, these officers should have agreed on a coordinated plan for the location and assignment of specific areas to air service units and their installations. Similar coordination with responsible Signal officers regarding the selection of sites for signal installations should also have been effected. As it was, a number of air service units moved into areas destined for future expansion of the airdrome. These units established their location without consulting the Task Force Engineer and with little regard for a layout map given them by the local air commander which indicated the planned development of these areas. This was due mainly to the fact that the local air command changed shortly after arrival, disrupting control over the varied air units. As soon as a permanent local Air Engineer was appointed, a coordinated effort was made to relocate these units. In some cases, however, they could not be moved in time to prevent delay in construction work.

Construction. Considerable enemy interference through the first 3 days on Wakde greatly impeded construction operations. During D plus 1 snipers continually fired at personnel working in the beach area. The infantry was too hard pressed for assignment to mopping-up operations, and an attempt was made by the engineers to eliminate snipers from the area where work was progressing. The effort met with partial success only; souvenir hunters from naval vessels and other service units continuously got in the line of fire. Had these men been properly controlled by their unit commanders, work could have proceeded much faster and casualties could probably have been reduced.

At dawn of D plus 2 an enemy patrol worked through the perimeter defense and into the motor pool area of an engineer aviation battalion. Before they could be wiped out, the Japanese set fire to several vehicles and some engineer equipment. The prevalence of these patrols behind the infantry perimeter defense made it necessary to send a security patrol along with all engineer equipment going to the airstrip on D plus 2 and D plus 3. No work could be done with safety on the night of D plus 2. Until D plus 5 it was necessary to keep all equipment working in one general area within a tight defense formed by a company of combat engineers. All infantry units were removed from the island on D plus 4, still leaving a number of the enemy in caves on the northeast corner of the island. To insure continued construction operations it was necessary to assign the job of clearing these caves to this same company of combat engineers. Four days later there were no more Japanese on the island.

During the next 2 weeks, work continued satisfactorily in daylight, but was halted frequently at night because of air-raid alerts. The airstrip was the target in all raids, and few items of engineer equipment were hit each time. At first it was difficult to get the equipment operators to return to their equipment promptly after the all-clear signal because sufficient warning had not been given prior to a raid to enable the men to find cover. This was eliminated by digging slit trenches with a ditcher each day near the area where the men would be working at night. The ready availability of these trenches enabled the men to find sufficient protection with just a few minutes' warning and greatly influenced the promptness of their return to work after each raid.

Despite delays occasioned by enemy interference, the 836th Engineer Aviation Battalion had the Wakde Drome operational by 21 May 1944, only 4 days after landing. By 16 July 1944 the 7,000-foot strip with its pertinent and extensive parking and alert areas, taxiways, and hardstandings had been completed. As soon as the tactical situation permitted, the engineers also repaired and extended roads linking key points both on the mainland and on Wakde.

Biak Island

27 May 1944

Recently captured airfield sites in the Hollandia area were still inadequate both in size and completeness for the staging of heavy bomber aircraft. Meanwhile, directed aerial reconnaissance had failed to locate suitable sites west of Hollandia other than on the island of Biak. Heavy bombers were, therefore, forced to continue operations from airfields in the Admiralty Islands, over 400 miles east of Hollandia, pending further amphibious operations to the westward. The strategic urgency of the situation was evident, and planning began for the seizure and occupation of Biak Island (Horlicks Operation) with subsequent establishment of airfields and air warning and minor naval facilities thereon.

The enemy had established three airstrips, Sorido, Borokoe, and Mokmer Dromes, all on the southern edge of Biak. With the accent on early seizure of airfield sites, Bosnek was selected as the landing area because of its close proximity to Mokmer Drome, and also because there was a break in the cliff line paralleling the beach in that area which permitted access to the interior of the island.[18] The first planning conference below the Theater level, held at Headquarters, Alamo Force (Sixth Army), Finschhafen, after analyzing the tactical feasibility of a successful amphibious assault on Biak, advanced the D Day date for the Wakde operation from 21 May to 17 May and scheduled the Biak operation for 10 days later. Since the conference for the operation was not held until the second week in May, little time was left for detailed planning.

The Hurricane Task Force, responsible for the assault in the Wakde area, and for the canceled Sarmi landing, employed the 41st Division (less one regiment) for the landing on Biak. These troops were subsequently reinforced by the 163d Regimental Combat Team upon its release from the Wakde operations so that the entire 41st Division, reinforced, was eventually engaged on Biak.

The Engineer, 41st Division, was designated as Task Force Engineer, and engineer units assigned for the assault landing were a task group of the 542d Engineer Boat and Shore Regiment (2d ESB), the 116th Engineer Combat Battalion, the 1112th Engineer Construction Group, and a survey detachment of the 650th Engineer Topographic Battalion. Subsequent echelons of engineer troops for the construction program included five engineer aviation battalions, a construction group, one construction battalion, a water supply battalion, an engineer light ponton company, a port construction and repair company, a petroleum distribution company, and an engineer depot company.

Amphibian Engineer Operations

Amphibian engineer support to be provided by the 542d EBSR task group, staging at Hollandia, consisted of a battalion of shore engineers, a boat group to be brought in on successive echelons of naval shipping, totaling 25 LCVP's, 67 LCM's, 1 LCS, and 1 control boat, and an ESB support battery group of 2 flak LCM's, 4 rocket LCVP's, 1 rocket Buffalo (LVT), 4 combat Buffaloes (LVT's), 28 troop-carrying Buffaloes (LVT's), and 3 rocket DUKW's. The plan called for the first three assault waves to be taken ashore in Buffaloes from LST's. Thereafter, DUKW's, LCVP's, and returning Buffaloes were to ferry the remainder of the troops and supplies ashore.

Rehearsal. The morning of D minus 4 was designated for a coordinated rehearsal of the assault waves of amphibian vehicles, the LST's to carry them, and the naval control vessels. Thereafter, barely sufficient time would remain to load LST's and to repair and service the vehicles. The rehearsal was held as planned, although only a few of the DUKW's to be employed took part. The troops to be landed did not participate. It was soon evident that the waves of LVT's, the DUKW's, and the naval control vessels were not prepared to operate as a coordinated team. Vehicles were discharged from the LST's smartly, but control as to timing, formation, and direction was lacking. Communications between control vessels and assault waves did not exist.

It was recognized that a second rehearsal to correct the deficiencies noted was desirable, but neither the LST's nor the amphibian vehicles could be spared in the time remaining. A conference was held instead on the afternoon of D minus 4 with all officers concerned and many of the vehicle drivers attending. The landing plan was thoroughly explained and measures were agreed upon to effect control and coordination. It was decided that the timing of assault waves crossing the line of departure could best be accomplished through assumption of control by each LST as to the time of launching its component of each wave.

Ship-to-Shore Movement. At first light on the morning of the actual invasion, it was impossible even from a point only 2,000 yards offshore to see the jetties which were to be the landmarks for the initial landings. The Task Force

[18] *Editor's note: See* Map No. 31, "Biak, Plan of Battle, Engineer Construction," Vol I, this series.

ESB Support Battery elements, in foreground, at Bosneck, Biak Island, on D Day after successful completion of assault landing. LST's in background are unloading over a recently launched ponton causeway.

Group of Fngineers clearing Japanese from a pillbox on the beach near Mokmer Airstrip, Biak.

Japanese cave defenses in these cliffs commanded sea and coastal road approaches toward the village of Mokmer.

Mokmer Drome, Biak Island—Coastal road leading (left) to Borokoe and Sorido Dromes.

Completed airdrome on Owi Island; Biak would be visible in the background of a slightly larger photograph.

carried excellent photographs of the beaches, but these photos were obliques and did not give the panorama from sea level. Soon after first light the naval and air bombardment started and smoke almost immediately obscured the entire coast line.

Meanwhile, at 0657, the first wave of Buffaloes (LVT's) left the LST's, and the second and third waves of Buffaloes started in at 5-minute intervals. These waves landed about 2 miles west of the proper beach because of strong westward currents and inability to discern the smoke-screened landmarks. The leader of the first wave stated that they were 50 to 60 yards from shore before they could see land through the smoke. Instead of the coral beach as expected, mangrove swamp was encountered. He then realized the landing had been effected far to the west of the jetties. Half the wave disembarked and worked through the mangrove to firm ground. The remaining craft executed by the right flank, took a course parallel to the beach for almost 2 miles to the vicinity of the jetties, and then landed. Fortunately neither group experienced enemy fire upon landing. However, the flank movement of half of the first wave, and, to a lesser extent, of the following second and third waves only 200 to 300 yards offshore, placed them in a vulnerable position should the enemy have decided to actively defend the beaches. Meanwhile, as soon as the smoke cleared and the deviation of the axis of attack to the west was appreciated, the naval control officer was able to turn succeeding waves and conduct them to the proper beach. Bomber aircraft, however, had no trouble identifying the jetties. This suggested that in future operations a naval cruiser might well catapult a plane into the air to check the exact beach location for control vessels before waves of landing craft moved shoreward.

Support Fire. The 120-tube rocket Buffalo and the three 120-tube rocket DUKW's of the ESB support battery group were not employed in the initial landing inasmuch as naval rocket fire was expected to be adequate for covering the approach run of landing craft to the beach. The Task Force Commander, therefore, scheduled instead as many troop-carrying vehicles as possible in the initial waves to insure sufficient troops ashore for seizure of the beachhead.

During the actual assault the naval support fire seemed excellent except for the fact that most of it was directed too far to the west because of the obscurity of the jetties. A part of the 40-mm. fire was too high, going clear over the bluff and exploding high in the air 3,000 yards beyond the beach. The LCI rocket fire was similarly misplaced, but it did cover the beaches well in the area designated for LCI beachings. All the LCI rocket fire observed was confined to too short a period. Buffaloes (LVT's) travel at a rate of only 120 to 160 yards a minute. Most of the rocket LCI's opened fire about 0710 when the first wave was about 1,200 yards from the beach, and firing was completed within a minute and a half. Thus the leading wave made the last 1,000 yards to shore with no covering fire except the fire from the four ESB support battery combat Buffaloes in the first wave and some from troop-carrying Buffaloes. For future operations it was recommended that the period of supporting rocket fire be extended to cover the leading wave while it closed from 1,200 yards to within 300 yards of the beach, or to about a duration of 6 minutes instead of only 1 to 1½ minutes.

Shore Party Activities. Unloading of LCT's and LST's and the distribution of supplies on shore by the engineer shore battalion with attached labor details were well handled. There were a few minor difficulties, however. Insufficient trucks were available to unload the four LST's at Jetty 1 and one LST at Jetty 2 because of the slow return of cargo trucks to the beach after their initial trip inland. The unloading of Buffaloes, DUKW's, and trucks in the dump areas was slow. Seemingly some junior officers were lax in control of their unloading crews, allowing men to wander off to look for souvenirs. At one time (1535) seven Buffaloes and five trucks were observed in the ration dump area with no details attempting to unload them. Traffic got into several unnecessary snarls caused by double banking of trucks and listless corrective action by some military police. Individual military police seemed to work more or less independently without officer coordination and leadership. Numerous souvenir hunters, including naval personnel, were observed.

Considerably facilitating unloading at Biak, on the other hand, was the effective use of ponton causeways. Their original employment attempted at Aitape by elements of the 3d ESB had proved impracticable in the 3- to 4-foot surf prevalent during that operation. But at Biak the sea was calm enough not to interfere with their launching, and so for the first time in the Southwest Pacific ponton causeways were used with success. Four ponton causeways had been taken forward on the sides of LST's. Two were installed on D Day, and the other two were anchored 400 yards offshore to be added to the causeway at the LCT beach after D Day. The latter were launched in the LST area, over 2 miles from the LCT beach, where they were eventually used. Two LCVP's and a tug towed them to shore and maneuvered them into place. It was evident, however, that piles should always be driven as soon as practicable after placement of a causeway. If the seas had become rough, only firm pile clusters could have held these unwieldly pontons in position.

Although the initial landing met with little opposition, nonetheless resistance was encountered in establishing the beachhead. An almost vertical coral cliff ran parallel to the beach about 200 yards from the water.[10] This cliff was honeycombed with caves in which the enemy had placed mortars, machine guns, and snipers. Shore engineers frequently had to fight before they could perform their work.

ESB Support Battery. When it came to fighting, the ESB support battery proved itself indispensable throughout the operation. It was called upon to silence enemy mortars and to place rocket fire on strong points. Mortars and dugouts were promptly reduced. Seven enemy aircraft were brought down by the battery's effective antiaircraft fire. Its Buffaloes while on a resupply mission rescued an infantry battalion which was cut off for a day and a half when the enemy drove a wedge between advance elements approaching Mokmer Drome and their line of communication along the narrow beach to the initial landing point. As the lumbering Buffaloes approached the Japanese positions along the beach, enemy field guns opened up on them with such accurate fire that all but one were forced out to sea. One Buffalo driver ran his cumbersome craft in a zig-zag approach run to the beach and somehow eluded shells bursting on all sides of him. He brought the hard-pressed battalion ammunition, their first rations and drinking water since the previous night, and, most important, blood plasma and morphine for the seriously wounded. Then he loaded all the wounded he could carry in his Buffalo and ran the gauntlet of Japanese fire again. Impressed by the success of this single craft, the commander of this Buffalo detachment decided to commit his craft one at a time to present a smaller target. The strategy worked. Rocket Buffaloes let loose at the caves with everything they had while their troop carrier counterparts successively grounded over the coral to take aboard loads of soldiers and put out to sea, never pausing until they had moved the whole battalion back to safety.

Mission Accomplished. The Biak operation was officially closed on 20 August 1944. Amphibian Engineers had not only carried, but *thrown their weight.* In the original D Day assault the number of troops and the amount of equipment and supplies landed over a difficult and imperfectly known beach, practically without casualty, had been far in excess of expectations. The troops in the *assault* landing numbered more than 12,000; equipment and supplies included 12 medium tanks, four 155-mm. howitzers, twelve 105-mm. howitzers, twelve 75-mm. howitzers, and an estimated 2,400 tons of bulk

[10] *Editor's note: See* Map No. 31, Vol I, this series.

cargo plus 600 tons mobile loaded. The invasion definitely had been a success. However, in order that erroneous conclusions may not be drawn from this success, it is important that the fundamental reasons for it be stated. They were: (1) complete tactical surprise, (2) weak enemy resistance at the beachhead reduced considerably by preinvasion air and naval bombardment, and (3) a landing force composed of seasoned, experienced troops.

During the period 27 May–20 August, while gains on Biak were being consolidated, the 542d EBSR task group unloaded 66 LST's, discharging a total of 23,898 tons, and 51 cargo vessels, discharging a total of 108,746 tons. Its boats made 32,039 sorties covering a distance of 174,485 miles, carried 190,781 personnel, and lifted 175,040 tons.[20]

The performance of the ESB support battery in the battle for Biak had been so outstanding that some news reporters termed the operation "the Buffalo victory." Through their tireless and gallant efforts the capture of Mokmer Drome had been made possible. They had saved the lives of many casualties by their prompt action in evacuating wounded from forward beaches. Their exceptional service merited and received official recognition—the award of the Distinguished Unit Citation on War Department General Orders, No. 66, dated 10 August 1945.

Task Force Engineer Operations

Preparatory Intelligence. The Hurricane Task Force found itself under an immediate handicap by the changing of operational plans on such short notice. The shift in objective area from Sarmi, Netherlands New Guinea, to Biak Island, as discussed in the previous Wakde Islands operation, was wise, but so late as to materially impede adequate planning and preparation.

A considerable amount of preliminary engineer intelligence data on Biak had already been assembled by the Office of the Chief Engineer (OCE), GHQ, SWPA, and this assisted in the selection of this objective rather than Sarmi. Concentrated effort on the study of aerial photography as soon as available by the Engineer Intelligence Section, OCE, GHQ, SWPA, in the limited time remaining enabled the production in manuscript form of sketch maps detailing all possibilities of the engineer phases of the operation. However, final publication of the engineer annex could not be accomplished prior to 20 May despite the most extraordinary efforts. Distribution of the annex in quantity, therefore, could not be made in time for its use by the units engaged in the operation.

Also pressured for time, and considering the means afforded, the Engineer Section, Sixth Army, did a remarkable job in issuing available maps. The only existing map was a sketchy 1:250,000 sheet of poor quality. Contact with OCE, GHQ, SWPA, evidenced that there would be insufficient time for the Base Map Plant at Melbourne, Australia, to prepare maps from aerial photography for the Task Force. Besides, the only aerial photography available had been obtained from a few flights along the coast extending inland about 1 mile. Better coverage could not be obtained in the limited time. There was no alternative, with time so short, except to have the 69th Engineer Topographic Company (Corps) prepare the 1:63,360 sheets and the 1:20,000 battle map-photomaps. The resulting maps were poor. Using these maps, however, together with general information made available by GHQ, SWPA, regarding terrain, the Task Force formulated its plans. Provided with evidence of a wide, fringing coral reef, the Task Force Engineer paid special attention to problems incidental to the initial landing of men, equipment, and supplies. Information regarding the existence of two jetties at Bosnek determined the method of loading of engineer troops and equipment. Shortly after D Day when additional photography was secured, maps were revised and distributed in time to be of use in the later phases of operations.

[20] *Editor's note:* These figures included attached craft—LVT's, DUKW's, and LCT's.

Planning. Changes of target dates and areas in directives and increases and decreases ordered in the construction of facilities, while playing havoc with planning and efficiency in this operation, had one salutary effect: they again stressed the normal objective that advance planning of all staff sections should include *all* service requirements of the proposed base involving construction. These plans should have determined such requirements as conclusively as possible to eliminate the need for constant changes which disrupted the plans of the Task Force Engineer and working efficiency of engineer units. Proper planning, resulting in smooth and progressive work without constant tearing up and reconstruction, is a major morale factor in addition to being a prerequisite to the effective execution of an operation.

Factors Limiting Effectiveness. Initial plans for landing of engineer units and supplies were somewhat modified for later echelons because of revisions in directives and the scope of the project, as well as shipping availability. In this connection, shipment by air of various detachments to expedite their arrival in the objective area did not prove very satisfactory. The limited capacity of air transport prohibited these troops from bringing along housekeeping equipment, vehicles, and heavy equipment needed for smooth operations upon arrival in the operational area. This threw an added burden on the few engineer units already in the area.

Enemy interference prevented early concentration of the engineer units available on required construction as planned. Once again engineer troops and equipment were utilized to assist tactical units to the detriment of the over-all engineer mission. As an example, combat engineer duties were executed by a company of aviation engineers during the period 10–20 June. This unit, working on Mokmer Drome under fire, had repaired 2,300 feet of the runway until intensified enemy action permitted only intermittent work. By direction of the Task Force Commander all work on the drome was discontinued, and this unit was assigned to provide combat engineer support to infantry troops holding desperately their hard-won position on the drome. Engineer support in opening temporary supply roads and destroying pillboxes was outstandingly performed by aviation engineer troops green to combat conditions. However, the employment of these aviation engineers to transport food, water, and ammunition, and to hold a portion of the defense perimeter, while undoubtedly essential in this instance, adversely affected the established construction schedule. Such diversion of engineers, engaged in construction, reduced the advantages gained by early capture of an airdrome site because it retarded engineer development of runways and allied facilities essential to speedy air support. Therefore, though the combat operations of these aviation engineers were outstanding, they, nevertheless, represented an expenditure of highly trained technical personnel on a mission which should have been accomplished by the infantry or service troops with less pressing responsibilities than those assigned to the engineers in this early phase of the operation. This was expensive use of engineer effort.

Supplies and Equipment. Equipment of initial engineer units ashore was in poor condition with the extremely unusual exception of one aviation battalion which had a month to repair equipment and prepare for the operation. Other units were handicapped by the excessively heavy operation of equipment in the staging areas up to time of outloading coupled with an inadequate supply of spare parts available to them. Experiences of the 808th Engineers with regard to equipment in this operation explicitly demonstrated the administrative and supply difficulties under which engineer units performed their missions—even units which came in, as the 808th, after the assault and reinforcing phases of the operation had long been concluded.

This battalion upon the close of the operation at Saidor, Northeast New Guinea, continued work on airdrome dispersal areas, docks, bridges, roads, and buildings at that base until 9 May when all projects were completed and only maintenance of existing installations was required. On 5 May the 808th Engineers had been relieved from attachment to Sixth Army and had reverted to USASOS control for administration and operations. Every effort was made during the slack period to repair equipment which was repairable and to obtain replacements for equipment requiring major overhaul so that the battalion would be properly equipped for the next move. As a result of engineer and ordnance inspections, the battalion was ordered to turn in all dump trucks, approximately halt of all remaining vehicles, and all heavy tractors for major overhaul and rebuilding. Efforts to repair other equipment which could be handled direct by the battalion shop were handicapped because of the nonavailability of spare parts.

The battalion was reattached to Sixth Army effective 17 June 1944, and was alerted for movement to Biak on or after 30 June 1944. Thirty days level of Class I, II, III, and IV supplies, including cots, heavy tentage, all organizational supplies, antimalarial supplies, and three units of fire were to be taken. Action was initiated immediately to procure all classes of supplies for the movement. Repeated efforts were made to have equipment requiring overhaul replaced and spare parts procured for that which could be economically repaired. Instructions were received to leave the trucks and equipment recommended for major overhaul and salvage with ordnance and engineer depots at Saidor; their replacement by subsequent direct shipment to Biak would follow. However, no information was available as to when shipment might be expected. Past experience in such matters indicated that a period of from 2 to 6 months would probably elapse before a high enough priority could be obtained to make shipment possible. Therefore, to prevent the battalion from arriving on a new mission without any heavy tractors and only one-fifth of its authorized number of dump trucks, nine of the best old dump trucks and five old heavy tractors were included in the loading plan.

On 4 July 1944 a radio message was received from Base F, Finschhafen, Northeast New Guinea, advising that *Vessel R-1728* would arrive at Saidor on 7 July 1944 to load the 808th Engineer Aviation Battalion plus as much of the 874th Airborne Engineer Aviation Battalion equipment as space permitted. This message reflected meager logistical appreciation of the weight and space requirements of equipment in an engineer aviation battalion, particularly since lists of the equipment of both the 808th and the 874th had been previously furnished to the Engineer, Base F. Loading plans based on scale drawings of *Vessel R-1728* indicated that the ship would take only 80 percent of the 808th's equipment, exclusive of that left behind for salvage, with space between decks in Nos. 1, 3, and 5 holds, and on deck for only 500 officers and men. This necessitated leaving Company A and a detachment of Headquarters and Service Company, totaling 7 officers and 210 enlisted men at Saidor. Equipment requiring a loading area of 4,100 square feet would also have to be left behind. This consisted principally of asphalt equipment, rock crushers, and the organic transportation of Company A. Base F was notified immediately of the complete shipping data on the remainder of the 808th personnel, and a list of the equipment and logistics for the 874th were again forwarded for information purposes.

The vessel, a Liberty ship, arrived as scheduled, with no provisions for troop accommodations, no dunnage for covering bottom bulk storage, and only 200 life preservers. Troop accommodations were hastily improvised. Bulk stores were covered with 4- and 6-inch timbers, one-half of which were available from stocks in the depot and the rest gathered piece by piece from old, abandoned camps. Additional life preservers were flown up from Finschhafen on request. The battalion began loading for movement from Saidor. No information had been received in the meantime as to action taken to reequip it with replacement tractors. Only 10 dump trucks were received to replace the 50 ordered turned in.

The 808th Engineers arrived at Biak on 27 July and unloading of all their equipment and supplies was completed on 30 July 1944. By 28 August the replacement tractors and dump trucks had not yet arrived. The battalion, in the meantime, had been able to keep an average of 2 of the old tractors and 12 dump trucks in operation. Because of the shipping shortage, the rear echelon, left at Saidor, had also not yet been able to move up to join the battalion.

The small percentage of authorized key items of equipment on hand, and the fact that supply agencies had been unable to reequip the battalion for this assignment, had a demoralizing influence on both officers and men. The entire battalion had been looking forward to working under the almost ideal conditions existing at Biak for runway construction; on every one of their last three major projects, these men had operated under difficulties of heavy rains, unsuitable soil conditions for runway construction, and costly production of paving materials. However, it was not until 22 September that the battalion received any additional equipment. On that day, three new dump trucks arrived. On 26 September they were issued another slight increment—four rebuilt tractors resplendent with new coats of paint. One had seen 4,357 hours' service, one would not start, one had a leaking radiator, another a smoking motor. Of the lot only one was in condition for assignment to runway construction. Heavy equipment requirements were finally met by 6 October—after the battalion had been alerted for movement from Biak.

Meanwhile, all attempts to get the rear echelon transported from Saidor to Biak had proved fruitless. A Liberty ship dispatched during the middle of September to pick up the remaining troops and equipment had failed to reach Saidor ahead of a severe storm which blew a Dutch ship clear through the dock at Saidor and completely wrecked the landing pier. Subsequently, when movement of the 808th Engineers from Biak was being contemplated, staff officers in higher headquarters, without appreciation of the resulting effect, decided to leave all remaining 808th equipment at Saidor and ship only the personnel so as to ensure the early consolidation of the unit prior to movement. This was finally accomplished via LCI's on 28 September. The personnel from Saidor had had so little time to load that they arrived at Biak on 3 October even without footlockers.

One of the weakest links in the engineer effort in this Theater, over and above personnel and construction material shortages and low transportation priorities, continued to be the inability of supply agencies to properly support engineer units in forward areas by timely replacement of old and unserviceable equipment and by provision of even a necessary minimum of spare parts constantly needed for repair. Three engineer aviation battalions at Biak (808th, 860th, and 863d) were able to keep an average of only two large tractors per battalion in operation by improvised repairs and by the undesirable and costly practice of *cannibalization*. Yet the Tables of Organization and Equipment under which these engineer aviation battalions operated authorized 18 large tractors per battalion.

A study of the Biak operation concluded: "Spare parts situation: *NORMAL—ACUTE SHORTAGE AS USUAL.*" Engineer combat and engineer aviation battalions arrived with limited spare parts. Around-the-clock operation of equipment caused a large percentage of it to be constantly deadlined for lack of spare parts. Radioed requisitions for spare parts were submitted, and by the middle of July a total of 3 requisitions out of 40 submitted were filled.

Need for Balanced Construction. The Chief Engineer, GHQ, SWPA, striving for balanced construction programs, had been repeatedly stressing on the Theater level and within the staffs of subordinate commands, including Sixth Army, the need for allotting high priority to engineer supply shipping and to the movement of engineer units involved in task force operations. However, at the demand of the commanding general, Advance Echelon, Fifth Air Force, air units preceded construction units into the Biak area. Their early arrival was not only inconsistent with the time of their employment, but their use of critical shipping space prohibited the early movement of engineer units into the area and resulted in a serious delay to construction. In this connection, the importance of a balanced construction program, the service forces and means necessary for its accomplishment, and its relation to successful tactical operations was discussed at some length in a letter from the commanding general, Sixth Army, to the commanding general, Fifth Air Force. The indisputable principles for sound operations stressed in the following quoted excerpts, are applicable with equal significance in any theater of operations:[21]

The construction of airdrome facilities is considered paramount with the mission of occupying an objective area by all responsible individuals of this command. As you know, in order to construct airdromes, other facilities such as jetties, docks, and roads are equally essential adjuncts to permit the discharge of personnel and cargo and to permit air operations and supply to function upon the completion of dromes. Task Force commanders are, and constantly have been, impressed with the necessity of prosecuting a *balanced* construction program which calls for the most astute judgment to insure that priority of effort is concentrated at the right place and at the right time—all with the end in view of operable and secure airdrome facilities at the earliest possible date.

In this connection, as you know, GHQ construction directives have required the prosecution of such a program by often placing an equal—and, in the assault phases, sometimes greater—priority on the necessary port facilities to discharge cargo than on airdromes. I believe it would be most helpful, both to your headquarters and to mine as well, and to your representatives in the field as well as my task force commanders, if comprehensive recognition were given the entire construction program as well as air facilities. I believe if this can be effected that many of the misunderstandings that have arisen can be eliminated.

For instance, the arrival of engineer construction units in the objective area, the unfavorable engineer equipment situation, and inadequate parts supply are obviously factors of the greatest importance in their effect on the airdrome construction program. Although, for the Biak operation, I have constantly given high priority within this command to the loading and movement of engineer organizations it will probably be three months (from D-Day) before they are closed in the Biak area. Most of the competition for forward call of vessels in this respect has been furnished by the required movement of Air Force troops which you have repeatedly urged as necessary to your operations. . . . It should be noted that this conflict between Air Force and Engineer troops has existed primarily because of the lack of port facilities, which, in turn, are in competition with airdrome construction requirements.

. . . . .

This headquarters, of course, has endeavored, throughout the course of operations, to meet GHQ construction schedules and I have of necessity assumed that various factors, such as Air Force operating requirements, the means made available to this headquarters for construction, the shipping situation, etc., have all been duly taken into consideration by GHQ in establishing target dates. Naturally any schedule required to be devised jointly by our representatives in the field must likewise take all factors into consideration and arrive at the best solution. In this connection, I am informed that a meeting was held by the Task Force at which your representative was present and it was indicated that the Borokoe Drome could be completed on 20 August for one fighter group, to which no exception was taken by your representative. When your radio of 7 August was received, work involving the completion of Liberty dock approaches and the repair of a critical main road was being prosecuted concurrently with Borokoe Drome. A report from the Task Force Commander indicated the imperative nature of the repair of the road in question, which was in such deplorable condition that it was greatly affecting unloading operations and had caused the deadlining of a large percent of motor transport. Nevertheless, since this road had been rendered passable by that time, the diversion of equipment from docks, avgas installations, important roads, and combat engineers in support of distant outlying troops was directed by the Task Force Commander in order to meet the 5-day earlier date. This was done at the expense of necessary equipment to keep up the prescribed GHQ port construction schedule. The overall loss of productivity in switching engineer units hastily from one essential job to another is obvious, but was sacrificed in an effort to meet your operational needs in this particular case.

. . . . .

There is one further point that I feel should be brought to your attention in connection with a mutual understanding of the entire problem. I note in your letter . . . that you suggest that, if vessels loaded with fuel and bombs were anchored in the harbor at Biak instead of at some rear port, such supplies could be unloaded as needed and that, therefore, in the initial stages of construction this would save effort for dump and road construction with the resulting earlier forward displacement of Air Force combat units. I agree that such a plan has considerable merit, and I have suggested that it be done in the case of ships containing dock material. However, this is exactly our problem in that I am constantly under the strongest instructions from GHQ to unload and turn around ships as fast as possible, and I can say unquali-

[21] Pers Ltr, Lt Gen Walter Krueger, CG, Alamo Force, to Maj Gen Ennis C. Whitehead, CG, Fifth Air Force, 16 Aug 44. In Sixth Army files.

fiedly that this requirement is the greatest single factor competing with airdrome construction. . . .[22]

In sum, I fully recognize that certain minimum airdrome facilities must be provided in order that you may properly fulfill the missions assigned your command. I propose to continue to conduct operations in an effort to meet Fifth Air Force requirements, but it should be equally recognized that such requirements must be consistent with the means available and other requirements imposed; and that a balanced program must be prosecuted that insures overall operational and supply feasibility of air operations on dromes in accordance with the completion of various phases of their development.

Availability of Engineers. The problem of engineer troop availability at objective areas in time to meet scheduled target dates ranged between the Theater and task force levels. The decision as to what units, whether tactical or engineer, went into an operation was the prerogative of the Task Force Commander, held responsible for the success of the operation. Priority of movement of air units was decided by Sixth Army which determined also their loading on LST's and cargo ships, and, in general, arranged the echelon. While the Task Force Engineer indicated a need for intervention by Sixth Army to increase the availability of engineer units at Biak, Sixth Army was confronted with the Fifth Air Force demands for movement priorities considered essential to scheduled performance of aerial missions assigned by GHQ, SWPA. These circumstances predisposed the Engineer, Sixth Army, to turn to the Chief Engineer, GHQ, SWPA, for a solution whereby construction target dates established in operations instructions would conform to a seemingly fixed engineer availability curve. The Chief Engineer, GHQ, SWPA, having determined the engineer troop list for the operation, agreed that perhaps an optimistic rate of engineer troop movement had been assumed. On the other hand, he felt that the exacting target dates should help both the Engineer, Sixth Army, as well as the Task Force Engineer, to secure from their staffs a reasonable movement of engineer troops with which to accomplish essential construction. The fact remained that the Task Force Commander, and, in turn, the commanding general, Sixth Army, were autonomous as far as permitting or refusing to permit themselves to be coerced into moving certain types of units in ahead of others. The engineer availability curve, therefore, while fixed as to the number of battalions assigned, was, nevertheless, flexible and dependent upon the rate at which these units were moved into the objective area.

Pressure of air commanders alone did not tip the scales when weighing responsibility for committing unbalanced forces to an operation. Ground commanders and staffs evidenced a recurrent lack of appreciation for the early employment of engineer troops. This underestimation undoubtedly resulted from the fact that the vital role, necessary to logistical support, performed by the engineers in actual combat operations had not been simulated in a realistic manner in maneuvers in the United States. Nor were logistical matters the everyday problems of division commanders and their staffs. On the contrary, the very system which permitted them to devote all their time to tactical issues until they arrived in the combat zone deprived them of the opportunity of facing logistical issues. In the United States, logistical responsibility was assumed by Army Services of Supply (later Army Service Forces), and in the Theater, by USASOS bases where divisions were staged. Inadequate appreciation and understanding of logistics, including engineer problems, by tactical task force commanders, therefore, developed as a matter of course, and logistical considerations in forward

[22] *Editor's note:* In explanation of the Sixth Army commander's remarks regarding instructions from GHQ, SWPA, to unload and turn ships around as fast as possible, it should be pointed out that the prompt release of shipping from task force supply points was necessary for movement of units, essential for effective support of future operations, from the South Pacific and rear areas to the Southwest Pacific. Because previous inadequate provision had been made for prompt transfer of engineer units from the South Pacific to the Southwest Pacific, one engineer aviation battalion and four engineer aviation companies committed to SWPA were withdrawn by the War Department. Delay in moving urgently needed units from the South Pacific did not compare favorably with repeated urgent SWPA requests for these units and SWPA representations of a need for their early operational employment.

areas suffered. So did the engineers. Shipping priorities for engineer units and their supplies did not prove proportionate to the need for engineer support which manifested itself on the far shore. As a consequence, the delayed arrival of sufficient engineer units retarded improvement of port capacity and construction of access roads and dumps essential to prompt discharge of shipping. In turn, tremendous backlogs of shipping accumulated, curtailing turnaround shipping urgently necessary for bringing in reinforcing units. The deduction was, and is, obvious. Engineer plans must be considered in conjunction with tactical plans. Otherwise, if provision for adequate engineer support and necessary shipping and priority of movement for engineer troops and supplies is not made, a commensurate delay in the completion of essential requirements must be accepted by tactical commanders.

Construction Accomplished. Despite all obstacles, however, the engineer units at Biak displayed enterprise and perseverance of the highest order in accomplishing the task required. By 20 August the runway at Mokmer Drome had been extended to 7,000 feet, with 27,000 feet of taxiways and 122 hardstandings. By the same date, Borokoe Drome, consisting of a 5,500-foot runway, 6,300 feet of taxiways, and 35 hardstandings, was completed. Construction of Sorido Drome, which by 12 August 1944 had a 4,000-foot runway usable for transports, was temporarily curtailed by a change in plans, and completed later. On neighboring Owi Island a 7,000-foot runway with 7,500 feet of taxiways and 52 hardstandings was operable by 12 July. By 20 August 1944 a second 7,000-foot runway had been completed on Owi Island with 20,000 feet of taxiways and 130 hardstandings.[23]

Other facilities were established concurrently. Twelve LST slots were completed by 10 July. A Liberty floating dock was built by 20 July and work on a triple-berth fixed Liberty wharf was started on 4 August. The latter, however, was not completed until the end of September because of delays occasioned by shortages of supplies. By mid-August a fuel jetty was established for bulk unloading, and a few days later a field hospital was in use. A major bomber base was quickly taking shape under the untiring efforts of the engineers whose limited numbers throughout the Theater necessitated their maintaining a speedy rate of progress in the face of all odds.

Noemfoor Island
2 July 1944

The rapid Allied advance along the northern coast of Netherlands New Guinea apparently increased the importance of Noemfoor Island in Japanese strategy. (See Chronology.) Evidence of enemy activity to develop the airstrips on the island gave impetus to GHQ, SWPA, planning for supplementing the landings on Biak by seizing Noemfoor. Not only would such action immediately nullify any Japanese development of Noemfoor, but Allied establishment there of air and minor naval facilities could neutralize the major Japanese base at Manokwari, located approximately 50 miles to the west on the coast of Netherlands New Guinea. The long deferred Cyclone Task Force was, at last, actually formed around the smallest separate component of the Hurricane Task Force, the 158th Regimental Combat Team. Reinforced by artillery, antiaircraft, tank, engineer, and service units to a total of 7,078 men for the initial assault landing, the 158th RCT was further supported, subsequent to its amphibious attack, by the 503d Infantry (Parachute). Prior to and during the entire operation, naval forces maintained patrols, preventing any reinforcement of the Japanese garrisons on Noemfoor. For 3 weeks preceding the operation, Noemfoor was continuously and heavily pounded by aerial and naval bombardment which reached unprecedented intensity in a record attack the day prior to the landings.

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[23] *Editor's note: See* Map No. 31, Vol I, this series.

Kamiri Drome, running parallel to the northwestern shore line of Noemfoor,[24] was selected as the landing point because, from aerial photographs, it was evident that the barrier reef surrounding the island at that point was relatively smooth and level. The availability of good vertical and oblique aerial photographs was of considerable assistance in the selection of this landing beach as well as for the development of a special plan to insure a successful landing. The early evidence of the unnavigable reef surrounding the island which these photographs furnished, prevented any possibility of a repetition of the situation experienced by the Marines at Tarawa. These photographs permitted the usual pattern of amphibious attack to be modified to circumvent existing obstacles, and instead of the small landing craft generally used, sufficient LVT's (Buffaloes) and DUKW's, which could be landed successfully were designated to transport the initial assault waves to shore. Of considerable assistance also were the excellent maps of Noemfoor Island, prepared from aerial photographs by the Base Map Plant at Melbourne, Australia. Sections of the 1:20,000 map, including Kamiri and Kornasoren Dromes, were suitable for naval use and were overprinted to show naval gunfire target areas, transport areas, landing craft lines of departure, and beaches.

Elements of two engineer special brigades were employed in support of the Task Force. The 3d Engineer Special Brigade furnished the Shore Battalion, 593d EBSR, and one boat company, operating 42 LCM's, of the 543d EBSR, together with regimental headquarters and medical detachments. The 2d Engineer Special Brigade furnished the 2d ESB Support Battery, operating 3 flak LCM's and 41 LVT's.

Landing Craft Activities. Participation of the boat company from the 543d EBSR, for lightering of supplies and subsequent far shore operations, involved movement of this company under its own power from Finschhafen to Noemfoor. This was an extraordinary trip for small craft inasmuch as the distance to be covered exceeded 1,000 miles. Fortunately, only a few breakdowns occurred en route, and these were repaired while underway by the company maintenance LCM taking the defective craft in tow until it could proceed independently. The company made the trip without the slightest organic operational difficulty. Refueling presented the only problem. Fuel secured en route had to be examined before taking it aboard as inferior grades of diesel oil were found in certain of the Liberty ships used for refueling. Refueling arrangements with fuel depots at each port of call en route were made with difficulty. These depots evidenced a natural reluctance to independent refueling of a large number of small craft because of the time involved. The answer to this problem, suggested in subsequent reports, was an escort of LCM's equipped as fuel boats to accompany each boat company convoy. Through provision of such fuel boats, not only an adequacy of fuel when required, but faster refueling could be insured. The LCM fuel boats could secure a sufficient load alongside of a fuel ship or dock to refuel all other craft when necessary, and would eliminate the necessity of individual LCM's maneuvering alongside distribution points to secure fuel direct.

Naval schedules established had not taken into consideration the problems of running small craft, and this boat company arrived at Toem, Netherlands New Guinea, with only 7 hours remaining in which to unload all of its equipment, strip its boats for combat loading, reload, and refuel. Nevertheless, all of the LCM's left Toem on schedule with the Navy LCT's and joined the main naval convoy, carrying the support battery's Buffaloes (LVT's) from Wakde, off the far shore.

Outloading Problems. The Task Force staged at Toem, and loading plans were drawn up at this point by the staff. Shipping was

[24] *Editor's note: See* Map No. 32, "Noemfoor, Plan of Battle, Engineer Construction," Vol I, this series.

loaded by the 3d ESB elements right up to sailing time because bulk supplies and landing craft to be loaded for the initial assault phase kept arriving until the last minute. Several factors contributed to making the outloading of the Shore Battalion, 593d EBSR, a more difficult than ordinary procedure. (1) The Tornado Task Force, after initial operations in the Wakde Islands area, had encountered unforeseen enemy resistance on the New Guinea mainland in the vicinity of Maffin Bay which necessitated large increases in supply requirements. These were filled by deleting some of the equipment and materials allocated to the Cyclone Task Force for the Noemfoor operation. (2) Relief units for the 593d EBSR, which was still busily engaged in unloading harbor shipping and in construction activities in the Toem area, were not available early enough to permit the Shore Battalion, 593d EBSR, to adequately service its equipment before outloading. In addition, the late arrival of relief units left staff personnel limited time for detailed planning, besides preventing release of sufficient personnel to competently supervise outloading. In fact, shore battalion personnel directed cargo unloading from the harbor until the moment they boarded assigned Task Force shipping. (3) Outloading plans for cargo and personnel were retained to a great extent at unit command posts instead of being disseminated down to loading points. Loading officers were appointed for each LST, but smaller craft either had no loading officer, or one insufficiently instructed.

Ship-to-Shore Movement. Profiting by the lesson learned at Biak, a destroyer, assisted by a spotting plane, was in position off the beach upon arrival of the control ships to insure that they took proper stations initially. H Hour was set for 0800, 57 minutes after sunrise. This was later than was customary in this area, but was adopted with the double purpose of allowing more time for prolonging naval gunfire bombardment and to insure the existence of sufficient light for accurate beach identification. The naval bombardment of the beach commenced at 0630 and continued until just before H Hour. The first wave of 16 LVT's (Buffaloes) hit the beach at 0803. Four of the Buffaloes rendered close fire support by strafing the beach and firing rockets overhead until the wave was only 200 yards from the beach.[25] The two succeeding waves hit the beach at 3-minute intervals.

The first three LCM's employed in the landing were badly damaged about the hulls in an attempt to jump the reef by hitting it at full speed. The following craft thereupon merely deposited their loads on the edge of the reef. Tanks and engineer tractors and bulldozers were carried forward in 13 LCT's. They were landed with the assistance of DUKW's and Buffaloes, beginning with the eighth wave, across the coral reef. The successful landing of these vehicles was considered to be so vital to the success of the operation that the risk of serious damage to the LCT's on the reef was accepted.

Between the beach and Kamiri Drome was a 20-yard strip of undergrowth, small trees, and bomb-cratered sand dunes. The slope from the beach to this area was gradual. Troop-carrying Buffaloes approached it, crossed it with very little opposition, and unloaded. After that, the Buffaloes immediately proceeded back across the reef and began ferrying troops and supplies and salvaging DUKW's and wheeled vehicles from the coral ledge under increasing mortar fire. Practically all vehicles up to and including 2½-ton cargo trucks, whether waterproofed or not, had to be towed from the reef until a lowering tide permitted their debarkation and movement ashore without choking of submerged motors.

Shortly after the initial landing, the enemy set up a fairly heavy concentration of mortar and

[25] *Editor's note:* While it is difficult to assess the destructive power of rockets, it seems significant that in every operation in this Theater where rockets were used, enemy resistance at the beach was negligible. While of doubtful value against dug-in positions, they prevented any aboveground movements. Their bursting zone is horizontal rather than conical, as is a bomb burst, and the concussion waves of bursting rockets were distinctly felt 1,200 yards offshore. There was no doubt of their favorable morale effect on troops of the leading waves.

On D Day, Engineers exit from beach to site of Kamiri Drome, Noemfoor Island.

Elements of 503d Infantry (Parachute) land at Kamiri Drome on D plus 1 where Japanese-constructed runway is being improved and extended.

heavy artillery fire in the water area between the beach and the ships. Without regard for their own safety, the Buffaloes continued to haul troops and supplies from ship to shore and moved wherever needed to tow stranded vehicles and equipment onto the beach. The crews worked the entire day and the greater part of the night without letup.

Shore Party Activities. At several times between H and H plus 3 hours, the reef was dangerously crowded with vehicles. Ashore, men were prone to get to the beach, bunch up, and sit down, and had to be practically pushed forward by representatives of the shore party commander so as not to impede organization of the beachhead. Also, incoming cargo was dumped in large quantities on the very small beach instead of being moved directly to the dumps farther inland. Subsequent reports attributed these irregularities to a poor dissemination of landing plans whereby many men and officers were landed on the beach with little or no instructions, and to an insufficiency of guides provided by the shore battalion.

The establishment of the shore party command post in a DUKW proved extremely valuable. It was mobile, protected from the elements, and carried all its communications and accessories along with it. Radio microphones and earphones were equipped with service extensions for use outside the DUKW if necessary. Later, a large cut was made in the side of a sand dune which provided excellent protection from shrapnel and strafing, and telephone lines were dropped in without any trouble from the shore battalion switchboard. This command post was located in the center and to the rear of the beach until D plus 15 with the shore battalion command post close by.

Maintenance of all ESB equipment, both ground and amphibian, was very difficult during the early phase of the operation. The majority of vehicles required a major check-up and overhaul at the first opportunity because of the immersion of motors in salt water during the wet landing. Angledozers and trucks required considerable maintenance because of the beach terrain which forced them to work continually in and out of salt water and over rough surfaces. Such maintenance was particularly difficult because of the limited spare parts available for vehicles. DUKW's were used extensively because of the nature of the operation, and, owing to their frequent trips over the coral reef, predominated among deadlined units. By D plus 20, only 20 percent of the DUKW's were operative. This was not due to a lack of mechanics or maintenance facilities, but rather to a lack of spare parts peculiar to DUKW's such as boots, seals, wheels, shafts, and struts.

ESB Support Battery. The work of the 2d ESB Support Battery in this operation was outstanding. Its assigned mission was to place assault infantry on the far shore and to protect their initial advance with automatic-weapon fire. When the troops were landed, the battery divided into two groups. One group, working under mortar fire, used its Buffaloes to pull wheeled vehicles and DUKW's over the coral reef. The other group advanced over Kamiri Drome with the assault infantry. When enemy soldiers ran from the seaward side of the drome runway to gain protection of the fortified positions dug into the limestone terraces on the inland side, the support battery went into action. Only a few of these Japanese succeeded in reaching the positions armed with mountain guns and 37-mm. cannon which threatened to hold up the advance. Unhesitatingly the support battery, using its light amphibian Buffaloes as land tanks, advanced to within several feet of the fortified entrances, and blasted the positions with flamethrowers and automatic weapons.

The combat Buffaloes performed missions over and above those normally contemplated in basic tactical support of an operational landing. They were continually called upon by troop commanders to destroy pillboxes and enemy machine-gun nests which held up establishment of the infantry's perimeter defenses. Concentrating rocket fire on enemy-held positions, they dispersed and weakened Japanese resistance, and facilitated the accomplishment of the infantry mission. The Buffaloes, regardless of their own vulnerability, lumbered into territory which Sherman tanks could not negotiate.

Similarly, the battery's flak LCM's did an excellent job of strafing in advance of the infantry. In conferences prior to D Day, a method of assisting the infantry by strafing ahead of assault troops with flak boats was worked out. The troops marked their advance by a red smoke grenade. During visibility of the smoke, the area 300 to 500 yards in advance of the infantry was thoroughly strafed. When the smoke disappeared, the flak boat stopped strafing. If the infantry was then able to move forward, no smoke grenade was used. If they desired more strafing, another one was fired. After observing the first support battery barrage, the naval LCI (rocket) adopted the plan and laid down a barrage of everything it had. Most of the time its fire was directed in advance of the flak boats or overhead. Even the destroyers followed a similar scheme on D plus 1.

Task Force Engineer Operations

Planning. Difficulties relevant to swift strategic moves beset advance engineer construction planning for Noemfoor. Warning instructions for the operation were issued by GHQ, SWPA, via radio on 14 June 1944, and supplemented by operations instructions on 17 June. The latter, however, contained no detailed engineer construction annex, but included only general instructions for the provision of facilities at Noemfoor, which with detailed terrain and photographic annexes published on 14 June by OCE, GHQ, SWPA, were available to lower echelons for planning purposes. Preparation of a detailed engineer construction annex was delayed because specific Allied Air Forces (AAF) requirements did not reach OCE, GHQ, SWPA, until 28 June, when a draft of a detailed directive of AAF requirements was prepared and returned for concurrence.

In the meantime, however, a meeting of staff officers representing Allied Naval Forces, Sixth Army, and Fifth Air Force was held on 20 June, planning was coordinated, and 2 July recommended as D Day. The following day, 21 June, the engineer annex to the Sixth Army field order was published, specifying only tentative requirements based on then known requests of the Fifth Air Force plus all accessible information. Construction directives were not forwarded to the Cyclone Task Force until detailed information amplifying original requirements became available. Under the circumstances, the Task Force Engineer, a RAAF officer, did not receive specific construction directives on airdrome facilities, including POL storage and handling facilities, until the operation was actually under way.

However, in preparation for the operation, the Task Force Engineer Section, using the available aerial photographs, terrain intelligence, and general instructions, compiled a layout plan for the entire area. Tentative layouts were prepared for each of the three existing dromes, Kamiri, Kornasoren, and Namber, and for one alternate. It was planned to construct Kamiri Drome as soon as possible after D plus 2, the day the first engineer aviation battalion was scheduled to arrive; then, after earliest possible reconnaissance, to construct either Kornasoren or the alternate strip farther east, followed at some later date by Namber. Preparation of a more complete and definite schedule of construction was not possible prior to D Day in view of the limited information available as to requirements.

When AAF requirements reached OCE, GHQ, SWPA, on 28 June, it was evident that, with the engineer effort available for the operation, the indicated target date of D plus 30 for completion of the final phase of construction could not be met. More nearly attainable target dates were substituted for AAF concurrence with the explanation that the original schedule requested by AAF would necessitate an increase of approximately eight additional engineer aviation battalions over the equivalent of five battalions assigned to Noemfoor. Such an increase would have had to be drawn from rear bases where their loss would have jeopardized other construction programs and eventually the over-all strategical plan of advance. In addition, it was doubtful if shipping to lift all of these units into Noemfoor at a sufficiently early date after D Day for accomplishment of this construction would be available. To shorten the time period required for airdrome construction, it was possible, in view of air superiority, to give consideration to development of standard, limited dispersal areas for reduction of the amount of paved area needed. Therefore, initial construction of large paved areas for undispersed parking was specified in the GHQ, SWPA, directive to provide early accommodations for a sizable concentration of aircraft at Noemfoor.

Construction. The initial delay to construction was more a question of geography and occupation of construction sites by tactical units than any deficiency in applied effort. Kamiri Drome, on which the initial landing took place, runs parallel and close to the shore line for its entire length. The inland side of the drome is bounded by a bluff about 60 feet high, blocking further movement into the hinterland. Both ends of the drome were confined by heavy jungle and poor roads. As a result, initial dumps had to be situated on areas projected for taxiways and hardstandings of the drome. Many troop units bivouacked on the drome, Task Force established its headquarters there, and supporting artillery fired from areas selected for taxiways and hardstandings. Besides being vulnerable to attack, this congestion of troops and equipment naturally delayed the progress of engineer work on the drome. A number of night bombings were sustained, but the most serious damage was limited to the firing of an aviation gasoline dump involving a loss of 500 barrels. However, these unfavorable conditions were the direct result of the unique terrain situation; subsequent engineer reconnaissance revealed no more suitable place for a landing on the entire island.

What little construction the Japanese had attempted on Noemfoor had been primitive, and had been effected solely by hand labor of Formosans, Javanese, and natives. The beach road, between Kornasoren and Kamiri, and the road over the hills, from Kamiri to Namber, were merely unsurfaced, native tracks widened to accommodate vehicles, and these represented the only Japanese improvements to the primitive communication system already existing on the island.[26] By the close of the operation, Task Force engineer units had constructed approximately 15 miles of two-lane coral access roads. Kamiri Drome was made serviceable; one coral runway together with limited dispersal for one fighter group (75 planes) was prepared in 14 days. Kornasoren Drome, with a runway 6,000 feet long and one large alert area, was made ready to receive a group of fighters in 9 days (16 July to 25 July) despite extremely difficult jungle clearing and heavy pavement requirements caused by an uncertain subgrade condition. A coral jetty with slips to accommodate three LST's simultaneously was completed by 1 September. Bulk aviation gasoline installations constructed consisted of a 1,650-foot pipe-line jetty, one 10,000-barrel, two 5,000-barrel, and two 1,000-barrel storage tanks with pumps and connecting pipe lines to the dromes. Sufficient dumps and warehouses were also constructed to disperse all supplies unloaded and stored on the island.

Combat Engineer Operations. Japanese land mines, consisting of aerial bombs set with the nose fuse upwards, were found along the roads and coast. Company A, 27th Engineer Combat Battalion, assisted by the Bomb Disposal Squad, 62d Works Wing, removed over 400 of these bombs. In general, they were not concealed, were poorly placed, and, in some instances, not fused. None was booby-trapped, and all were removed without a casualty. There was little other combat engineer work in support of the infantry. As enemy resistance collapsed, the

[26] *Editor's note: See* Map No. 32, Vol I, this series.

27th Engineers were absorbed into construction activities and accomplished their missions, in the words of the Task Force Engineer, "with enthusiasm, efficiency, and sound organization which have earned the 27th Engineers the enviable reputation of being able to do more with less equipment than any other engineer unit in the Southwest Pacific Area." [27]

Supplies and Equipment. Besides the ever prevailing shortages, not even all of such equipment as was available to the engineers on Noemfoor Island was adequate for the type of construction required. Construction of the bulk aviation gasoline pipe-line jetty and mooring dolphins proved exceptionally laborious because of the difficulty of driving piles through hard coral with only a light drop-hammer-type pile driver. A large floating rig would have considerably facilitated the work which involved blasting in some instances and the erection of trestles in places where the piles would not penetrate the coral.

Engineer materiel was, as usual, in short supply. Some supplies were brought from Aitape which enabled the most urgent work to proceed. Little was available from any other source. The spare parts situation was difficult and much deadlined equipment resulted. By D plus 59 scarcely any materials had been received against requisitions for construction supplies submitted immediately following activation of the Task Force. During the outloading of the Task Force, insufficient space on LST's and cargo ships was allocated for engineer supplies and equipment. Subsequent reports of the operation almost unanimously recommended that for future operations a small ship be loaded exclusively with engineer supplies and unloaded in the objective area as soon after D Day as permitted by the tactical situation.

Availability of Engineers. The adequacy of engineer troops for the mission was estimated as only 60 percent of those necessary to meet established completion dates for construction projects. However, despite shortages of engineer troops and supplies, there was the best possible spirit of cooperation everywhere, and, in the opinion of the Task Force Engineer, never before had Australian units worked alongside of U. S. units, both white and colored, with such a spirit of comradeship.

Cape Sansapor, New Guinea
30 July 1944

No time was lost in preparing for the next operation furthering the northwestward advance. Two days before the scheduled assault on Noemfoor Island, operations instructions were issued for seizure of the Sansapor area on the Vogelkop peninsula, the northwestern extremity of Netherlands New Guinea. In continuation of the bypassing policy, this move (Globetrotter Operation) would completely isolate Manokwari, the Japanese air base with an estimated strength of 13,000, dominating the northeastern area of the Vogelkop peninsula, approximately 50 miles across Geelvink Bay from Noemfoor. Seizure of the Sansapor area, on the northwestern end of the peninsula, and the establishment of air and minor naval facilities thereon would also ultimately neutralize the enemy base at Sorong, 70 miles down the sloping coast west of Sansapor. As the relentless northwestward advance would continue from Sansapor beyond the mainland of Netherlands New Guinea, Sorong would be left in frustrated impotence.[28]

The Typhoon Task Force, consisting of the 6th Division, reinforced, less one RCT, was assigned to the Globetrotter Operation. Combat units of the force totaled approximately 13,500 men, and service troops, about 7,000. The initial assault was to be made with one regimental combat team, reinforced, totaling about 7,500 men, while one RCT was to be held in the staging area at Maffin Bay in Task Force reserve for subsequent movement forward.

[27] Memo, Engr, Tabletennis Task Force, for CO, 27th Engr (C) Bn, 25 Sep 44, no sub. In OCE, GHQ, SWPA.

[28] *Editor's note: See* Map No. 33, "Sansapor, Plan of Battle, Engineer Construction," Vol I, this series.

The Sixth Army original troop movement plan provided little early engineer strength in favor of large shipments of tactical units. Inasmuch as anticipated enemy opposition at Sansapor was negligible, and the engineer task a heavy and intensive one upon which future operations involving air support were also contingent, the Chief Engineer, GHQ, SWPA, felt that the projected arrival of engineer units was unbalanced and inadequate. When the Sixth Army plan was presented to the Commander in Chief, SWPA, the Chief Engineer, GHQ, SWPA, therefore, stressed the importance of engineer construction units being scheduled to arrive with the first convoy, particularly since unpredictable intervals between convoys had developed because of delayed turnarounds in advance operational areas. On the strength of this recommendation, the Commander in Chief directed that this phase of the plan be reviewed. It was, and the resultant increase of engineer troops assigned, not only to the initial convoy but to early assault waves as well, proved of material benefit to completion of the operationally important engineer mission in the Sansapor area on schedule.

Amphibian Engineer Operations

Prior to the departure of the Typhoon Task Force from Maffin Bay, Netherlands New Guinea, on D minus 3, it was decided to cancel all scheduled naval bombardment preceding the landing. This decision was based on late information from scouts which indicated that no organized enemy resistance to the landing would be encountered. The object was to exploit the surprise element to the maximum. Radio silence was, therefore, to be maintained as well. It was estimated that this procedure would permit the landing of the entire D Day echelon before the enemy fully realized that a landing in force was in progress.

The landing was executed on 30 July 1944 with amphibian engineer support provided by the 543d Engineer Boat and Shore Regiment (less two boat companies) of the 3d ESB. No enemy resistance was encountered. Twelve LCVP's were carried on LST's; eight LCM's were towed to the objective area. The ESB craft were released prior to the landings and proceeded to the vicinity of the Wewe River where organizational equipment was unloaded and preparations made for a shore-to-shore movement of the 3d Battalion, 63d Infantry, direct to Sansapor on D plus 1.[20] The engineer shore battalion together with infantry elements was landed on Red Beach, east of the Wewe River, by LST's.

Shore Party Activities. Each engineer shore company was reinforced by 60 men from the 1st Battalion, 63d Infantry, and unloading of troops and vehicles commenced promptly. Necessary ramps were built by using sandbags stowed forward on LST's and by use of spoil resulting from cuts in a 10- to 12-foot bank to permit movement inland from the beach.

While secondary landings of infantry troops were being effected by naval personnel on Middelburg and Amsterdam Islands, organization of the beachhead and unloading activities on the mainland were accelerated. All ships were unloaded within 12 hours after beaching, although some confusion was caused by naval personnel aboard ships ordering the off-loading of trucks before ramps were ready and attempting to get extra men and trucks assigned to the discharge of their particular ships. Traffic poured across the beach before roads were established. Overloaded vehicles bogged down in the extremely soft sand and had to be towed out by tractors. Large quantities of wire mesh for beach roadways could have been used to great advantage, but although the need for it had been foreseen, the shore party had not been able to procure it in time for the operation. Bulldozers rapidly cut roads inland from beached LST's and provided adequate dispersal, but the congestion caused by overloaded and mired vehicles along the beach on D Day would have provided an easy target for hostile aircraft if enemy air reaction had then developed.

[20] *Editor's note: See* Map No. 33, Vol I, this series.

Unloading operations during the period after D Day were carried on through a high surf which at times interfered with the beaching of LCM's. Increasing enemy air attacks and daily alerts interfered with efficiency. Japanese stragglers were also a nuisance, and the shore battalion was forced to build and maintain a stockade for prisoners their patrols captured. Unfortunately, this original prisoner of war stockade was placed in the bivouac area, which was a most undesirable location as the prisoners carried many types of diseases.

As soon as the initial influx of off-loaded supplies was disposed of, a systematic schedule of improving beach roads and dump areas was established. Subsequently all-weather roads were developed, required ammunition slots constructed, and almost 50 percent of the shore engineer construction effort was devoted to establishment and maintenance of dump areas which required extensive drainage operations.

Landing Craft Activities. In the meantime, on D plus 1, the engineer boat company transported an infantry battalion from Red Beach to Sansapor and made resupply runs the remainder of the day. Subsequently, all ESB boats were moved to the landing craft pool established at Amsterdam Island. Two LCM's were assigned to run ferry service from division headquarters to Middelburg Island and Amsterdam Island, and the remaining LCM's were used on special runs.

Task Force Engineer Operations

Factors for Success. Several factors contributed to the success of the engineer mission in the Globetrotter Operation. Adequate accurate information was available from air and ground reconnaissance. Engineer planning was completed and concurred in by Allied Air Forces prior to arrival in the objective area. Initial plans, once established, were followed with only minor changes. Despite the need for staff officers in the objective area, some senior Engineer officers were retained in the staging area to insure forward movement of engineer troops and supplies in proper sequence according to plans. Fifty percent of the LST space between D and D plus 10 had been allocated to the forward lift of engineer troops and supplies as a result of the special efforts of the Chief Engineer, GHQ, SWPA, in securing a revision in assault shipping allocation from that initially projected by the Task Force. Echelons of personnel and equipment were moved in on a requirement basis and not on a unit basis. Units were moved principally in three echelons and were assigned compact and complete tasks, suited to their equipment, which required no unsatisfactory detachment of plant from parent units and dispersal of unit effort. Engineer work on all unit bivouac areas was limited to construction of access roads and clearing of storage areas and motor pools; occupying units handled the remainder of work in their respective areas.

Supplies and Equipment. There were difficulties, of course, which required corrective action. Difficulties were first encountered at the staging area where engineer assault supplies were being unloaded from Liberty ships and combat loaded on LST's. A deficiency of 50 percent was found between the manifest of certain incoming ships and what was actually received. This unusually high disparity was considered possibly due to conditions experienced in the past; first, the confusion usual in any area for the staging of assault forces whereby considerable supplies were misplaced, or appropriated by others, and lost to the Task Force Engineer; and secondly, to the turnaround of shipping with cargo still remaining aboard.

Pipe and pipe fittings, electrical supplies, and most necessary miscellaneous construction supplies, such as wire nails, arrived in quantities so small that high priority construction was delayed.[30] This condition, insofar as base sup-

[30] *Editor's note:* Aside from two kegs of 20d nails, no nails smaller than 60d were received until D plus 45. USASOS, however, reported that a shortage of nails and plumbing fixtures continued to be critical because of conditions created by stepped-up and unforeseen operations injected into the over-all supply plan in the preceding several months.

port was concerned, was aggravated by the inadequate allocation of shipping space from Australia to New Guinea bases. Every possible action had been taken to alleviate these shortages, but even at the moment a considerable tonnage of nails awaited shipment from Australian bases. The limited shipping available coupled with unbalanced priority allocations precluded their early arrival in forward areas.

Forwarding of spare parts for deadlined engineer equipment was also poor. The first shipment did not arrive until D plus 38. Despite USASOS attempts to stock all engineer maintenance companies with a 30-day supply of most commonly used spare parts prior to their forward movement, the maintenance platoon assigned to this operation had not received any spare parts or supplies during its last two operations. The services of this platoon were consequently restricted to repairs compatible with stock on hand. It was necessary under the circumstances for units to send representatives to rear supply bases to expedite movement of spare parts. For instance, engineer equipment could not be operated efficiently during hours of darkness because replacement headlight bulbs (an ordnance supply item) were not available. Engineer units soon exhausted their unit supplies and several, when moving on to their next operation, did so without having replenished their authorized allowances.

In line with continued previous recommendations of the Chief Engineer, GHQ, SWPA, it was suggested by the Task Force Engineer that at least a 30 days' supply of spare parts, including ordnance items, be assembled for units going into an operation and forwarded with the rear echelon. He further recommended highest priority air shipment of all spare parts which were left at rear depots for long periods awaiting shipment, and suggested that transport aircraft carrying supplies should not be unloaded until they reached the advance base of operations to eliminate delays involved in layovers for further transshipment.

Initially there was a shortage of various types of harrows and sheepsfoot rollers required for scheduled engineer operations which made it necessary to move in additional equipment by air transport. It was noted that certain engineer units did not consider this type of equipment an important part of their equipage and left it or turned it in at some rear base. The only engineer unit on this operation with such equipment had recently arrived from the Zone of Interior and had not yet uncrated it.

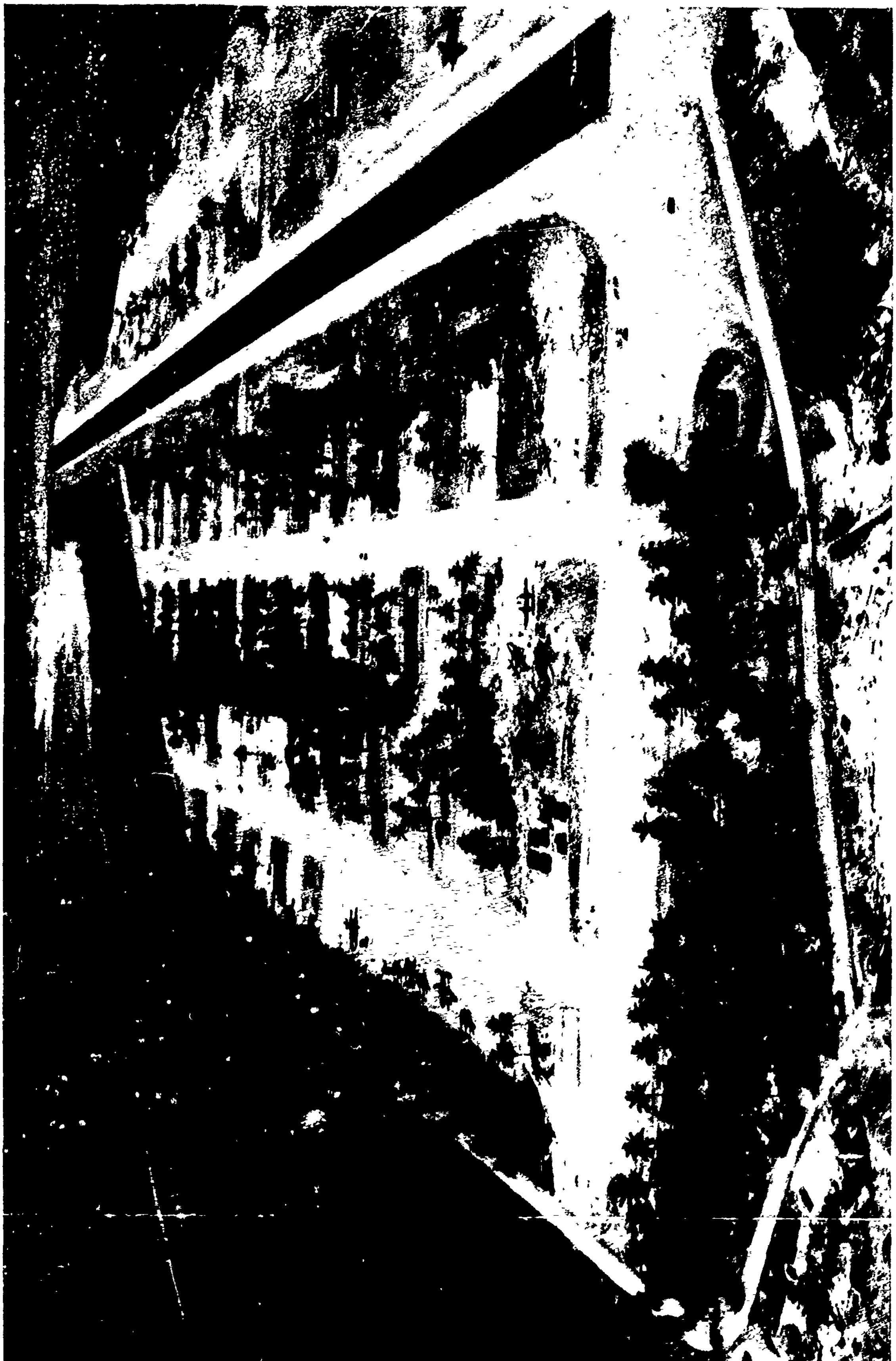
Authorized power shovels of aviation battalions were found to be inadequate on these projects, and at least one 2-yard shovel per battalion was subsequently recommended in the Task Force Engineer's report of the operation. The size of shovels was a recurrent factor for criticism in operations reports. Their inadequacy was stressed at Port Moresby. Shore battalions at both Saidor and Aitape indicated preference for ¾-cubic-yard shovels over ½-cubic-yard. Here at Sansapor the importance of efficient shovel operations was again emphasized by the specific selection of this item for special recommendation. The number of such recommendations on this particular piece of equipment would seem to indicate the need for study of, and revision in, sizes authorized by Tables of Equipment.

Construction. The major items of construction accomplished by engineer units included the Middelburg Drome with a 5,400- by 100-foot runway and related facilities on Middelburg Island, and the Mar Drome on the mainland with a 7,500- by 100-foot runway and facilities.[31] Approximately 13 miles of road were constructed on the mainland in addition to access roads to dump areas. Bulk petroleum storage on the mainland included a tanker berth and three 5,000-barrel storage tanks with pipe line laid on the ocean bottom, and on Middelburg Island, an unloading jetty and three 2,000-barrel tanks. An LCM landing jetty and one small-craft and personnel unloading jetty were established on the

[31] *Editor's note: See* Map No. 33, Vol I, this series.

Aerial photograph of Middelburg Island prior to D Day.

The first aircraft landed at Middelburg Drome on D plus 15. This over-all photograph was taken on D plus 28.



Close-up aerial view of Middelburg Drome constructed by Engineers during the Sansapor Operation.

mainland besides a river pumping station with approximately 11,000 feet of 4-inch pipe laid to the beach for the supply of fresh water to LST's. Buildings included those necessary to operations on both dromes, hospitals on the mainland, and a 400-man transient camp on Middelburg Island.

Construction accomplished during this operation demonstrated prominently the employment of military engineer expedients. On the mainland the Mar Drome was located just beyond the beach area in a dense rain forest which was very difficult to clear. Only underbrush and normal size trees could be removed by a bulldozer working independently. The remainder had to be blown down by explosives and then removed by bulldozers working in pairs. Some trees had to be blown down and then cut in several pieces before they could be moved. The water table at the airdrome was approximately 3 feet below the ground surface, and in one section only 18 inches below grade line of runway. There was also a large swamp between the airdrome and the beach. Before construction could proceed this swamp had to be drained and the water table lowered. This was accomplished by means of dragline ditches draining into the ocean which permitted the water table to be lowered approximately 2 feet. Soil consisted of very loose beach sand that was difficult to compact and required constant watering during subgrade preparations. Calcareous clay was added at a ratio of 30 percent and a 6-inch stabilized surface developed.

Construction of roads was difficult because materials varied from beach sand to heavy clay, both requiring addition of other materials before proper stabilization could be obtained. All of the beach above high-water level across the entire lighterage landing area on the mainland was stabilized by adding 8 inches of coral and working it into the sand by truck traffic. This developed a more stabilized beach and permitted loaded trucks to move from LCM's to the beach road with very little difficulty.

On Middelburg Island also the primary difficulty encountered in construction was achieving proper soil stabilization. The soil available for airdrome construction consisted of a white coral sand with very little cementation qualities, and satisfactory stabilization could not be obtained without addition of coral from the surrounding reef. This was a very difficult procedure as materials could be obtained only at low tide. However, once definite procedures on stabilization were determined and prescribed, soil stabilization proceeded satisfactorily.

Once again the engineer mission was successfully accomplished. Schedules were met despite outside (other than engineer) predictions to the contrary. Allied Air Forces missions from Middelburg Drome were sustained.

Morotai Island
15 September 1944

One more step remained before General MacArthur's long-anticipated return to the Philippines could be launched. Between Sansapor, Netherlands New Guinea, and Mindanao, in the Philippines, lay Morotai Island. This island, together with others of the Moluccas Group, bars any direct sea route between Netherlands New Guinea and the Philippines, and flanks any movement west or southwest towards Borneo and Java. Besides isolating enemy concentrations on nearby Halmahera Island, occupation of Morotai and the establishment of air, air warning, and naval facilities thereon would provide forward airdromes and a motor torpedo base for operations against the Philippines. (See Map No. 3.) Accordingly, operations instructions were prepared by GHQ, SWPA, in July 1944, and forwarded to Theater ground, naval, and air elements for detailed planning of this, the Interlude Operation. D Day was set for 15 September, and the Tradewind Task Force for the mission was built around Headquarters, XI Corps, the 31st Division, and the 126th RCT (32d Division). Combat units for the operation, including divisional combat engineers and engineer special brigade regiments, totaled 27,907 troops.

Service units totaled 12,198. Of the latter, approximately 7,000 were engineer troops, indicating the constantly growing recognition of the importance of adequate engineer service support.

The D Day mission of the Tradewind Task Force was to establish a beachhead at the southwest corner of Morotai Island and form a perimeter defense. Landings were to be made on two adjoining beaches. The 31st Division, less 124th RCT, with attached troops, was to assault Red Beach, in the vicinity of Doroeba, and then push on to form a perimeter beginning north of Doroeba and extending inland to just east of Pitoe Drome. The 126th RCT of the 32d Division, with attached troops, was to land at White Beach, 1,100 yards south of Pitoe Drome, advance eastward rapidly to approximately 1,000 yards beyond the site of Wama Drome and make contact with 31st Division advance elements about 1,000 yards to the north.[32]

Amphibian Engineer Operations

Amphibian engineer support for the Tradewind Task Force was effected through two provisional task groups organized by the 4th Engineer Special Brigade. Task Group 301, consisting of the 534th EBSR (less boat battalion), with attached units, was to land at White Beach, the more southerly of the two beaches selected, to support the landing of the 126th RCT. Task Group 401, 544th EBSR (less 1 boat company), was to land on Red Beach in the vicinity of Doroeba to support the initial landing of the 31st Division with two regiments abreast. The commanding officer of the 534th EBSR, with the 544th EBSR attached, was made responsible for beach operations, LST landings, and Task Force Cargo Control on both Red and White Beaches. Except for initial assault waves, all small landing craft for lighterage and outloading boat services after D Day were to be provided the Tradewind Task Force by Task Group 401, 544th EBSR, the shore battalion of which was to assume beach operations on Red Beach under control of the commanding officer, 534th EBSR.[33]

Ambiguous Control. Obscurity and confusion existed regarding various command and staff responsibilities. As indicated, the commanding officer of the 534th EBSR had been made responsible for organization and operation of the beaches and Task Force Cargo Control. The 544th EBSR had been attached to him to assist in accomplishment of this mission and for the supply of lighterage and outloading boat services. Nevertheless, during the first phase of the operation the two regiments operated separately and individually, each on its own beach, with the intention of consolidating effort in the future. This resulted in loss of centralized control over beach operations at a critical time and when its lack might have proved serious had enemy opposition been encountered.

At Red Beach a need for coordination between the shore battalion, beachmaster, and naval control officer was evident. Here, craft were irresponsibly pushing in and getting rid of their cargoes indiscriminately, while LST's, without prior clearance through the Task Force Cargo Control officer, were being diverted southward to White Beach which was already congested. Subsequent comments on the organization of the port recommended appointment of a brigade, rather than regimental, commander as task force cargo control officer for operations where two EBSR's were employed. In preference to one regimental commander being attached to, and operating under, another regimental commander with incidental problems of a mixture of the two regiments on the staff or one regimental staff carrying the entire responsibility, the brigade commander and his staff, assisted by Transportation Corps personnel attached to brigade headquarters, could coordinate the two regiments with unquestioned authority.

Originally, the Transportation Control Section of the Task Force duplicated the duties of

[32] *Editor's note: See* Map No. 34, "Morotai, Plan of Battle, Engineer Construction," Vol I, this series.

[33] *Editor's note:* Only 17 LCM's were employed by Task Group 401 on D Day. Additional ESB craft arrived on later echelons.

the Cargo Control officer and created an unnecessary intermediate headquarters between Cargo Control and the Task Force Commander. This situation was, however, remedied in the initial stages through prompt corrective action induced by recommendations of various 4th ESB unit commanders.[34]

Arrangements had been made during the planning phase for an immediate ground reconnaissance of beaches at the time of the initial assault to locate alternate landing areas in the event Red and White Beaches were found unsatisfactory. These plans were sound, provided command could be centralized and communications made available to redirect vessels and units during the actual landing. The original selection of beaches did not equal expectations, but, under the existing divided control of the beaches, early beach reconnaissance could not be employed as effectively as possible to correct the situation. It was evident that the procedures directly and vitally affecting the success of a landing were: adequate, advance aerial photography and its exact interpretation prior to the landing, intensive beach reconnaissance subsequent thereto, and maintenance of undivided, thorough beach control on landing.

Landing Conditions. Landings were made on far shore beaches that from interpretation of aerial photographs were judged to be composed of white coral sand forming a thin veneer on a gently sloping, hard coral rock shelf. The actual conditions encountered, however, proved the sediment on the reef to be soft and thick, and the underlying coral rock surface to be very irregular and riddled with potholes. Disembarking troops had difficulty in extricating themselves from the soft sticky mud, and, on occasion, vehicles and heavy equipment sank almost out of sight upon leaving the ramps of LST's. These unprecedented conditions not only emphasized the value of D Day field studies to aid beach specialists in making correct interpretations of beach and reef conditions from aerial photographs, but also drew attention to the deficiencies of black-and-white aerial photographs for reef interpretation when compared with low-altitude color photography.

The landing conditions at White Beach were considerably improved by a decision to move its site approximately 300 yards to the south of that specified in original plans after the first three LCT's began unloading over the extremely difficult terrain. At the new location LST's beached 200 to 250 feet offshore, and the falling tide facilitated unloading of vehicles. Much of the success of the unloading on this beach was attributed to staging area loading plans of the 534th EBSR which directed tractors and DUKW's to be the first vehicles to debark from each LST.[35] This provision insured immediate availability of this equipment to tow out any subsequent vehicles which became mired. In addition, the reef from the LST's to the beach was uniform and permitted full use of roller conveyors. However, when diverted LST's from Red Beach began to arrive, this short section of usable beach became considerably congested. Moreover, the beach was suitable for LST landings during extremely low tide only. As a result, on D plus 1, LST's were diverted from White Beach to Blue Beach (Pitoe Beach) on the east side of the peninsula where D Day reconnaissance had confirmed that the narrow coral ridge at that point permitted the beaching of this type of craft within 50 feet of the high-water line. Here, however, conditions were unadaptable for unloading of Liberty ships because of inadequate anchorages and shelter from the southeast winds, but coral sand was plentiful for the construction of LST slips, and a level hinterland permitted road construction from beach dumps to inland assault dumps with minimum effort.

[34] *Editor's note:* XI Corps published an SOP for cargo control on 5 October 1944 after difficulties of the operation had taught several vital lessons.

[35] *Editor's note:* The 534th brought 15 tractors and 11 DUKW's ashore initially. This permitted some tractors to work on road nets and dumps while others stood by to pull out bogged-down vehicles.

Red Beach, where the main landing was made, proved considerably worse than White Beach which benefited somewhat from the choice of an alternate site. On Red Beach assault troops were landed in LVT(2)'s (Buffaloes), launched from LST's, and in LCI's. Supplies and additional reinforcing troops were landed by LST's and APA's. LCM's of Task Group 401 were carried to the objective area in an LSD, while shore battalion equipment and personnel were transported in LCT's towed to the rendezvous area by LST's. From that point the LCT's proceeded to the beach under their own power. The Buffaloes penetrated no more than 100 yards before they were stopped by dense undergrowth. Many were halted on the beach which averaged a depth of 15 feet. Just offshore the bottom consisted of mud about 3 feet deep, lightly covered with sand, and spotted with coral heads beneath the water. The LCI's had to beach well out and disembarking troops had to wade ashore in water up to their shoulders. More than 75 percent of the vehicles unloaded from LCT's, which followed the LCI's into the beach and carried shore battalion equipment, were drowned out or bogged in the mud. The tracked vehicles which did get ashore were used to tow other vehicles on to the beach. LCM's landed in splendid formation and discharged their mobile loads which were towed to shore. Their cargo, however, consisted of artillery equipment and combat engineer trucks. Considering the mired vehicles and bulldozers littering the approach to the beach as far as 200 feet offshore, it was readily apparent that, together with tactical requirements, an adequate space allocation in LCM's of initial waves should also have been reserved for bulldozers, shovels, and other mechanical equipment of the engineer shore battalion to assure shallow landing and early entrance of this essential equipment to the beach.

Shore Party Activities. Prior planning had anticipated the landing of shore battalion equipment complete by H plus 35 minutes. However, besides the misinterpretation of existing approaches to shore, provisions designed for the most effective utilization of shore party support were further disrupted when naval LST's started indiscriminate beaching contrary to signaled directions. This nullified the excellent preparations which had been made for the most advantageous employment of the shore party. Personnel of the shore battalion had not been detailed as labor to unload LST's; they were required only to man the dumps. This left an adequate number of shore party engineers to prepare the designated beach for unloading. Moreover, the average LST was lightly loaded with about 200 tons of bulk supplies, had 100 men assigned for its unloading, and was scheduled to land on call on the left flank of Red Beach. The ways and means for rapid unloading were prepared and ready. The LST's, however, came in without orders on the right flank, the worst part of the very poor beach, despite repeated signals from their own beachmaster not to land on the right flank. The necessity of shifting shore battalion personnel and equipment about 500 yards from the left to the right flank of the beach naturally resulted in somewhat delayed assumption of shore party supervision. Before ramps could be constructed out to beached LST's, bulldozers, trucks, and DUKW's immediately started coming ashore in 4 feet of water and immobilized themselves in the mud. Some vehicles, including a D–7 dozer, had not been pulled out by the morning of D plus 1.

Most vehicles, though very well waterproofed, did not reach shore at Red Beach under their own power. Many motors were still running even with water up to the hoods of vehicles, but the coral, and particularly the mud, proved impassable. Various means were used to get the vehicles ashore, but the three most successful ways were: winching larger vehicles with TD–18 winches and smaller vehicles not badly stuck with 2½-ton truck winches, and towing by Buffaloes. Trying to tow directly with a bulldozer or truck usually proved ineffective.

The circumstances encountered here led to an obvious conclusion: vehicle unloading should be discontinued after it is evident that an unreasonable percentage will become immobilized before reaching the shore. The loss of irreplaceable equipment is a serious setback. Upon encountering so unstable an approach to shore, only bulldozers and trucks with winches should have attempted to move ashore early in this landing. When it was apparent that there would be difficulty in getting vehicles ashore, the remaining vessels on board should have been assisted by winching and towing to the beach, if practicable. These vehicles should not have been moved from landing craft until assistance was available and attached.

Three LST's were later forced to withdraw from Red Beach and continued unloading over their ramps to LCT's offshore. Roller conveyors ran the full length of the LCT's and as far into the LST's as available conveyor sections permitted. All supplies in the rear of LST's had to be carried about 50 feet because of the shortage of roller conveyor. Yet roller conveyor played a significant part in easing unloading difficulties at both beaches. Those LST's which beached 200–250 feet from shore at White Beach on D Day were unloaded by roller conveyor set up on ammunition boxes, and at Red Beach roller conveyor was employed on beached LST's as well as those unloading into LCT's offshore. Based on their experience in this operation, shore engineers recommended that each shore battalion should be organically equipped with a minimum of 1,500 feet of roller conveyor. Besides this, each LST should carry at least 300 to 500 feet of roller conveyor to be used on beaches and later to revert to task force control for use in dumps.

Subsequent to D Day all landing craft used Blue Beach while parts of Red and White Beaches were used for unloading by lighterage from ships anchored in sheltered water west of the peninsula. At Blue Beach LST slips were constructed by dozing sand, earth, and coral out to the ramps of LST's. A minimum of 1,000 sandbags per slip were filled prior to the beaching of a ship and were used under the ramp. If the sides of the slip needed revetment, additional sandbags were used for this purpose. Sandbags were drawn from the engineer dump after the supply carried by the shore battalion was exhausted. For future operations it was recommended that 5,000 sandbags be aboard each LST arriving in the objective area.

In the initial landings, because of a falling tide, LST's had beached too far offshore to bridge the intervening distance to the beach by the number of ponton causeways carried. Ponton equipment, therefore, was not utilized until brought in later as lighterage jetties. At Red Beach, a set of ponton causeways and three LCT(6)'s (Landing Craft, Tank (Mark VI)) were used to provide such jetties over which LCT's and LCM's could discharge cargo lightered from LST's offshore. However, the insufficiency of ponton equipment to span the gap between the beached LST's and the shore for direct discharge worked somewhat of a hardship on unloading operations, which for the first 7 days totaled a tonnage of 47,000 deadweight tons that had to be handled by roller conveyor, lighterage, and earth ramp techniques.[36] Additional ponton equipment over which to discharge cargoes of offshore LST's direct to the beach would have considerably facilitated unloading activities. The 4th ESB strongly stressed the advisability of an arrangement with naval authorities to have a total of at least twelve 14- by 106-foot navy cube pontons placed on LST's for transfer to the shore battalion so that a broad frontage for unloading could be provided regardless of beach and underwater conditions.

The use of the LCT(6)'s provided one of the most effective and quickest means of installing a D Day jetty. This type of LCT permits the stern bulkhead to be removed and is so constructed that, when necessary, successive craft can be

[36] *Editor's note:* To the above figure there should be added approximately 300 deadweight tons of mobile-loaded supplies and equipment which did not land at designated beaches.

placed bow to stern to form a long pier. When LST's, butted to the open stern of the outermost LCT(6), were being unloaded, a drop of approximately 2 feet from the LST ramp to the deck of the LCT(6) had to be spanned. This drop was overcome by use of heavy rope matting, or fender spars, usually carried aboard LST's. In this connection, should heavy matting prove unavailable or not sufficiently rigid for very heavy loads, it was recommended that lumber be carried to make a ramp.

Because of the heavy use of lighterage for transportation of small tactical groups, including radar and antiaircraft artillery, to adjacent islands and areas, little lightering except of personnel could be accomplished until D plus 3. At 1700, D plus 2, only six LCT's and two LCM's remained for cargo lighterage assignments; the balance were engaged in outloading tactical missions. Inability of LCT crews to berth quickly on the only two, narrow 14-foot pierheads existing, together with the extreme length of the piers, also delayed cargo handling. After consultation of interested commanders, it was deemed necessary, in view of the small lighterage fleet available and the restricted pier capacity, to send Liberty ships which arrived on D plus 2 to sea overnight and to postpone their unloading until 0700, D plus 3. The ultimate job of beach improvement to meet existing contingencies involved construction of a small boat port with little equipment and under very adverse terrain conditions. Clearly evident throughout this phase of the operation was the advisability of using an independent beach in any possible location on the far shore for outloading tactical missions so as to leave inbound facilities free for unloading cargo.

The need to intensify training of shore battalions to include three-shift operation of all available earth-moving equipment and to improve general construction techniques was also evident. A review of the heavy engineer construction equipment on hand during this operation disclosed that a large amount could not be used efficiently by shore engineers because of the lack of trained operators for three-shift operation. All in all, however, these battalions had a most difficult problem and energetically tried all means practicable. No serious enemy opposition was encountered, and all objectives were attained in early phases of the assault.

Landing Craft Activities. Boat work was well handled, and as of D plus 7, only two LCM's required serious maintenance. Sufficient marine spare parts for about 3 weeks of operations were on hand, and the Task Force Commander had permitted a maintenance boat and an engineer maintenance company to land on D Day. These measures permitted good maintenance practice and were strongly recommended as procedures to be followed in future operations.

Task Force Engineer Operations

The mission assigned the Tradewind Task Force was primarily one of construction of airdromes and related facilities necessary for the establishment of an air base. Other projects, subordinate to this mission but yet of definite importance, included the building of roads and the preparation of dumps to insure the adequate flow of supplies and material, the purification and supply of water, and the construction of essential port facilities and installations required to support minor naval operations.

Water Supply. From a study of the intelligence bulletins on Morotai it was realized that water supply would be a serious problem. On arrival there, the troops found that water even in sufficient quantities to fill canteens was very scarce. Unfortunately, many units did not land with water mobile-loaded either in drums, tanks, or in 5-gallon cans. Many brought in empty cans. Water had to be obtained from the LST's. Initially, village wells were used, but very shortly all were condemned except one in Gotalamo which operated for several weeks until the great demands upon it turned it saline and made it useless except for showers. Several bomb craters were found with approximately 2 feet of water standing in them. These provided the main source of water for the first few days. Portable purification units were set up in these craters by combat engineers and pumped steadily at 10 to 15 gallons per minute until RAAF engineers bored a well about 200 yards from the bomb craters and another large water point was dug by hand in a deep gully. The essential need for a well-digging rig in an objective area where there are few streams was amply illustrated. So, too, were requirements for deep well pumps of fair capacity (50 g. p. m.), and more water purification sets than authorized by Tables of Equipment, especially to mobile and larger units. Above all, the importance of perfect operating condition of water supply equipment issued was definitely emphasized at Morotai where even a brief breakdown could have caused serious shortages.

Supplies and Equipment. Supply during this operation, conforming to those preceding it, was difficult. Although the scheduled influx of engineer supplies was adequate to support initial needs, ships were detained in the harbor for several days because of unloading difficulties. Steel mat, POL, initial construction and major construction materials due on D plus 4 were not only late in arriving but their availability was further delayed through retarded discharge. Only one 500-barrel aviation gasoline tank arrived although two were scheduled. The outloading of POL tanks in general was such that early construction could not be initiated because essential parts were, as a probable result of transshipment, in the lower holds of several ships. Early construction effort on port facilities was delayed because of the late arrival of materials and subsequent unloading difficulties thereof. Mishandling of two 2-cubic-yard shovels resulted in considerable damage. One shovel was made serviceable from the two. Engineer supplies arrived at the engineer dump in poor condition. Certain equipment issued to the 340th Engineer Construction Battalion at the staging area was definitely second-hand and soon deadlined. In an endeavor to relieve the critical spare parts situation, a radio message was transmitted to Intermediate Section, USASOS, at Oro Bay, requesting information on location and status of spare parts requisitions submitted by the Engineer, XI Corps. A reply was received from the Engineer Depot, Base A (Milne Bay), stating that shipment of spare parts was made early in September and that it might have been diverted to another base. In the meantime equipment was becoming deadlined daily and progress of construction was being delayed.

Corrective measures to obviate similar deficiencies in future operations were suggested by the Task Force Engineer. His first suggestion, allocation of ships designated for the exclusive transport of engineer supplies, was by now becoming the most repeated recommendation in the Theater and one of the most consistently supported by the Chief Engineer, GHQ, SWPA. For many months prior to operations at Morotai, the shipping situation and difficulties of the priority system had been stressed by the Chief Engineer, GHQ, SWPA, with the affected general staff sections. It had been pointed out time and again that the limiting factor in the support of forward operations was the capacity of the New Guinea ports, development of which had not proceeded to the extent desired because engineer supplies and unit equipment had not been accorded sufficiently high priorities to be available in the preliminary stages of operations. Conferences and correspondence with G-4, GHQ, SWPA, constantly emphasized the need for allocation of a proper number of ships exclusively for engineer cargo in the preliminary stages so that ports and base facilities might be established in time for the adequate support of operations. These efforts, although receiving consideration on the Theater level, had not yet developed into material allocations, and obscured by levels of command, were not apparent to task force engineers. On this latter level, the need was obvious and seemingly neglected. Repeated recommendations, therefore, were SOP.

The second suggestion of the Task Force Engineer was prompted by the unsatisfactory condition of many supplies after unloading. This recommendation stressed rigid supervision of loading and unloading to rectify negligent handling of supplies and equipment. A means for early provision of materials to speed completion of dock facilities was also advocated. It was pointed out that in a contingency involving nonavailability of space on LST's, docks could be partially fabricated in rear areas and towed to a not-too-distant objective area as barges with deck loads of piling and other items essential to provision of port facilities.

Construction. The debarkation of troops during the initial phases was accomplished faster than the building of roads with the result that some units established bivouacs which straddled proposed roads. Inasmuch as very few organizations had maps showing the proposed location of roads, and none had maps showing the actual tracks existing, some confusion in determining the designated areas for unit dumps and bivouac areas was inevitable. The situation logically reflected a seeming failure on the part of the task force to distribute the engineer annex, or excerpts therefrom, to the smaller units concerned in the operation. Engineer construction, as a consequence, was adversely affected.

Initial roads consisted only of cleared rights-of-way without grading or drainage improvements. The only heavy engineer equipment available for road work consisted of eight heavy tractors with dozer attachments. This primary road system would have been sufficient had the rainfall been normal. A 4-inch rainfall was indicated as normal for the whole month of September. However, from the 15th to the 30th it rained almost 6 inches, including one downpour of approximately 2 inches. This unexpected rain made the majority of roads on the high ground a mass of thick, gummy mud, and those on the flat land a very soft mush of black humus. These latter roads disintegrated so completely that even jeeps found them impassable. Many small tractors had to be diverted from other work to keep traffic moving through the bad spots. Motor transportation never completely bogged down, though often it only writhed along. However, clearing through coconut groves was comparatively simple, and an alternate system of routes kept traffic moving. Clearing through the rain forest was naturally more difficult, and in most cases took a heavy dozer to make any progress.

In general, units operating the various dumps did their own construction except for clearing requiring heavy dozers. The ordnance ammunition dump presented the biggest problem for the engineers because the area was covered with thick growth generally too heavy for removal by a D–4. Also, the schedule for unloading ammunition was such that the project had to be pushed to the maximum. As a result, at times it was necessary to have two D–8's and a D–4 working in the area. This caused a commensurate shortage of dozers to work on roads.

Surfacing operations brought to light the unpredictability of coral. Here, at Morotai, coral, the only surfacing material available, alternated between a sand which was of too fine a texture and a rock of almost granite hardness. To break it up sufficiently for use a considerable expenditure of explosives and extensive employment of rooters were required. Practically no coral of an intermediate grade was found. Drome construction was appreciably slowed by the experimentation required to determine the amount of moisture to be added to the various types of coral found in different pits. This unfortunately often required reworking of portions of the construction and delayed completion.

The standard lessons of drainage, maintenance of supply routes, and other well-known engineer fundamentals were again illustrated at Morotai. As each new base for ships and planes and men on their relentless way back to the Philippines was carved from virgin jungle and reef-bound coral island, engineer experience broadened and proficiency increased.

Having arrived off Morotai, the LCM's of an Engineer Boat Battalion leave the well deck of the LSD and head for Red Beach.

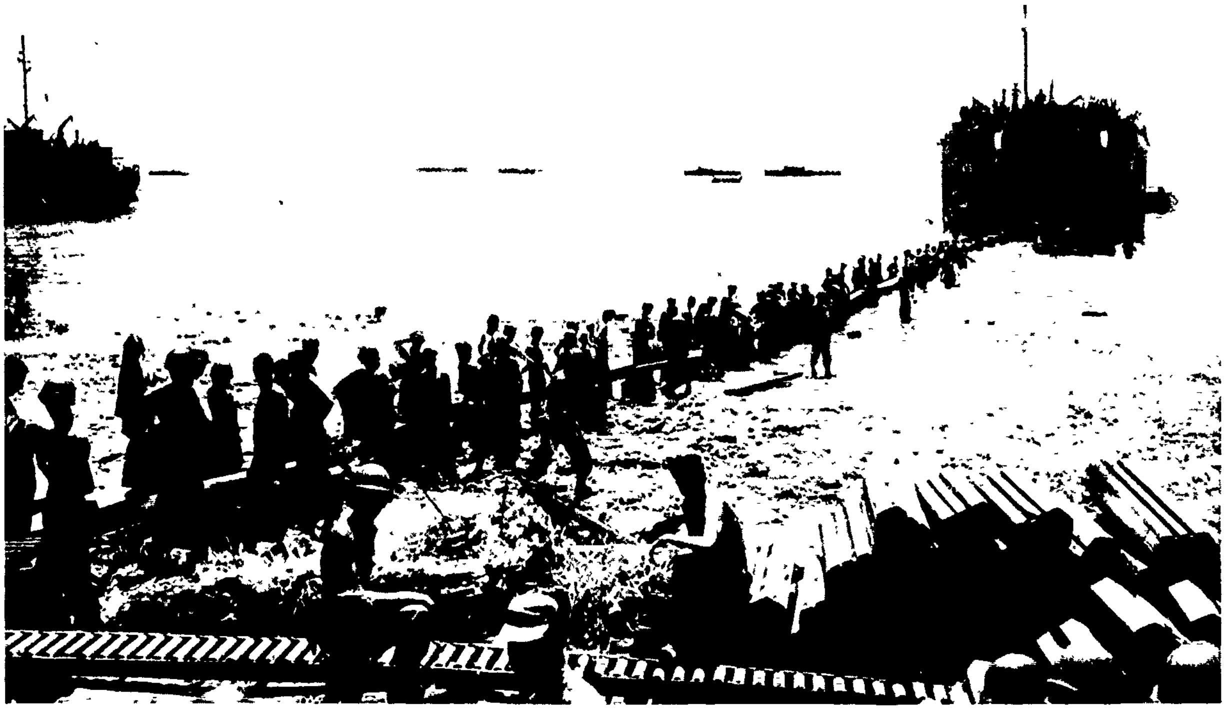
Engineers use a bulldozer to get their heavy earth-moving equipment ashore over the sandy beaches of Morotai.

Vehicles that have bogged down in the soft beach silt of Red Beach, Morotai, await Engineer bulldozers that will tow them to firm ground.

This Engineer bulldozer sank in the soft silt of the tide flats while helping stranded vehicles over Red Beach, Morotai.

Ponton causeways subsequently brought into Red Beach on a high tide are used as lighterage jetties for unloading of LCT's and LCM's operating between beach and offshore LST's.

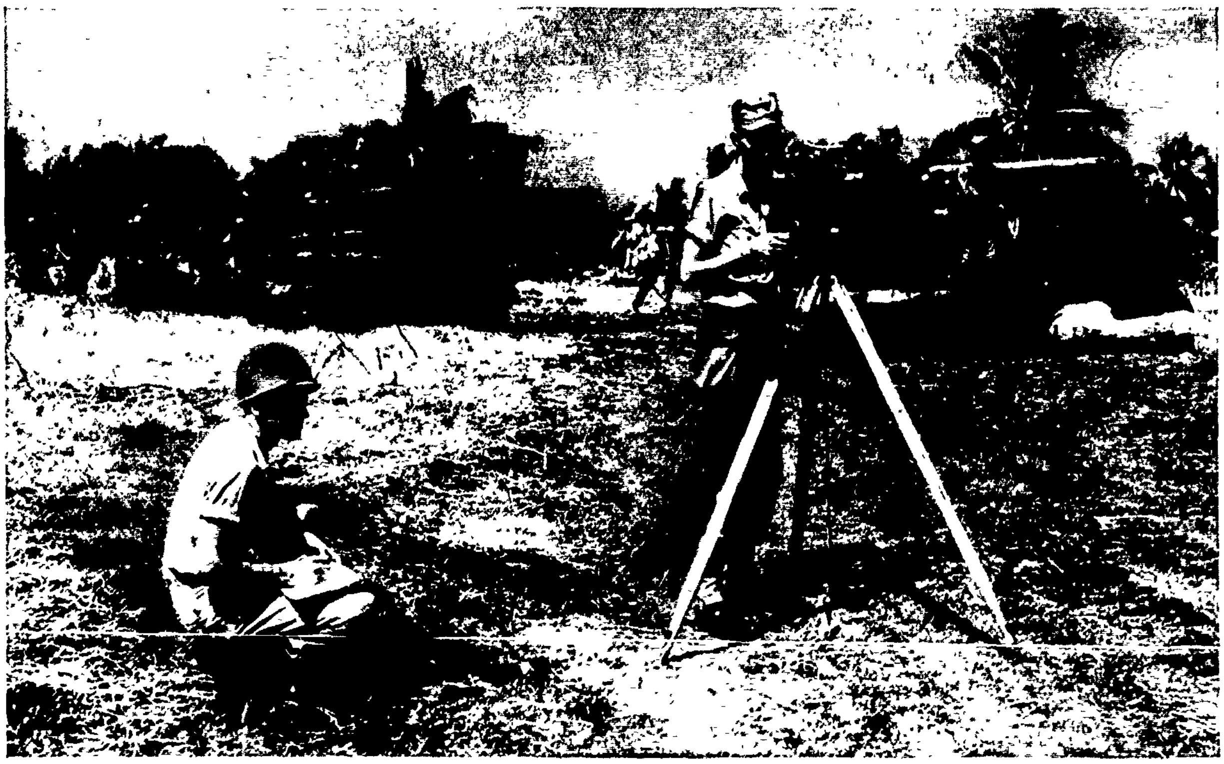
Shore Party Engineers constructed these sandbag ramps to the open doors of LST's, which made satisfactory landings at White Beach, Morotai Island.



Roller conveyors, operated by an Engineer Shore Battalion, played an important part in easing unloading difficulties at both White and Red Beaches, Morotai Island.

After D Day, LST's made satisfactory landings at Blue Beach in Pitoc Bay, opposite White Beach, one of the initial landing areas.

Infantry patrol, which has been carried over the beach in an LVT, leaves the Engineer craft and advances inland on Morotai on foot.



Engineer surveyors and bulldozers commence work on the newly won Pitoe Airstrip, Morotai Island.

Over-all Engineer Highlights

It was now evident that engineer constructed bases were indispensable links of the Allied air and sea blockade thrown around Japanese concentrations in the Southwest Pacific. The principal engineer missions, which made possible to a large extent the success of each new advance, all gravitated to high-speed construction of airdromes and their accompanying bulk fuel handling and storage facilities, provision of ship berths or beach landing facilities, and establishment of roads, bridges, covered storage, and hospitals. The pattern of attack in the Theater followed through four general and successive phases: air bombardment, naval bombardment, then the landing of assault forces, followed by construction. "Base to beachhead to base" was the procedure from the beginning to the end of every forward move in the Southwest Pacific. Under the protective cover of solidly based air power, amphibious task forces seized a beachhead large enough for engineers to develop a new sea and air base, which, in turn, became the springboard for the next jump forward.

These fixed land bases were as important to the advance of air and sea support as they were to the ground forces. Air and sea forces both required land bases from which to strike and to which they could return. Bombers and fighters had to return in a matter of hours. Carrier aircraft had the same limitation, and the carrier itself had to return eventually to a fixed land base. Ground forces fought and lived where they fought, but they continually advanced to consolidate air or sea victories by seizing and holding bases from which all three, ground, sea, and air, staged for their new objectives. The mission of the ground forces was to seize ground, occupy it to prevent the enemy from establishing an advance base there, and to defend the base from overland enemy forces so air and sea forces could advance their support. As each new gain was consolidated and a base established by the engineers, therefore, the cycle was repeated.

The pay-off of such tactics is evidenced in the preceding chapters listing the links of the chain of solidly established bases reaching from Port Moresby and Milne Bay through Lae, Finschhafen, Saidor, Aitape and Hollandia up to Biak, Noemfoor, Sansapor, and Morotai. These bases were islands of twentieth-century America in the middle of a primitive jungle. They were strung out over an area as wide as Europe. With control of the water around them, engineer-built bases made the enemy a prisoner of the jungle.

Engineer Intelligence

The pitiful shortage of even reasonably accurate maps and the paucity of information on the objective areas had been a considerable handicap to task forces. Early in 1944, in an endeavor to improve the situation, the Chief Engineer, GHQ, SWPA, had reorganized his intelligence section, putting considerable emphasis on the acquisition of engineer information and its processing into engineer intelligence for dissemination to tactical forces. Task forces had had to rely largely on limited available aerial photography, hastily prepared maps, restricted in their content by a lack, or delayed receipt, of aerial photography, and studies issued by the Allied Geographical Section (AGS). The latter, while quite comprehensive on general conditions, rarely contained specific information on underwater slopes, beach conditions, or soils for the selection of proper landing areas and absolute locations of airdrome sites. For example, while presence of coral heads was indicated, their location as shown was only symbolic, giving considerable negative value to the study as a warning, but little positive value upon which to rely. Aerial photography, unfortunately, deteriorated to the point where on many an occasion the last possible moment for important basic command decisions had passed and aerial photography had not yet arrived. Contact prints of portions of the objective areas were the main source of information during much of this period, and although the prints were often furnished late, engineers still managed remarkably good interpretations not only on airdrome sites, but on planning dumps, depots, dock areas, and especially landing beach areas. From them it was possible to assist task force commanders in selecting landing beaches, to estimate necessary construction, and determine the engineering effort and resources required for the job.

Engineer Annexes to AGS Terrain Studies. The timely preparation of engineer annexes to terrain studies and their expeditious delivery to subordinate planning staffs had been especially stressed by the Chief Engineer, GHQ, SWPA. Unfortunately, however, on various occasions these annexes did not reach subordinate staffs until after planning was well advanced. In other instances this information arrived in staging areas too late, or just in time to reach an embarking task force headquarters.

The compilation of these rather detailed technical reports was still being retarded in mid-1944 by the continuing reasons of: (1) the small staffs and limited time available for the production of engineer annexes to terrain studies; (2) the rapid changes in the strategic and tactical situation which necessitated discarding many partially completed studies after much work had been expended; and (3) security measures which delayed the issue of basic information and aerial photography to engineer personnel responsible for the production of these annexes. However, of these hindrances, the most restrictive was the increasing inadequacy of aerial photography available for engineer interpretation and guidance in preparing these annexes. Notwithstanding engineer appreciation of the importance of these terrain study annexes to assault troops, both in planning and in early operational phases of a campaign, they could not be satisfactorily completed if aerial photography was not available in quantity and quality for engineer interpretation of terrain conditions.[37] This did not mean, however, that there was a complete stoppage in the downward flow of engineer intelligence. Engineer prepared maps, special reports, and partial data as obtained at GHQ, SWPA, were constantly being distributed through engineer technical channels. Staff planners at, or on temporary duty at, GHQ, SWPA, from subordinate headquarters, were completely briefed from the most recently developed information or terrain intelligence by specialists within the Engineer Section, GHQ, SWPA. Much available data for the formal terrain studies could be previewed in manuscript form, including partially completed and annotated aerial photograph mosaics.

USASOS, Medium of Supply

The problem of supply still remained unsolved, but it was improving. The great distances involved made distribution even within the Theater a tremendous obstacle. Engineer equipment underwent constant and unprecedentedly heavy usage, and the flow of spare parts was still critical. Yet, as long as one U. S. engineer D–8 tractor bulldozer could do the work of a thousand natives, each piece of equipment successfully moved to a site where needed assured engineering superiority over the Japanese.

Supply, of course, was synonymous with USASOS. To present the scope of USASOS activities behind each individual operation is not possible within the limitations of this report. Yet, no operation could be reported without some reference, however indirect, to its varied responsibilities. For no man ate, swallowed Atabrine, fired a gun, or drank from a water point without benefit of this command. Long in advance of tactical operations the pulsing current of USASOS activities, leaping through sources at hand to the Zone of Interior and back again, in its provision of the over-all supply program, prepared the logistic support for the individual task forces already discussed and those to follow.

Through various phases of reorganization and decentralization, after the fall of the Philippines,

[37] *Editor's note: See* (1) Chapter V, Vol III, *Engineer Intelligence*, this series, for a presentation of this situation; (2) Memo, CofS, GHQ, SWPA, to Comdr, AAF, 1 Jun 44, sub: [Dependence of Theater plans and operations upon timely receipt of requested aerial photography]. In Records Section, GHQ, SWPA.

collapse of the Netherlands Indies, and the eventual initiation of the Allied offensive, USASOS primary responsibility developed into provision of supplies (other than U. S. Army Air Forces technical items), transportation, hospitalization, and evacuation services necessary to support operations of U. S. Army ground and air elements in the Southwest Pacific Area in accordance with policies established by higher headquarters. Typical functions of USASOS were: (1) Operation of replacement depots (except for Air Force replacements); (2) Reception, staging, and quartering of all U. S. Army units, replacements, and casuals arriving in the Southwest Pacific and their movements in the Theater except in combat areas; (3) Operation of rest and recreation areas; (4) Operation of graves registration service, including burials; (5) Procurement of all equipment, supplies, and services to be obtained from sources within the Theater; (6) Requisitioning of all equipment and supplies to be obtained from the United States to maintain prescribed stockages; (7) Reception of all equipment and supplies and storage pending issue to troops; (8) Establishment and operation of supply points for issue of supplies and equipment; (9) Repair and maintenance not normally performed by corps or division troops; (10) Hospitalization of all Army personnel except temporary hospitalization within task forces; (11) Evacuation of sick and wounded from corps troops, divisions, separate ground force units, and task forces as required by the situation; (12) Operation of all water, rail, and motor transport except that organically assigned to troop units or task forces; (13) Coordination of requests for air transportation; (14) Construction and all acquisition of real estate; (15) Reclamation and disposition of all abandoned and unserviceable property; (16) Disposition of all captured enemy materiel (except air forces materiel); and (17) Payment for all services and supplies procured in the Southwest Pacific, and all approved claims.

Besides pertinent engineer responsibility throughout these various functions of USASOS, the Chief Engineer, USASOS, was charged with implementing the majority of the construction and real estate functions of the G-4 Section, USASOS. As the offensive grew in scope and troops and supplies reached the Theater in ever increasing proportions, vast engineer projects had to be planned. Construction of successively advancing supply bases was essential to support rapidly progressing tactical operations, and problems of the extending supply line with attendant transportation difficulties had to be solved. As an example, when Port Moresby, the initial port operated for the reception of U. S. troops and supplies in New Guinea, declined in importance as operations moved forward, Milne Bay and Finschhafen were developed into the major supply ports and staging areas. At both locations USASOS engineer troops had to initiate construction projects in primitive, thickly matted jungle. Swamps had to be drained, jungle cleared, and roads built. Airdromes and docking and unloading facilities had to be developed. Warehouses, water treatment plants, and hospitals had to be constructed to prepare these ports to fulfill their mission as major supply bases for the support of combat troops operating in more forward areas. At each succeeding site, none, or only the most primitive facilities, greeted the engineers charged with establishing an advance base of operations. Any Japanese airfields captured were inadequate for U. S. aircraft; other existing facilities might better have reverted to jungle. Invariably the engineer construction mission began from *scratch*—and always under the pressure of *time,* with limited resources of manpower, equipment, transportation, and supplies required for the task.

Logistical Planning. Initial supply planning required constant revision because of the limited information on tactical plans available to USASOS and the constantly changing tactical situation. This was improved considerably by GHQ, SWPA, making its tentative and current operational plans available to USASOS sufficiently in advance of operations to permit logistic planning. Procedures were developed for achieving coordinated planning within Headquarters, USASOS, and for close liaison with GHQ, SWPA, planning agencies. Following the receipt of a general operations plan from GHQ, the Plans Division in the G-4 Section, USASOS, collected all the available maps and aerial photographs of the area involved in the construction of the new base. At the same time, estimates were made of the engineer and other service troops which would be required, and of the reserve supplies needed for the period during which the port was being built. By means of weekly meetings at GHQ, SWPA, USASOS was kept in touch with any variation in GHQ plans which might be necessitated by changing conditions. Later a GHQ, SWPA, outline plan for the specific operation was presented at a meeting of the commanders who were to take part. The next step was the issue of the operation instructions by GHQ, SWPA, which required the commanding generals, Sixth Army, Far East Air Force, Fifth Air Force, and USASOS, to submit to GHQ detailed plans to carry out a specific operation. A draft of the USASOS detailed plan, the logistic instructions, was first prepared by the G-4 Section, USASOS, and submitted for comment to the special staff sections of USASOS, and sometimes, dependent on time, to the commanders of advance bases and sections. Based upon their comments, a revision was drawn up, and the revised logistic instructions were sent to GHQ, SWPA, for approval. Information regarding the revised plan was furnished to all special staff sections, which were then able to make their own plans for furnishing the necessary supplies and services.

Concurrently, a base commander and staff for the projected base were designated, and the entire group was assembled in the Plans Room of the G-4 Section for the purpose of preparing specific plans, requisitions, and estimates for establishing the base.

Once the operation commenced and the troops landed, readjustments in the plan were made when unforeseen circumstances necessitated alteration. However, despite minor adjustments, the basic concept of the plan generally remained the same. The adoption of this procedure for the preparation of logistic instructions made possible the assembly of the necessary personnel, equipment and supplies, and a steady flow of construction materials, service troops, and supplies into the new base.

However, engineer support commensurate with specific requirements was not spread throughout the Theater without difficulties. Problems of securing supplies, distribution difficulties, and lack of personnel, trained and experienced in supply procedures, almost continually cast a frustrating influence on the best efforts of USASOS engineers.

Procurement. Originally, engineer supplies and equipment were obtained by: requisition on the San Francisco Port of Embarkation (SFPE); by "contract demand" on Australian governmental agencies (which, in turn, placed orders for materials to be supplied against Reverse Lend-Lease); by direct purchase from Australian sources; by requisition on the Australian Military Forces; and by requisition on the Australian Commonwealth for items of "distress cargo," the distribution of which was under Australian control. Initially, requisition on SFPE constituted the least effective means of obtaining engineer supplies because of the low priority of SWPA as compared with other theaters of operations, the shortage of supplies in the United States, shipping shortages, and because of the insistence of higher headquarters, that Australian potentialities be exploited to the maximum. In addition, the Supply Division, Engineer Section, USASOS, had difficulty in convincing others that their estimates of requirements were within the realm of reason, although subsequent developments proved that the estimates erred on the side of conservatism.

Procurement by contract demand was accomplished through any one of several Australian governmental agencies which investigated potential sources, approved the contract demand if the items were procurable, placed orders with the supplying firms, and arranged for inspection before delivery to a base depot. The personnel of the Supply Division developed many of the potential sources of important supplies and recommended to the Australian agencies that these sources be allowed to manufacture or furnish the supplies. In many cases, however, local pressure resulted in firms receiving contracts for items they were incapable of producing, or in contracts being withheld from firms which could have supplied an acceptable product in the quantities required.

Only minor requirements involving small quantities were authorized for direct purchase from suppliers. Requisitions on the Australian Military Forces principally covered combat materials. Distress cargo was the major source of engineer supplies in the early days. Vessels destined for ports in the Far East were diverted at the outbreak of the war to Australian ports and their cargoes were stored and inventoried by the Australian Government and issued on requisition.

As the Theater developed, however, the relative importance of the various sources of supply changed, until, finally, practically all of the supplies were obtained by requisition on the San Francisco Port of Embarkation, and Australian procurement played a minor part. During operations in Netherlands New Guinea, necessitating an unprecedented expansion of the entire engineer supply system, a considerable improvement in tonnage receipts from the United States began to manifest itself.

Distribution. Distribution difficulties, not readily evident to task forces, even more than engineer supply shortages, developed bottlenecks open to solution only by compromise. These distribution difficulties were caused to a considerable extent by inability to develop advance base facilities and ports (including service support of other services) rapidly enough to keep pace with the forward movement of combat operations. This, together with the basic shipping shortage, caused large stocks of supplies to pile up in Australia awaiting call forward to New Guinea ports. Under the circumstances, if limited available supplies at a forward supply base were on requisition for a specific task force but were more urgently needed to complete essential construction in another area affecting high-priority over-all operations, diversion of such supplies to more urgent requirements was the only recourse. Delivery to the task force was, therefore, deferred until supplemental shipments arrived.

Task force engineers did not regard this supply system as satisfactory and subjected it to various criticism. The Engineer, Sixth Army, who had over-all technical supervision of numerous task force engineer operations, felt the system was unsound because task force engineers could not be certain of receiving supplies on schedule from USASOS depots, but were, nevertheless, held to construction deadlines established by GHQ, SWPA. It was the opinion of the Engineer, Sixth Army, that USASOS should be held unequivocally responsible for stocking sufficient supplies to meet task force engineer demands at all times, or that supplies at USASOS bases should be definitely allocated to Sixth Army, Fifth Air Force, New Guinea Force or USASOS in advance, and under no circumstances be diverted at the discretion of USASOS engineer supply officers.

The Chief Engineer, GHQ, SWPA, reviewed the question of establishing credits or allocations of engineer supplies for the various commands in the forward areas, and advised against it. To effect inviolate reservations from inadequate over-all stocks was out of the question because freezing of these supplies in the full and sometimes inflated quantities requisitioned would virtually stop other urgently needed construction. The Chief Engineer further held that the USASOS engineer organization, as a responsible logistics agency, should be given leeway in deciding whether task force engineer requirements should be anticipated by stocks on hand or whether supplies should be diverted to other vitally needed construction while task force requirements were held in abeyance for future delivery and filled from supplementary shipping. Though USASOS engineers were responsible for filling task force engineer requisitions to the best of their ability, they also had to give consideration to providing supplies for urgently needed base construction and other operations. It was their task to coordinate logistic support in the interest of maximum efficiency.

Problems and Progress. That coordination of logistic support was carried out to the best advantage by USASOS engineers can best be seen if the various supply difficulties behind the scenes are taken into consideration. Operations were supported with an engineer supply structure handicapped by inadequate depot facilities, shortages of depot operating personnel, and inadequate and unbalanced supplies. The first trained spare parts company did not arrive in the Theater until February 1944. Prior to that, spare parts were processed from Milne Bay by details assigned from a depot company and other units which, in turn, were handicapped by loss of the manpower involved. Despite a tremendous backlog of unbinned parts, even the detailed parts personnel were not always available for their basic mission. As mentioned in an earlier chapter, the Chief Engineer, USASOS, did not command engineer troops, while base section commanders, reporting to the commanding general, USASOS, but not responsible to any Engineer officer in a higher echelon, were responsible for engineer construction work. Therefore, with insufficient appreciation of specific engineer problems, these base section commanders on occasion employed engineer parts personnel on erection of their unit warehouses, rather than for administration of parts supply, while construction troops in some cases were employed on camp projects that could have been executed by the ground forces themselves.

There was no systematic shipment of Class IV equipment replacement stock and regular parts stock direct from the United States to the forward areas. Furthermore, the spasmodic shipments effected were bulk, rather than block, loaded so that such stocks were inaccessible on arrival and had to be off-loaded at rear bases and transshipped forward, usually on priorities not commensurate with their importance. Theater shipments, on the other hand, were beset with multitudinous problems, the major bottleneck being to get loading and shipping priorities through the regulating system. Other difficulties involved unloading U. S. ships at the wrong points, pilfering and loss en route to depots, limited availability of transport aircraft and efficient express boat service to forward areas for emergency transshipments, and failure of regulating officers to realize the importance of parts shipments in deciding shipping priorities. Remedial action in connection with Theater shipments, however, was brought about during 1944 by the intervention of the Chief Engineer, GHQ, SWPA, which resulted in the chief regulating officer giving the highest priority to movement of engineer equipment from Milne Bay to Finschhafen, Hollandia, and Biak.

Despite all difficulties, bases in support of the long-planned return to the Philippines were laboriously but surely advancing on the heels of the combat troops. The initial hobbled steps of engineer support, on which so much of USASOS progress depended, were now developing into strong, forceful strides. Engineer depots in New Guinea by October 1944 extended through Port Moresby, Milne Bay, Oro Bay, Lae, Finschhafen, Hollandia, and Biak. Marine spare parts, initially only available from the U. S. Navy Spare Parts Distribution Center at Brisbane, Australia, were now issued through engineer marine supply sections established at Milne Bay, Finschhafen, Manus Island, and Biak, as well as on a floating mobile warehouse, the barge *Douglas Fir.* At long last, the need so often stressed by engineers on the Theater level, as well as those at subordinate levels, for ships exclusively stocked with engineer spare parts to be used as mobile depots was being met, and the *Robert Louis Stevenson,* the first Libery ship so assigned, was being carefully prepared for this purpose for future operations.

Statistics of Accomplishment

Over and above the many supplemental air bases discussed in this chapter, the main springboards carved out of the jungle by this time were Milne Bay, Nadzab, Finschhafen, and Hollandia.

Milne Bay became a city of 12 square miles with a population of 100,000. This base, with its 12 Liberty ship berths and numerous docks and jetties for smaller ships, provided sufficient storage and related facilities to unload, encamp, and stage 80,000 men with all their equipment and supplies.

In the Nadzab area of the Markham Valley, a huge air base was built with 9 miles of runways, 52 miles of taxiways, and hardstand areas sufficient to park 656 heavy bombers, 1,300 medium bombers, or 2,000 fighters.

The "City" of Finschhafen, stretching out over 25 miles of coast line along several bays and harbors, became a busy metropolis with 4 principal highways, an airdrome, berths for 11 Liberty ships at one time, and 2,200,000 square feet of covered storage.[38] Sixty-five hundred hospital beds were available here, and staging camps for two divisions.

Hollandia, covering an area of 25 square miles, became an air, ground, and naval base constructed to stage and supply troops on the final drive to the Philippines. Here, accommodations for 85,000 ground and air force troops were available. This base with its three airdromes and its seaplane base provided facilities for transshipment of troops and supplies to forward areas and hospitalization for troops evacuated from combat zones. Sixth Army set up its headquarters there on 6 July 1944, and on 8 September 1944 General MacArthur brought his headquarters up from Brisbane. On this same date Lt. Gen. Robert L. Eichelberger was assigned to command the newly activated Eighth Army with headquarters also at Hollandia.

Operations for the establishment of these and the many supplemental bases had been conducted under adverse weather conditions and over formidable terrain. Roads were lacking in almost every area occupied and as a result, troop movements and supply were extraordinarily difficult. The prompt "roll up" of rear bases, however, permitted an economical employment of the same personnel, material, and equipment again and again as operations advanced so that despite the lower priority given Southwest Pacific operations, they could be continued and maintained. And in preparation for their continuance, Allied Air Forces were sweeping the Japanese aerial threat from the skies. Powerful air strikes at strategic targets from newly established advance bases were effectively stopping the flow of supplies to bypassed enemy units and impairing the ability of the Japanese to maintain their widely scattered forces elsewhere. Allied operations were now *zeroing-in* for the return to the Philippines.

[38] *Editor's note:* Twelve Liberty ship berths were available at Finschhafen at the close of 1944, as well as several small wharfs, docks, and jetties.

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CHAPTER VI

Philippine Campaign

October 1944–September 1945

The sun was now beginning to set for the Land of the Rising Sun. The Japanese schedule for their over-all plan of sudden conquest was more than slightly off balance. They had disregarded an elementary military axiom by overextending themselves. Their forces, spread over a front more than 3,000 miles long, were too widely dispersed to defend every point and base. Lightly held strategic areas had fallen into Allied hands through a calculated plan of bypassing Japanese strong points and cutting their supply lines. Allied engineer troops not only played their part in taking these strategic areas, but, as already indicated, developed them into great advance bases which extended the *Bomber Line* and provided staging areas and ports for hundreds of thousands of troops and millions of tons of supplies and equipment.

Leyte
20 October 1944

While defensive perimeters were being maintained elsewhere and bases were being secured with only isolated and sporadic local engagements occurring, initial planning for the return to the Philippines had begun in Brisbane, Australia, on 25 July 1944. These early plans, known as KING I and KING II respectively (see Map No. 12, "Philippine Campaign, 1944–1945"), called for a landing in the Sarangani Bay area of Mindanao on 15 November, followed by a landing on the island of Leyte on 20 December 1944. The preliminary planning at Brisbane was completed on 8 August, and the various representatives returned to their areas for further implementation of the respective roles assigned them.

On 15 September, however, General Headquarters, Southwest Pacific Area (GHQ, SWPA), canceled the Mindanao operation and advanced the target date of the Leyte (KING II) operation to 20 October 1944. (See Map No. 12.) Plans had to be hastily revised on this basis. All previous planning for the Leyte operation was of little value because of the changes in composition of the forces and shipping involved.

The distance from the nearest principal staging area at Hollandia, Netherlands New Guinea, to the Leyte beaches is approximately 1,500 miles. However, many units assigned to the operation were staged from widely separated areas, and naval shipping had to pick up some elements staging as far as 600 miles to the rear of Hollandia. Considering the time involved in loading

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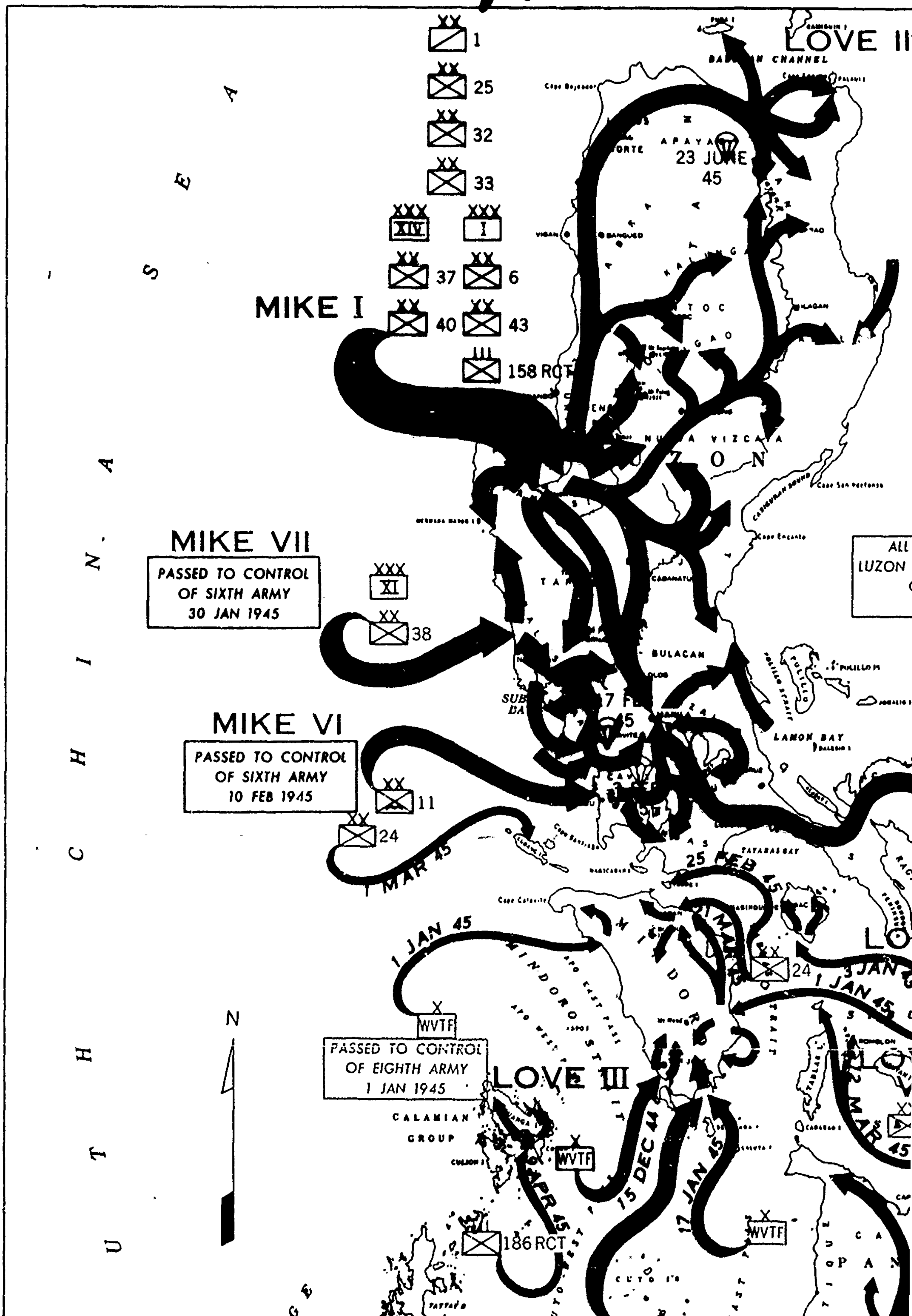
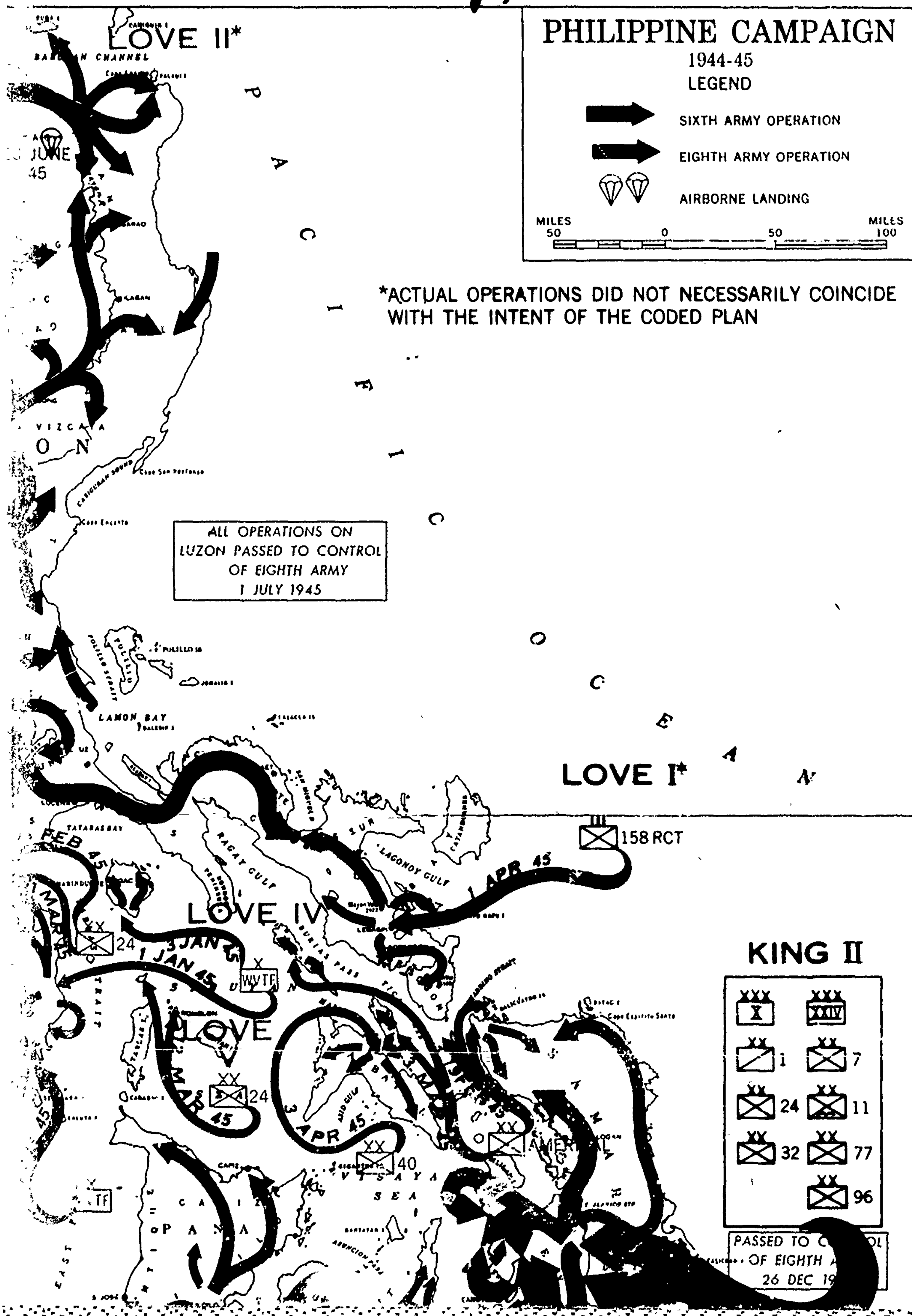
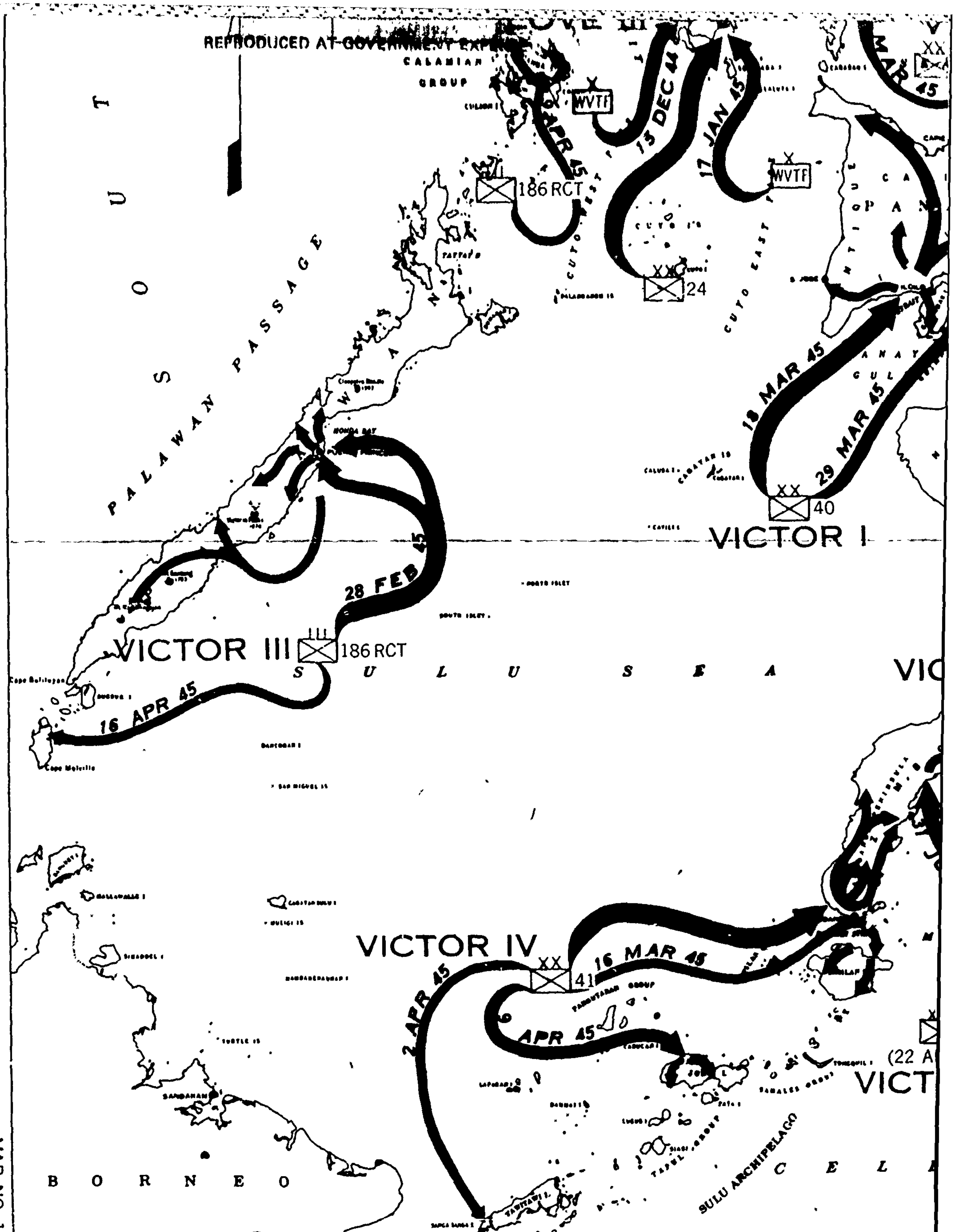


LOVE II
BALINTANG CHANNEL
1
25
32
33
XIV
I
37
6
MIKE I
40
43
158 RCT
23 JUNE
45
LUZON
S O U T H   C H I N A   S E A
MIKE VII
PASSED TO CONTROL
OF SIXTH ARMY
30 JAN 1945
XI
38
BULACAN
MIKE VI
PASSED TO CONTROL
OF SIXTH ARMY
10 FEB 1945
11
24
1 MAR 45
LAMON BAY
25 FEB 45
1 JAN 45
MINDORO
APO EAST PASS
APO WEST PASS
24
3 JAN
1 JAN 45
N
WVTF
PASSED TO CONTROL
OF EIGHTH ARMY
1 JAN 1945
LOVE III
CALAMIAN
GROUP
WVTF
15 DEC 44
17 JAN 45
APR 45
2 MAR 45
186 RCT
WVTF

20f4


PHILIPPINE CAMPAIGN
1944-45
LEGEND
SIXTH ARMY OPERATION
EIGHTH ARMY OPERATION
AIRBORNE LANDING
MILES 50 0 50 MILES 100
*ACTUAL OPERATIONS DID NOT NECESSARILY COINCIDE WITH THE INTENT OF THE CODED PLAN
LOVE II*
BALINTANG CHANNEL
PACIFIC OCEAN
VIZCAYA
ALL OPERATIONS ON LUZON PASSED TO CONTROL OF EIGHTH ARMY 1 JULY 1945
LAMON BAY
POLILLO STRAIT
LOVE I*
158 RCT
1 APR 45
LAGONOY GULF
RAGAY GULF
LOVE IV
3 JAN 45
1 JAN 45
WVTF
24
LOVE
24
3 APR 45
40
VISAYA SEA
KING II
X
XXIV
1
7
24
11
32
77
96
PASSED TO
OF EIGHTH
26 DEC



MAP NO. 12

SOURCE: Hq, Eighth Army (Additions by OCE, GHQ, AFPAC (Historical)).

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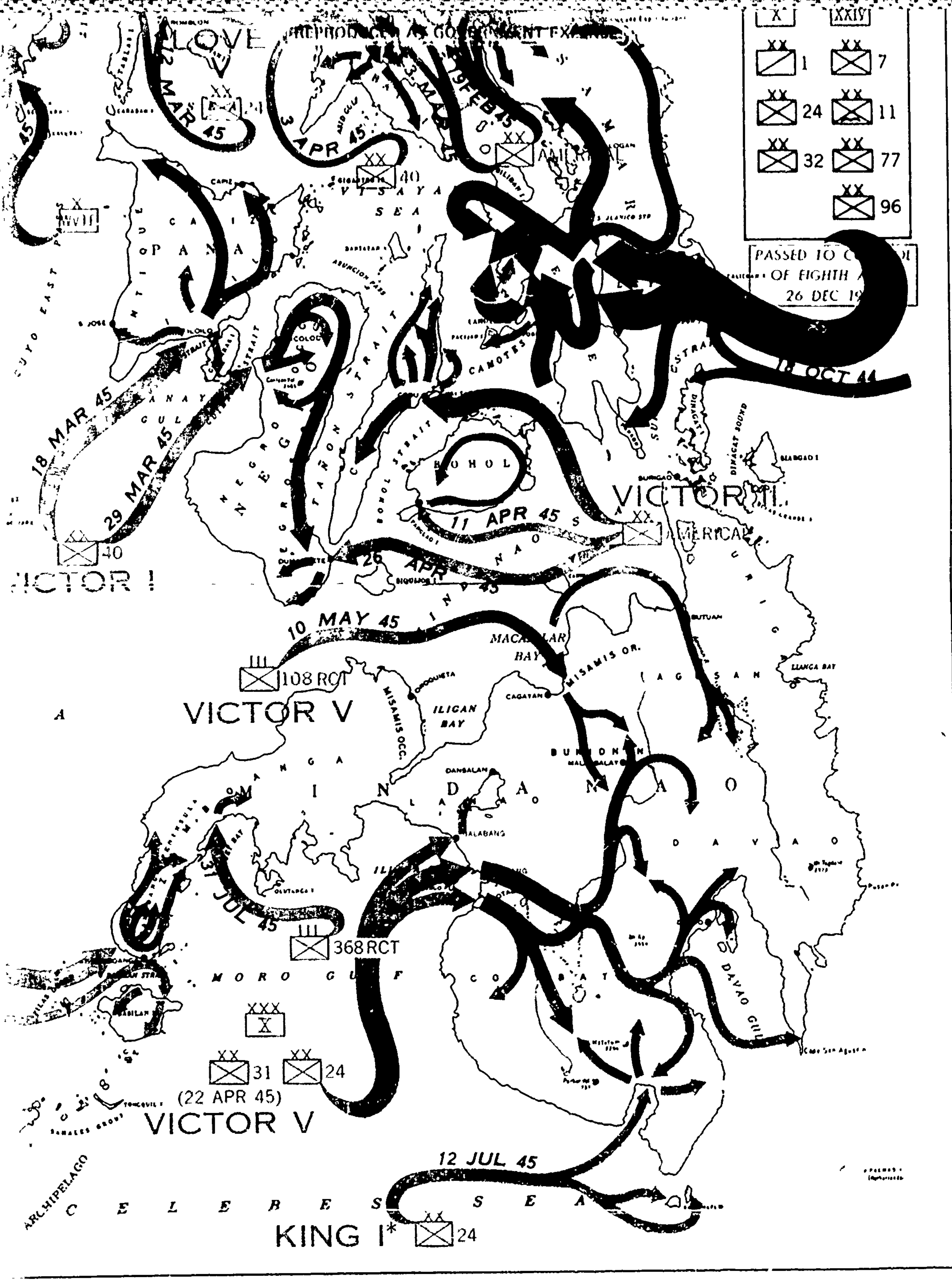

LOVE
REPRODUCED AT GOVERNMENT EXPENSE
12 MAR 45
3 APR 45
3 MAR 45
19 FEB 45
AMERICAL
40
VISAYA SEA
PANAY
PASSED TO CONTROL OF EIGHTH ARMY 26 DEC 1944
18 MAR 45
29 MAR 45
40
VICTOR I
NEGROS
TAÑON STRAIT
CAMOTES
BOHOL
11 APR 45
VICTOR II
AMERICAL
20 OCT 44
26 APR 45
10 MAY 45
MACAJALAR BAY
108 RCT
VICTOR V
ILIGAN BAY
MISAMIS OCC.
MISAMIS OR.
CAGAYAN
BUTUAN
MINDANAO
DAVAO
17 JUL 45
368 RCT
MORO GULF
X
31
24
(22 APR 45)
VICTOR V
12 JUL 45
CELEBES SEA
ARCHIPELAGO
KING I*
24
1
7
24
11
32
77
96
X
XXIV

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and the 9-knot speed of LST's, this meant that initial movement of ships had to start on 4 October or 18 days from the time the actual planning for the final Leyte operation was begun. All Seventh Amphibious Force shipping was, in the meantime, supporting the Morotai operation and its resupply. The last of these ships arrived back in Hollandia on 6 October, or two days after shipping was to begin moving out for the Leyte operation. The resultant curtailment of loading time caused great quantities of essential engineer heavy equipment to be left in the staging areas.

Under the new schedule, relief of XIV Corps from existing missions in time for employment by Sixth Army for this operation, as originally planned, was impossible. Replacement was, therefore, made by diverting XXIV Corps *at sea* from its projected operation against Yap Island, and transferring the Corps from the Pacific Ocean Areas to the Southwest Pacific Area with assignment to Sixth Army. There was no time for reloading or rearrangement of troop lists, which, unfortunately, included only one heavy construction unit because no construction work of any magnitude had been contemplated for initial operations on Yap.

Prior to the major amphibious assault on Leyte Island, it was essential to secure the entrance to Leyte Gulf and sweep the surrounding waters of enemy mines. On 17 October (D minus 3) the 6th Ranger Battalion, reinforced by two companies of the 21st Infantry, made successful amphibious landings on Dinagat and Suluan Islands which command the approaches to Leyte Gulf. The following day Homonhon Island was secured. Naval mine sweepers methodically swept Leyte Gulf and specially trained demolition teams neutralized or removed obstacles along the beaches in the face of enemy fire. This was the first phase of the operation and paved the way for the main effort.

On 20 October, preceded and supported by heavy naval bombardment, X and XXIV Corps of Sixth Army made the major amphibious assault on the east coast of Leyte Island between San Jose and Dulag, and on those coastal areas of Leyte and Panaon Islands dominating Panaon Strait. (See Map No. 13, "The Sixth Army Plan, Leyte, Philippine Islands.")

Amphibian Engineer Operations

In its assault of the northern beaches in the San Jose–Palo areas (White and Red Beaches), and the Panaon Strait area (Green Beach), X Corps was supported by the 2d Engineer Special Brigade (ESB). The entire brigade participated with the exception of the 542d Engineer Boat and Shore Regiment (EBSR) (less one boat company, reinforced), most of which was moved into Leyte with subsequent echelons. Brigade boats were responsible for ship-to-shore unloading and subsequent boat missions on the far shore. Three hundred and eighty-nine 2d ESB craft were moved to the operational area by the Seventh Amphibious Force. The lift represented the largest movement of small landing craft in any Southwest Pacific operation thus far. Shore parties supervising the unloading over White, Red, and Green Beaches were made up of the 532d and 592d Engineer Boat and Shore Regiments.

In its seizure of the San Jose[1]–Dulag area to the south, XXIV Corps was entirely dependent upon naval landing craft for ship-to-shore movement. Shore parties for the beaches in this area were made up of the 1122d Engineer Combat Group at Orange and Blue Beaches (San Jose area), and the 1140th Engineer Combat Group at Violet and Yellow Beaches (Dulag area). However, these landings were executed under the handicap imposed on XXIV Corps by the shift of its objective from Yap Island to Leyte. Initial landing preparations had been made for an entirely different type of operation. All assault troops were aboard LST's, and their planned ship-to-shore movement after reaching Yap Island contemplated a transfer to Navy

[1] *Editor's note:* This town of San Jose should not be confused with the previously mentioned and more northern town of the same name.

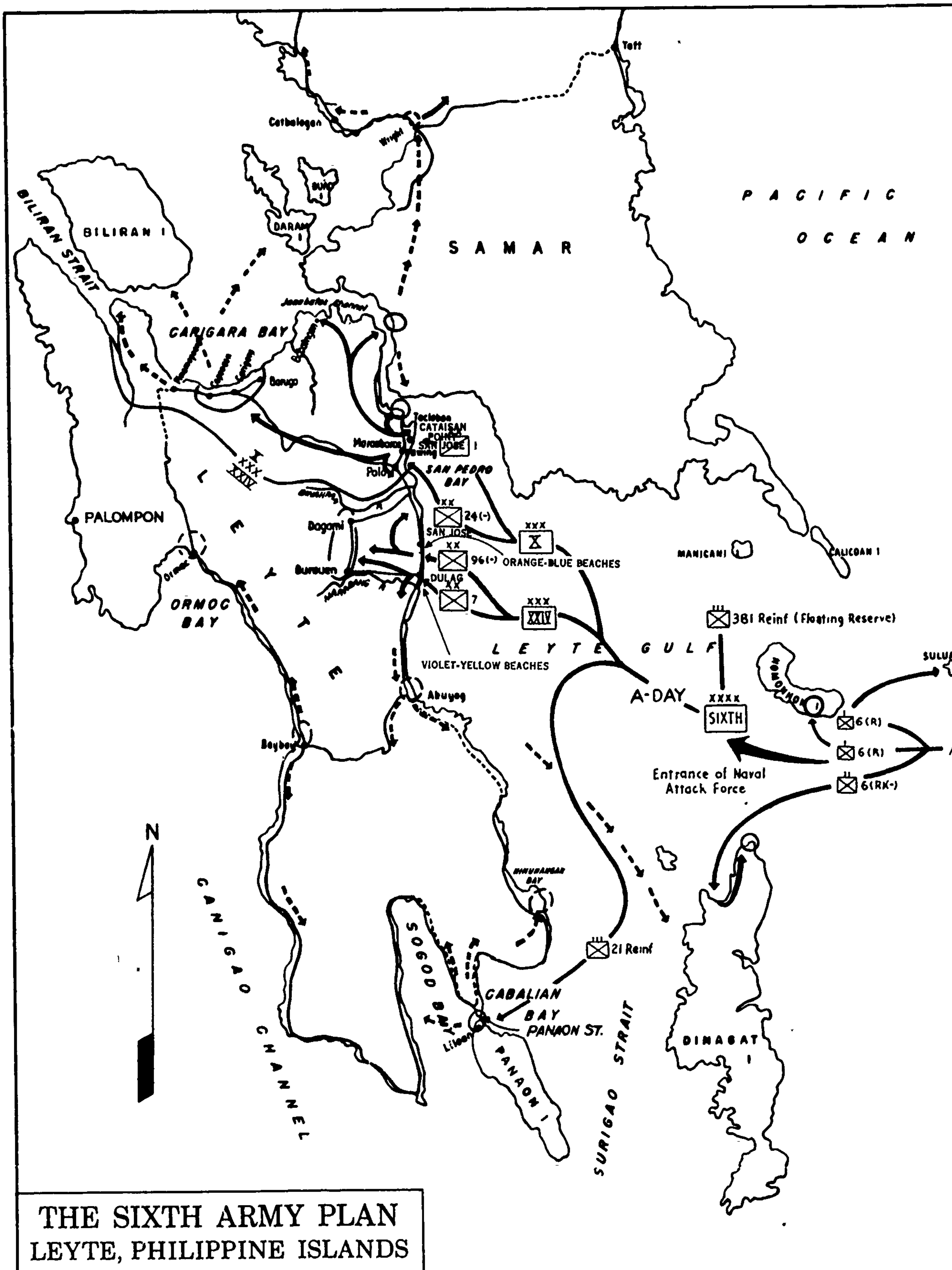
LVT's (Buffaloes) for the purpose of navigating offshore reefs. Initial beaching of LST's on the far shore had not been contemplated. The original engineer plan for the Yap operation had been based on attacking and mopping up a small island having few roads and little surface water. Equipment and supplies to meet these conditions had been balanced against extremely limited engineer shipping space. The sudden diversion to the Leyte operation had not permitted reloading or rearrangement of troops, and landing plans necessarily had to be revised en route.

Landing Support Fire. Unlike previous operations undertaken with limited naval support, the Leyte operation was provided with considerable heavy naval support. Aerial bombing and strafing of the beaches was, therefore, not employed. It was believed that naval gunfire and rockets could more effectively keep Japanese beach defenders under control than to stop bombardment for 10 to 20 minutes while aircraft came in for, at most, a 5-minute bombing and strafing run. Tactical air support was highly desirable against enemy troop concentrations and lines of communication farther inland, but it was determined that such support should not be used against beach targets just prior to the landing at the expense of heavy naval gunfire. This policy was consistently followed with great success in this phase of operations.

Smoke Screens. The subjection of small landing craft, which preceded LST's, to enemy artillery and mortar fire was considered by preliminary ESB after action reports as indicative of the desirability of promptly covering vulnerable LST's with smoke. Practically no fire was encountered from Japanese shore defenses at any of the X Corps beaches except in the vicinity of Palo (Red Beach). There, however, ESB craft met more artillery and mortar fire than they had ever before encountered. No ESB landing craft were lost, but four LCM's were damaged by fragments, and one Navy LCVP was sunk. It was also reported that three LST's on the left flank of assault waves suffered from five to nine direct hits. The Navy, however, did not lay smoke on Red Beach until the unloading phase of the operation; and then, not before twilight.

Resistance on the XXIV Corps beaches was minor. The landings were made on a broad front with divisions abreast. Some Japanese mortar and light artillery fire was directed against the boats, but with few casualties. Initial operations at these beaches also progressed without benefit of any smoke screen during daylight. Complete reliance was placed in the ability of fighter cover to prevent serious and threatening air attacks during daylight while counterbattery fire from support vessels silenced shore-based mortar and artillery fire. However, no night fighter protection against night air attacks was available. To permit uninterrupted unloading, ships were retained at anchor under protection of a heavy smoke cloud generated just before sunset by securing smoke floats alongside. While this procedure provided a rapid means of covering ships, commensurate disadvantages of its application promptly manifested themselves. Many XXIV Corps troops had not yet been landed, and since the ships were alerted for action, these troops were still confined to their berthing spaces. The density of the smoke screen laid so close to the ships made their compartments uninhabitable, and the troops had to be ordered to the weather decks. Several cases of near asphyxiation resulted during the first smoke screen, and artificial respiration had to be resorted to in some cases. This developed into a Navy recommendation that smoke floats in the future be placed aboard small craft and carried some distance to windward prior to releasing them to permit dissipation of the toxic effect of the smoke. It was further recommended that persons who were highly sensitive to the nauseous effects of thick smoke concentrations use gas masks, and that the interior of ships be kept cleared of smoke by stopping the intake ventilation blowers while in a smoke screen.

During daylight, with ample antiaircraft fire from ships available, and especially with the pro-



THE SIXTH ARMY PLAN
LEYTE, PHILIPPINE ISLANDS

MILES 10 5 0 10 20 30 MILES

SOURCE: Hq., Sixth Army, Report of the Leyte Operation, 20 Oct – 25 Dec 1944
(Additions by OCE, GHQ, AFPAC (Historical))

MAP NO. 13

tection of a combat air patrol, area smoke was considered of little value by the Navy. Smoke screens were, therefore, maintained only during the critical dusk periods at sunset and just before dawn until day fighters were on station. In fact, subsequent reports of the action in Leyte Gulf carried the Navy recommendation: *Do not use smoke under any conditions during daylight.* For at Leyte Gulf Japanese air tactics changed from those noted previously. In the past, except for sporadic occasions, Japanese air attacks had followed the more or less orthodox patterns of dive bombing, torpedo plane attacks, and low-level bombing. At Leyte Gulf these tactics no longer obtained. Instead, suicide dive bombers appeared in relatively large numbers—and the surest defense against such tactics was, of course, gunfire. It was, therefore, essential that the air overhead be kept clear so that batteries would be subject to a minimum of limitations or delays in opening up on suspicious targets.

Landing Conditions. The beaches in the XXIV Corps zone of action, though unsheltered and subject to high-surf conditions in heavy blows, were excellent for unloading of all types of landing craft. In the X Corps zone, White Beach, as anticipated from study of available maps and aerial photographs, proved to be the most suitable of the two unloading beaches. Even so, considerable difficulty was encountered in maintaining the 100-foot-long earth causeways that had to be constructed out to each grounded LST. At the other beach (Red), sand bars paralleling the shore line caused the LST's to ground at the stern approximately 100 to 200 yards from the beach with a depth of 4 to 8 feet of water at the ramps. Only one LST was able to approach close enough to the beach to unload. A second LST lowered its ramp and a bulldozer attempted to get ashore but slid into 8 feet of water and jammed the ramp so it could not be lifted. All the other LST's grounded with bows in such deep water and so far out from shore that landing was impossible and building of sand causeways, because of existing currents, impracticable. This contingency had been pointed out in the terrain studies of the Chief Engineer, GHQ, SWPA, which were based on careful aerial photographic studies and analyses of an accurate hydrographic survey prepared in peacetime (the first available in 1½ years of Theater operations). To surmount this obvious difficulty, both the commanding general, Army Service Command, and the Engineer, Sixth Army, had urged during the planning phase that ponton causeways be brought in with the LST's scheduled to land on Red Beach. However, no provision was made for the supply of these pontons on Red Beach (X Corps) other than that they could be moved up from the Dulag area (XXIV Corps) on call. When the immediate need for these ponton causeways presented itself during the actual landing on Red Beach, therefore, it took 36 hours for the first of the ponton-string equipped LST's to arrive from the Dulag area. By then, confusion had begun. While waiting for the ponton causeways to be brought up from Dulag and installed, some LST's, which had grounded off Red Beach and were exposed to Japanese air and artillery bombardment, were unloaded by LSM's and LCM's. Other LST's, diverted from Red Beach, however, landed on Cataisan Point, adjacent to White Beaches, where dry landings were possible, and unloaded several thousand tons of ammunition, supplies, and equipment across Tacloban airdrome. The resultant congestion at the airdrome area impeded all construction operations there until unloading over it was stopped by D plus 3. Subsequent LST's were then diverted to White Beach, and only a few LSM's continued to ferry to Red Beach. It was obvious that future landings should not be attempted on flat beaches unless ponton causeways were provided and time allowed for their installation prior to landing of LST's. Commenting on this incident, the Engineer, Sixth Army, reported: [2]

[2] Ltr, Engr, Sixth Army, to CofS (thru G-3), Sixth Army, 12 Nov 44, sub: Comments on K-2 Operation. In Sixth Army files.

While the conditions to be expected at Red Beach were repeatedly stressed in Staff conferences, and with the Navy, we should not have been satisfied with assurances that *in case* Red Beach turned our poorly, pontoon rafts and lighterage would be provided from the Southern sector. Since there was no conflicting reason, this equipment should have been in the vicinity of Red Beach at H hour as this headquarters requested. The result was nearly disastrous as so many LST's had to be transferred to White Beach and Cataisan Point (where Tacloban drome is located). This caused congestion of the airdrome area with ammunition, POL, rations and other supplies and miscellaneous units—all resulting in such a traffic problem that dump truck capacity was seriously reduced in traveling from coral pits to the runway. This retarded completion of the airdrome 1–2 days at a critical time in the operation when the hostile Navy took the offensive. . . .

Upon arrival of the causeways, two or three sections were sufficient for the initial landings; later, however, it was necessary to use as many as five sections to reach grounded LST's. A lower tide, and, especially, the gradual build-up of a sand bar by LST propellers created a need for extending the causeways.

Assignment of LST's to respective beaches for unloading also presented a problem and was accomplished almost on a trial and error basis. Early echelons ashore had no information as to what troop units were carried aboard specific LST's. As ground reconnaissance showed originally planned areas unsuitable for units assigned to them, considerable shifting between beaches was necessary. And in determining the serial numbers of the Navy LST's carrying specific units to be diverted, much time was lost. For example, it was known that two LST's from Hollandia (Base G) were designated to carry a certain unit, but initial echelons on the far shore did not have the identifying numbers of the LST's assigned for this purpose. For future operations it was recommended that both the naval beachmasters and the shore party have a tabulation of the serial numbers of arriving craft and a troop list of units aboard each craft.

Shore Party Activities. The unloading phase, carried out by different organizations on the various beaches, can best be presented by separately considering the beaches in the X and XXIV Corps areas. First, it is necessary to point out, however, that over-all cooperation, coordination, and integration among all commands concerned with the unloading was considered to be of the highest order on practically all beaches. Transportation on the same ship of both the Navy beachmaster and the Army shore party commander assigned to and jointly responsible for a respective beach made possible advance agreements on many details for joint operations ashore, and eliminated many causes for misunderstanding. This arrangement permitted speedy interpretation, coördination, and dissemination of last-minute changes in instructions, and was recommended by both Northern and Southern Attack Forces, U. S. Seventh Fleet.

In the X Corps area, on the northern beaches, approximately 42,300 troops and more than 26,400 tons of supplies and equipment were included in the D Day assault. Subsequent echelons arrived on D plus 2 and D plus 4. Despite numerous air raids and alerts, all unloading schedules were satisfactorily met, and Navy shipping was able to return to the near shore on the planned schedule. In fact, one echelon was able to return a day ahead of schedule.

Naval beach parties operated in conjunction with each ESB shore party on these northern beaches. The Navy transport groups furnished transport beach parties which proved of considerable assistance to the shore party in off-loading landing craft from the respective transports. As a result, LCM's and LCVP's used in unloading transports were able to return to them for subsequent unloading so promptly that average unloading time for APA's was held to 4½ hours.

Coordination of activities on the beach was considerably assisted by the fact that all personnel assigned for work with the shore party had their trousers marked with white or yellow paint to distinguish them from troops not in the shore party and to assist in controlling them. This measure proved most effective. Of benefit also was the provision of prefabricated wooden horses to support roller conveyors in the water.

Considerable disadvantage, however, was suffered by the landing of excessive quantities of drummed POL supplies in the early days of the operation. The large accumulations of POL on the beaches could not be adequately dispersed for protection against fire. The first fire on White Beach, involving some 100 tons of POL, was attributed to Japanese bombing, but the second tremendous fire, involving over 1,000 tons of POL, was apparently caused by low flak from vessels in the harbor striking inadequately dispersed POL supplies in the White Beach area.

Loading plans also evidenced a seeming lack of consideration for initial and urgent engineer missions in the objective area. Ships were loaded with little provision apparent for facilitating the early establishment of landing fields which were always of prime importance. Despite the obvious need to load landing mat where it could be reached promptly, it was buried under tons of other supplies and equipment. As a result, on D plus 1 when a critical need for landing mat occurred at Tacloban airdrome, there was no ship in the harbor which did not have various miscellaneous military impedimenta loaded on top of the urgently needed materials. There was, in addition, considerable wasted effort involved in emergency changes of unloading priorities. On D plus 4, for example, the planned unloading had to be entirely revised because of the necessity of getting 1st Cavalry Division rations off a Liberty ship, although the division had presumably landed with a 10 days' supply. On boarding the ship it was found that many heavy layers of naval ponton cubes were on top of the rations. These all had to be unloaded before the rations could be reached.

Many previously experienced difficulties manifested themselves. Congestion occurred on the beaches because of their limited areas and inadequate exit roads to the hinterland. The early outloading of landing craft for tactical missions and resupply runs hampered lighterage efficiency. Commitment to combat of reserves initially attached to shore parties as labor troops, without replacement of this lost manpower on the beaches, worked a considerable handicap. Intensely heavy rains and two typhoons delayed progress. Much equipment and supplies not needed in early days of operation, which were, nevertheless, brought in on D Day and D plus 2, overcrowded the very limited beaches. Overloaded trailers caused frequent stalling of vehicles and delay in off-loading. Staging area orders, which called for each LST to have at least one dozer near the ramp, 500 feet of roller conveyor, 5,000 sandbags, and 150 feet of ARC mesh readily available, were not scrupulously followed in all cases. On some LST's bales of sandbags were so large that they could not be manhandled. A great deal of valuable time was lost by apparently needless air alerts. Military police generally lacked authoritative influence and proficiency in handling congested traffic conditions. Despite the serious handicap of insufficient truck transportation for unloading, there was unauthorized commandeering of shore party trucks by various units for their own use.

These were the minor irritants which usually made the "means" so difficult, but the "end" was successfully achieved as usual. Comments regarding the engineer special brigade in the report of the Northern Attack Force (Task Force 78) evidence as a matter of record the performance of the amphibious engineers on this mission: [3]

> Shore Parties in this operation were provided by the 2d Engineer Special Brigade. The splendid work of this organization contributed materially to the rapid unloading of ships and dispersal of supplies under most difficult conditions. The 7th Amphibious Force and the 2nd Engineer Special Brigade have been associated in numerous amphibious operations in the past; complete understanding has been achieved through this close association and was reflected in the smoothness with which the LEYTE unloading operations progressed.

On the XXIV Corps beaches in the south, the rate of unloading was generally fairly satisfactory. Despite the shore party having originally been formed and outloaded for the Yap operation in

[3] Ltr, Comdr, Task Force 78 (Comdr, Seventh Amph Force), to CinC, US Fleet, 10 Nov 44, sub: Report on LEYTE Operation. In Records Section, GHQ, SWPA.

which the projected flow of supplies and equipment to the beach would have been much slower, unloading progress reached 74,569 tons during the first 5 days of the Leyte operation. To permit unloading and withdrawal of assault transport shipping, LST's, after discharging their initial loads, were used to some extent for receiving loads from transports. However, the arrival and unloading of support echelons on D plus 2 and succeeding days considerably delayed the final unloading of LST's so employed.

Here, as in the X Corps area, some congestion occurred on the beaches, particularly in the San Jose area (Orange and Blue Beaches). Vehicles, off-loaded from LST's before shore party activities of the 1122d Engineer Combat Group could be organized, stalled and required the diversion of bulldozers and DUKW's to pull them onto these beaches. Most of the vehicles stalled as they approached the beach through the shallows because waterproofing had dried out and cracked during the unexpectedly long voyage (40 days). This weakness had been foreseen when the objective was changed, but neither the supplies for repairing waterproofing nor space had been available on LST's to permit correction.

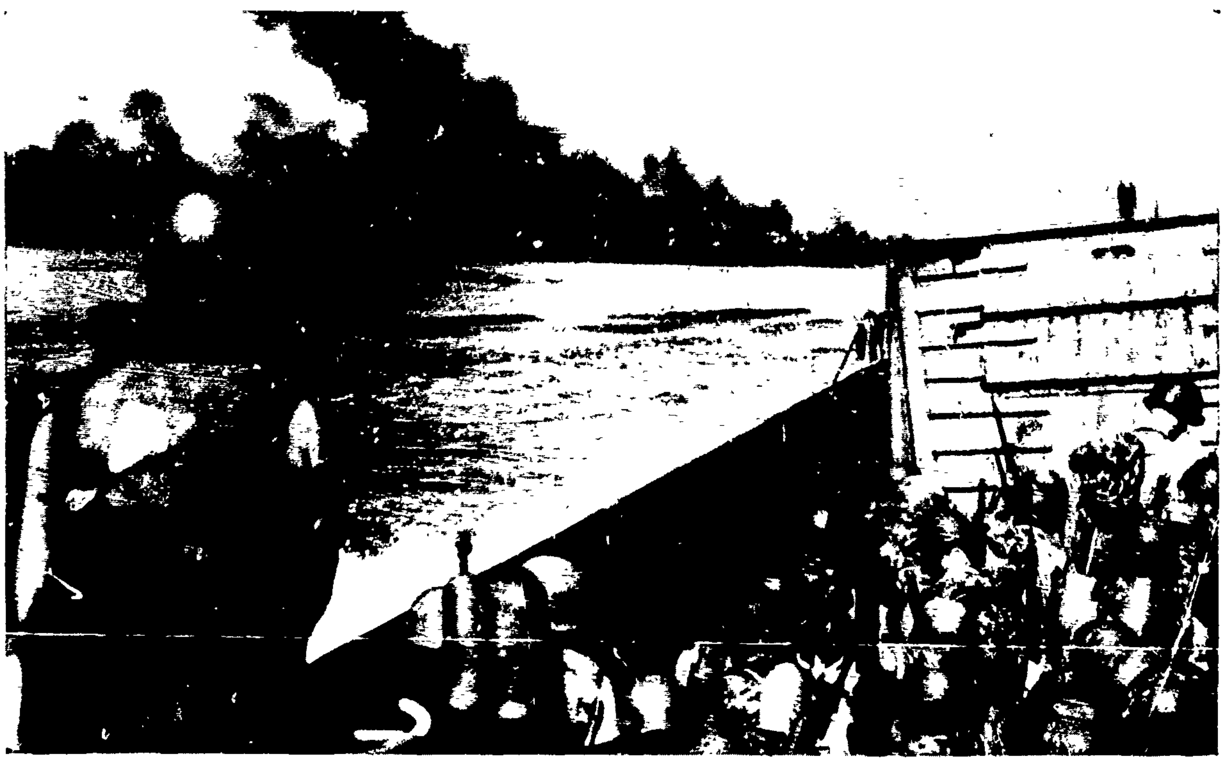
Unloading on Orange and Blue Beaches could have been greatly accelerated, however, if adequate personnel had been available to the 1122d Engineers. On these beaches, shore party strengths generally consisted of 350 men per beach. Of these, approximately 100 were used for perimeter defense, about 50 were assigned to dumps, and others were assigned to military police duties. Only the remainder of a hundred or so were available for actual work on the beach. This organization provided no reliefs for the men and little officer supervision of working parties and truck drivers. Adequate maintenance personnel for LVT's, DUKW's, and bulldozers were lacking. There was a corresponding shortage of bulldozers, tractor cranes, roller conveyors, and transportation to keep the beach clear. In addition, elements of the 1122d Engineers were diverted to the building of roads beyond the beachhead in support of advancing tactical forces. Under the circumstances, it was impossible to empty landing craft at the beach as fast as they could be loaded at the ship.

Unloading on Orange and Blue Beaches was also retarded by the fact that too much unnecessary impedimenta had been lifted by the initial ships landing at these beaches. For example, 23,000 barracks bags were aboard assault shipping, consuming 80,500 cubic feet of shipping space. In addition to the time required to discharge these barracks bags, unloading operations were further delayed somewhat while shore party personnel located their own bags. Assault shipping was also excessively overloaded with garrison supplies. Had garrison supplies and equipment been properly echeloned to arrive in the objective areas after the assault units had cleared the beach, more rapid unloading of ships could have been possible with less burden on the shore parties.

At Yellow and Violet Beaches in the Dulag area of XXIV Corps operations, the 1140th Engineer Combat Group, providing shore party support, was comprised of three engineer combat battalions. Each battalion was comprised of 540 officers and men, all of whom worked two alternate 6-hour shifts daily to permit the group to function on a 24-hour basis. The organization of this command for unloading the 7th Division was based on one engineer battalion per beach to operate the cranes, trucks, and tractors, build and improve roadways, and maintain security of the beachhead area. The assignment of a battalion each to Violet No. 1, Violet No. 2, and Yellow No. 2 Beaches proved an equable arrangement and was conducive to the smoothness of operations evidenced in the Dulag area.[4] It was found that the staff, personnel, and equipment of an engineer combat battalion were all necessary for efficient shore party operations. In fact, with two companies necessary for beach operations, and one for dump or storage

[4] *Editor's note:* The 7th Division did not desire much cargo unloaded at Yellow Beach No. 1.

Troop-laden LCT's approaching the shore at Red Beach, Leyte, Philippine Islands.



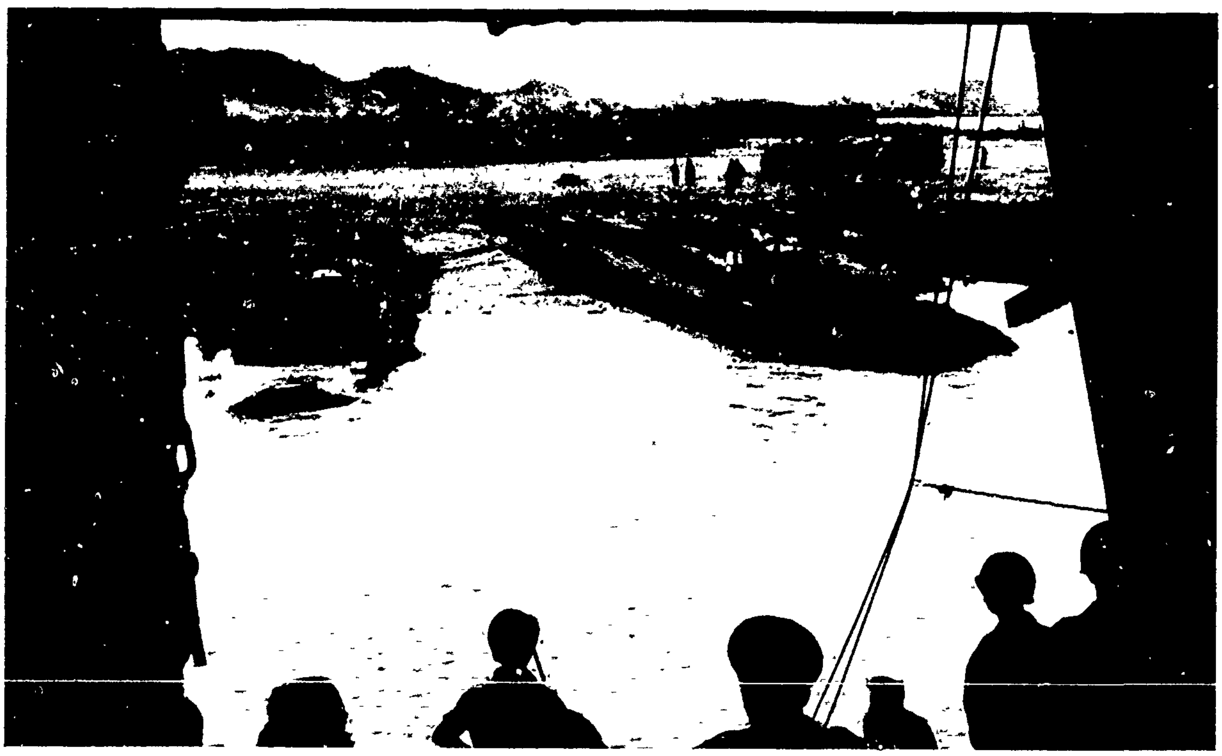
Smoke of the preinvasion bombardment still rises from the Leyte beaches as the assault troops near the shore.

Supported by fire from an Engineer rocket craft offshore, the initial wave lands on Leyte at H Hour, 20 October 1944.

Landing on the beach under enemy fire, the reserve troops seek the protective cover of American tanks on the beach at Leyte.

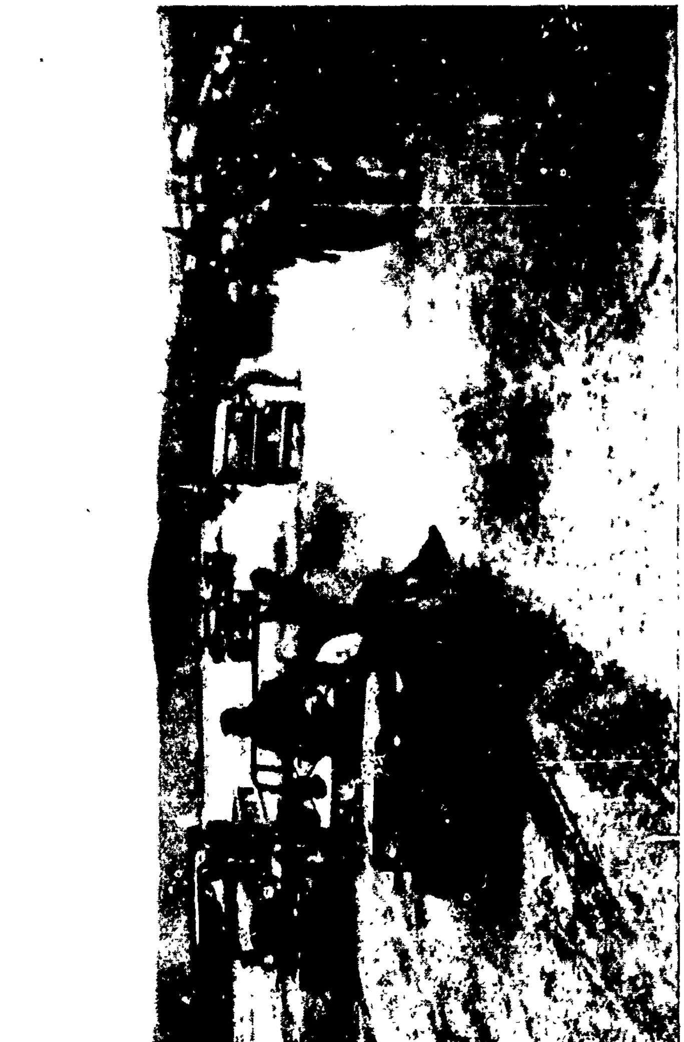
LCVP's making a satisfactory landing at Leyte, P. I., 21 October 1944.

Following closely in the wake of the initial waves, the supply echelons land and discharge their cargoes on the beach at Leyte.



Troops and vehicles wait patiently in the well deck of an LST while Engineer bulldozers push sand ramps out from the beach of Leyte.

A constant stream of supplies pouring over the beaches of Leyte to support inland combat operations.



Engineers speed construction of Tacloban Airstrip, Leyte, between Japanese air attacks.

PORT [illegible]ITY ANALYSIS SHEET

[illegible]GHTERAGE

Day (D+)	(1) No.	(2) Type	(3) Tons Per Day	(4) Total Tons	[illegible] Efficiency (%)	(6) Net Tons	(7) Total Lighterage Discharge/Day	(8) Shore Factors (%)	(9) Efficiency (%) w/Interference	(10) Net Shore Capacity/Day (Less LST's)
	Number of Lighters	LCM, LCT, etc.	Daily discharge under good conditions based on Sixth Army experience. See Legend: Lighterage Daily Discharge Experience Ratings.	Columns 1 x 3	Variable, based on estimated diversion to tactical operations and deadlining. See Legend: Lighterage Efficiency.	Columns 4 x 5	Cumulative net total (DWT) all types per day.	Variable, based on weather & availability of beach storage space & beach roads, condition & number of egress roads to hinterland affecting efficiency. See Legend: Shore Experience Factors.	Variable, based on expected operation under conditions of enemy ground action, red alerts, LST convoys discharging simultaneously with lighterage on same beaches on certain days, surf, and weather. See Legend: Efficiency (%) w/interference.	Columns 7 x 8 x 9

WHARVES			LST'S	STATUS OF PORT TONNAGES						
(1) No. & Type	(12) Net Tons/Type	(13) Total Daily Cargo Capacity	(14) LST Bulk Unloading	(15) Total Port Capacity DWT — Daily	(16) Cumulative	(17) On Ships Beginning of Day	(18) Received During Day	(19) Total to Unload	(20) Total Daily Port Capacity	(21) On Ships End of Day (DWT)
Small ship docks, etc.	Daily discharge based on Sixth Army	Columns 11 x 12	No. of LST'S x 500 DWT	Columns 10+13+14		First day from ships' manifests;	From ships' manifests.	Columns 17+18	Entries identical to Column 15.	Column 19 minus

WHARVES			LST'S	STATUS OF PORT TONNAGES						
(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
				Total Port Capacity DWT						
No & Type	Net Tons/Type	Total Daily Cargo Capacity	LST Bulk Unloading	Daily	Cumulative	On Ships Beginning of Day	Received During Day	Total to Unload	Total Daily Port Capacity	On Ships End of Day (DWT)
Small ship docks, etc.	Daily discharge based on Sixth Army experience considering enemy interference, availability of depot storage, motor transportation, etc. See Legend: Wharf Discharge Experience Rating.	Columns 11 x 12	No. of LST'S x 500 DWT	Columns 10+13+14		*First day from ships' manifests; thereafter total from Column 21, previous day.*	*From ships' manifests.*	*Columns 17+18*	*Entries identical to Column 15.*	*Column 19 minus Column 20.*

LEGEND

Lighterage Factors

Type	Lighterage Daily Discharge Experience Rating	Lighterage Efficiency (%)	Shore Experience Factors (%)	Efficiency (%) w/Interference
LCT	100	90		
LCM	40	30-50 by D+30		
DUKW	12	50		
J-Barge	70	50-90 by D+15		
All-net DWT			40 to D+5	
"			50 to D+10	
"			60 to D+15	
"			70 to D+25	
"				60 to D+8
"				70 from D+8

Wharf Discharge Experience Rating

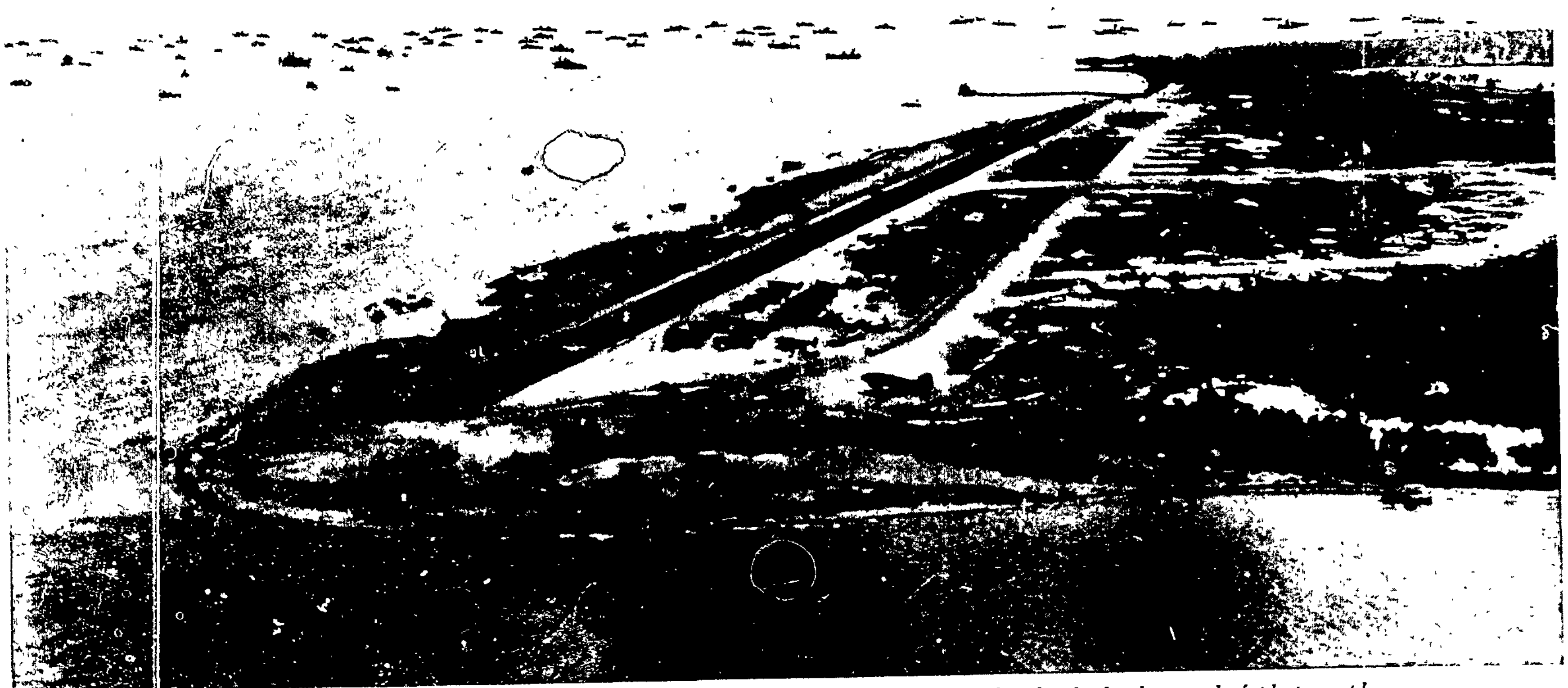
Discharge/Berth 200-750 DWT/Day

NOTE: Efficiency factors, based on experiences of Sixth Army, are typical, but their numerical value entirely depends on an estimate of the effect of various factors in each particular objective area.

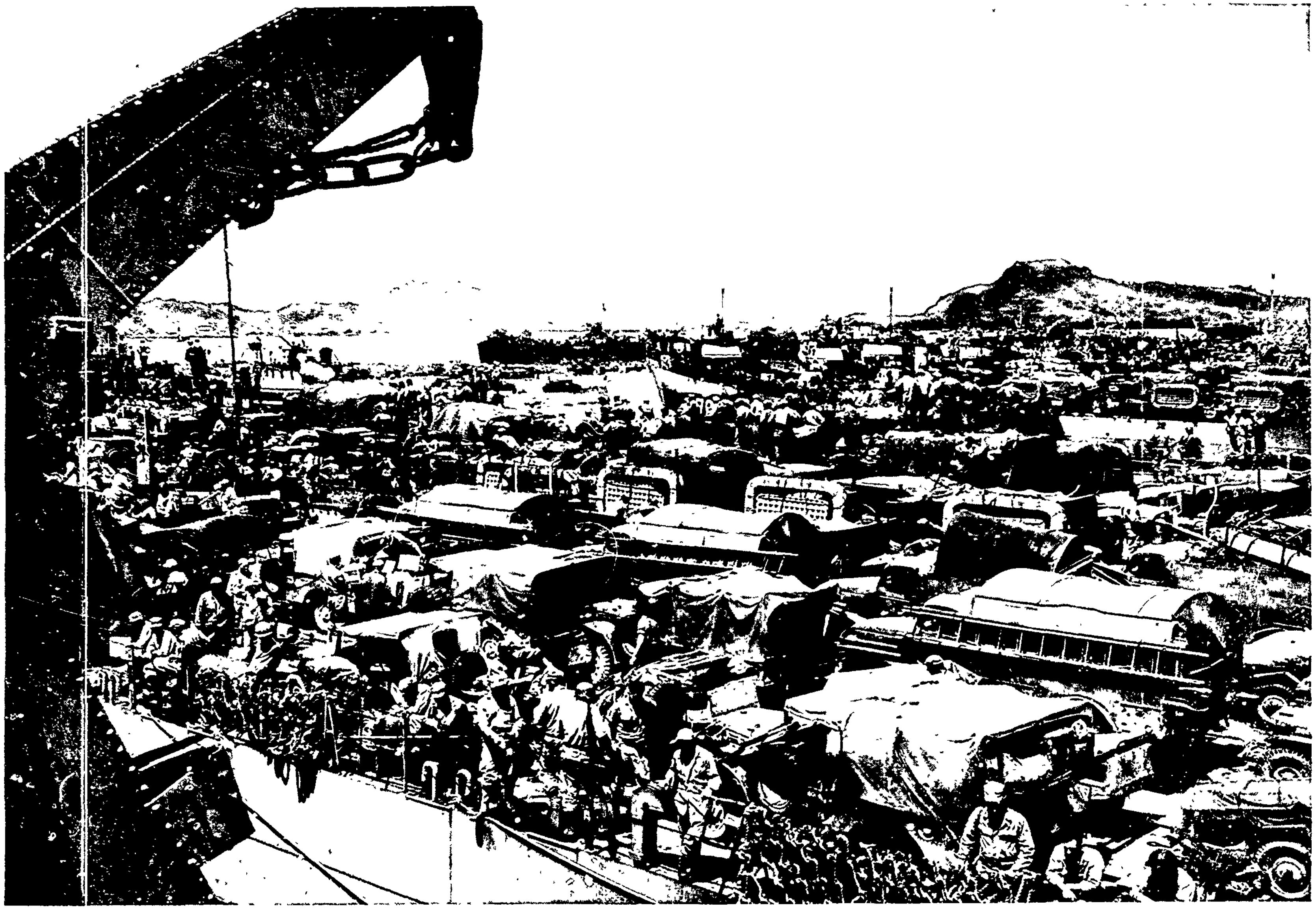
SOURCE: Pers Ltr, Brig Gen S. D. Sturgis, Jr. (formerly Engr, Sixth Army), to Editor, 4 Jun 47.

CHART NO. 2

2 of 2



Aerial view of Tacloban Airstrip, Leyte; Allied shipping can be seen in the harbor in the background of photograph.



Diversion of LST's to the White Beach—Cataisan Point area on Leyte Island which seriously impeded construction of adjacent Tacloban Airstrip.

operations, a reinforced battalion per beach was required. The attachment of a military police platoon to each engineer battalion on shore party operations would have been particularly advantageous, for on these beaches, as on those in the San Jose area, the use of engineer shore party personnel for military police duty reduced the working strength of each shore party battalion. On these beaches this loss amounted to 36 technically trained men per battalion.

The successful handling of cargo by the 1140th Engineer Combat Group on these beaches averaged a daily rate of 7,000 tons off-loaded and dispersed. Beached and offshore shipping were unloaded simultaneously. Heavily loaded causeway barges were towed ashore by small naval craft, broached on the beach to permit maximum efficiency in the utilization of cranes and trucks operated by the shore party, and promptly unloaded. Bulk cargo on any ponton barges, of course, had to be carried in nets from ships to dumps for effective handling by cranes which were used most advantageously. Nine of the 20 cranes brought in by the group were of the long-boom type (40-foot booms with a 4-ton capacity). The long radius of the boom allowed several boats and/or barges to be unloaded at the same time without moving a crane along the beach. Small, mobile cranes proved most practical in dump, dispersal, and such other beach areas which required mobility on the part of cranes. When these cranes were unable to keep pace with the cargo being landed, tractors with A-frames were employed. The A-frame tractor would drag netted cargo from a landing craft, over the sand, and to a dump via one of the trails previously established. Over the soft sand no damage was done to either nets or cargo. In other instances, idle DUKW's were employed to drag sled pallets from landing craft to dump areas. All equipment was constantly in use.

However, the time set for completion of unloading with the limited equipment available and the nature of the terrain at Dulag prevented adequate dispersal of supplies. This had been anticipated during planning, and, as a consequence, dispersion by class of supply as a measure of safety against fire and explosion was effected by the shore party. One-third of each type of supply was landed at Violet No. 1, Violet No. 2, and Yellow No. 2 Beaches where ammunition dumps and fuel dumps were interspersed between ration dumps and bivouac areas. This care in planning proved to be invaluable when two Japanese bombs struck the artillery ammunition dump on Violet Beach No. 1. There was little doubt but that a major portion of the 7th Division's supplies would have been lost had not this plan been prepared and followed. There is no doubt of the lesson evidenced here for future operations: storage of supplies by type must be carefully planned to avoid total destruction by bombing should time, equipment, and terrain prevent ideal dispersion.

The activities of the 1140th Engineers on their particular beaches in the XXIV Corps area definitely reflected excellent shore party planning and execution including coordination and cooperation with the naval elements concerned. Comments on their performance in the resports of the Navy Task Group commander assigned to this area of responsibility are a conclusive tribute to the support of these Engineers: [5]

> The unloading phase must be considered as achieving close to perfection. . . .
>
> The planning and execution of the shore party activities by the 1140[th] Engineer Group which was assigned that duty appears to be exemplary.

Task Force Engineer Operations

Map Coverage. The advance of D Day to 20 October 1944 left insufficient time available for Sixth Army and subordinate units to become properly familiar with the anticipated engineer problems of the major Leyte operation and to plan steps to meet them. This was especially true in regard to special training of units, equipment supply, and map supply. Maps and photographs available for detailed study and

[5] Hq, US Fleet, 30 Apr 45, Amphibious Operations, Invasion of the Philippines, October 1944–January 1945, pp. 7–1 and 5–15. In Records Section, GHQ, AFPAC.

planning of engineer problems on the far shore were not generally suitable for the purpose. The only detailed coverage of the island, and that only around the coast lines, was a 1:200,000 U. S. Coast and Geodetic Survey map. Some prewar 1:25,000 maps of the east coast were available, but were very inaccurate, besides which their coverage extended only about 1 mile inland from the coast. The limited flight range of land-based photographic aircraft of the Allied Air Forces precluded photomapping missions over the Philippines until early October 1944, when an air base had been established at Morotai Island. Naval carrier-based aircraft had secured considerable photography of the east coast and northeastern part of the island for mapping, but the coverage was incomplete and photomaps prepared from this photography were relatively poor. As a result, 1:50,000 sketch maps of the areas to be initially occupied were hastily prepared and distributed. The two topographic companies (corps) were placed under Sixth Army control and assigned the task of completing additional 1:50,000 sheets by *blowing up* existing intermediate-scale maps, which had been corrected from limited available photography, for use when the combat units would advance inland and beyond the limits of the sketch maps originally distributed. The resultant maps, providing poor and inaccurate coverage, were all that was available to the completion of the operation.

The situation again forcefully demonstrated that ground forces cannot depend upon air forces for mapping when total available photographic means are limited and are used primarily for tactical photography with photographic mapping coverage considered of subordinate importance. Photographic aircraft for ground force mapping must be controlled by some agency other than that responsible for aerial combat. Costly errors occurred, and in many cases were directly attributable to inadequate maps. Artillery fired upon friendly infantry, patrols were lost, and platoons and larger units sent out to rescue pinned-down troops failed to make contact. The Engineer, X Corps, listed inadequate maps as the principal engineer deficiency on Leyte. Yet topographic units engaged in preparing the maps could not be censured because it was obvious when the scheduled date of the operation was advanced that time and source materials would be entirely inadequate for preparation of good maps. The experience, nevertheless, made everyone cognizant of the necessity of providing accurate maps to combat troops.

ASCOM. As Theater operations converged on the Philippines, the scope of planning and logistic responsibility increased. The projected operations on Leyte, requiring logistic support to a major tactical force approaching one-quarter of a million men operating hundreds of miles from rear bases, indicated that early engagements had been more or less preliminaries to the over-all campaign of regaining the Philippines. For projected operations in the Philippines, therefore, a new command, the Army Service Command (ASCOM), had been organized with Maj. Gen. Hugh J. Casey, temporarily relieved as Chief Engineer, GHQ, SWPA, in command. Army Service Command was to support Sixth Army by assuming the logistical and construction responsibilities for each major operation to come. Previously, each Theater task force had had to improvise such a command group largely by detail from the various staffs and units forming part of the task force. This procedure had allowed limited time and opportunity for such staffs to function as an integrated group. Subsequently, major dislocations had occurred upon transfer of logistic responsibility from Sixth Army to USASOS when such staffs and commands had to be replaced by newly arriving USASOS personnel who were unfamiliar with local conditions. The vast scope of the Philippine operations indispensably demanded the Army Service Command to be in full operation for initial objectives on the Islands and to be prepared to carry out its logistic and construction responsibilities after the initial tactical phase had been completed.

The first task of ASCOM was the detailed planning of the operations with which it was charged. Incident to this, it was essential to so organize as to insure an efficiently functioning operating agency. The primary missions assigned to this command were the construction of facilities in accordance with directives of higher headquarters and the development of a major supply base capable of providing logistic support to future operations. These responsibilities were of such scope and importance that it was apparent separate sections of the organization should be established to deal with each. Similarly, it was obvious that the men who would later be held responsible for these important operations in the field should be given an opportunity to participate in the planning of ways and means. Early selection of key personnel for the originally projected Sarangani Bay, Mindanao, and Leyte operations was, therefore, indicated. These were selected; some were charged with base responsibilities, others with construction. All were immediately assigned to Headquarters, ASCOM, for participation in the subsequent planning to insure continuity of thought, policy, and procedure.

Construction planning was initiated coincident with the base organization and development program. Based on the limited photography and terrain data available, the most appropriate site for each service area within the space allocated for base installations was selected and a plan for each service center was prepared. This included locations of warehouses, shops, interior roads, bivouac areas for troop units, and special facilities such as hospitals, laundries, and bakeries. Initial dumps were designated as near as possible to proposed depot locations. Studies were initiated as to location of landing beaches and docks, and location and number of troops to be served. Primary considerations were economy of construction effort, reduction of traffic haul, increasing efficiency of depot operations, and determination of construction supplies based on initial tentative studies.

Tentative troop lists, both for construction and base operating services, were issued by USASOS and Sixth Army and revised from time to time. These lists were compared by ASCOM with service troop requirements, and deficiencies in units were called to the attention of Sixth Army and/or USASOS. This became a continuing process, because as time for the operation drew nearer, changes were made in the lists of potentially available units almost daily. Another factor of vital importance was the contemplated schedule on which engineer service units initially attached to tactical forces could pass to ASCOM control. Decisions were difficult to obtain; Sixth Army, influenced by the uncertainty of tactical developments, withheld firm commitments. Service troops originally allocated for the Sarangani Bay operation on Mindanao were, in general, adequate, but when this operation was canceled and troops earmarked for it were diverted to the larger Leyte operation, many deficiencies existed. Unfortunately, the additional units required could not be provided, particularly in the early phases. Over-all efficiency was again jeopardized through lack of adequate and balanced service forces.

A plan for inspecting, equipping, and briefing ASCOM units both before outloading and while en route to the objective area was developed. Each unit was briefed on the general nature of the operation, its individual mission, and the types of obstacles that would probably be encountered. To this end, specific instructions were prepared and given to each unit prior to departure. The preliminary information and instructions so furnished greatly accelerated the early employment of these units.

Availability of Engineers. Rapid construction of fighter airstrips in the objective areas was of prime importance to the tactical plan. This, of course, necessitated the arrival of a number of engineer aviation and construction battalions and considerable airdrome construction supplies with the D Day shipping echelon. The estimated number of battalions required to complete the basic construction program within the time allotted had been set at 34—all to arrive in the objective area not later than D plus 15. Actually, the total number of battalions made available for construction was 24. Seven battalions arrived prior to the start of the rainy season (D plus 5), and the balance arrived by increments up to D plus 23. Other types of engineer units arrived as late as D plus 45.

Engineer units made available to one Corps were not moved in on high enough priority, and, as a result, Army engineer support was required by the Corps that would otherwise have been unnecessary. In addition, Corps engineer units left some equipment in rear areas that should have been brought forward early. It was obvious that units arriving early were much less difficult to handle when they had a specified mission on arrival. The 46th Engineer Construction Battalion and 808th Engineer Aviation Battalion under ASCOM, executing definite assignments on previously prepared detailed plans of operations, had moved directly to airfield sites and started work. Some units with prearranged assignments, however, found themselves somewhat in the way for a few days because they could not reach their work areas. On the other hand, elements of Corps units which had initially moved too far forward for road maintenance, had to be withdrawn because of enemy action. Congestion and confusion on the already overtaxed and inadequate road net was commensurately increased. The strong and continued enemy resistance not only delayed the release of Army tactical engineer units originally scheduled for early reversion to ASCOM control, but required the diversion of other ASCOM heavy construction units to close tactical support of Army combat elements. Engineer heavy construction units were, in addition, brought in too slowly after D plus 4. The ASCOM base and airdrome construction program was, of course, proportionately handicapped. It was impossible to meet the scheduled construction program with the reduced number of units available. The operational importance of speedy airdrome construction and road and bridge construction and maintenance warranted earlier arrival of engineer units. This important need had been fully presented and emphasized during the planning phase, but sufficient shipping was not made available for a more complete movement of engineer units.

Complex Command Channels. Certain features of command organization and responsibility also adversely affected engineer efficiency. The divisions initially operated the beaches; Corps control was not assumed until D plus 3, and Army command not until D plus 4. Yet Corps control was essential from the beginning, while lack of Army control in the first few days was critical since the plan of operations retained major logistic responsibility in Army. Further, the provision that during the earliest phases of the landing the senior tactical commanders ashore would report direct to the naval task force commander caused confusion in initial organization and direction of ground operations. An example of the adverse effect on engineer efficiency by consecutive assumptions of command was the diversion of LST's from Red Beach to adjacent beaches with resultant congestion impeding construction in the Tacloban area. High-echelon commanders charged with logistic responsibilities had not been available for consultation. And logistic considerations involving construction responsibilities were beyond the sphere of initial tactical commanders ashore when they reported to the naval task force commander who, naturally, was concerned primarily with effecting landings as quickly as possible.

Much initial confusion could have been eliminated if Army and Corps headquarters had maintained a continuity of command while still afloat by controlling shore operations from adequate communication ships. Coordination of engineer activities could have been considerably improved had the Engineers, X Corps, and XXIV Corps, and the Shore Party commanders come ashore on D Day. As it was, coordination of engineer operations encountered difficulties even in later phases of the operation because of poor communications between Headquarters, Sixth Army, ASCOM, and Corps. This situation, however, was corrected by periodic meetings of the Engineers, ASCOM, X Corps, and XXIV Corps, with the Engineer Section, Sixth Army, at the latter's headquarters.

Not only echelons of command, but the number of various headquarters as well, were considered confusing during the initial phase of the Leyte operation. The early concentration in the objective area of GHQ, SWPA, and Headquarters, Sixth Army, ASCOM, Army Garrison Forces, Base K, Allied Air Forces, Far East Air Forces, Fifth Air Force, and the Philippine Civil Administrative Unit proved rather complex to newly attached subordinate agencies which were given insufficient time to assimilate this manifold organization. In addition to problems related to determination of command channels, there were the complexities of area allocations, priority of construction, and priority of unloading ships.

Area Allocations. When it was found that suitable space did not exist along the coastal area selected for the start of the Leyte operation, the problem became one of allocation of the limited space available and the determination of priorities. It had been originally planned that the commanding general, ASCOM, would handle detailed space allocations within the general area allocated for his base, and other tactical headquarters, air commands and such units, within general areas allocated to them. However, since the base area continued for some time as a combat area and numerous Corps troops and installations were established there, conflicting requirements arose. The plan of having representatives meet all incoming units and guide them to their respective areas was now ineffective because of the unexpected diversion of shipping and nonavailability of the originally selected bivouac areas. As a result, in the early phase, many units, both air and ground, selected areas on their own initiative and established themselves only to be forced to move as later units came ashore. Meanwhile the situation was becoming aggravated by the arrival of more ships, more men, and more supplies.

This crisis was eventually resolved by the establishment of the Area Allocation Board. This Board consisted of two senior officers from each major command under Sixth Army (XXIV Corps, X Corps, and ASCOM), Allied Naval Forces, and Allied Air Forces, plus about 20 "legmen," mostly junior Engineer officers assigned to go out in jeeps and survey usable sites. Prompt and continuous reconnaissance was immediately initiated for suitable areas between the swamps, rice paddies, and other poorly drained areas. The board handled all requests for allocation of areas and assigned space subject to the approval of the commanding general, Sixth Army.

This worked very well in allocating available space to first things first, but it also confirmed that there was a totally inadequate area available for minimum needs. Excellent beach areas, ½- to 1-mile deep, stretching several miles south of Tolosa, had been reserved for numerous high headquarters. Both the commanding general, ASCOM, and the Engineer, Sixth Army, had recommended that these various headquarters, scheduled for early shipment to Leyte, be held in staging areas to make these beaches available for critically needed facilities, especially hospitals. The recommendations had not been approved, and the consequent construction requirements for several major headquarters besides GHQ, SWPA, were not only placed on the limited engineer capabilities at this critical time, but, even more serious from the engineer viewpoint, the only really suitable and accessible locations for hospitals and logistical facilities were unavailable.

Further, the responsibility for the selection of airdrome sites on Leyte during the planning phase was, upon the insistence of Fifth Air Force, assigned by GHQ, SWPA, to that headquarters. Previously task force engineers had selected proposed sites and had obtained the concurrence of the local air commanders on the ground. This change from standard procedure employed in the past, together with the limited photographic coverage available when plans were prepared in Brisbane, had indicated a need for prompt and detailed engineer reconnaissance of projected construction sites upon arrival in the objective area. Advance elements of ASCOM's 5201st Engineer Construction Brigade had, therefore, been briefed prior to the operation on specific reconnaissance missions which were initiated immediately upon arrival on Leyte and followed closely behind the infantry as proposed airdrome and base facility sites were captured. Reports by D plus 2 from these reconnaissance parties disclosed that all the proposed airdrome sites except Tacloban were unsound for rainy season construction, and that many of the proposed depots were located in rice paddies and swamps. Worse still, the reconnaissance revealed that there was very little available space that would not become a quagmire when the rains started except the various beach areas between Tanauan and Dulag.

More importance should definitely have been placed on appreciation of terrain when selecting beaches, beach exits, and areas suitable for base development, airdrome construction, and headquarters installations. Target dates and phase lines made no allowance for the possibility of unsatisfactory terrain conditions despite the limited information available during initial planning phases. Weather conditions, on the other hand, were anticipated, although the full effect of such conditions on the terrain encountered obviously was not. The Leyte operation was deliberately undertaken during the rainy season to insure dry weather for the projected operation on Luzon which was expected to be a more difficult objective of greater scope. Established schedules on Leyte were, as a result, impossible to maintain while endeavoring to construct airdromes on clay-silt soil in rainy weather or to build roads across rice paddies and swamps, particularly under conditions of continued enemy resistance to previously scheduled advances. Nor could proposed bivouac areas and depots be reasonably established in swamps and rice paddies. The inconsistencies of the dilemma evidenced the need for all planning agencies to give adequate consideration to the effects of weather and terrain conditions on the progress of combat operations and engineer construction so that the tactical and logistical phases of operations might be kept as nearly in balance as possible. Both construction layouts and tactical plans must be based on the exploitation of terrain determined to be the most practical through careful analysis of all terrain information available by experienced and competent personnel.

Airdrome Construction. It was immediately evident when the decision was made to land on Leyte to construct major air and supply base facilities at the beginning of the rainy season that the engineer problems on that island would be numerous. Information available on the terrain of Leyte indicated that it consisted for the most part of rough, wooded, mountainous regions and lowland rice paddies and swamps. Soil conditions were apparently generally unfavorable to construction during the rainy season inasmuch as the soil was predominantly a silty clay. Heavy rainfall was anticipated from previous records, and it materialized beyond expectations. From D plus 5, when the rains started, 27 inches of rain actually fell during the next 40 days.[6]

Such conditions, of course, obviously stressed the necessity for particularly detailed planning of the initial phase of the operation to assure that the tactical plan conformed to the engineer means available and was based on full cognizance of the terrain. However, planning for the Leyte operation was, perforce, hasty. Initial concentration had been applied to the projected Sarangani Bay operation which was canceled, and planning for Leyte was subsequently cur-

[6] *Editor's note:* Precipitation based on records of Philippine Weather Station at Tacloban and official meteorological records of the RAAF Weather Service for that area.

tailed further by the advance in operation date. The detailed analysis normally desired for a large-scale operation of this type, if time and circumstances permit, was impossible. Responsible engineer commanders did not have sufficient time in which to study their anticipated missions and to train and equip their units, nor to assemble supplies to assure successful accomplishment in the objective area.

Both ASCOM and the Engineer Section, Sixth Army, were particularly concerned about the southern group of airdrome sites which were located on plastic soil, poorly drained, swampy in spots, and entirely dependent for access upon the Dulag–Burauen Road. (See Map No. 14, "Leyte Operations, 20 October–2 November 1944.") At a conference held by ASCOM on D plus 4, it was recommended to Fifth Air Force that, if alternate runway locations on beaches were not acceptable, at least the engineer effort available should be concentrated on airdrome construction at Tacloban and Dulag. However, at that time (D plus 4) the weather was dry, and Fifth Air Force insisted on development of all the sites selected plus construction at San Pablo.

Tacloban airdrome was supposed to be completed for one fighter group by D plus 5. The 46th Engineer Construction Battalion had landed at White Beach and immediately moved to the airdrome. As previously stated, the weather for the first 4 days was fairly dry, but it was necessary to establish the runway 10 degrees off its original alinement to obtain the specified length of 6,000 feet. This practically meant a new construction job. For the first 3 days interference from Japanese air elements was moderate. On the other hand, congestion on Tacloban airdrome, occasioned by unloading of diverted shipping from Red Beach, was terrific. Dump trucks, moving at a snail's pace from the coral pit at the south end of the runway, had to buck an enormous amount of traffic transporting off-loaded combat supplies and equipment in the opposite direction. By about D plus 4, as hostile naval forces approached Leyte, Japanese land-based aircraft really had a field day, and local air defense became very inadequate.

To add to construction difficulties, on D plus 5, naval fighter (Grumman) aircraft began coming in for emergency landings from escort carriers which were sunk or disabled. Since the base of the original Japanese runway was entirely inadequate in bearing power and new sections of the airdrome were in varying degrees of construction, many of these carrier-based aircraft cracked up in landing. Though the pilots were saved, about 25 such wrecks had to be bulldozed off the site in order not to delay airdrome construction.

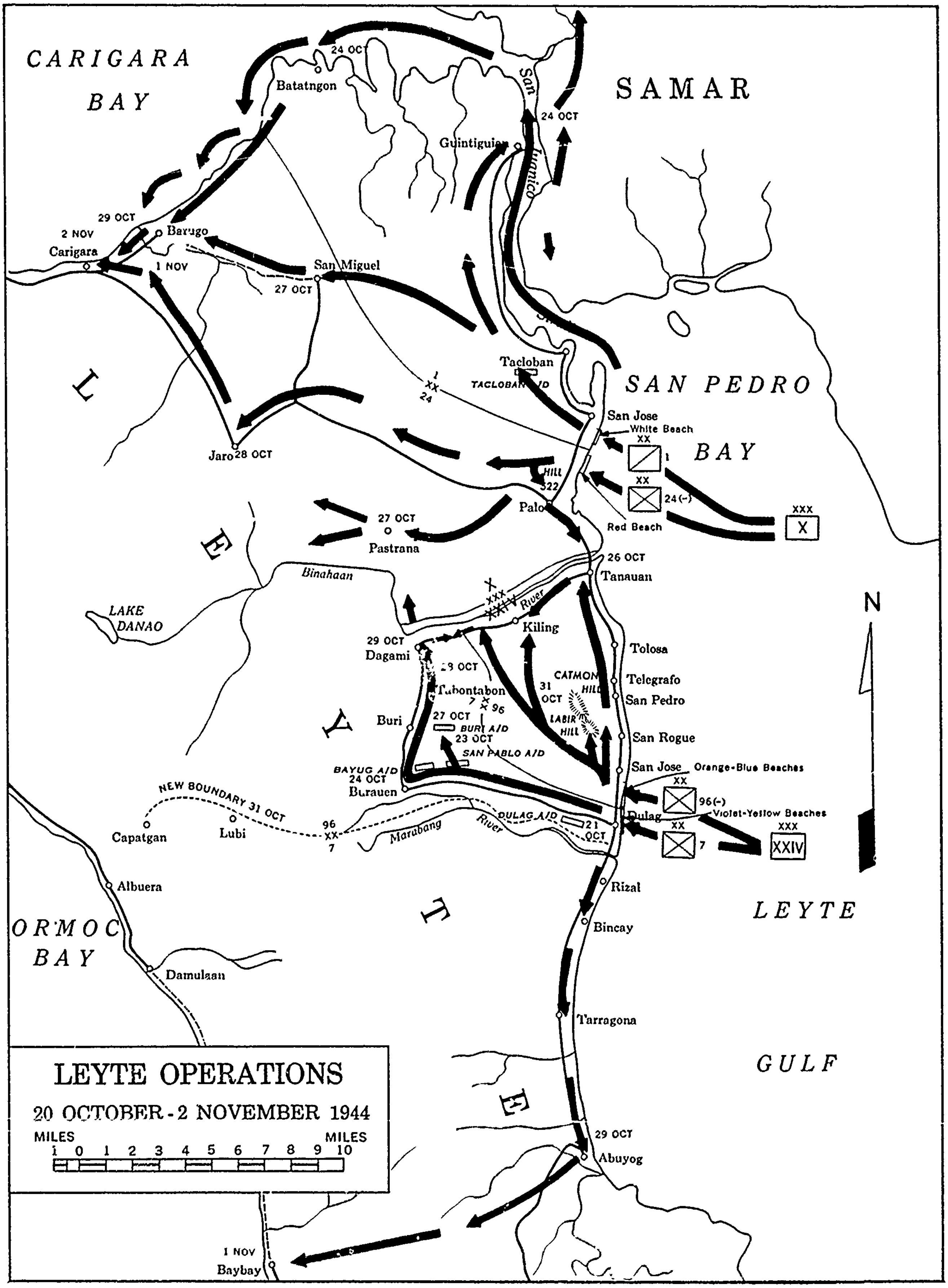
When a firm 6-inch coral base had been prepared, the laying of steel mat was started from both ends and quarter points of the runway, and cut and welded at points of juncture to accelerate completion. Unloading the mat from offshore shipping and getting it ashore under a veritable shower of *Kamikaze* aircraft occasioned an unprecedented contingency, which was unflinchingly and successfully handled by the 2d Engineer Special Brigade. Any time a vessel carrying any landing mat was sunk, it seemed as though the entire Sixth Army groaned. From D Plus 5 for the next 6 weeks Tacloban airdrome was showered in almost equal proportions by rain and bombs. The 1881st Engineer Aviation Battalion and the 240th Engineer Construction Battalion had joined the 46th Engineers just prior to the Japanese naval and air reaction, and were all camped on Tacloban peninsula to be near their work in spite of the limited space available. By working around-the-clock, frequently in spite of red alerts, these battalions had the airdrome ready for fighters with limited dispersals by D plus 6—a major achievement. From initiation of their construction mission these engineer troops took a real beating day and night for the following 45 days.

Another great impediment to completion of the drome for heavy bombers was occasioned by exhaustion of the coral pit on Cataisan Point. This shortage was corrected by use of the cutter-head suction dredge, *Raymond*. This dredge, originally assigned the mission of dredging the navigation channel to Tacloban Harbor, was diverted by ASCOM to pumping sand fill for grading purposes instead. The performance of the *Raymond* in the midst of chaos was a bright commentary on the versatility of the engineers. The *Raymond* and its engineer crew had arrived in New Guinea in September 1944. Because of its slow speed, it had been scheduled to be the first ship of the first convoy to depart for the Leyte operation. No time had been available for combat training of its crew. Upon its arrival at Tacloban, it had remained offshore for the first few days of the operation near combat ships of the supporting naval task force. However, when Japanese naval forces decided to dispute U. S. control of Leyte Gulf, this became a very unsatisfactory location inasmuch as the *Raymond* was directly in the zone of battle between the U. S. and Japanese naval forces. Its tug began towing it from the area, and the dredge crew decided it was an appropriate time to try out the guns they had so laboriously greased and cleaned. They shot down two enemy aircraft and qualified the *Raymond* as a "combat vessel."

At Tacloban airdrome, the *Raymond* went into full operation under bombing attacks, rendering somewhat unconventional services for a dredge. This cutter-head suction dredge was capable of cutting through sand, coral, soft rock, and gravel. The powerful pumps could transport solid matter 1 mile though pipe line floated across water or laid on land. The total of 2,800 horsepower in the pumps could pump its dredged materials against a 300-foot head. Confronted with a curtailed supply of gravel and coral, the harassed engineers found the dredge's pipe line the quickest way to move fill material for lengthening the Tacloban runway despite mechanical difficulties which sometimes developed. During this time which was to have been their first month of training, the dredge crew, under daily bombing attacks, combined training, operations, and combat all at once. Their contribution to the construction of vital air facilities at Tacloban merited and received commendation.

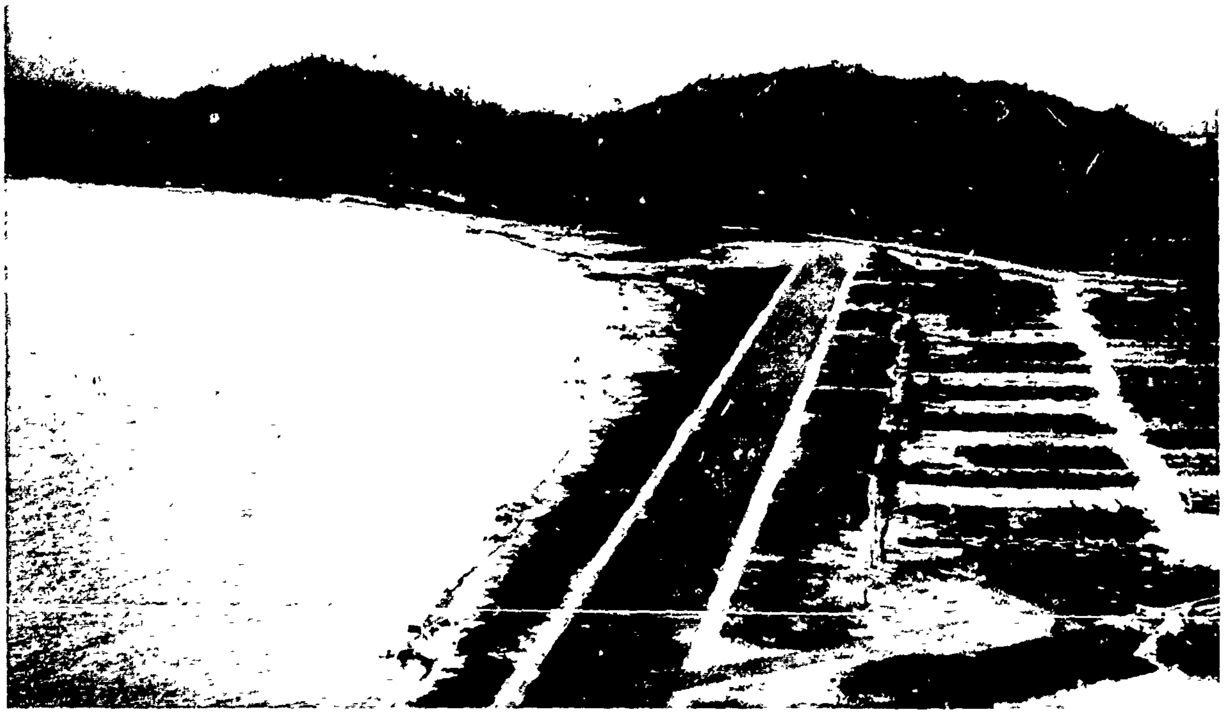
By D plus 35, Dulag airdrome had become operable for one fighter group and Tacloban airdrome was coming along well in its development for heavy bomber operations. With only two combat airdromes operable out of five planned, however, there still was a critical shortage of facilities for local air defense, particularly while facing the problem of supporting the Mindoro operation in the near future. At this time the 1874th Engineer Aviation Battalion, scheduled for release to the Mindoro Task Force, became temporarily available when that operation was postponed, and two more battalions became available when Fifth Air Force decided to abandon the unfeasible San Pablo airfield project. Numerous reconnaissances, however, had located but one additional potential airdrome site capable of quick development. This was on the beach near the town of Tanauan, and was at that time occupied by Headquarters, Sixth Army. In spite of the very difficult tactical situation then prevailing, however, the commanding general, Sixth Army, agreed to move his headquarters in the midst of operations, and construction was begun on 28 November.

Squarely centered on the approach at the south end of this proposed airdrome was a rocky dome-shaped hill, some 250 feet high, which limited the glide angle at that end to only 1 on 11. The north approach was out to sea, and, therefore, unlimited. Initial Fifth Air Force reaction to an engineer recommendation for use of this one-way approach site may readily be imagined. However, analysis of soil conditions had indicated that airdrome construction at this site was feasible whether it continued to rain or not, and under concentrated effort Tanauan airdrome became operable on 16 December, 18 days after initiation of construction, and not a day too soon to support the Mindoro operation. The speed and efficacy of this work reflected the appli-



SOURCE Hq, Sixth Army, Report of the Leyte Operations, 20 October 25 December 1944. (Additions by OCE, GHQ, AFPAC (Historical). MAP NO. 14

A general view of Tacloban airdrome, Leyte, P. I., at the start of surfacing the firm 6-inch coral runway with steel mat.



Tanauan Airstrip, Leyte: Engineering considerations demanded its construction.

Over-all view of Tanauan Airstrip, Leyte: American transports, fighters, and bombers are lined up on the ready strip in foreground.

cation of sound engineering principles: timely preparation of haul roads, quarries, and coral pits; early establishment of adequate drainage; coordinated flow of material; and good organization of dove-tailed construction operations. Although sites such as Tanauan with its hazardous south approach should normally be avoided, there is no record of an accident occurring because of this approach. In fact, pilots seemed to get quite a "kick" from skimming over this hill and "dropping the bottom out" to hit the runway. When "the chips are really down" as they were on Leyte, comparing the 18 days required to establish Tanauan airdrome against the 5 battalion-months largely wasted on the San Pablo and Buri airfield sites leads logically to the conclusion that the merit of sites on which to rapidly construct airdromes for tactical air support may readily be gauged by factors of soils and drainage.

Roads. One of the first engineer problems was to provide for dispersion beyond the limits of the beachhead. This was not too difficult initially in the Dulag area (Orange and Blue Beaches) which was fairly open country. The town, although destroyed by naval bombardment, offered a certain amount of hardstands for dumps and graveled streets for traffic circulation. In proceeding inland, however, everything bottlenecked into one narrow road leading west from Dulag on which the four airdrome sites were located, and which grew progressively inferior toward Burauen.

When the rains started, it was obvious that under conditions of heavy rainfall first the shoulders of the very narrow Dulag–Burauen Road (see Map No. 14), and then the entire road, would disintegrate under two-lane traffic. Yet, heavy traffic of tactical elements concentrating their forward movement over this one narrow supply road prevented adequate maintenance or improvement by XXIV Corps engineer units. The rains increased in intensity as could be expected, and traffic bogged down for miles along the road. Construction under these conditions became a nightmare. Local gravel sources in the lower stream beds near the airdrome sites could not be used because they were flooded, and this necessitated long hauls over the jammed roads from upstream sources near the mountains. Dump trucks hauling gravel from these sources were slowed down and often completely stopped for long periods by the flow of combat and supply traffic moving in the opposite direction.

Egress from Red and White Beaches was initially effected by utilizing a dusty, unimproved, country road from White Beach which was also an access road from bivouacs of air combat units to Tacloban airdrome. All heavy traffic from Red and White Beaches poured inland over this track until a new road was completed from Red Beach to Highway No. 1. But when the rains came on D plus 5, the country road, providing the only overland means of getting from White Beach to Red Beach, disintegrated. Supplies could still reach Tacloban airdrome, but their movement inland from White Beach was virtually cut off until intensive and concentrated engineer effort could be applied to this section of road.

But it was not only the roads that adversely affected engineer operations; suitable ground areas everywhere were lacking. Water covered many camp sites. Even at higher elevations it was impossible to get off the road any distance without miring vehicles. The existence and accessibility of ordinary dry land upon which to set up depots, hospitals, and even troop bivouacs, became a critical problem.

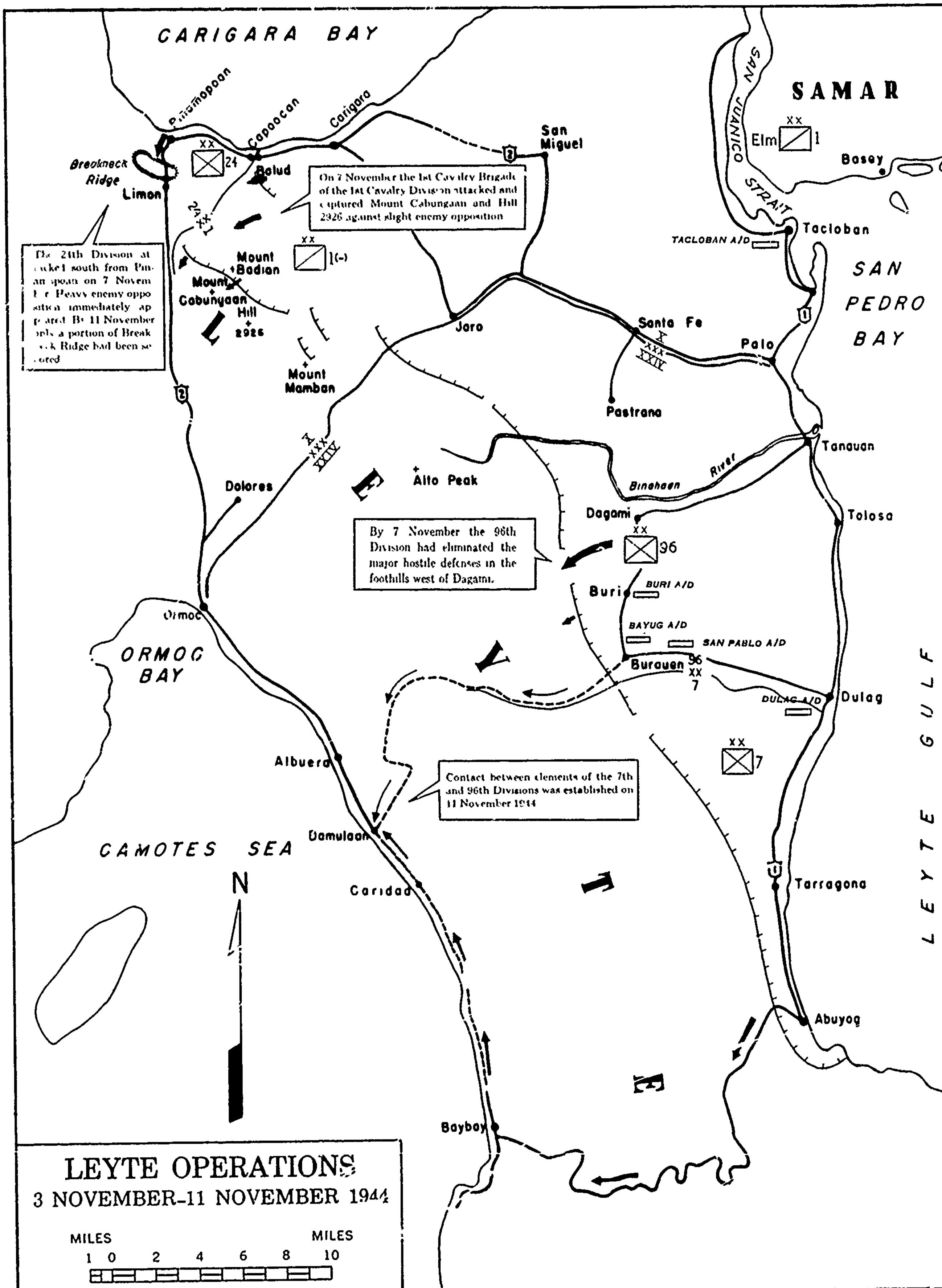
During the period between D Day to D plus 13, only divisional engineers were supporting combat troops driving west from Palo through Leyte Valley, and around the north coast to Carigara. (See Map No. 14.) The expanding mission of opening and maintaining the long X Corps lines of communication was fast exceeding the capabilities of these organic engineer units. Yet, the one construction battalion originally assigned to X Corps had to be withdrawn by Sixth Army on D plus 4 to construct exit roads from Red and White Beaches or nothing could get out of the beachhead. On the other hand, the road along the north coast from Carigara to Pinamopoan, over which X Corps continued its advance, became an absolute bog and had to be temporarily abandoned in favor of a supply point established at Pinamopoan and supplied through the San Juanico Strait by 2d ESB LCM's operating without air or naval support. (See Map No. 15, "Leyte Operations, 3 November–11 November 1944.")

Progress of combat troops by about D plus 35 slowed down considerably in the planned pincer movement across the mountains into the Ormoc Valley from Pinamopoan by X Corps, and over the mountains at the waistline of the island, thence up the west coast to Ormoc by XXIV Corps. (See Map No. 15.) Supply became extremely precarious because of the length of overland lines of communication. It became absolutely essential that two construction battalions be diverted to support X and XXIV Corps. As previously indicated, Fifth Air Force had abandoned the morass that had been selected as an airdrome site at San Pablo, and also Buri by this time. However, against the recommendations of Sixth Army, and in spite of the fact that Bayug airdrome could not be reached until the Dulag–Burauen Road was reconstructed, Fifth Air Force felt it was necessary to maintain air operations from Bayug. As a consequence, at least one aviation battalion remained assigned to that difficult task.

Because Sixth Army engineer units were not available in sufficient numbers to both relieve the two Corps of certain engineer responsibilities and handle the many construction problems arising, much of the effort of divisional combat engineer troops had to be expended to keep troop and supply routes open to front-line elements. It was not unusual for an engineer combat battalion to be responsible for maintaining 30 to 40 miles of road which constituted the main supply route for its division. The roads were narrow and not suitable for two-way traffic. Surfacing, if at all, was light, and, under rain and heavy military traffic, the roads disintegrated. Many of the engineer troops were inexperienced; others had had little opportunity in the limited overland advances of earlier island campaigns to absorb the importance of certain principles of good road construction. They failed, initially, to appreciate the importance of using a proportion of well-applied hand labor, and sometimes bogged down heavy construction equipment on work which was more suited for manual accomplishment.

Considerable confusion occurred initially in the use of Bailey bridging. There had been none of this equipment in the staging areas, because the critical shipping situation had prevented movement of the very limited amount of the bridge stored at Milne Bay to forward areas for training purposes. Inexperienced in its assembly, engineer troops upon arrival at a bridge repair site often found themselves in difficulty because all necessary parts of the extremely limited quantities of this bridging equipment available had not been drawn from the depot.

Tactical commanders in many cases failed to realize the damaging effect of military traffic on combat roads. They ordered heavy loads over them at times when irreparable damage was done. They failed initially to set up any system of traffic control, and insisted on dragging vehicles through impassable mire with bulldozers until both vehicles and dozers were hopelessly bogged down. There was an evident lack even of elemental appreciation for engineering, and a reluctance to ask for, or take, engineer advice. This procedure of trying to "bull through" only complicated the engineer task of rehabilitation. Military police lacked a strong organization and were poorly trained in their traffic control mission. Hundreds of unnecessary vehicles used the roads. No plans for controlled traffic existed initially; there was a lack of coordination between military police and engineer units in breaking road blocks, and subordinate commands were diliatory in initiating any traffic control de-



LEYTE OPERATIONS
3 NOVEMBER–11 NOVEMBER 1944

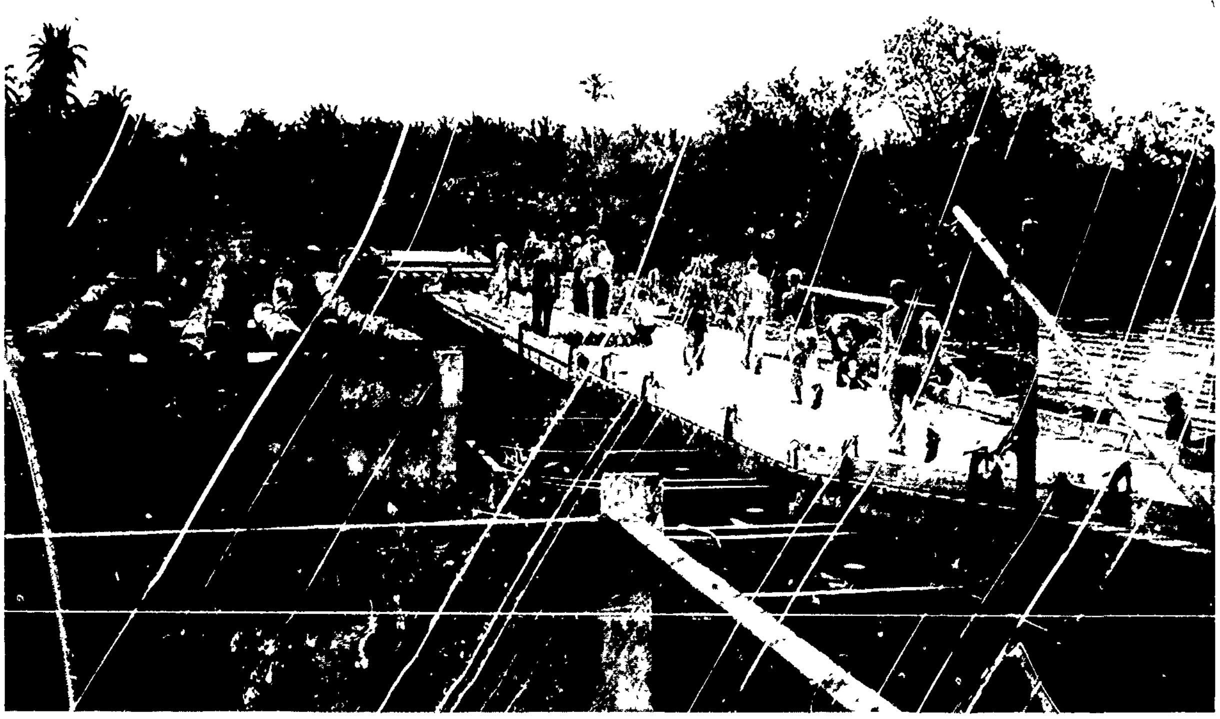
SOURCE HQ, SIXTH ARMY, Report of the Leyte Operation, 20 Oct -25 Dec 1944
(Additions by OCE, GHQ, AFPAC (Historical))

MAP NO. 15

Engineer water purification unit and portable canvas reservoir are in operation on Leyte early on D plus 1.

Moving inland from Leyte beach, Engineers find that much must be done before the roads will carry heavy American equipment.

Engineers constructed this ponton bridge alongside of one destroyed by the retreating enemy over the Capoocan River, Carigara, Leyte.



Ponton bridge at Palo, Leyte, maintains the advance to the northwest.

signed for the common good of all. Further, combat roads were not used at night as much as they possibly could have been for the routing of heavy, slow moving equipment, although this practice was stressed and strictly adhered to in the ASCOM base area.

An adequate organization for definite assignment to road responsibility was lacking. The road maintenance program was impeded because inadequate provisions were made to include emergency crews for repairing breaks in communication routes or removing traffic-blocking vehicles. Roads were worked when too wet. The wrong types of equipment were often used through ignorance and lack of training. The main supply, access, and haul roads were not given their proper construction priority over airdromes during the initial stages. One of the predominant errors was the failure to promptly provide drainage facilities, the importance of which was not appreciated initially because of the brief period of favorable weather that followed D Day.

Considerable emphasis was placed on correcting these deficiencies by the Engineer Sections, Sixth Army and ASCOM. Those attributable to engineer troops were readily corrected except that the principle of hand work by engineer troops had to receive great emphasis to overcome the modern engineer soldier's attitude that machinery can always do the work. The correction of defects in traffic control was far more difficult. The commanding general, Sixth Army, took a personal interest in this vital matter. At one time he considered placing all traffic movement under his Engineer when improvement proved unsatisfactory. Eventually, however, a systematic pattern was established by having the Engineer work in close cooperation with the provost marshal. Plans calling for military police-engineer coordination on each reach of important road were prepared and published. Traffic courts and distribution of traffic, particularly troop movement during night hours, were urged and adopted. Military police established one-way or one-way-controlled traffic as recommended by local engineers; on a par with ambulances and jeep safe-hand-message-carriers, engineer dump truck and road equipment traffic was given first priority of movement. Roads were given priority of construction over airdromes—actually in order to speed up the eventual completion of the latter. Thousands of native Filipinos and engineer soldiers were employed on providing drainage by hand labor methods. Commanders were directed to abandon roads involving uneconomical use of engineer maintenance effort. One-way-controlled traffic was established at one-way bridges. Columns were halted at least 100 yards from bridges to avoid congestion, and bridge floors were repaired to prevent vehicles from falling through and blocking traffic. Stringent orders to keep unnecessary vehicles off roads were published, and trip tickets were invariably required. In sum, by making road construction and traffic control a command matter, with engineer advice a predominant factor in the establishment of policy, order was brought out of chaos in spite of extremely adverse conditions.

The problems encountered illustrated clearly that road and bridge maintenance must be started early and must be emphasized throughout the period of operations; otherwise, a complete breakdown of roads and bridges can result. Such a situation, beyond the handicap of disrupted lines of communication slowing down interim operations, would require a disproportionate expenditure of engineer effort.

Camouflage. To a considerable extent, camouflage on Leyte depended on local field expedients, primarily because of the shortage of shipping space in the early phases of the operation. As a result, the 641st and 642d Engineer Camouflage Companies gained valuable experience in concealment and deception schemes for camouflage of artillery positions, bivouac areas, airstrips, and aircraft. It was observed that the most obvious features in bivouac areas were the many roads leading into and stopping at these areas. This was, of course, occasioned by the fact that only prime movers could be brought into some areas because of the extremely boggy condition of the terrain. Similar trails in the vicinity of artillery positions set them off in high relief also. The desirability of selecting positions, if at all possible, along hard-surfaced roads was, therefore, evident. However, where this could not be done, an effective means of disguising new tracks leading into an area was achieved by extending them beyond the area and setting up dummy positions there. Although the cooperation of the artillery battalions in this operation was excellent, it was recommended that engineer camouflage officers attached to artillery battalions be given more authority to enforce camouflage discipline. At Leyte it was entirely voluntary whether advice given was taken.

Supplies and Equipment. Engineer supply was in its usual critical state. The advance of D Day for this operation precluded the timely arrival of supplies requisitioned from the United States for projects planned on the previously contemplated schedule. The best possible utilization had to be made, therefore, of such limited stocks as were locally available and those designated for the entirely different and previously scheduled Mindanao operation. The supply officer, 5201st Engineer Construction Brigade, had to function also as Engineer supply officer, ASCOM, with insufficient personnel, and was, therefore, too overburdened to expedite unloading, supervise depot operations, and handle his brigade supply responsibilities with the concentration necessary to efficient discharge of such duties. Many units, largely because of inadequate shipping allocation, entered the objective area without the 30 days' stock of specific engineer supplies prescribed. Bridging and landing mat were not readily accessible and were not given shipping priorities high enough to permit unloading with sufficient speed to meet requirements. Tactical commanders who controlled unloading priorities in the early phase of the operation were overly inclined to give preference to unloading of tactical units, ammunition, and rations at the expense of urgently needed engineer construction materials. About 250 tons of landing mat per day were unloaded when 500 tons were required to meet airdrome construction requirements. Lumber vitally needed for bridge construction came ashore in fragmentary quantities for the first 20 days. The most critical deficiencies, however, were water purification chemicals and sets, dump trucks (an item of ordnance supply), power shovels, bridge hardware, culvert pipe, sandbags, Bailey bridging, spare parts, and hand tools.

Engineers were able to meet portable bridging requirements only because the Japanese failed to destroy many bridges that would have been difficult to replace. Bridging was unloaded from ships in scattered areas and problems of assembly ensued. The 556th Engineer Heavy Ponton Battalion arrived with only about half of its 25-ton ponton bridging, the remainder had been lost on a crossing job at Finschhafen where considerable bridging of all types was lost in a storm. These continuing shortages precluded the early substitution of two-way bridges for the many one-way installations provided initially.

Much heavy equipment had been left behind because of the shipping shortage. The scarcity of large shovels retarded quarry and gravel pit operations at a time when surfacing materials for roads and airdromes were of principal importance. Before the bulk of engineer units arrived with their road equipment, the few days of dry weather passed. Moreover, those engineer units reassigned from the Central Pacific were generally deficient in organization and equipment upon arrival. They had been diverted suddenly, some after having put to sea, from an operation differing in requirements and terrain in the objective area. These units were, therefore, improperly trained and equipped for the type of operation encountered at Leyte, and lacked dump trucks, road graders, and training for heavy construction of roads and bridges which constituted the major engineer effort on Leyte besides airdromes.

The engineer supply situation was further aggravated by the delay in establishing an adequate engineer depot for receiving supplies. The area in the vicinity of San Jose, which had been planned for the engineer depot, had to be allocated to Fifth Air Force for billeting of air combat units because of the nonexistence of other space within 2 miles of Tacloban airdrome. All the space available in the Tacloban area was occupied by troops or installations, and the extensive beach area south from Tolosa, which would have been most suitable, was reserved for higher headquarters. Consequently, there was no place for the thousands of tons of landing mat, bridging, lumber, and other critically needed construction supplies except the already overcrowded area behind Red Beach. The result was a dispersion of engineer supplies in many places, wherever a few acres were available, in order not to block the unloading of other supplies. Early construction of roads, airdromes, and facilities was recognized as the key to a favorable tactical and logistical situation. Yet, the establishment of an efficient engineer depot, which is a primary requisite for initiating rapid construction, was prohibited by the reservation of space for the subsequent arrival of a major headquarters that would increase already difficult unloading and construction responsibilities.

Subsequent reports of operations on Leyte stressed that engineer depot platoons should land in each Corps area not later than D plus 2 and establish temporary engineer dumps to receive all surplus stocks of materials turned in by units, all engineer supplies unloaded from ships and not authorized for immediate issue to units, and in which to assemble captured engineer materials. Meanwhile, preparation of depots should be given high priority even at a slight initial expense of airdromes and other projects of high priority to insure proper handling of supplies and the efficacy of the supply system upon which all construction projects depend.

Abetting the supply situation at Leyte, on the other hand, was a procedure worked out by the engineers during the New Guinea Campaign for providing the initial POL requirements in an objective area. Briefly, this procedure consisted in the provision of a number of steel fuel barges of 3,000- to 5,000-barrel capacity, which, together with a heavy floating pile driver (port construction group equipment), could be transported to the objective area in naval LSD's (landing ship, dock). These craft, submerging a few feet, would open lock-like end gates and permit the various shallow-draft floating equipment to enter. The gates would then be shut and ballast pumped out until the vessel rose again to cruising depth. Heavy losses, incurred in early experiences when long-distance tows were used, were eliminated by this means of transportation. It avoided use of additional convoy vessels for accompanying slow tows, and assured the timely arrival of important POL equipment in objective areas. A fuel barge carrying on its deck a 500-barrel tank, a few hundred feet of invasion pipe, and a pump, was beached by D plus 4 just inside the northern tip of Cataisan Point by use of this method. Within 24 hours the tank, fed from the barge, was in operation ashore, distributing aviation gasoline to Fifth Air Force tank trucks. By shuttling barges to Y-tankers in the harbor, supply was continuous until dolphins could be driven by the floating pile driver and a sea line connected to the Y-tanker discharge facilities. Normally, the next step in this procedure would have been the erection of a 10,000-barrel tank on Cataisan Point and replacement of the sea line by a jetty, but the latter project was planned instead at another location.

Statistics of Accomplishment. At the official close of the Leyte operation (25 December) and before Eighth Army took over mopping-up operations, the engineers had received ashore less than 20 percent of the construction materials requisitioned; only 40 percent of the battalions estimated as needed in the critical first 15 days of the operation; and only 70 percent of the total number of battalions estimated as required for the entire operation. Of the latter, many increments arrived only shortly before the official closing date. Meanwhile, tactical engineer units, previously planned for reversion to base construction, not only could not be spared but actually required reinforcement by reason of the extended combat phase of this operation. Nevertheless, in spite of the lack of means and a combination of mud and rain rarely equaled, these engineer units had completed every facility vitally necessary. In the 65 days prior to the termination of the operation, construction accomplished included three airdromes in advanced stages of completion and two others in operable condition. Over 100 miles of axial roads had been reconstructed, or improved, and maintained. Port capacity, through dock construction and dredging of channels, was developed to handle 10,000 deadweight tons per day. This capacity exceeded substantially that of any other base in the Southwest Pacific. The partially completed construction of POL installations by this time included one tanker jetty, one tanker anchorage, three lighter moorings, five filling stations, and 21 miles of 4-inch and 5 miles of 6-inch distribution pipe lines, besides 67,000 barrels of fuel storage. Three general hospitals and one station hospital were operating on a limited scale, and clearing and construction for two others of each type initiated. The Naval Service Command under ASCOM supervision had constructed docks, barge jetties, POL installations, ship repair facilities, and a permanent headquarters on Samar. A PT base was installed and operating on Jinamoc Island, and at Guiuan, on the island of Samar, the airdrome, air depot, and repair and housing facilities were well under construction.

However, construction did not meet originally assigned missions. The determined defense put up by the Japanese had extended the period of resistance materially beyond that originally estimated. As already indicated, this situation not only prevented the reversion to ASCOM of certain service units, particularly engineers, that had been expected to be available, but also necessitated the actual diversion to the tactical forces of many critically needed ASCOM units, construction equipment and materials, and transportation. In addition, all construction accomplished had required adjustment to a terrain situation which necessitated complete revision of all earlier plans. Yet concurrent with construction during this period, logistic support for approximately 250,000 troops was provided and the next operation at Mindoro had been partially staged and logistically supported from Leyte. Despite the engineers' inability to accomplish all of their originally assigned tasks, few participants in the Leyte operation will be found to express anything but sincere appreciation and respect for their comrades of the dozer and shovel and the conditions they overcame. In truth, it was on Leyte that the often used description of fighting in the Pacific, "It was an Engineers' War," reached its peak. No finer record exists of courageous and energetic performance of duty by engineer troops against great odds and at high stakes than that of the engineer battalions on Leyte.

Influence of Engineering on Tactics. Accomplishment of the scheduled engineer missions at Leyte was impeded considerably by a lack of appreciation among various echelons of command for the effect of engineering factors on both strategy and tactics. Accorded inadequate consideration, provisions for engineer requirements were not commensurate with the measure of engineer support indispensable to tactical success. Perhaps the greatest lesson taught by the Leyte operation was that in modern war combat plans and operations cannot be divorced from engineering plans and operations upon which they so fundamentally depend. Leyte was a striking illustration of what can happen when this simple truth is not fully realized by planning agencies.

Construction requirements submitted by various agencies were not carefully screened and reduced to the minimum required for balancing them with the construction means available. Considering the engineer means made available and the scheduled arrival of engineer troops in the objective area, construction target dates provided little apparent consideration for the effects of rainfall, type of soil, and time to be lost during blackouts. The result was a hard-won victory at Leyte, the success of which might well be attributed in part to the respite gained through a wavering Japanese admiral's bewildered deductions. Pursuing his basic mission of destroying the assault shipping in Leyte Gulf, he was successfully maneuvering the Japanese *Center Force* of battleships and cruisers through San Bernardino Strait. Passage into Leyte Gulf through the strait on D plus 5 would have been virtually uncontested. However, landing instructions *in the clear* to stranded naval aircraft aloft from U. S. carriers under fire confused the Japanese commander. On the verge of victory, this officer allowed himself to be thrown into indecision by misinterpreting the clearly audible voice instructions. Unchallenged, but confounded, he ordered the Japanese *Center Force* to turn back.

The greater part of pierced steel landing mat, critically essential to the completion of Tacloban and Dulag airdromes, was still afloat on D plus 5. Losses of engineer cargo to *Kamikaze* attacks and other difficulties had already resulted in the total supply of landing mat becoming very precarious. Yet the time element involved in getting runways in operating condition was the deciding factor in the struggle for essential air supremacy, and the possible loss of a large part of the landing mat afloat, had the Japanese *Center Force* not turned back, could have delayed completion of airdromes 6 weeks to 2 months. Under these circumstances it is reasonable to assume that the Japanese air advantage would have been materially increased, and U. S. tactical and logistical operations, already supported by a dangerously small margin of supply, would have been seriously set back. A much more grave and wholly plausible consequence would have been the immediate total loss of all shipping and supplies afloat in the objective area. Thus, the outcome of naval operations offshore had a decided effect upon engineer operations ashore. Conversely, the possibility of engineer operations exerting a critical influence upon the naval battle must not be overlooked. Voice instructions *in the clear* to naval aircraft aloft from U. S. carriers, which were picked up by the Japanese *Center Force,* directed emergency landings at Tacloban and Dulag airdromes. Although runways were not yet in operating condition, these instructions constituted a desperate expedient to save airmen whose carriers were under naval fire or sunk. The Japanese, however, interpreted these instructions as an indication that land-based aircraft were also operating from these airdromes, and this erroneous conclusion was a deciding factor in their turning back. The Japanese admiral's postwar explanation: ". . . If I did not get into the [San Bernardino] Straits by night, the next day was hopeless for me because I could be brought under attack by land planes. . . ."[7] indicated the considerable influence of engineer constructed facilities, not only in ground and air, but in naval decisions as well. For there is no denying that the early introduction of engineer units for airdrome construction on Leyte saved many navy aircraft and their crews, and indirectly may well have had a profound effect on the Battle for Leyte Gulf.

Thus, the operations at Leyte had again substantiated the proven facts of military history: engineering cannot be regarded merely as a technical specialty; it must be a prime consideration in successful strategical and tactical planning.

Mindoro
15 December 1944

Following the first step in the return to the Philippines at Leyte, the island of Mindoro, south

[7] Transcript of Interrogation Nav No. 9 in Nav Analysis Div, USSBS (Pac), *Interrogations of Japanese Officials,* I (OPNAV-P-03-100), 47.

of Luzon, was scheduled for the next assault. Although, in size and population, not one of the more important of the Philippine Islands, Mindoro was of strategic significance. On one hand, a strike there would prove a diversionary feint. It would lead the Japanese to expect a landing on the southern coast of Luzon instead of the planned northern assault at Lingayen Gulf. On the other hand, the recapture of Mindoro would be of tactical importance. Control of this island would immediately open the important South China Sea bordering its west coast for extensive Allied operations. Upon the establishment of airfields on Mindoro, U. S. land-based aircraft would be within a 165-mile run of Manila. Original Theater plans had, therefore, directed its recapture prior to the Luzon operation and set 5 December for the attack.

Air cover for activation of the airfields on Mindoro was to be provided from Leyte. However, at Leyte, in the meantime, construction of airfields was laboriously progressing against adverse weather and terrain conditions. There could be no certainty under the circumstances that airdrome capacity there would be great enough by 5 December to guarantee the necessary cover at Mindoro. Because of this and other factors, the Mindoro operation (LOVE III) was, therefore, postponed until 15 December. On that date, following a preliminary naval bombardment by Seventh Fleet elements, troops of the Western Visayan Task Force under Sixth Army effected landings near San Jose in southwestern Mindoro. (See Map No. 12.) This task force was composed of the 19th Regimental Combat Team and the 503d Regimental Combat Team (Parachute). Scheduled engineer support, in addition to two companies of organic combat engineers, consisted of an approximate regiment of amphibian engineers, three engineer aviation battalions, an engineer construction battalion, an airfield construction squadron of the Royal Australian Air Force (RAAF), and detachments and platoons of various engineer organizations considered necessary to the rather limited construction planned.

Amphibian Engineer Operations

On 22 November the 532d EBSR (less the Boat Battalion, plus a detachment of Boat Battalion Headquarters and Headquarters Company, Company B, and one platoon of Company C) was relieved from operation of Red Beach at Leyte and placed under the operational control of the Western Visayan Task Force. The 1458th Engineer Maintenance Company (less one platoon) was attached to the force, and 66 LCM's and 13 miscellaneous craft were prepared for the operation.

Loading. The planned order of loading was disrupted while staging at Leyte by the unexpected necessity of dividing the bulk loading between the tank deck and the upper deck on the insistence of several LST captains. Advance planning for loading had contemplated careful utilization of each square foot of space, and loading arrangements for equipment had been prepared for the most economical stowage. A last-minute change, such as occurred, completely disarranged loading plans and could have resulted in indiscriminate loading of equipment, waste of precious space, and sacrifice of unloading efficiency. Under the circumstances, it was suggested that every effort be made to acquaint future unit commanders with any special regulations which might be promulgated by naval or other authorities in regard to loading.

All available engineer expendables were loaded directly with the units. This obviated the necessity of establishing temporary engineer dumps and eliminated the usual attendant losses of initial engineer assault supplies.

Landing Conditions. En route to Mindoro Japanese air attacks harassed the convoy. One *Kamikaze* sneaked in low, unobserved by naval lookouts, and crash-dived a cruiser of the convoy. Resultant casualties and damage were considerable. All other Japanese aircraft maneuvering overhead were successfully intercepted by air cover provided by escort carriers and the Fifth Air Force during daylight, and kept at a distance by accurate antiaircraft fire at night. At dawn on 15 December the objective was sighted. Destroyers and rocket LCI's began bombarding the beach near San Jose at 0700. At 0730, initial landings were effected at both Blue and White Beaches. No enemy ground resistance was encountered at either beach. As the first LST's were beaching at approximately 0855, however, seven enemy aircraft attacked the D plus 1 LST echelon which was standing by offshore. Despite intense antiaircraft fire, two of the LST's were crash-dived, set on fire, and had to be sunk later in the day. Their destruction represented the enemy's total successes during the critical landing phase in exchange for the expenditure of some one hundred *Kamikaze* aircraft.

The *Kamikaze* had definitely become the enemy's primary daytime air weapon. Increased frequency of its use had to be accepted until measures could be perfected to counter its menace as U. S. forces poised on the very bastions of the enemy's Luzon defenses. In the meantime, the D plus 7 convoy of LST's, LCI's, and Liberty ships dodged *Kamikaze* aircraft most of the way to Mindoro. The LCM's of the 532d EBSR were being towed from Leyte by LST's of this echelon. When several of the latter were sunk by crash-dive tactics, the LCM's in tow were immediately endangered. Quick thinking and determined action by 532d crewmen and passengers saved craft and lives. In one instance, an LST went down so fast, the crew of the towed LCM had to shoot the tow lines away with their carbines to prevent their craft from being submerged with the sinking ship. Other 532d men, not so endangered, went to the rescue of survivors. Undeterred by exploding ammunition, by shrapnel, or by oil fires on surface waters, they directed their LCM's into the danger area, took positions along the narrow, exposed catwalks of their craft, and saved numbers of both military and naval personnel. Only two 532d EBSR LCM's of this convoy had to be abandoned and sunk after the crews were removed. Their losses were increased, however, when the D plus 15 convoy was similarly subjected to heavy enemy air attack. Three more LCM's were lost and casualties amounted to five killed and four wounded.

Shore Party Activities. While the lack of ground opposition, coupled with ideal beach and terrain conditions, helped immeasurably in making the Mindoro landing a success, the extensive experience of the 532d EBSR clearly showed itself. Initial shore party personnel landed in the third wave on D Day, promptly set up shore party command posts in the center of both beaches, performed necessary reconnaissance for beach roads and dump sites, and established contact with the naval beach party before the LSM's, carrying the 532d EBSR command personnel and shore battalion equipment, landed. These LSM's, beaching at 0750, were quickly unloaded, and all retracted by 0815. By 1830, all scheduled LST's, plus 15 LST's of the D plus 1 echelon, were completely unloaded and had retracted. D Day unloading on both Blue and White Beaches totaled 1,914 vehicles and 6,307 tons of bulk cargo despite Japanese air attacks.

With no slackening of ESB efforts toward organizing the beachhead, a perimeter defense was organized and manned each night. In view of the proximity of Mindoro to Luzon, attempted enemy paratroop landings were an ever present danger, and special precautions were required. Camp installations in the meantime were solely of a primary character. The men slept in the open at their perimeter posts right next to their fox holes. There was practically no shade from the hot sun and little protection from rains if they came. Fortunately, though, while operations at Leyte were in a sea of mud, Mindoro was in the middle of the dry season.

From D Day until the opening of the Luzon operation, air activity showed a sharp increase over San Jose. Shipping offshore was the principal daylight target, and newly constructed airstrips the principal night target. Hours of rest at night were severely limited by these attacks, and daytime unloading activities were punctuated by them.

Task Force Engineer Operations

Planning Aids. The Engineer Section, Western Visayan Task Force, was officially formed on 21 November 1944 at the Task Force headquarters in the Sixth Army area at Tanauan on Leyte, Philippine Islands. The Task Force Engineer drew up the detailed plan for engineer construction, and the engineer annex to the field order was completed and published on 22 November 1944. The dispatch with which this detailed construction planning was accomplished fully demonstrated the far reaching advantages of obtaining the best possible aerial photography of an objective area well in advance of the landing date. The early availability of such photographic coverage had permitted publication of a Preliminary Terrain Estimate by GHQ, SWPA, on 20 October 1944, and Landing Beach Conditions and the Engineer Annex to the AGS Terrain Study by 5 November 1944. All of this data was, therefore, prepared in ample time to be fully utilized during the general and detailed planning phases. The supply of subsequent low-level photography and the assignment of an experienced aerial photograph interpreter (in this instance a professional geologist) by OCE, GHQ, SWPA, to the Task Force Engineer made possible the speedy development of sound advance plans, and contributed considerably to the rapid and efficient execution of the engineer mission.

After intensive study of photographic, topographic, and meteorologic data available, tentative sites were selected for four airdromes. An initial road net from the landing beaches into the two areas scheduled for immediate airdrome development was marked out. Each engineer unit commander was given a photomap on which the four airdrome sites and the proposed road net were designated. Instructions were given the units as to the route to be followed in moving troops and equipment to the sites assigned to each, and each commander was given copies of two detailed letters of instructions covering specifications and assignment of tasks. Several meetings were held with unit commanders and their S–3's to insure proper understanding of the tasks assigned, and to familiarize all personnel with the topographic, climatic, and soil conditions to be encountered.

This thorough preliminary planning and the services of the previously mentioned specialist in selection of areas to be developed, coupled with ideal construction weather, were important factors in the success of operations on Mindoro. Planned organization and assignment of work proved a great time saver. Engineer units were able to start construction on the two initial airdromes approximately 6 hours after landing, and within 15 minutes after the chosen sites had been secured by ground troops. The support of the Task Force commander, who thoroughly understood the importance of the engineer mission, also contributed considerably to the success of engineer operations.

Shipping Allocations. All engineer personnel were transported on LST's and LSM's allotted to each unit. The allocation of four LST's and one LSM to each of the two engineer aviation battalions arriving with the assault echelon worked out well from a tactical standpoint. Reconnaissance and survey elements were loaded on the LSM's which beached before the LST's. This arrangement enabled both battalions to have routes of approach marked prior to unloading of the LST's, and permitted engineer equipment to clear the landing beaches with a minimum of delay. However, the transport of gasoline and other distillates on separate shipping resulted in considerable inconvenience during the first few days of the operation. For the future it was suggested by the Task Force Engineer that a minimum of 10 days' stock of such requirements be landed with each unit.

Supplies and Equipment. Engineer supplies in general were inadequate throughout all phases of construction. Building materials of all kinds were in short supply. Bitumen was a particularly critical item; application of a dust palliative course on a runway in the San Jose area was arranged only through a last-minute air shipment of 72 drums. Construction was impeded by the scarcity of other issues. Trucks on gravel haul were inoperable for periods totaling 5 days because of an intermittent shortage of fuel in the first 45 days of the operation. Approximately thirty dump trucks were deadlined at different times for want of tires. The first 5,000-barrel POL tank did not arrive until 15 January, and no 10,000-barrel tanks arrived until 29 January; storage facilities for aviation gasoline were critically short at all times prior to D plus 40.

Just before assumption of responsibility by Eighth Army on 1 January 1945, Japanese suicide aircraft disabled a ship carrying vitally needed bitumen, timber, POL installation materials, and general engineer supplies. Delay in arrival, and incomplete cargoes, of ships from New Guinea carrying landing mat and POL tankage further complicated engineer supply. In this operation the extreme scarcity of assigned Theater shipping, combined with supply priorities for more urgent operations elsewhere, made the problem more than usually acute. Some of the units were fortunately in possession of small stocks of spare parts and other engineer supplies. These were distributed among all the organizations where needed and greatly aided in keeping some equipment from being deadlined.

Construction. The assistance of an experienced Air Engineer in keeping motor vehicles of the local air garrison off open, unfinished, engineer airfield construction work saved much equipment effort which was generally lost from this cause on earlier operations. Continuous control of these vehicles, particularly following rains, not only aided engineer efforts but expedited air operations as well. Through such disciplined control, air facilities, following the two periods of rain, were reopened at the earliest possible moment with a minimum of maintenance effort. This cooperation was of such considerable assistance that the traffic control authority allocated to the Air Engineer by the local air commander was recommended as standing operating procedure for future operations.

Through the efforts of all personnel, despite extensive enemy air activity during the first 15 days of the operation, the required target dates on airdrome construction were met. In fact, with few exceptions, all construction target dates were met or bettered. The exceptions were definitely due to enemy action on supply lines and construction projects. For instance, completion of the POL jetty was delayed by naval shelling of the supply ship carrying piling. Another unavoidable delay occurred at Hill Field where a 1,000-barrel tank was destroyed by enemy bombing and had to be rebuilt on a new site.

Three factors, according to the Task Force Engineer, were responsible for the successful meeting of target dates, namely: (1) thorough advance planning assisted by the early availability of aerial photography; (2) capable and cooperative engineer units and personnel; and (3) favorable weather. With regard to the latter, it was the Task Force Engineer's recommendation that "a realization of the great difference that weather makes in what an engineer battalion can accomplish be brought to the attention of all echelons of command. A comparison of results obtained by engineers at Leyte and at Mindoro would make excellent material for dissemination throughout the Corps of Engineers." [8]

With regard to assignment of engineer units and personnel, the Task Force Engineer was most fortunate. Officer personnel of all units were excellent, and all of the units had participated in previous operations. Actual experience had afforded the best training. The three engineer construction units arriving on D Day (2d Australian Airfield Construction Squadron, RAAF, and the U. S. 866th and 1874th Engineer Aviation Battalions) all distinguished themselves by

[8] Engr Sec, Western Visayan Task Force, n.d., Mindoro Operation, 15 Dec 44–30 Jan 45, Engineer Report. In OCE, GHQ, SWPA.

efficient execution of the initial engineer mission and by their demonstration of fortitude in the face of frequent bombing and strafing attacks by Japanese aircraft.

Luzon

9 January 1945

When the Mindoro operation was postponed from 5 to 15 December 1944, the scheduled date for the Lingayen Gulf landing on Luzon was deferred from 20 December 1944 to 9 January 1945. Adverse weather and terrain conditions on Leyte had delayed construction of airfields there for provision of air cover to operations on Mindoro. The subsequent suspension of air support had delayed establishment of airfields on Mindoro essential to air cover over Luzon. In addition, plans for the Luzon operations had run into logistic difficulties. Certain vital equipment, supplies, and troops were not in the Theater, and maximum compromise efforts had to be made between securing what could be obtained from the United States and devising ways and means of substituting for that which could not reach the Theater in time.

Luzon was to be liberated by means of a series of operations (MUSKETEER Operations). In accord with GHQ, SWPA, operations instructions, Sixth Army was to launch the initial and largest of these operations from New Guinea and Leyte bases against the Lingayen Gulf area (MIKE I Operation). (See Map No. 12.) Hostile forces in central Luzon were to be destroyed, and the Manila–Central Plains area secured. The ultimate purpose was by now a familiar one: establishment of bases to support future operations. Concurrently, complete occupation of Luzon would reestablish the Philippine Government.

The landing of Sixth Army on the shores of Lingayen Gulf was to be accomplished by elements of I and XIV Corps abreast. I Corps, comprised of the 6th and 43d Divisions, was to land on the eastern shore of the gulf near San Fabian at Blue and White Beaches. XIV Corps, comprised of the 37th and 40th Divisions, would assault the southern shore of Lingayen Gulf near the town of Lingayen at Crimson, Yellow, Orange, and Green Beaches. (See Map No. 16, "Operations Map, Lingayen Gulf, Luzon, 9 January 1945.")

Preceding the amphibious operation, Japanese lines of communication were interrupted or destroyed by intensified air action. In anticipation of redoubled and widespread guerrilla activity on the island, the Chief Engineer, GHQ, SWPA, had conferred with the general staff and stressed the necessity to control excessive destruction of bridges on projected routes of advance. The need for this precaution was conveyed to the guerrillas, and when they were alerted on General MacArthur's direction, destruction of bridges and roads to prevent the enemy from shifting forces to meet the assault was carried out with a measure of discretion. Meanwhile, guerrilla demonstrations diverted Japanese attention to the south while Allied Naval Forces swept Lingayen Gulf for mines and destroyed enemy installations threatening the beachhead.

The approach plan for the attack forces (I and XIV Corps) was so coordinated that the four attack groups, one for each division participating in the assault, arrived off their designated beaches on Lingayen Gulf practically simultaneously. Initial opposition was conspicuous by its absence, and by late afternoon all four division commanders had assumed control ashore. The Japanese, recognizing American superiority, resorted to delaying tactics and set up a pattern of defense that would enable them to take maximum advantage of terrain as a counter to American strength. They organized three central defensive positions: the Shobu sector, covering the mountainous regions of northern Luzon, including Baguio, Balete Pass, and the Cagayan Valley; the Kembu sector in the center, defending the area west of Clark Field and Fort Stotsenburg; and the Shimbu sector in the south, located east of Manila in the mountainous country around Ipo Dam, Montalban, Marikina, and Antipolo.

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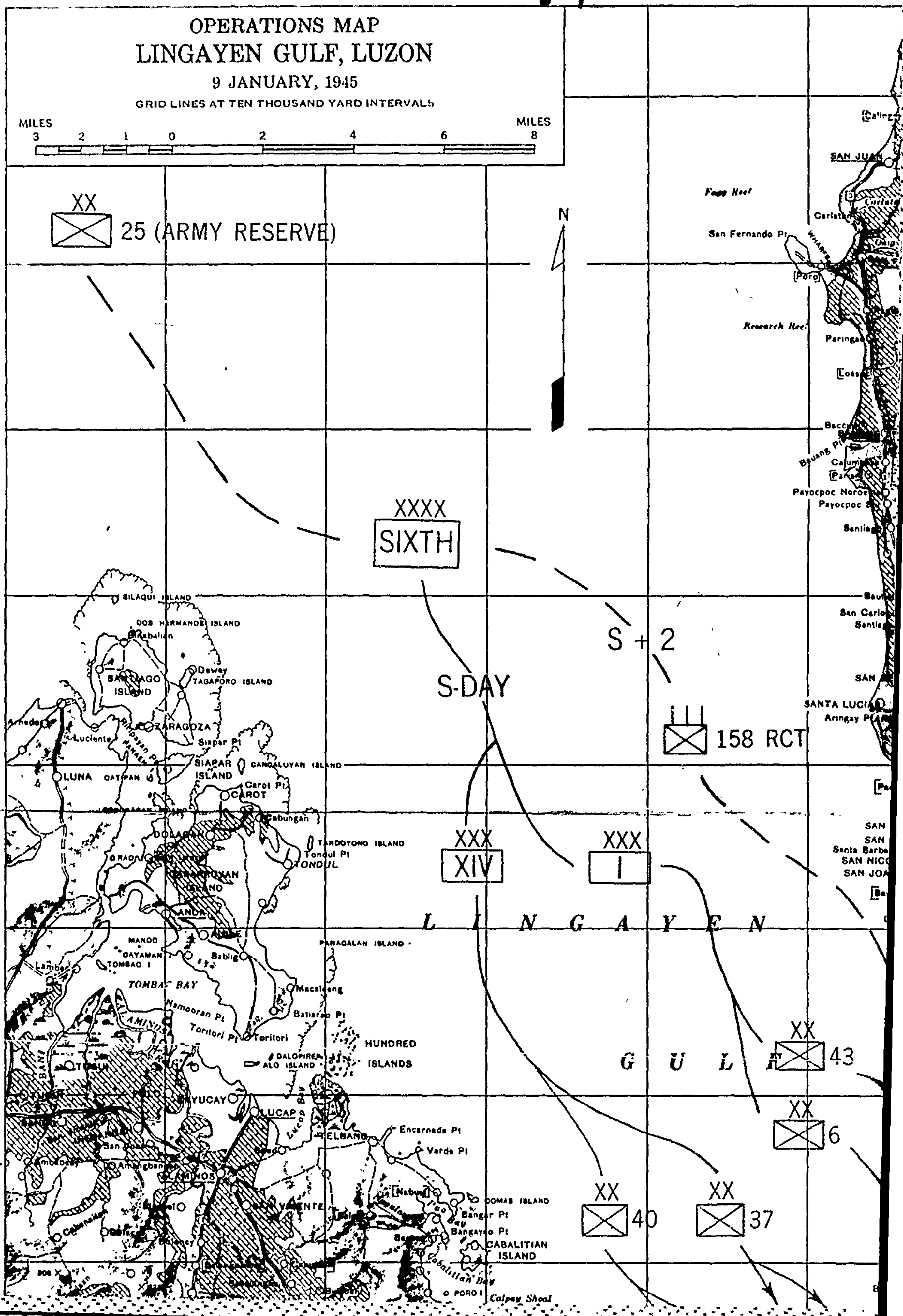
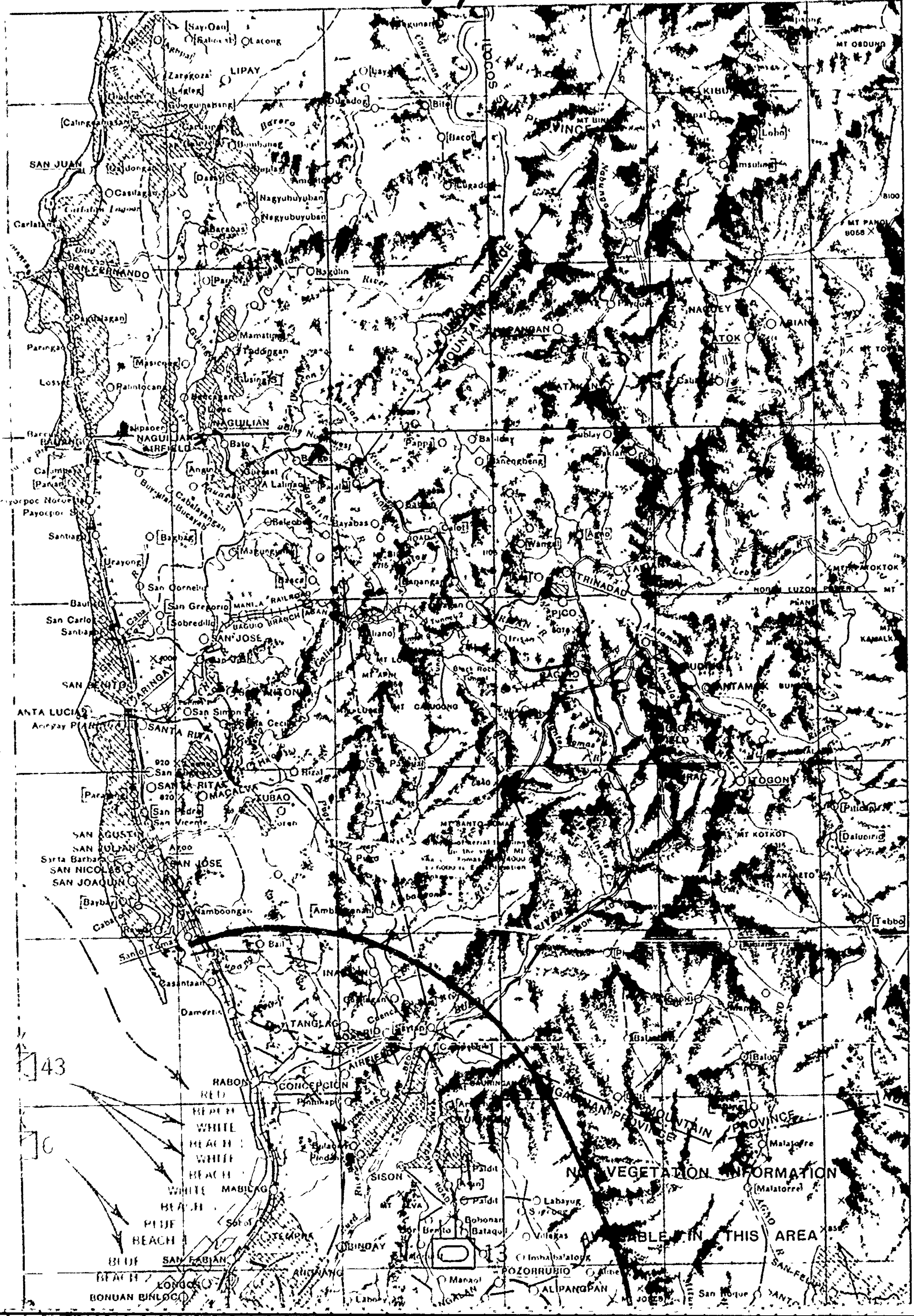
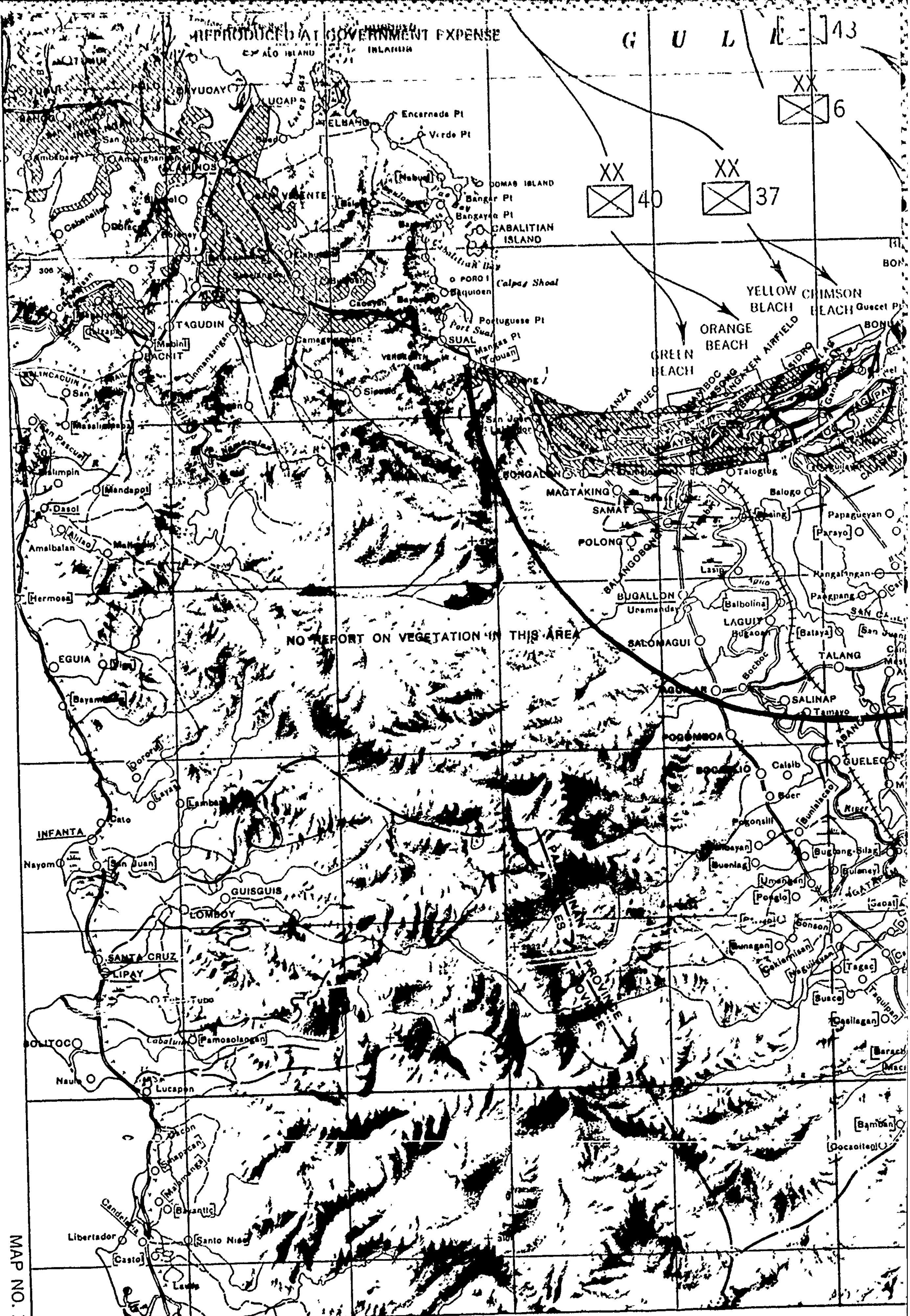

OPERATIONS MAP
LINGAYEN GULF, LUZON
9 JANUARY, 1945
GRID LINES AT TEN THOUSAND YARD INTERVALS
MILES
3 2 1 0 2 4 6 8
MILES
XX
25 (ARMY RESERVE)
N
XXXX
SIXTH
S-DAY
S + 2
III
158 RCT
XXX
XIV
XXX
I
L I N G A Y E N
G U L F
XX
43
XX
6
XX
40
XX
37
SAN JUAN
San Fernando Pt
Research Reef
Paringao
Payocpoc Norte
Payocpoc
SANTA LUCIA
Aringay
San Carlos
Santa Barbara
SAN NICOLAS
SAN JOAQUIN
SILAQUI ISLAND
DOS HERMANOS ISLAND
SANTIAGO ISLAND
TAGAPORO ISLAND
ZARAGOZA
Luciente
Siapar Pt
SIAPAR ISLAND
CANGALUYAN ISLAND
LUNA
Carot Pt
CAROT
Cabungan
DOLAGAN
TANDOYONG ISLAND
Tondul Pt
TONDUL
CABARRUYAN ISLAND
ANDA
MANOO
CAYAMAN
TOMBAC I
Lambes
Sablig
PANACALAN ISLAND
TOMBAC BAY
Macaleeng
Namooran Pt
Toritori Pt
Toritori
Batiarao Pt
HUNDRED ISLANDS
DALOPIREP
ALO ISLAND
BAYUCAY
LUCAP
Lucap Bay
ELBANG
Encarnada Pt
Verde Pt
Amangbang
SAN VICENTE
COMAS ISLAND
Bangar Pt
Bangayao Pt
CABALITIAN ISLAND
Cabalitian Bay
PORO I
Calpay Shoal

2 of 4


LIPAY
SAN JUAN
SAN FERNANDO
NAGUILIAN
BAUANG
NAGUILIAN AIRFIELD
SAN JOSE
ARINGAY
SANTA RITA
SAN BENITO
SANTA LUCIA
CABALAYANGAN
MACALVA
TUBAO
SAN AGUSTIN
SAN JULIAN
SAN NICOLAS
SAN JOAQUIN
AGOO
SANTO TOMAS
TANGLAG
ROSARIO
CONCEPCION
AIRFIELD
RABON
RED BEACH
WHITE BEACH 1
WHITE BEACH
BLUE BEACH
BLUE BEACH 2
MABILAG
SAN FABIAN
BONUAN BINLOC
SISON
BINDAY
POZORRUBIO
ALIPANGPAN
MOUNTAIN PROVINCE
ILOCOS SUR PROVINCE
LA UNION PROVINCE
PANGASINAN PROVINCE
ATOK
TRINIDAD
PICO
BAGUIO
ANTAMOK
ITOGON
MT SANTO TOMAS
NORTH LUZON POWER PLANT
MT OBDUNG
MT TOKTOK
MT KOTKOT
NO VEGETATION INFORMATION AVAILABLE IN THIS AREA



MAP NO. 16

SOURCE: HQ, Sixth Army, Annex 4 to FO 34, 20 November, 1944 (Additions by OCE, GHQ, AFPAC (Historical)).

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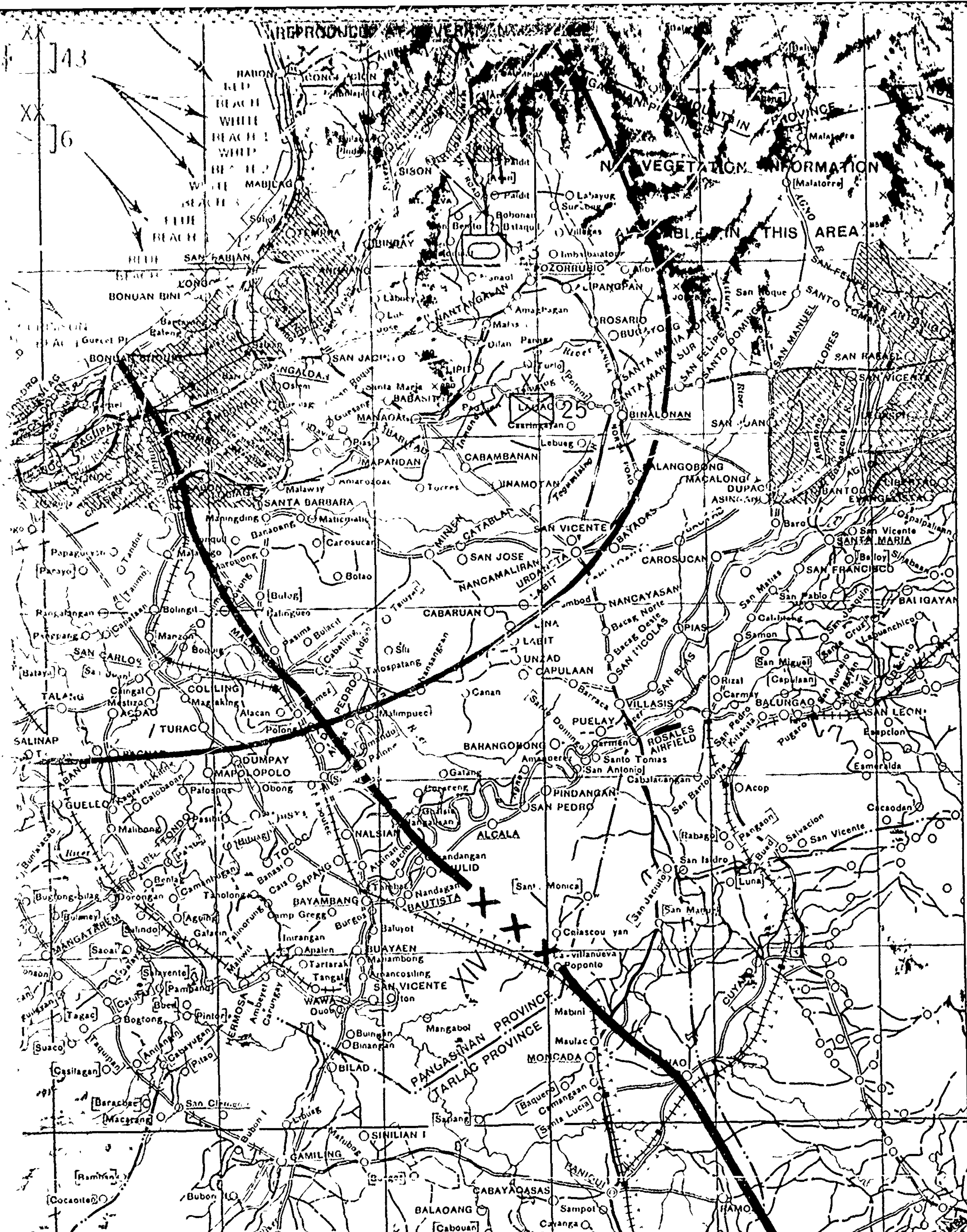

NO VEGETATION INFORMATION
AVAILABLE IN THIS AREA
MOUNTAIN PROVINCE
RED BEACH
WHITE BEACH 1
WHITE BEACH 2
WHITE BEACH 3
BLUE BEACH
SAN FABIAN
MABILAO
SISON
POZORRUBIO
BINDAY
MANAOAG
SAN JACINTO
MANGALDAN
DAGUPAN
CALASIAO
SANTA BARBARA
MAPANDAN
BINALONAN
ROSARIO
SANTA MARIA SUR
SAN MANUEL
SANTO TOMAS
SAN FELIPE
SAN QUINTIN
SAN VICENTE
SAN JOSE
URDANETA
LABIT
CABARUAN
NANCAYASAN
SAN NICOLAS
VILLASIS
ROSALES AIRFIELD
SANTA MARIA
SAN FRANCISCO
BALIGAYAN
BALUNGAO
SAN LEON
SAN CARLOS
COLILING
TURAC
MALASIQUI
DUMPAY
MAPOLOPOLO
SAN PEDRO
PINDANGAN
ALCALA
BAUTISTA
BAYAMBANG
NALSIAN
URBIZTONDO
MANGATAREM
SAN VICENTE
WAWA
BUAYAEN
MALUNGUEY
PANGASINAN PROVINCE
TARLAC PROVINCE
MONCADA
CAMILING
SINILIAN I
CABAYAOASAS
PANIQUI
BALAOANG
CARINO
GERONA
TAGUMBAO
MAYANTOC
SAN VICENTE
SANTA IGNACIA
NAMBULAN
TARLAC 8 MI.
XIV
25

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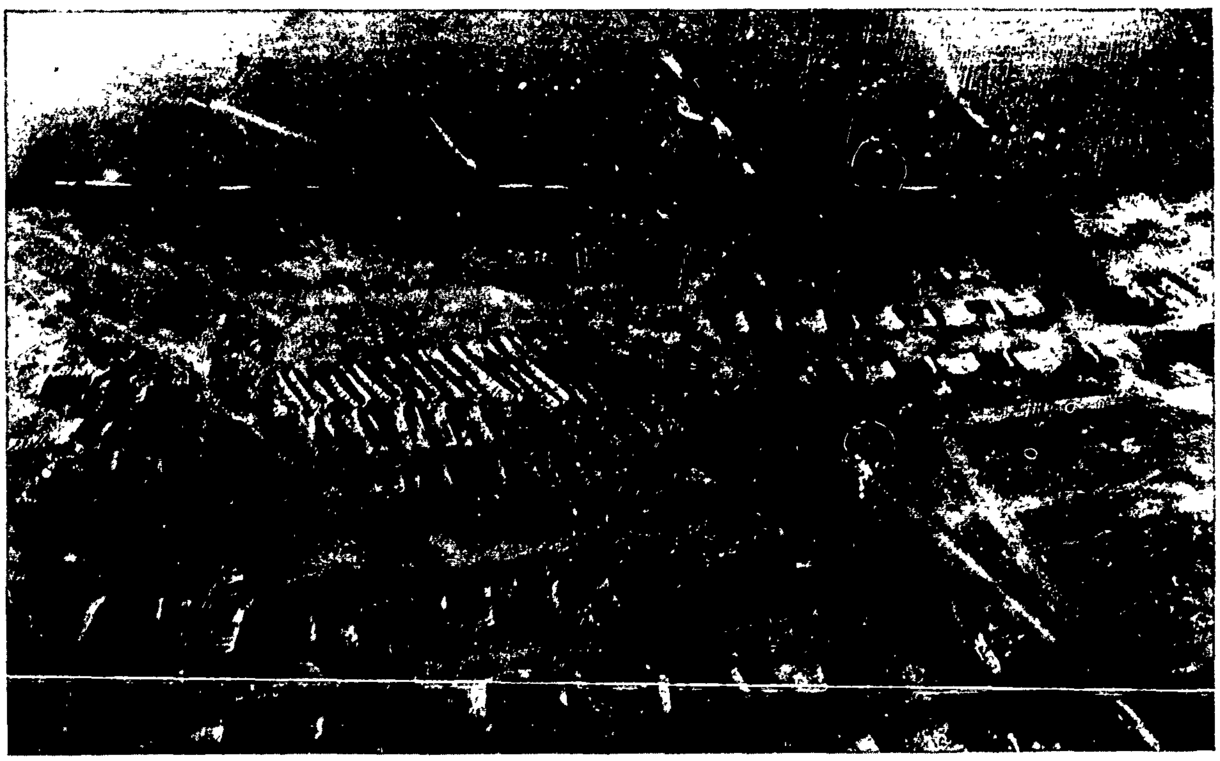
LST's take Engineer LVT's aboard from Aitape beach prior to departure for the Lingayen Gulf operations.

Aircraft of an Air Sea Rescue Squadron fly over the vast array of surface craft arriving in Lingayen Gulf, off the coast of Luzon.

Engineers form a human chain to unload ammunition and rations from their landing craft on the beach at Lingayen Gulf, Luzon.

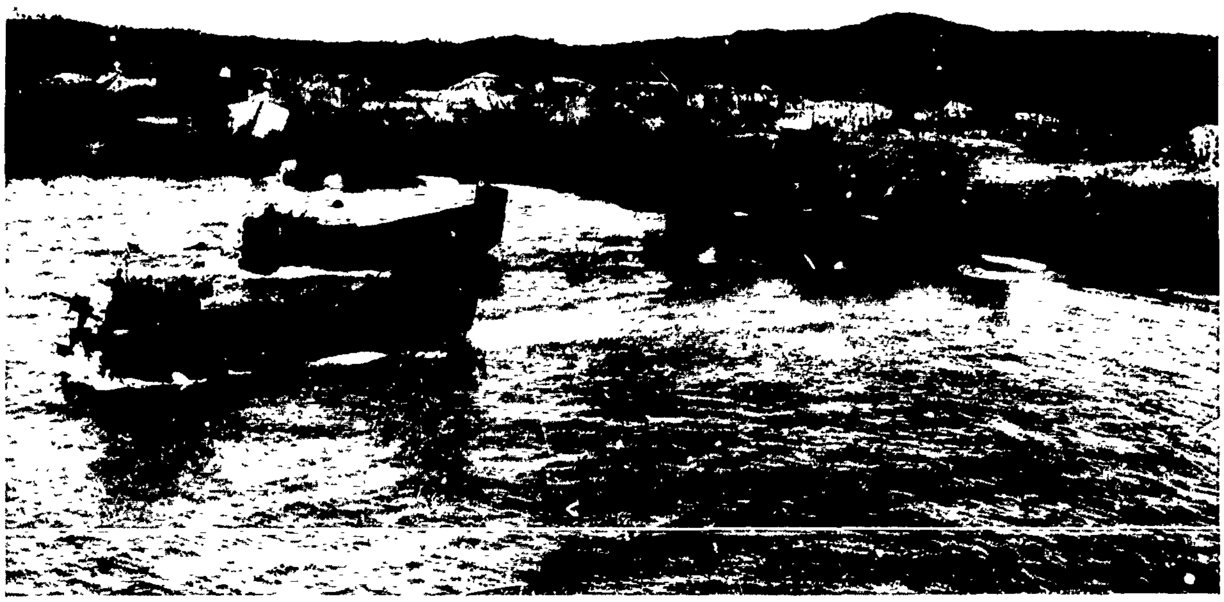
Engineers laying ARC mesh on the beach at Lingayen, Luzon, to prevent heavy trucks and equipment from sinking into the soft sand.

A view showing the great quantities of supplies piled on the beach at Lingayen Gulf.



General view of the beach at Lingayen Gulf showing the organization of the beachhead dump area and the dispersal of supplies.

Engineers moving supplies ashore by means of roller conveyor two hours after landing of assault forces on Corregidor.



Engineer LCT's come in for a landing while LST's discharge their cargoes on the bomb-scarred beaches of Albay Gulf, Legaspi, Luzon.

The variety and type of terrain over which subsequent fighting took place, ranging from a well-developed and populated alluvial valley to the most rugged jungle-covered mountains, 7,000 feet high, presented a myriad of technical engineering problems to solve. Not only was Sixth Army responsible for its own lines of communication on Luzon, but, with its own army service command (ASCOM), it was given responsibility for the construction of its own base and all air force ground facilities within its zone of action. The close relationship which must exist between tactical operations and engineer operations was brought out in bold relief. The tremendous scope of the operation and the proximity of the objective area to Formosa and Japan greatly increased vulnerability to hostile air attack and placed tremendous pressure on the engineer service to insure timely completion of airdromes. On the other hand, the degree of rapidity with which lines of communication could be repaired to support the advance of Sixth Army on Manila was directly woven into the tactical situation. Rushing the leading troops pell-mell on Manila without proper support by substantial lines of communication would have invited the one setback which, it was subsequently learned, the enemy counted upon as their only chance. In the effort to capture Manila at the earliest possible moment, therefore, engineer support was a deciding factor and the engineers had to be driven to the utmost.

Amphibian Engineer Operations

In the interest of brevity, and considering the number of landings made on Luzon (see Map No. 12) by various elements of the engineer special brigades, comments must necessarily be limited to excerpts of experiences having significance for the future. Major landings, following those in the Lingayen Gulf area, were effected on beaches in southern Zambales Province, at Nasugbu, adjacent Corregidor Island, and Legaspi. Many of the difficulties encountered in these operations were recurrences of difficulties experienced at Aitape, Sansapor, Morotai, and Leyte.

On 9 January 1945 the 4th ESB, less one boat battalion but with two boat and shore regiments of the 3d ESB attached, furnished shore parties and lighterage, and coordinated all operations on I and XIV Corps beaches in the vicinity of San Fabian and Lingayen on Lingayen Gulf. The 592d EBSR of the 2d ESB furnished lighterage and shore parties to supervise all beach operations for XI Corps (under Eighth Army control until 30 January 1945) at Red and Blue Beaches for the landings made on 29 January in the vicinity of La Paz, southern Zambales Province. (See Map No. 12.) No ESB unit was assigned to the initial landing on 31 January 1945 at Nasugbu by the 11th Airborne Division, reinforced (under Eighth Army control until 10 February 1945), where the 127th Airborne Engineer Battalion was required to assume shore party responsibilities.[9] Boat and shore elements of the 592d EBSR transported men and supplies of the reinforced battalion of the 34th Infantry which participated with the 503d Infantry (Parachute) in the assault of Corregidor from Mariveles on 16 February, and the 158th RCT (reinforced), which landed at Legaspi on 1 April 1945 (see Map No. 12), included a task group consisting of boat and shore elements from the 592d EBSR.

Preinvasion Bombing. The procedure of keeping beaches under naval bombardment and rocket fire rather than stopping and shifting to air bombardment and strafing during the period immediately before H Hour was followed again with success in the Lingayen Gulf operation. Air bombardment, of course, was highly desirable in the rear areas, particularly on reverse slopes and on targets beyond the range of naval gunfire. At Legaspi, however, some observers were of the opinion that the air and naval bombardment was too indiscriminate. For several days prior to this landing on 1 April air elements

[9] *Editor's note:* Boats of Co C, 592d EBSR, began arriving at Nashugbu on 4 February for lighterage and patrol missions.

conducted a systematic bombing of the objective area. On 1 April they returned at 0730 to complete the mission of destroying all remaining enemy positions. Preceding the landing, at 0900, naval surface elements began shelling designated as well as opportunity targets. The effect of the air and naval bombardment was the destruction not only of the enemy defensive installations, but major destruction of both the port and town of Legaspi. Except for the concrete pier, which suffered but one hit during previous bombings, the port was reduced to a mass of rubble. All streets and roads were covered with the ruins of buildings. Debris blocked all passages during a period when their obstruction could have been a serious setback, and space for storage was denied by the demolition of buildings.

Landing Conditions. Early on D Day, the Lingayen Gulf beaches assigned to the 6th Division (I Corps) and to the XIV Corps were found to be largely unadaptable to respective landing schedules. A large amount of shipping was, therefore, directed to White Beach which had been assigned to the 43d Division (I Corps). Generally, however, this diversion was effected without prior notice to the White Beach shore party, without instructions as to relative priority with the shipping originally scheduled for White Beach, and without delivery of ships' manifests.

The 11th Airborne Division landing at Nasugbu, with no ESB units attached, encountered very poor landing beaches, and the LST's grounded on a sand bar.[10] By repeatedly retracting and ramming the obstructing sand bar at high tide, five out of the six LST's in the convoy were brought to within 60 feet of shore, and sand ramps were dozed out to them. However, one LST broke its retracting winch and was lying 150 feet offshore with 12 feet of water at its bow. For some undetermined reason, it was decided that vehicles should be unloaded even though it was necessary to tow them ashore submerged. The resulting damage from salt water was severe.

At Zambales Province while no mud or swamps were encountered as at Leyte, the soft, steep beaches, as previously indicated in engineer terrain intelligence, were a considerable obstacle.[11] The sand was so deep, loose, and coarse that wheeled vehicles could not negotiate it without a tow. Efforts of the 2d ESB to secure ARC mesh or pierced plank for this operation while at Leyte had been only partially successful; in view of existing shortages at that base, only 27 bundles of pierced plank could be obtained. This small quantity was utilized entirely for the exits from the LST ramps. It was fortunate that the LSM with most of the shore battalion dozers on board was available and could be called in for unloading as soon as the infantry cleared the beach. These dozers, together with all other tracked vehicles, were commandeered for towing stalled vehicles off the soft beach, and artillery prime movers returned to the beach to assist whenever they could be released from other tasks.

It was pointed out by the 2d ESB that there was no reason to believe that soft, sandy beaches of this type might not be encountered in future operations, and it was essential, therefore, that task forces procure the necessary quantities of ARC mesh and pierced plank to overcome the impassability of such beaches. Had there been serious opposition on the beach, heavy losses would have been incurred while pulling stalled vehicles off the beach, and artillery would have been considerably delayed in getting into position for action against the enemy.

Landing conditions on Corregidor, where there were no extensive interior areas to which the Japanese could withdraw, involved overcoming such heavy opposition initially that the entire "Rock Force," as the attackers were named, received the Distinguished Unit Citation.

[10] *Editor's note:* Landing Beach Conditions and the Engineer Annex to the AGS Terrain Study had been published by OCE, GHQ, SWPA, 6 weeks in advance of this operation and had indicated conditions to be expected.

[11] *Editor's note:* In the planning phase, two landing beaches were selected near San Narciso in Zambales Province from studies of aerial photographs and sounding data. Naval authorities, however, did not concur in this selection and chose their own sites. Later, these beaches did not prove entirely satisfactory.

Going into the beach, the 2d ESB LCM's of all waves encountered heavy machine-gun fire from caves in the cliff. A lethal curtain of small-arms, machine-gun, and mortar fire from the south shore of Bottomside dropped across the path of the landing craft as soon as the first wave was about 300 yards offshore. All craft in the assault were hit but made successful landings. One LCM in the third wave experienced over 40 hits, but only one hole was below the water line and this was plugged quickly by the crew. The ease with which the slugs penetrated the steel plating, and later examination of slugs found embedded in the heavy steel mounts, proved that the Japanese were using armor-piercing .50-caliber machine-gun ammunition. There were no underwater obstacles, but the beach was heavily mined. Some of the vehicles and dozers which landed initially hit these mines and were disabled. Engineer guides were immediately dispatched to meet succeeding waves and to stop all vehicles as soon as they were off the landing craft. A party of engineers, assisted by an infantry mine platoon, meanwhile rapidly cleared and marked a gap through the mine field while the remaining engineer troops uncovered and removed all other mines.

Lighterage and Control. As in the Leyte operation, a large number of small landing craft for lighterage was required at Lingayen Gulf. The only means of transporting these craft to the operational area was by naval assault shipping, and ESB LCM's were, therefore, lifted in this manner on D Day. To assist the heavy demands for lighters, naval elements also established a pool of 24 LCT's, 12 small self-propelled barges, and 32 large self-propelled barges.[12] The problem of lifting an adequate supply of small landing craft suitable for lighterage was the greatest single problem facing an ESB group assigned to any assault operation.

Those ESB LCM's which were transported aboard assault ships (APA's and AKA's) in lieu of the ships' own LCM's were under naval control during assault phase unloading. These craft were used to unload the ships to which they had been assigned, then to unload the ships in the same transport division, and finally were assigned to the control officer for unloading the remainder of the assault shipping in the area. When the assault shipping was unloaded, these LCM's were released to the control of their respective engineer boat and shore regiments and were then employed in unloading critical material from cargo vessels. However, such multiple transfers are better expressed here than were understood by the boat crew personnel with the result that many LCM's reported directly to the engineer boat and shore regiment after unloading the ships in which they had been carried.

In the case of the subsidiary assault landing on Grande Island, launched from Zambales, the complicated control of ESB landing craft proved clumsy and delayed rapid planning. When the commanding general, XI Corps, decided to make the assault landing on Grande Island, 592d EBSR landing craft were still under naval control as lighterage serving AK's and AKA's that had not yet been unloaded. Release of these boats for the projected mission involved contacting the naval officer in charge of landing craft, who, in turn, had to secure the approval of his superior before the landing could be executed. The 2d ESB's report of this incident contained the following comments: [13]

> ESB Boat Units are officered and trained exactly for this type of shore to shore operation and have participated successfully in many landings of Battalions of this type. In similar operation in the future, it is believed that all subsidiary landings involving 2d ESB landing craft and attached Buffaloes or similar craft should be handled directly from the Task Force Headquarters to the Boat Battalion Commander, simplifying the entire procedure.

[12] *Editor's note:* LSM's and LCT's were used to assist in unloading assault shipping in the Lingayen area. Ponton barges, because of difficulties in maneuvering and controlling them in the extremely high surf encountered, were primarily used as ferries for carrying cargo from AKA's and AK's to LCVP's and LCM's that were lying to off the beach. While this required a double handling of cargo, it did facilitate unloading.

[13] Ltr, CG, 2d ESB, to CG, Eighth Army, 6 Feb 45, sub: Preliminary Report of 2d ESB Participation in M-7 Operation. In OCE, GHQ, SWPA.

In recent operations on the west coast of Leyte, with XXIV Corps, this procedure was always followed where only Army craft with possibly supporting PT Boats were involved.

Shore Party Activities. The necessity of landing essential engineer equipment at the appropriate time for initial beach operations elicited comment in the reports of practically all participants in the various Luzon operations. The Seventh Amphibious Force report of the Lingayen Gulf operation stated: "This operation again demonstrated the importance of the unloading phase. Not until sufficient heavy equipment and supplies have been landed can the troops carry on an effective campaign inland." [14] The 4th ESB, reporting on the same operation, stressed a specific recommendation for loading shore party personnel and equipment which provided: [15]

. . . one LSD carrying one LCT and 12 LCMs for the exclusive use of shore party equipment. This will insure as much as any provision can that an adequate number of bulldozers and cranes reach the beach regardless of beach conditions and unloading difficulties. Items of shore equipment required a few days after the landing, particularly maintenance equipment, must not be loaded on merchant shipping. It has been our experience in every operation that S+2 and S+4 Liberty shipping has remained idle at anchorage until S+5 or later because of the lack of priority for discharge.

At Legaspi the deficiency of shore party engineer equipment proved a considerable disadvantage. Here, where the beach would not support heavily loaded vehicles, dozers were at a premium. The previously discussed air and naval bombardment had been so devastating that all original beach exits were blocked, and dump areas were not available short of several miles inland from the beach. Before one beach exit roadway could be cleared, vehicles from LCM's became jammed laterally along the water's edge. Yet, space for but one dozer had been allotted to the ESB Task Group in spite of repeated efforts to get at least three or four on the first LSM's to land. This dozer was put to work immediately and soon had one exit cleared so that traffic could begin to move off the beach before the LST's landed. Two power shovels which stood idle on the beach for at least 2 hours after being unloaded were typical of the kind of equipment that was allotted space on the first two LSM's to beach.

In any operation, the necessity for getting dozers ashore ahead of the LST's early on D Day and the futility of cluttering the beach with unneeded heavy equipment cannot be overemphasized. Dozers were essential to prepare ramps for the first and subsequent echelons of LST's—to pull out of the water and off the beach all stalled or damaged vehicles—to destroy obstacles and fill in antitank ditches—to open up exits from the beach so it would not become congested—to push broached or damaged landing craft out of the way of incoming craft—to assist in placing ponton causeways when and where they were needed. The importance of these missions, so well demonstrated in previous experiences, more than justified space allocations for dozers on a comparable priority with other combat needs of task forces. It was recommended by the commanding general, 2d ESB, that these factors be incorporated in future instructions to task force commanders. Besides promoting uniformity of operations, such instructions would insure understanding of shore party requirements by staffs of newly constituted task forces. Understanding, in turn, would encourage tactical commanders to make proper provisions to meet these needs which permit quicker unloading and more prompt delivery of combat power ashore for the task force.

While the performance of the shore parties in the unloading of assault shipping at Lingayen Gulf was very satisfactory, experience indicated that the capacity of assault shipping to discharge cargo exceeded the capacity of the shore party to receive it. Shortage of cargo-handling equipment to remove cargo from the landing

[14] Ltr, Comdr, Task Force 78, to CinC, US Fleet, 12 Feb 45, sub: Report of the Lingayen Operation--San Fabian Attack Force. In Records Section, GHQ, SWPA.

[15] Hq, 4th ESB, Monthly Historical Report for December 1944 and January 1945. In OCE, GHQ, SWPA.

craft, shortage of trucks to keep the beaches clear, and physical exhaustion of shore party personnel were definite limitations in unloading which needed recognition.

When all of the XIV Corps, and part of the I Corps, shipping destined for unsuitable beaches during the Lingayen Gulf operation was diverted to White Beach (see Map No. 16), the overload exceeded the facilities of the shore party, especially in trucks. It was, consequently, impossible to discharge all shipping on its original time schedule. Repeated efforts were made during the first few days ashore to obtain definite advice from the tactical commanders, then responsible for unloading, as to relative degrees of priority between the diverted shipping and that originally scheduled for White Beach (zone of attack of the 43d Division, I Corps). Until as late as D plus 3, however, there was considerable uncertainty, which undoubtedly accounted for some delay in the unloading of critical cargo. The shore party commander was besieged by demands for top priorities by various commanders, but, lacking any basis for decision other than a general knowledge of the tactical situation, he was in most cases compelled to instruct them to apply for priorities through G–4, 43d Division. This occasioned considerable annoyance and criticism, especially when it developed that such priorities could not be obtained and transmitted to the shore party through proper channels in quick order.

Many units not under I Corps control, but passing over I Corps beaches, failed to provide manifests, passenger lists, and names of ships with units aboard. Consequently, the shore parties were forced to make estimates of amounts coming across beaches into dumps, and the status of balances aboard ships still to be unloaded in order to give the four assault divisions as accurate a picture as possible of unloading progress. In reporting on the assault phase of this operation, the 3d ESB stressed that every ship in succeeding operations carrying troops, equipment, and supplies should have a loading officer assigned to it, a passenger list indicating units aboard, and a complete manifest of tonnages and types of all supplies and equipment. All of this information should be tied in with the name and type of ship so that the complete data could be handed to the shore party commander and leave no doubts in his mind.

There was need for closer cooperation and coordination between the naval task force, the naval beachmaster, and the shore party commander at beaches in the Lingayen Gulf area. On several occasions ships arrived offshore and neither the naval beachmaster or the shore party commander was informed of their presence. Several times ships were reported in the area, but could not be located. On other occasions, in the initial stages, lighters landed troops on a beach without notifying the shore party or naval beachmaster of the identity of the units or the vessel from which they had disembarked.

It was pointed out by the 3d ESB that an officer should be put in charge of every boatload of men coming ashore and should be given instructions as to what to do when he landed. At least, the general direction of the unit's assigned bivouac area or command post should have been given to these troops to prevent confusion and milling around on the beach. In this connection, a recommendation of the 4th ESB in their report of this particular operation seems pertinent, namely:[16]

> All units have difficulty in locating their proper bivouac area and the beach installations. To prevent this and to insure a steady stream of combat troops away from the beach area it is suggested that directional signs in large numbers be prepared beforehand and posted by each tactical element along its route of advance from the beach. The present shore party marking system for assault dumps is adequate, but this plan must be carried over by division and corps service personnel when they assume responsibility for the movement of supplies inland.

Provisional truck companies were organized by the divisions for each of their assigned beaches, but only half of the units that were to furnish

[16] Hq, 4th ESB, Monthly Historical Report for December 1944 and January 1945. In OCE, GHQ, SWPA.

trucks ever reported to the shore parties. As a result, there was a shortage of trucks on the beaches for the first 5 days of the Lingayen Gulf operations. The responsibilities of unit commanders who were detailed to furnish labor or transportation to the shore party should have been clearly defined to them by the affected tactical forces and steps should have been taken to insure that the specified troops or trucks reported promptly to the shore party commander.

To augment the unloading efforts of shore parties, native labor began to appear by noon of D Day in the Yellow Beach area of Lingayen Gulf and was immediately used to the fullest extent. However, prior to the time the Philippine Civil Administrative Unit of ASCOM arrived, considerable difficulty was experienced in controlling and utilizing efficiently the natives who offered assistance. The regimental S–2 of the 544th EBSR was designated as labor control officer and organized a native labor control system by using the more educated Filipinos as a staff. This simplified pay records. The greatest problem was feeding the laborers in order to keep them working. Civilian rations had not been scheduled to arrive until D plus 2, and the regimental supply officer was not authorized to draw such rations until D plus 3. It was recommended by the 4th ESB that in areas where cooperation from civilians can be expected to augment the shore party, a small civil affairs section similar to a detachment of the Philippine Civil Administrative Unit be attached and made a part of the initial shore party elements landed to organize and control this native labor.

Inasmuch as efficiency and speed of unloading in any operation are definitely limited by port capacity, the early arrangements made to reserve the most adaptable points available in the Lingayen Gulf area for unloading considerably facilitated the discharge of cargo in the critical days of these landings. Numerous studies had been made by ASCOM regarding unloading inasmuch as this command was to undertake complete responsibility for unloading on D plus 6 and to provide full logistic support of the operation on D plus 20.[17] As a result of these studies, ASCOM insisted upon full exploitation of the Dagupan River. The estuary of this river, leading to the town of Dagupan near Lingayen Gulf, constituted an additional very efficient unloading point over and above available beaches. General Headquarters, SWPA, however, had spotted Dagupan for its command post and had issued instructions excluding Sixth Army units from the Dagupan area. This impasse had to be cleared. The method of tabular analysis of port capacity which the Engineer, Sixth Army, had devised at Hollandia, and which had proved its accuracy in succeeding operations, was again effectively employed. Preparation of this graphical analysis (see Chart No. 4, "Port Capacity—Lingayen Gulf Operation") enabled the commanding general, Sixth Army, to show the Commander in Chief, SWPA, personally the additional port capacity offered by Dagupan during the critical initial period from D plus 5 to D plus 40 (compare columns 14 and 19). The effect of the analysis proved decisive and instructions were modified. Dagupan became of significant operational importance when high surf made unloading operations impossible on all but two of the eight beaches.

In the later Zambales operation successful unloading was effected by use of 17 provisional companies of 100 soldiers each which were assigned solely for this mission. Four companies were assigned to Blue Beach and 13 to Red Beach. All of these men were returned on the B plus 5 echelon to their units at Leyte. This labor plan, which was initially used in the Finschhafen operation with the 9th Australian Division, was highly recommended by the 2d ESB for future operations. It did not interfere with the tactical units in the operation, and also had the advantage of fixed responsibility; the men on the

[17] *Editor's note:* Because of poor beach conditions and delay during the tactical phase in unloading service units and equipment, the assumption of unloading responsibility by ASCOM was put back until D plus 10 with the date of assumption of full logistic support remaining at D plus 20.

labor detail knew they had a specific job and that they would be sent back when their mission was completed.

In the absence of ESB personnel with the 11th Airborne Division in its amphibious landing at Nasugbu, the division Engineer was charged with the responsibility for all unloading and beach control. The only alternative without ESB support was assignment of the 127th Airborne Engineer Combat Battalion, divisional engineers, to this mission. As a result, this combat unit had to split its efforts between working the beach, unloading supplies, and supporting the advance of combat troops. Provision of an ESB shore party would have made the difference between complete or divided support to tactical elements. Under the circumstances, however, this battalion was able to extend only divided support.

Because of the shortage of organic motor transportation in an airborne division, the beach dumps at Nasugbu necessarily accumulated larger stocks than is normal in an amphibious operation. A narrow gauge railroad with a small quantity of rolling stock was operative in the vicinity, however, and the construction of a spur to the beach was started immediately. This spur proved to be of considerable value in moving supplies off the beach and greatly relieved what could otherwise have readily deteriorated into a critical situation.

Aside from the danger of enemy air attack on a beachhead, the greatest hazard reported on the beaches in the San Fabian area was from falling flak. Whenever a Japanese aircraft was reported in the vicinity, it seemed that every automatic weapon from shore installations, as well as the hundreds of ships, opened up, firing promiscuously, sometimes only in the general direction of the sound of aircraft motors. In one instance, .30-caliber machine guns were observed firing at an enemy plane flying at an approximate altitude of 25,000 feet. As a result of this promiscuous use of antiaircraft weapons, flak rained over the area at the sound or sight of an enemy plane, and it was surprising that the casualties were so low. More adequate control of antiaircraft fire should have been maintained. The absurd waste of ammunition expended by .30- and .50-caliber machine guns firing belt after belt at out-of-range targets was self-evident. The hazard of filling the air with potential death or injury to friendly troops when the slugs rained back on the beaches was a futile and unnecessary risk.

Communications. Since it had been learned from experience that vital engineer information was not given priority by corps and division commanders commensurate to that given tactical information, a portion of the signal company of the 4th ESB was attached to the Engineer Section, Sixth Army, with subattachments for radio communication to the Engineer, ASCOM, the Army Engineer Depot, and the 5202d Engineer Construction Brigade. As a makeshift system pending provision of an Army engineer net, this means proved most efficacious. Through it came a continuous flow of information on the beach situation which would have overburdened the tactical nets, and, in addition, on more than one occasion this independent system carried tactical traffic when tactical nets were disrupted. If used for no other reason than to provide an alternate tactical net, the ESB nets would have been well worth while.[18]

The work of another communication organization, composed of message center personnel from Company A, 592d EBSR, at Mariveles, is worthy of special mention. The SCR 193 was loaded on a weapons carrier, which, while traversing the distance from ship to shore, dropped into a bomb crater near the beach. Many parts of the radio were immersed in salt water. The men immediately stripped the radio, rinsed the parts in fresh

[18] *Editor's note:* In this connection, it was the conclusion of the Engineer, Sixth Army, that: "Where an army is operating on a broad front, there should be an Army-Corps-Division engineer radio net to obtain and disseminate promptly technical reconnaissance information and to effectively coordinate the use of engineer troops and equipment. In addition, this net should be expanded or an additional net provided for the handling of engineer supply matters." *See* Engr, Sixth Army, n.d., Report of the Engineer, Sixth Army, Luzon Campaign, 9 January–30 June 1945, p. 229. In Sixth Army files.

water, dried them, and saved them from being ruined. Shortly after D Day it became necessary to handle all traffic for the S-4 Section of the Task Force headquarters and for miscellaneous units which had no other means of communication with their rear echelons. Although this message center was set up to handle the 592d traffic only, by considerable lengthening of duty hours the message center personnel got vital messages through to other headquarters in addition to their normal traffic. When the traffic became too heavy for the coding machine to handle, the code clerks, to prevent delay, set up emergency codes and got messages through by this means as well as by the M-209-A converter.

Criterion of ESB Support. The performance of the engineer special brigades up to and including the Luzon operation did not go unnoticed as was evidenced in General MacArthur's letter of 19 March 1945 to the Chief of Staff, War Department, as follows: [10]

> In the succession of amphibious operations up the coast of New Guinea to Morotai, thence to the Philippines, the performance of the 2nd, 3rd and 4th Engineer Special Brigades has been outstanding. The soundness of the decision in 1942 to form organizations of this type has been borne out in all action in which they have participated. These units have contributed much to the rapid and successful prosecution of the war in the Southwest Pacific Area. I recommend that careful consideration be given to the perpetuation and expansion of such units in the future Army set-up.
>
> I pass on to you an item extracted from a report to me from Headquarters, Administrative Command, Seventh Amphibious Force . . . dated 15 February 1945, subject: "Report of the Lingayen Operations-San Fabian Attack Forces."
>
>> "It is believed that the Engineer Special Brigade as organized in the Southwest Pacific Area is the most efficient Shore Party organization now functioning in amphibious warfare and that the permanent organizations of these regiments have contributed in a large measure to the success of amphibious operation in this theater."

Task Force Engineer Operations

Planning. During the planning phase for the Lingayen Gulf operation on Luzon, the 5202d Engineer Construction Brigade, operating under the direction of the Engineer Section, Sixth Army, was assigned the task of determining engineer requirements for all tactical phases of the campaign to include the capture of Manila. Meanwhile, determination of necessary assault and pioneer supplies to accompany troops on assault shipping, and the planning for airdrome construction as well as development of San Fernando, La Union, and, subsequently, Manila, as base section ports were the responsibility of the commanding general, ASCOM. Over-all requirements were determined by the most intensive staff work between 19 September and 1 October 1944. Requisitions to cover these requirements were completed in regular form by 4 October and submitted to the commanding general, USASOS. It was urgent that many of the supplies be immediately procured in the United States because there were little or no stocks of certain items in the Theater. Previous operations had been of the shore-to-shore type. For this operation, involving rapid construction of long lines of communication to support an overland advance, many supplies not utilized heretofore were now essential. However, at a subsequent conference with the Chief Engineer, USASOS, a situation of considerable complexity arose because of the War Department regulation requiring submission of each contemplated operational project for War Department approval before procurement of supplies for projects could be initiated in the United States. Despite the urgency for early provision of the unstocked items, the commanding general, USASOS, in accord with the War Department regulation, had ruled that the over-all requisitions already prepared had to be broken down and applied to specific subprojects such as hospitals, bulk petroleum storage, airdromes, refrigeration, and the like. Furthermore, these subprojects had to be coordinated with a partial project which had already been submitted to the War Department by USASOS prior to determination of the tactical plan of operations in an endeavor to allow 150 days for delivery before

[10] Ltr, CinC, SWPA, to CofS, WD, 19 Mar 45, sub: Engineer Special Brigades. In Records Section, GHQ, SWPA.

D Day. The only items exempted from being supplied through the processes of the "project system" were certain tactical requirements, but these were limited to sandbags, barbed wire, explosives, and fortifications materials. Initial bulk petroleum storage facilities, for example, were considered a permanent base requirement for inclusion in an operational project. Since Sixth Army requisitions had been carefully and tediously prepared for combat loading on a schedule of arrival in the objective area to support the advance, the resulting confusion and delay to reproduce these requisitions for conformance to requirements of the project system were extreme. Itemization of contemplated operational projects, in accord with the War Department project system, by field armies planning operations 8 months to a year in advance, as in the case of the offensive against Normandy, is conceivable; in the Southwest Pacific Area, where, in effect, a strategic pursuit was being undertaken with short notice to field armies and with very limited information on objective areas, its application proved impractical.

Arrangements for treadway bridging presented another difficult problem. Prior to departure from Leyte, it was learned that the 1011th Engineer Treadway Bridge Company was the only unit made available by the War Department of the three such companies requested; and it was further found that this unit had been required to sail from the United States without either its bridging equipment or its special transportation. The only treadway bridging available in the Theater was the obsolescent M–1 model at Milne Bay which was unsatisfactory and unsafe. Moreover, this bridging was less than one-third of the minimum necessary. Nevertheless, it was decided to move this equipage to Leyte and mobile load it on trailers of the 556th Engineer Heavy Ponton Battalion. Numerous difficulties and delays were encountered in effecting this move. Because of the importance of this bridging, GHQ, SWPA, was requested by USASOS to direct special air cover from Hollandia to Leyte for the vessel on which it was to be transported. Highest priority was established for its unloading at Leyte, and the equipage was brought ashore, checked, tested, and reloaded in time to move out with the battalion. Even this accomplishment would have been impossible if the date of the operation, originally scheduled for 20 February 1945 and advanced to 20 December 1944, had not been postponed until 9 January 1945. In spite of the limitations of the project system, measures were also requested of, and taken by, GHQ, SWPA, to effect the earliest possible shipment direct to the objective area of two additional units of treadway bridge known to be at San Francisco and New Orleans.

The initial plan for movement of engineer supplies to the objective area involved the arrival of sufficient quantities in the order needed. This meant combat loading of ships, and top loading that which was immediately and critically essential. Several vessels were loaded in New Guinea bases according to this plan. However, it soon became evident that the original loading plan required some readjustment because many supplies which had to be obtained by diversion of shipping were already en route from the United States and were bulk, rather than combat, loaded. These supplies, originally intended for development and stockage of Base K, Leyte, had been designated as available to the Lingayen operation inasmuch as ships carrying other supplies, previously scheduled for the canceled southern Mindanao operation, had already been diverted to Leyte. While such diversion of shipping could be readily effected in the case of ammunition, rations, and other classes of supplies, controlled solely by numbers of personnel, the application of such a plan to engineer supplies was extremely difficult. Engineer effectiveness is necessarily based on quantity, type, and, especially, order of arrival of supplies to meet a particular situation in the objective area. Accordingly, to make the best of the situation, all available information regarding the cargo of these ships, including manifests and shipping documents, was obtained and carefully analyzed. Selections were then made of those ships which carried essential cargo most advantageously loaded to meet the Luzon operational requirements and the diversion of which would least adversely affect the development of Base K, Leyte.

Training and Preparation of Units. The opportunity for training engineer units, especially in engineer support to mobile warfare, had been negligible. Under the relatively static conditions existing in limited base areas in New Guinea, not only did the engineer troops employed there generally lack experience in mobile warfare, mine removal, security, and Bailey and floating bridge construction, but, because of the acute shortage of engineer units in the Theater from 1942 to 1944, they had been almost continuously engaged on one operation after another under extremely adverse conditions day in and day out for 24 hours a day. Proper preparation by Sixth Army of those engineer units in New Guinea which were assigned to the Luzon operation was impossible because of Sixth Army's participation in the preceding Leyte operation and the wide dispersion of staging areas. This task, therefore, was assigned to Eighth Army to be carried out in accordance with procedures established by GHQ, SWPA. Eighth Army was requested to conduct a vigorous training program for all engineer units under its control insofar as it was possible to relieve them from construction missions at the time. Similarly, USASOS was requested to relieve all units assigned to its command, which were scheduled for the Luzon operation, not less than 30 days in advance of embarkation for training under Eighth Army. However, USASOS, because of its heavy construction requirements, felt it impractical to relieve these units for training. In the case of a few units, such as the 79th Engineer Construction Battalion which was specified for direct support of I Corps in the Lingayen Gulf assault, it became necessary to request GHQ, SWPA, to relieve the unit from duty with USASOS in order to permit training under Eighth Army.

Inasmuch as most engineer units had been continuously employed for the past 12 months or more, they were also in great need of rehabilitation and replacements. Meanwhile, the engineer replacement situation had improved only very slightly over the past year and was aggravated by large losses sustained through sickness as well as rotation of personnel to the United States. Most units with long, uninterrupted service in the Theater were, therefore, forced to enter the operation understrength and were not reinforced until well after the operation had begun.

XIV Corps, Eighth Army, and USASOS were responsible for reequipping the engineer units under their respective control. When necessary, equipment was transferred from units not scheduled for the operation to those that were. By such measures, all engineer units assigned to the Luzon operation were equipped to within 90 percent of authorizations. However, a considerable amount of the heavy equipment loaded out was in need of heavy repairs or complete replacement inasmuch as it had been used on construction work up to the time of loading.

Mapping. Time and limited available aerial photography in the Theater had not permitted publication of a new series of maps for the entire Philippines or even of all of the operational areas in the Philippines. Fortunately, however, Luzon was the one island where large-scale map coverage of any appreciable area was available prior to World War II. Reproductions of the Army Map Service (AMS) series were, therefore, utilized for the most part and were furnished almost entirely by AMS. These maps were limited to medium-scale coverage for strategic planning, partial 1:50,000 coverage, and a coastal chart at 1:25,000 compiled from U. S. Coast and Geodetic Survey hydrographic sheets. Because of the advance in dates of both the Leyte and Luzon operations, the only map that could be revised even partially and reproduced in time to distribute to the units prior to their departure from staging areas for Luzon was a 1:50,000 scale map based on an AMS series. The few sheets of this for which supplemental aerial photography was available were overprinted in red. Distribution, however, presented a particularly difficult problem. Because all preparatory activities were telescoped into a much shorter period of time than originally planned, Luzon maps were being concurrently prepared by AMS in the United States, the 648th Engineer Topographic Battalion at the Base Map Plant in Melbourne, Australia, the 650th Engineer Topographic Battalion at Finschhafen, New Guinea, the 67th Engineer Topographic Company at Hollandia, New Guinea, and the 64th Engineer Topographic Battalion on Oahu in the Territory of Hawaii. The 64th Engineers, a Pacific Ocean Areas unit, prepared air support and naval bombardment charts and shipped them by air transport from Honolulu to Leyte, where Headquarters, Sixth Army, had moved from Hollandia. Complementing this dispersion of map reproduction and distribution facilities was the fact that combat divisions for the Luzon operation were widely scattered in still other areas, staging at New Caledonia, Bougainville, New Britain, the Admiralty Islands, Morotai Island, Leyte, and at least a dozen other places along a 1,000-mile stretch of the northern coast of New Guinea.[20] As a measure of control it was decided to retain a mapping officer and a part of the Sixth Army map depot at Hollandia to receive maps from the various agencies preparing them and to supervise their distribution by ship and plane. Upon request GHQ, SWPA, agreed to make distribution to the 25th Division in New Caledonia and XIV Corps on Bougainville. Reserve stocks were sent by ship to Sixth Army at Leyte. Additional Sixth Army reserve stocks were scheduled to be shipped with the D plus 2, D plus 4, and D plus 18 convoys to Luzon. Because of delays caused by unloading, however, much of the turnaround shipping fell behind schedule, and the last convoy did not arrive until D plus 25.

Each Corps assigned to the Lingayen Gulf operation had been given a reserve map stock 25 percent above its allowance. However, both Corps left this reserve at staging areas to come forward on later echelons which were delayed. As a result, Sixth Army had to expend its own reserve in the first few days and later print additional copies of numerous sheets. It was believed that if the two Corps Engineers had been charged with maps and map distribution instead of the Corps G–2, this situation would not have occurred. Steps were taken later to correct this procedure which apparently had developed during maneuvers in the United States where certain general staff sections were inclined to become operators rather than coordinators of service functions.

The entire topographic strength available to Sixth Army on Luzon immediately after D Day consisted of the 1679th Engineer Survey Liaison Detachment, serving as a battalion headquarters with three topographic companies (corps) under it, the 1603d Engineer Service Detachment (Map Depot), and the 1623d Engineer Model Making Detachment. The topographic units were engaged chiefly in reprinting existing maps and in overprinting half a dozen sheets to meet tactical developments. Many of the operational sheets available were old and inaccurate because of changes in culture, vegetation, and stream pattern. They were adequate, however, for the rapid overland movements that captured the Central Plains area of Luzon, and for which only 1:50,000 sheets were used inasmuch as both Corps turned back all 1:25,000 coastal sheets which lacked interior coverage required by their field artillery units. Road maps at 1:125,000, covering the area from Lingayen to Manila on three sheets, were also produced to replace the available 1:250,000 sheets which were of too small a scale to show sufficient detail.

[20] *Editor's note:* Since this situation was representative of the logistical difficulties faced in this theater, it is interesting to compare it with the distribution problem in the European Theater of Operations where units were concentrated in Great Britain prior to attacking the Normandy coast.

While the 1623d Engineer Model Making Detachment had been attached to OCE, GHQ, SWPA, a successful effort had been made to obtain special rubber materials. With these materials, this unit developed a field method of casting terrain models in rubber and produced a light, flexible relief map which could be rolled or folded that was superior to the fragile papier-mache or bulky plaster types. A related development used for much the same purpose as models was the approach sketch which consisted of perspective renderings in pencil made from contour maps and flight studies and printed in three colors. Because these sketches could be lithographed and given wide distribution, such work became a more important function of this unit than model making.

To supplement Sixth Army's topographic efforts and provide additional maps of north Luzon as of D Day, topographic units, directly under GHQ, SWPA, were assigned specific mapping responsibilities which were to take care of all possible contingencies. These included: revision of sheets of the Central Plains, starting with the Manila area and progressing northward (the slower the campaign, the greater would be the area covered by maps based on recent aerial photography); compilation and revision of sheets covering the Zambales Mountains west of the Central Plains (to cover the possibility that the enemy would make their principal stand in this area, readily reinforceable from the west coast); and compilation and revision of sheets covering Baguio, Balete Pass, and adjacent areas (providing for the possibility of a Japanese retreat toward Baguio and Cagayan Valley).

Unfortunately some of the effectiveness of this planned support was dissipated. Provision for a liaison officer between the Engineer Intelligence Section, OCE, GHQ, SWPA, and Sixth Army had not been made. In the meantime, signals and safe-hand messages came through slowly, if at all, and the weekly reports of the Engineer Intelligence Section, OCE, GHQ, SWPA, had failed to reach the Engineer, Sixth Army. Planning, operations, and distribution activities of the Map and Chart Subsection, Engineer Intelligence Section, OCE, GHQ, SWPA, were, therefore, unknown to Sixth Army. As a result, Sixth Army was unaware of Luzon mapping projects assigned to the 648th and 650th Engineers, although these projects were within Sixth Army's zone of operations. The resultant lack of coordination was responsible for failure by Sixth Army to advise GHQ, SWPA, that the Zambales Mountains were of no operational significance and that application of further mapping effort there would be wasted. Nor was GHQ, SWPA, informed that both Corps had decided to use 1:50,000 maps exclusively and had turned back all 1:25,000 sheets on which GHQ, SWPA, topographic units were still expending time and effort. Considerable concern arose at GHQ, SWPA, regarding repeated questions which had already been answered. Because communications were obviously inadequate, all back copies of the daily reading files were immediately forwarded to the 1679th Engineer Survey Liaison Detachment, responsible for coordinating and supervising all mapping activities for Sixth Army. To systematize procedures a representative of the Engineer Intelligence Section, OCE, GHQ, SWPA, was sent into the objective area and after conferring with Sixth Army representatives on 9 February 1945, coordination was restored.

Some combat divisions subsequently stressed the difficulty of obtaining accurate maps until near the end of the operation. The 1:50,000 maps were criticized for being prepared in form lines instead of contour lines. Sketch maps and battle maps were considered of greater value by the troops than any of the other maps issued. These were prepared by aerial photography interpretation teams with the aid of division artillery personnel, and were reproduced by the Corps Engineer. Definite preference for ease of reading in the field was expressed for 1:10,000 photomaps with stream lines, contour lines, and hill numbers overprinted.

Newly constructed ponton bridge over the Agno River, Villasis, Luzon; old demolished structure appears in background.

Manila-bound troop convoy crossing ponton bridge over canal near the Pampanga River, Luzon.

Engineers assembling pontons to be used in bridging the Pampanga River during the operations on Luzon.

Refugees use an improvised footwalk on an Engineer ponton bridge to cross the Pasig River and escape the battle that still rages in Manila.

Photograph shows the timbe. piling and part of the Bailey bridge construction in the Pampanga River bridge at Calumpit, Luzon.

Analysis of operations on Luzon, supported by experiences in previous operations, led to the following conclusions by the Engineer, Sixth Army: [21]

> Mapping for the use of ground forces will never be satisfactory until the control of photographic planes and development of photography is given to the ground forces.
>
> Approach maps are of great value to forward elements. Development along these lines in lieu of using models should be emphasized.
>
> Corps topographic companies are essential when corps are widely separated from army and virtually unmapped territory is the scene of operations. Otherwise they should be placed directly under army control.

Roads and Bridges. Egress from the landing beaches bordering Lingayen Gulf required considerable engineer effort and the use of all possible bridging techniques and available material. Natural obstacles in the form of swamps, fish ponds, estuaries, and rice paddies were encountered immediately behind the beaches and occasioned many immediate bridging problems. All major bridges along the route had been destroyed at least in part by the enemy. Several secondary bridges that had been left intact were structurally weak and incapable of supporting division loads. Extensive enemy demolitions and unrepaired damage from defensive operations waged by U. S.–Filipino forces during 1941–1942 (see Map No. 2) necessitated construction or repair of more than 35 major bridges during the Lingayen Gulf operation. Also during this operation some 550 miles of roads were repaired and maintained for the support of combat troops. The most noteworthy tactical road construction by combat engineers was in northern Luzon where trails were cut over what was considered impassable terrain to permit outflanking of enemy defensive positions. Road maintenance was initially the responsibility of division engineers, but the scope of the work exceeded the capabilities of these units, and Corps, Sixth Army, and ASCOM engineer units were soon operating well forward, relieving the divisions of much of this responsibility.

Moreover, progress down the Central Plains of Luzon was too rapid to allow division engineer units to construct anything except of a temporary nature. During this advance, portable bridging of all types was one of the most critical items of supply. Frequently it was necessary to utilize locally available materials as much as possible and to adapt and improvise with the limited quantities of standard equipment on hand. Corps engineer units and the engineer construction brigade under Sixth Army control eased the situation considerably by implementation of a plan to free the limited portable bridging for reuse by tactical engineer units progressing toward Manila.[22] Under this plan the Corps and Army engineer units initiated construction of permanent or semipermanent bridges simultaneously with installation of expedient crossings.

In the final drive on Manila construction of bridges over the Sulipan Canal and the Pampanga River, as well as those required across the Bigaa, Meycauayan and Tuliahan Rivers where all bridges had been demolished, proved among the most arduous engineer undertakings of the entire operation because of the critical shortage of bridging equipment, inadequate transportation facilities, and the extremely important time factor. In meeting these demands the engineer troops concerned performed their tasks with skill and untiring effort. Bridge construction crews and truck drivers worked as many as 60 hours without sleep or rest.

Only a portion of the total portable bridging required to cross the several rivers comprising the Pampanga River drainage system was available for the advance on Manila. Therefore, an endeavor was made to meet requirements by leapfrogging units of portable bridging forward as rapidly as possible. This was done by dismantling the treadway bridge at Bayambang for

[21] Engr, Sixth Army, n.d., Report of the Engineer, Sixth Army, Luzon Campaign, 9 January–30 June 1945, p. 229. In Sixth Army files.

[22] *Editor's note: See* Map No. 44, "Floating Bridge Installations, Lingayen to Manila, January–February 1945," Vol I, this series.

use over the Pampanga River at Calumpit. Available trucks were concentrated at Bayambang where, as quickly as the bridge was dismantled, the various parts were loaded and moved 98 miles overland to Calumpit. In the meantime, heavy ponton bridging was removed from the Bued River and dispatched to the Sulipan Canal across which the Bayambang treadway bridging had to leapfrog to the Pampanga site. At Sulipan, the ponton bridge was installed under blackout conditions and opened to traffic in 10½ hours to permit undelayed crossing of trucks transporting treadway bridging from Bayambang to the site on the Pampanga River at Calumpit.[23]

A method of installation that was very successful and caused a minimum of interruption to the flow of traffic was demonstrated on the Bigaa River crossing. It was found here that the only suitable location for the M–3 bridge, moved expressly for this purpose from the Sulipan Canal, was at the site of an infantry support bridge which had been the only crossing over the Bigaa. To keep the main supply route open as long as possible, the M–3 bridge was built downstream in a series of rafts and floated to the downstream side of the infantry support bridge. When all rafts were assembled, the infantry support bridge was cut loose and pulled upstream as the M–3 was pulled into position, and abutments, trestles, and rafts connected to form the bridge. A Bailey bridge was started at this site as soon as the equipment was available, and the M–3 bridge was eventually moved to the Tuliahan River.

The shortage of bridging materials was overcome again and again by improvisation. The assault crossing of the Pasig River in the vicinity of Jones Bridge in Manila was necessary for the attack on Intramuros which was at that time the stronghold of enemy resistance. The first crossing was made by 30 assault boats manned by personnel from an engineer combat battalion and an engineer light ponton company. Concurrently, an infantry support raft and one 3-boat ponton ferry were constructed and put in operation. To support the assault crossing, a footbridge was also constructed at this site. The river at this point was 400 feet wide and the total footbridge available amounted to only 250 feet. The complete crossing was made by anchoring a Japanese barge to the far shore as a substitute for 60 feet of the bridge, inserting the 250 feet of standard footbridge, and coupling a single track of infantry support raft treadway across individual assault boats to the footbridge. This was accomplished in 2½ hours by 40 combat engineers supervised by 4 men from the ponton company.

The majority of bridges constructed by the 108th Engineer Combat Battalion supporting the 33d Division on the drive to Baguio were of standard wood trestle design, but in many cases salvaged steel stringers were utilized. This resulted in a saving of bridge timbers which, during this phase of the operation, had to be hauled over a distance of more than 50 miles and required diversion of many trucks and prime movers from other engineer tasks. The steel stringers were cut from demolished bridges, drilled, capped with nailing strips, and held in stock by the battalion S–3 section. Beams, to simplify design, were all cut to standard lengths of 16 and 20 feet. All companies were familiarized with the stocks available, and when confronted with a bridge job merely contacted battalion headquarters for approved issue of the required beams. Generally, sufficient salvageable material was available at the site for bents and other components.

Combat Operations. The engineers made their contribution felt in every phase of the Luzon operation. The XI Corps landing near San Narcisco, Zambales Province, on the west coast of Luzon had the tactical mission of pushing in from the west coast along Highway 7, skirting Subic Bay, and cutting across the neck of the Bataan peninsula to join forces with XIV Corps in the Central Plains. (See Map No. 12.) The purpose of this maneuver was to seal off the peninsula and block the Japanese escape route to Bataan from Manila and the area to the north.

[23] *Editor's note: See* Map No. 44, Vol I, this series.

The Corps also had an important construction mission which involved the rehabilitation of San Marcelino airdrome for operational use and the restoration of the Subic Bay port facilities for use as a supply and naval base. A secondary landing, to be mounted from Subic Bay after its capture, was planned for a later date with the objective of securing Mariveles Bay on the lower tip of Bataan as a staging point for an amphibious attack against Corregidor Island. During these operations the intensity of combat engineer effort was exemplified in the fighting for Zig Zag Pass where the engineers destroyed 200 caves and 70 pillboxes.

Since the operation at Nasugbu was planned as a diversionary move, no construction or base development was contemplated beyond the minimum required to support the tactical mission. The planned procedure was to advance toward Manila along Highways 17 and 25 and either to draw off or to contain the Japanese forces in Manila and the area south in order to curtail the movement of Japanese reinforcements from those areas to meet the southward advance of U. S. forces from Lingayen Gulf. Engineer effort during the early stages of this operation was directed to the repair of vital bridges, demolition of road barricades, sealing of caves, and destroying pillboxes and dugouts. The latter work was most important to prevent infiltrating enemy forces from reoccupying positions previously cleared. In accomplishing this task, almost 100 percent of the explosive used was captured Japanese picric acid and gun powder.

The attack on Corregidor was a test of the ability of combined infantry and engineer troops to assault and hold one of the most strongly fortified positions yet encountered in the Southwest Pacific. Airborne engineer troops in support of the parachute infantry came in on the first lift. Combat engineers supporting the ground troops were landed by boat and shore units of the 2d Engineer Special Brigade. There was no heavy construction mission on Corregidor; this operation called instead for destruction, and engineers began systematically sealing off Japanese-held caves as requested by advance infantry patrols. Neutralization was effected by several methods. Flame throwers proved of limited effectiveness, but a charge of about 70 pounds of TNT provided a sufficient counterblast. While rifles or automatic weapons were used to cover the entrance, rockets or grenades were fired into the caves. This either drove the enemy defenders out into the open or to the rear of the cave where their fire power was neutralized. Demolition parties would then place charges. Frequently tanks were used to place point-blank fire into the cave openings. Another effective method consisted of employing a tank and a bulldozer as a cave-sealing team where the mobility of both was favored by the terrain, generally along the beach. While the tank gave close covering fire support, the dozer would drift a large quantity of earth across the mouth of the cave and completely seal it. It was basically an infantry job to rout the Japanese from the many separate, fortified positions after the enemy garrison was cut into two segments by opening a road to the top of the "Rock." However, the infantry's speed of advance and ability to hold ground depended solely on the rapidity with which the engineers cleared mines from the path of advance and closed or destroyed caves and tunnels to their rear. Over 300 caves and tunnels were demolished by the systematic destruction carried out by engineers on Corregidor.

The landing of the 158th Regimental Combat Team at Legaspi was integrated with plans for securing control of the area south of Manila to the southern tip of Luzon. The relatively few combat engineers supporting this operation reinforced 23 bridges, constructed 900 feet of fixed bridging, provided 500 feet of Bailey bridging, and installed a total of 330 feet of floating bridging over 3 rivers. In 10 places where fixed or floating bridges were not required, fords were constructed. Seventy miles of combat roads were built, and 130 miles of roads throughout the area maintained. Among primary missions were the repair and construction of the Legaspi and Anayan airfields. Rehabilitation and operation of the railroad branch line in this area proved an interesting example of what combat engineers may be called upon to accomplish in the absence of the specialized units ordinarily assigned to such work. This rehabilitation consisted for the most part of replacing track, constructing bridges, restoring repair shops, and reconditioning salvageable rolling stock. Since engineer troops were needed for many other missions during the same period, the maximum use was made of Filipino civilian labor under military supervision. However, all of the large bridge jobs were undertaken by combat engineers, and by 12 June railroad service extended from Legaspi to Naga, a distance of 60 miles.

Infantry–Engineer Bridge Seizure. On 16 March the commanding general, 33d Division, ordered the 130th Infantry to attack at dawn on 19 March, seize, organize, and defend the two highway bridges and the railroad bridge across the Bauang River and the high ground to the northeast and east thereof. The order called for a demolition detachment from the 108th Engineer Combat Battalion to perform a specialized task. Upon analysis it was determined to send an engineer platoon in order to insure the accomplishment of the engineer part of the mission, and the 3d Platoon, Company B, 108th Engineers, was attached to the 1st Battalion of the 130th Infantry for the attack.

Each bridge was known to be mined and prepared for demolition by Japanese forces in the vicinity, estimated at about 3,000 men. Approximately 70 enemy troops armed with a light machine gun were known to be posted as bridge guards and prepared to blow the bridges at the first sign of approach. From guerrilla reports just prior to the attack it was also known that the north end of the north bridge had two 100-kilogram bombs in the center of the roadway, and that the south bridge had numerous electric wires stretching from it to a cave at the south end of the north bridge.

The scheme of maneuver decided upon was that the engineer platoon would move forward along the road checking for mines and additional bridge charges along the chords of the trusses. One detail would be left to make an exacting check of the south bridge to remove demolition charges, if any, and to report to the platoon leader as soon as this mission was completed. The remainder of the platoon would move forward to the high ground between the bridges, and, as Japanese had been reported under the bridge, these engineers would deploy along the high ground perpendicular to the bridge with the mission of destroying the enemy under the bridge and providing security for the detail which was to remove the two 100-kilogram bombs. This detail of two men was to move swiftly to the two aerial bombs, cut the wires, and remove the bombs from the roadway.. Three additional engineer soldiers were to investigate for land mines and charges on the chords. As soon as the mission was completed, all engineers were to assemble on the high ground between the bridges and, by fire, refuse the enemy entrance to the bridge to place additional charges. The infantry was to send one company across the river by fording, destroy enemy forces assembled to the northwest, and attack Bauang from the west.

The troops left their forward assembly areas at 0300 with the engineers leading. The engineer plan went off as scheduled. The two-man detail reached the bombs despite continuous fire down the length of the bridge from the Japanese light machine gun. They pulled out the fuse lighters (no electric wires were found) and started to retrace their steps, still under fire, to the previously designated assembly area. Unfortunately one of the men was hit in the back. The other picked him up, set him up on a diagonal steel member, and returned to report the bridge all clear.

As the men assembled on the high ground between the bridges, the engineer platoon opened fire with its two heavy machine guns on the Japanese now swarming across the bridge in an attempt to drive off the engineers. The Japanese withdrew and their machine gun ceased firing. Meanwhile the arrival of the flanking infantry at Bauang was delayed for about 30 minutes. During this time the engineer platoon held and defended the captured bridge. When the infantry entered the town, the enemy had fled to the east. The suddenness of the carefully planned attack involving removal of the demolition charges had evidently caused confusion among the Japanese. Although they destroyed a concrete arch bridge east of Bauang, they had withdrawn without damaging the railroad bridge.[24]

The capture of this bridge intact was notable not only because of the heroism of the personnel, but because the splendidly planned and coordinated infantry–engineer action illustrated an effective method of saving important bridges. This coordinated action contributed substantially to the Luzon operation since at least a month of one engineer company's effort was saved, which, considering the great shortage of engineer troops, made a material contribution to the operation of I Corps.[25]

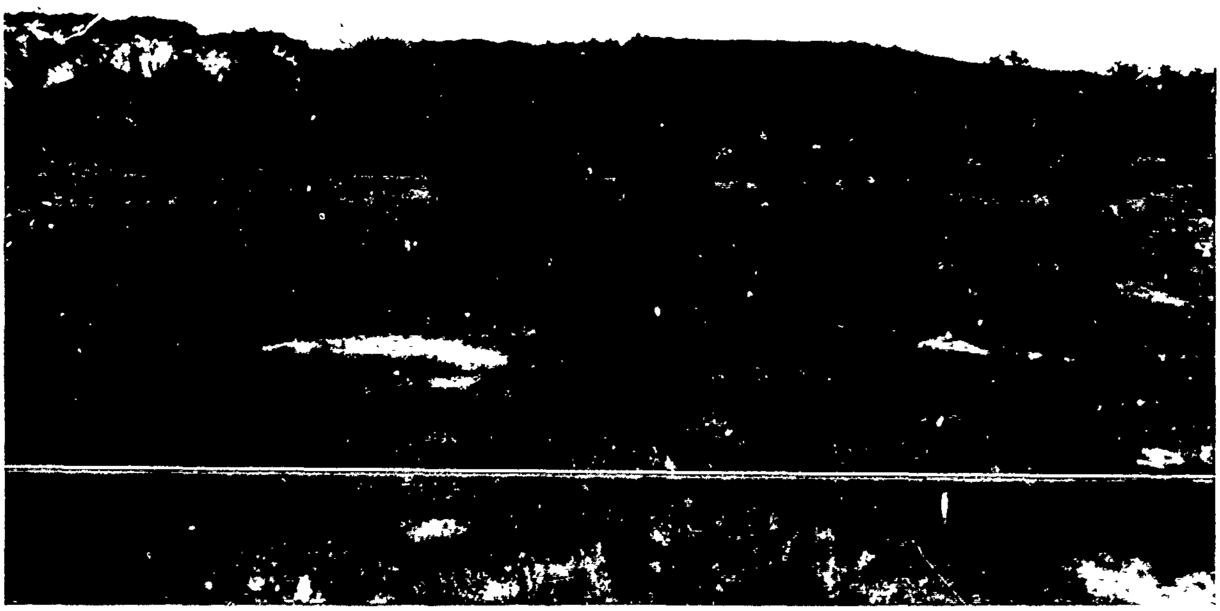
Mine Removal. The obvious fact that mine and bomb removal is more than a technical problem was quickly learned in south Manila. It was soon evident that an engineer soldier could not remove a 100-pound bomb from the ground while under constant and heavy enemy machine-gun fire. However, as operations on Luzon progressed, coordination of tank–infantry–engineer tactics was perfected and a very effective method of clearing streets of planted bombs in the face of enemy machine-gun fire was developed. Infantry occupied the ruins on each side of the street to prevent close-in sniper fire. A tank with a tow cable attached to its front advanced towards the mined area, and fired at enemy positions while a four-man engineer mine disposal team followed close behind. When the area was reached, the tank cannon fire was discontinued but machine-gun fire continued. An engineer ran forward to the field, disarmed a bomb, and, after attaching the tow cable, ran back to the rear of the tank. The tank, still spraying machine-gun fire, pulled the bomb out by backing away. This procedure was repeated by using alternate men until the area was cleared of planted bombs, and tanks and infantry could proceed without interference. Disarming and removal of a bomb by this method could be accomplished in from 10 to 15 seconds by a well-qualified mine disposal man. Casualties were few because the Japanese, raked by the tank's guns, could not effectively direct their fire on a man in that length of time. Nevertheless, the work was very exacting and exhausting and required frequent relief for mine disposal personnel.

No standard technique could be employed in the removal of mines since the Japanese had not adhered to any standard procedures or layouts in preparing their mine fields. Each mine field or spotted group of mines was dealt with as a distinct and individual mission, and the method applied depended upon the equipment at hand as well as the ingenuity of the mine disposal squad. The SCR 625 detector was used extensively to sweep suspected areas. In many cases the heavily mined areas had been previously reported by civilians. On restricted approaches, trails, and airdrome taxiways, mines were frequently located by visual perception and probing in addition to use of the standard mine detector. When it was necessary to clear mine fields covered by enemy fire power, as occurred in several areas at Clark Field, the infantry–tank–engineer team went into action. The value of methods used varied with changing conditions, and no one method could be judged as

[24] *Editor's note:* The two men removing the 100-kilogram bombs were decorated with the Silver Star and the three accompanying them were awarded Bronze Star Medals.

[25] *Editor's note.* In his report of these operations the Engineer, Sixth Army, recommended: "The combined infantry–engineer operation for the surprise capture of bridges before being blown by the enemy should be emphasized and perfected." *See* Engr, Sixth Army, n. d., Report of the Engineer, Sixth Army, Luzon Campaign, 9 January–30 June 1945, p. 229. In Sixth Army files.

Engineers deactivating a Japanese mine that has been booby-trapped to prevent its removal at San Jose, Luzon.



Engineer bomb disposal squad removing improvised Japanese mines from Clark Field, Fort Stotsenburg, Luzon.

While fighting still continues in the city, an armored Engineer bulldozer clears rubble and debris from the streets of Manila.

Engineer bomb disposal squad deactivating one of the many demolition charges placed about Manila by the retreating Japanese.

Engineer squad using mine detectors to locate the many mines planted along the Luzon roads by the retreating Japanese.

A dozer rescues an armored bulldozer on the Villa Verde Trail.

Mountainous terrain encountered along the Villa Verde Trail called for an almost superhuman effort on the part of the Engineers.

completely effectual because of excellent results obtained under ideal conditions.

Combat Use of Engineer Equipment. In performance, the bulldozer again distinguished itself as a doubly potential piece of engineer equipment. The invincible dozer inscribed the evidence of engineer participation on the rugged face of Luzon as it had on other areas of operation. Dozers pioneered the way in construction of the roads necessary to flank Highway 5 to the Cagayan Valley until that main artery of advance was cleared of artillery fire which the enemy habitually placed with extreme tactical skill along the road. The larger dozers were sent ahead through the Caraballo Mountains to undertake the more difficult work while all the smaller dozers that could be borrowed from infantry and artillery units were used to improve rear sections. Numerous downhill cuts were made on slopes so steep that the dozers were unable to walk back up under their own power. Various rigging schemes had to be used to enable the dozers to draw themselves up the slopes by using their winches. Besides the rugged terrain, the engineers were impeded by enemy artillery and mortar fire as well as infiltration. In some instances, the minimum security necessary for a dozer was a full strength infantry platoon. Inasmuch as some armored dozers had become available by this time, whenever possible, work on mountain roads was done with an armored dozer in the lead. Where tanks and mobile artillery were necessary for direct supporting fire and had to be brought up through heavily wooded terrain, over steep slopes and large boulders, it was necessary for a dozer to cut a road and maneuver space for the tanks in front of the infantry lines. While performing this mission the dozer was ordinarily subjected to heavy small arms, mortar, and artillery fire. Yet, a tank dozer was not more suitable for this work since it could not angle its blade for side-hill cuts, allowed poorer visibility, and tended to throw its tracks in steep terrain.

The importance attached to such engineer equipment by the enemy was well illustrated by a captured Japanese operational order directing its destruction: [26]

SOUTH MYOKO MT OPORD #38

"The OZAWA Platoon will organize one infiltration unit composed of a leader and two men and tonight the 17th will destroy the bulldozer or tank on Matsuzaki Mountain. The CO Construction Unit will set up as quickly as possible a mined zone in front of the Yonegura strong point. It will be necessary to keep in touch with each unit concerned."

On the Villa Verde Trail the concern caused the enemy by engineer equipment was similarly evidenced by captured documents: [27]

"SAMPEI Opn Order #43
Central District Unit Order
12 Apr 1800 hours No. 1 SALACSAC PASS

. . . . . 3. The KAGETSU Unit will destroy enemy bulldozers in the vicinity of the AUTUMN position. A penetrating party will be sent out on the 13th (Apr). They will draw "B" rations for two days from the Hq and draw explosives from the AIDA Unit (believed to be the 2d Armd Div Engr)."

"GEKI-HAZAMA Opn Order No. 34
0900 hours 10 May at MT HAKKO (Tn: Hill 508)

. . . . . 3. The Co will carry out its present mission with its main strength and a portion will carry out assault attacks to destroy the enemy's bulldozer.

. . . . . 4. The 3rd Plat Ldr will organize a KIRIKOMI Sec (Tn: Raiding Section) with well-trained personnel, consisting of a leader and three men. Their mission will be the destruction of the engineer bulldozer . . ."

"Central District Unit Order No. 77
1800 hours 12 May at MT HAKKO

1. The time has come when a moment's delay is not permitted for the destruction of enemy's M-4 and bulldozers. Destruction of our positions and damaging of our weapons by tank guns is great . .
2. TAKE group (Tn: Misc Air Unit) is to destroy the M-4s and bulldozers and secure their positions.

CDU Comdr Maj SAMPEI"

From a different viewpoint, the importance of the dozer was just as emphatically indicated by comments of the Engineer, Sixth Army, on the Luzon operation: [28]

Mountain warfare requires the same dozer power as jungle warfare. Our heavy equipment in mountain warfare was capable of building roads and tracks to precipi-

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[26] Quoted in Engr, Sixth Army, n. d., Report of the Engineer, Sixth Army, Luzon Campaign, 9 January–30 June 1945, p. 172. In Sixth Army files.

[27] *Ibid.*

[28] Engr, Sixth Army, n. d., Report of the Engineer, Sixth Army, Luzon Campaign, 9 January–30 June 1945, p. 229. In Sixth Army files.

tous heights over 5,000 feet. This meant that supply and evacuation vehicles could reach our troops while the Jap had to carry, and was an important factor in his defeat.

Civilian Labor. Troop strength was supplemented by recruiting civilian labor for work on all projects where such labor could be utilized to an advantage. Almost all engineer units employed civilians to some extent. The 5202d Engineer Construction Brigade, operating directly under Sixth Army, and the 1136th Engineer Construction Group under I Corps utilized this source of labor to the fullest extent. The brigade expended 350,000 man-hours of civilian labor in the accomplishment of its missions from 9 January to 15 February, while the 1136th Group expended approximately 330,000 civilian man-hours during the same period. In the XI Corps sector (southern Zambales), approximately 550 civilians were employed daily during construction of the airdrome and POL facilities. Later, approximately 300 laborers were utilized on road maintenance. In some localities the prewar municipal and provincial maintenance organizations were reestablished and assigned specific road sections for maintenance. It was found that these groups, which were organized with foremen or section chiefs, worked more efficiently than groups of workers secured at random and employed under the supervision of military personnel.

ASCOM, with its Civil Affairs Section, which maintained district offices through which military units could requisition civilian labor, made extensive use of local workers. This permitted the employment of troops on more skilled work while civilians were used for handling cargo, clearing camp areas, general mosquito control, and sanitary precautions. Skilled labor, such as carpenters, plumbers, and local engineers, also supplemented engineer troop effort in base, hospital, and camp construction. However, the greatest number of workers was employed on road repair and maintenance. By extensive use of manual labor, heavy construction equipment could be concentrated on the most important work. Some difficulty was originally encountered in getting civilians to work on Sundays. This was soon resolved, however, by arrangements for church services near the site of operations or, where this was impossible, by adoption of a Sunday schedule whereby civilians were given a couple of hours off in the morning and still paid for a full day.

Supplies and Equipment. A better engineer spare parts service was experienced on Luzon than had been available on any previous operation. Since Corps were separated and operating on substantially independent missions, each Corps was provided with necessary depot and maintenance units. These were in reality advance Sixth Army dumps, but for purposes of close control they were placed under the respective Corps Engineers for operations. Coordination between the Corps and Army Engineers insured choice of dump locations which best fitted the over-all supply plan and enabled Army to relieve the Corps of the operation of their rearward dumps. The engineer maintenance unit of each Corps, in addition to performing maintenance, served as a spare parts subdepot for all units of the respective Corps. This grouping of engineer supply and maintenance units provided a central point for the provision of Class II and IV supplies, spare parts, and maintenance service.

To free the Sixth Army depot for early displacement forward, ASCOM established its initial engineer depot in the base area along the railroad east of San Fabian. This eventually became the main engineer supply depot. At the time, however, ASCOM found it necessary to set up sub-bases almost immediately in order to handle the enormous tonnages scheduled to pass through the Army base area. These were established at White Beach, Dagupan, and Port Sual, and engineer supply subdepots and spare parts subdepots in these vicinities considerably augmented the effectiveness of engineer supply.

The unexpected speed of the combat troops in reaching their objectives resulted in supplies being called forward sooner and in larger amounts than originally anticipated. To assist the hard-pressed motor transport, a section of the Manila Railroad was rebuilt by ASCOM and placed in operation. Supplies were moving over this road 5 days after repairs had been started.

Throughout the operation, however, the shortage of sufficient transportation presented a supply problem. To alleviate the acute shortage of ASCOM and Army truck and rail transportation, it was necessary to organize an independent engineer truck transportation system. Two engineer dump truck companies were assigned to this engineer transportation pool and it was augmented by ponton trailers from engineer bridge units which could be used to excellent advantage for hauling long bridge timbers and piling. At times, cargo trucks from the Transportation Section, Sixth Army, also supplemented the operations of this engineer truck pool. Although the system expedited movement of engineer supplies, utilization of the engineer dump truck companies for its operation delayed the hauling of gravel for high-priority road construction. Another weakness of the system was the necessity for reassembling the heavy trailers on short notice when required for immediate displacement forward of portable bridging equipage.

This was the first operation in which Sixth Army was confronted with the problem of handling considerable captured civilian property, former U. S. Army property, and enemy supplies. These materials, utilized to relieve immediate combat requirements, contributed materially to speeding up operations and reducing the burden on the supply system. Heavy timbers and steel shapes were ideal for bridge construction. At Clark Field several items of heavy equipment which had been captured from U. S. forces in early 1942 were found, and with only minor repairs were promptly set to work. Initially, no records were kept of captured materials, but as service units assumed control in rear areas, records of materials on hand and of amounts utilized were made. In all possible instances ownership was established. However, pilfering, vandalism, and souvenir hunting, both by troops and civilians, were frequent. It was impossible to establish adequate guards for all captured supplies even though troops, guerrillas, and civilians were used extensively for this purpose.

Construction. Engineer operations on Luzon advantageously reflected the experience acquired from operations of the past. Positive steps were taken to insure against heavy concentrations of troops, equipment, and supplies on engineer work areas such as occurred on Tacloban airdrome at Leyte during the initial phase of operations. As for Leyte, a layout was prepared during the planning phase of this operation showing all essential facilities planned and their probable location. But, in order to impress on XIV Corps the necessity of avoiding occupation of the Lingayen airdrome area, a senior Engineer officer was dispatched from Leyte to Headquarters, XIV Corps, at Bougainville, with instructions to explain the proposed airdrome requirements and advise the Corps commander of the urgency of coordinating his operations so as to avoid to the maximum extent any use of the airdrome area.

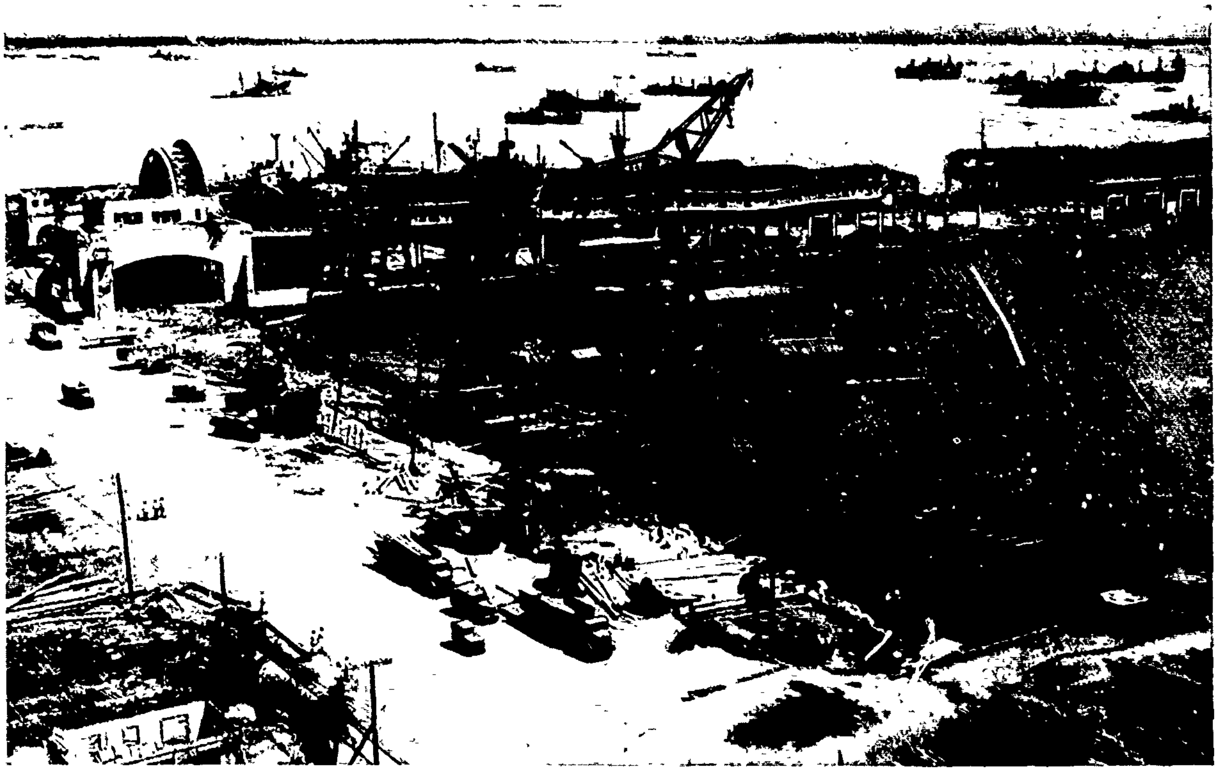
Shortly thereafter a conference was called at GHQ, SWPA, by the Commander in Chief and attended by the commanding generals, Sixth Army, FEAF, and ASCOM, together with chiefs of their respective G–3 and Engineer Sections. The purpose of this conference was to discuss the opinion of the commanding general, FEAF, that ground forces landing in the vicinity of Lingayen would critically delay the construction of Lingayen airdrome. The commanding general, ASCOM, to whom this construction had been delegated by Sixth Army, expressed the opinion that, under currently established shipped priorities for engineer units involved and landing mat required, the earliest date air operating facilities could be guaranteed was D plus 8. The Commander in Chief, however, indicated that because of the necessity of withdrawing supporting naval carriers on D plus 7, it was critically essential that the Lingayen airdrome be completed on D plus 6 to permit operations by land-based fighter aircraft. It was agreed that this date could be met, dependent upon certain provisions. To prevent troops and equipment from piling up in the vicinity of the airdrome area, treadway bridge equipage for facilitating advance inland from the landing beaches would have to be given top priority. Precautions would have to be taken by XIV Corps to prevent landing on beaches directly seaward of the airdrome area. It would be essential that at least five ships carry landing mat and begin discharging simultaneously not later than D plus 2 to provide the 2,500 tons which would have to be available between D plus 2 and D plus 5. These stipulations were concurred in by the commanding general, Sixth Army, approved by GHQ, SWPA, and the necessary action initiated.

Facilities required immediately by FEAF to insure local air cover made it necessary to complete one 5,000- by 100-foot runway with undispersed hardstandings for one fighter and one night fighter group. However, work of improving and extending the existing strip did not begin until D plus 2. This delay was occasioned by the inability of divisions then in charge of disembarkation to unload ASCOM engineer units on schedule. Scheduled to land progressively on D Day, D plus 1, D plus 2, and D plus 4, these units were delayed an average of 48 hours when waves 8 to 10 feet high broached many craft on D plus 1 and unloading had to be postponed. Landing mat, of necessity, was similarly unloaded behind schedule.

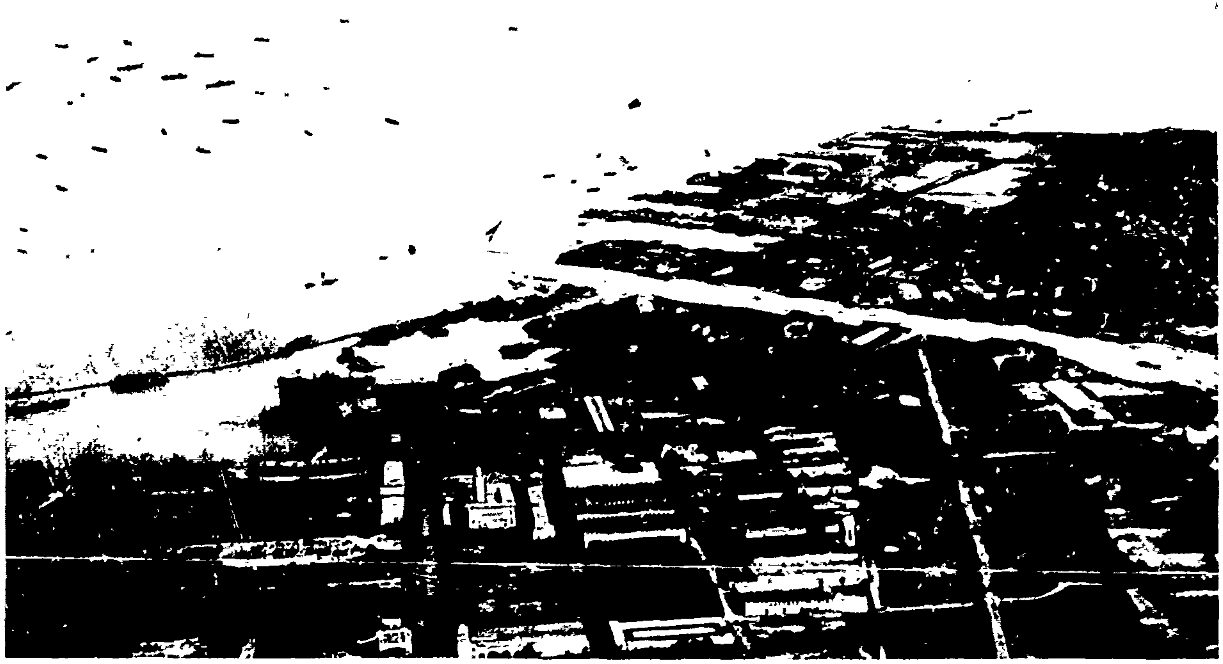
On arrival at the site, these engineer units found the airdrome area extensively cratered by bombing and initial efforts had to be immediately concentrated on filling of bomb craters with beach sand. After all necessary filling and minor grading were completed, the entire surface was covered with palm fronds in an effort to control the blowing of sand by propeller backwash. Those portions of the taxiway system on barren beach sand were covered with woven bamboo mats before the steel mat was laid. After the steel mat was in place, the entire surface, except where woven bamboo mats had been used, was shot with tar in a further effort to control dust and erosion. In spite of the reduction in available work effort from that required and delays and difficulties in unloading steel mat, the Lingayen airstrip was prepared in time to receive the fighter aircraft when they arrived. And by 1700 on 16 January (D plus 7), 5,000 feet of steel mat runway with undispersed parking was ready for operation.

On D plus 4 work had started on a second airdrome site in the vicinity of Blue Beach. After 6 days' work, however, it was apparent that this location would require excessive expenditure of engineer labor and equipment because of soil conditions. An alterate site was selected by the commanding general, ASCOM, at Mangaldan in a rice paddy area which was adaptable for rapid airdrome construction at the time only because of the prevailing dry season. At this location the clay soil merely required light blading to remove rice stubble and low earth dikes around the paddies. Engineer effort was promptly diverted to this site and 5 days later 120 aircraft were operating from Mangaldan airdrome. The 3,000 feet which had been graded and compacted at the former site were eventually utilized as a crash strip for Mangaldan drome.

Inasmuch as railroads in Luzon had been heavily damaged by U. S. forces in 1942 and by subsequent guerrilla sabotage, they had proved only of limited use to the Japanese in the interim. Consequently much of the rolling stock and locomotives had fallen into disrepair. Air operations prior to and during the advance down the Central Plains at this time effectively prevented enemy troop movements by rail on the few sections still intact and naturally caused additional damage to roadbed, bridges, and rolling stock. In turn, the retreating enemy accomplished further demolition to deny the use of railroads to U. S. forces. Despite this destruction short

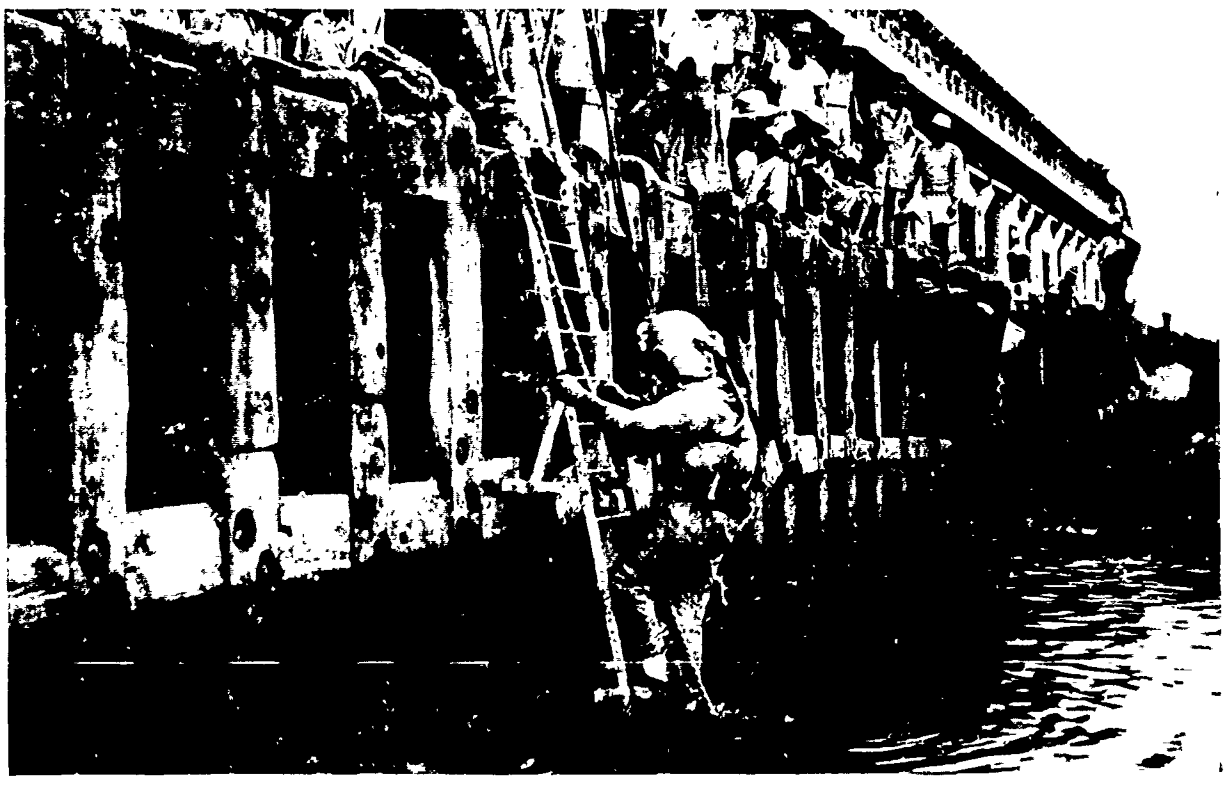


Directly upon entering the city, Engineers begin construction and repairs on the bomb-damaged piers in South Harbor, Manila.



Aerial view of the anchorage and docks at Base X port area, Manila.

Supply vessels from all parts of the world unload vitally essential cargoes over the docks of Base X port area in Manila.



Diver of an Engineer port unit descending to inspect sunken ships at Pier No. 7 in the Pasig River, Manila, prior to undertaking of salvage operations.

stretches were used by combat troops during the advance. Meanwhile, concurrent with the advance, ASCOM and 5202d Engineer Construction Brigade units rehabilitated the entire line from San Fabian through Dagupan, Bayambang, Tarlac, and Calumpit, to Manila. By D plus 12 the line was open to the Agno River at Bayambang where major railway bridge repairs were required. These were completed and railroad facilities extended to Tarlac by D plus 20. On 12 March, 15 days after the end of organized resistance, the first train from the north arrived in Manila. By the end of April, the railroad was handling 1,700 deadweight tons per day.

The Japanese also accomplished a very thorough and unusually intelligent job of pier demolition and harbor obstruction in the port area of Manila. The clearing of the harbor and the repair of damaged piers was the most extensive salvage job ever undertaken in any theater of war. It was estimated as three times the magnitude of the Cherbourg project undertaken in the European Theater of Operations during World War II. Under direction of a U. S. Navy salvage group, utilizing both U. S. Army and U. S. Navy Engineer personnel, some 195 ships had been raised by the end of April, less than 2 months after the entry of U. S. troops into Manila. Repairs to extensively damaged pier No. 7 in the port area were initiated by engineer troops during the final stages of the battle, and the first Liberty ship berthed at this pier on 19 March, only 22 days after the end of organized enemy resistance in Manila. Dredges were moved into the harbor in early March, facilities for large landing craft were rapidly prepared, and by the end of March the port of Manila, which the enemy had sought to close for many months to come, was handling 10,000 deadweight tons of supplies per day.

Over and above extensive base construction,[29] by September 1945, in Manila alone, the engineers had provided 65 million gallons of water per day largely for the civilian population (20 million gallons more than before 7 December 1941); they had rehabilitated 220 miles of water mains, 30 miles of storm drains, 105 miles of sanitary sewers, and 15 miles of esteros (open drainage ditches). Engineers had cleared and repaired 87 miles of streets and constructed four fixed bridges across the Pasig River. Damaged power plants had been repaired by use of all materials available. The output of existing plants had been augmented by numerous portable generator installations. And the electric power generated for military, industrial, and civilian requirements was carried by more than 100 miles of distribution lines provided by the engineers.

Southern Philippine and Borneo Operations

Early in 1945 Eighth Army began a series of amphibious landings known as the VICTOR Operations for the liberation of the southern and southwestern islands of the Philippine Archipelago. (See Map No. 12.) The southwestern islands, consisting of the Palawan group, the Sulu Archipelago, and the Zamboanga Peninsula of Mindanao, represented a dominant land bridge of supply and communication between the Japanese home islands and the Netherlands Indies. In a series of successive operations Eighth Army, supported by combat and service-type engineer units, brought these islands under control for the establishment of U. S. bases. (See Map No. 12.) Elements of the 2d Engineer Special Brigade assisted in landing the 186th Regimental Combat Team (reinforced) of the 41st Division in the first of the assault landings directed against the southwestern islands at Puerto Princesa Bay, Palawan, on 28 February. When units of the 41st Division landed west of Zamboanga City, Mindanao, on 10 March, and on nearby Basilan Island on 16 March, they were assisted by elements of the 3d Engineer Special Brigade. Thereafter a few islands of the Tawi Tawi Group, which offered

[29] *Editor's note:* For a detailed account of construction, including bases and airfields, on Luzon, *see* Vol VI, this series.

no resistance, and Jolo, which was contested, were overrun in quick order. Construction effort throughout these operations was directed primarily to the early establishment of airfields while considerable combat engineering was necessary, particularly on the Zamboanga Peninsula of Mindanao, to support tactical operations.

Operations against the southern Visayas (Panay, Negros, Cebu, and Bohol) were carried out by the 40th Division taking Panay and Negros Occidental, and the Americal Division taking Cebu, Bohol, and Negros Oriental. (See Map No. 12.) Amphibious support to these operations was provided by units of the 2d ESB. The first assault landing was made on Panay near Iloilo City on 18 March. Little initial resistance was met although determined resistance developed in the rugged interior. Operations against Cebu on 26 March suffered an initial setback when heavily mined and excellently camouflaged areas delayed advance inland. Here again the Japanese retreated into the hills and took advantage of difficult terrain. The assault on Negros Occidental on 29 March which met with little initial opposition also developed into an arduous elimination of the enemy from inaccessible mountain defenses. The seizure of Bohol on 11 April represented an easy and rapid accomplishment of a mission, while on 26 April Negros Oriental operations followed the pattern of fanatical resistance in rugged mountainous country.

Combat phases of these operations kept engineer troops fully occupied in removal of mines and obstacles, demolition of pillboxes, and combat road building through difficult and mountainous terrain. Engineer construction missions involved provision of airfields, POL storage facilities, and hospitals, besides rehabilitation of existing docks, wharves, electric-power plants, water systems, ice plants, railroads, and even a cement plant, plus provision of considerable covered storage.

Although operations on the Zamboanga Peninsula established U. S. control over the extreme western portion of Mindanao, sufficient Japanese forces still remained on the island to hinder operations. These enemy forces had been constantly harassed by guerrillas in the interior of the island since 1942 and were finally overcome by attacks against the Malabang, Parang, and Cotabato areas carried out by X Corps (including the 24th and 31st Divisions and units of the 3d ESB). On 17 April landings were effected at Malabang and Parang. With the aid of guerrilla forces Davao City was taken on 2 May. Another landing was made at Macajalar Bay on 10 May, and the final one on 12 July at Sarangani Bay to conclude the mopping up of surviving Japanese forces. (See Map No. 12.) The usual enemy tactics employed in the Philippines developed at Mindanao and the increased and determined resistance in the rugged and mountainous terrain of the interior required exceptionally difficult road building, heavy maintenance operations, and complex bridge construction by U. S. engineer units. Adding to the difficulties of terrain and weather was the need for carrying out such engineer missions under enemy fire more often than not.

The Borneo operations were closely related to those against the southern Visayas and Mindanao, and a brief resume at this point will facilitate absorbing later comments and criticisms of those portions of these operations which varied from the ordinary or the significance of which merits special comment. In the interest of brevity and an endeavor to avoid too much repetition it is necessary to depart from chronological reporting of each individual operation, particularly since each is completely covered in other volumes of this history.

Three assaults were made on Borneo by Australian and Dutch troops assisted by U. S. naval and air elements and units of the 3d ESB. These assaults were directed against Tarakan Island on 1 May, Brunei Bay on 10 June, and Balikpapan on 1 July 1945.[30] The landings were effected with practically no opposition after the neu-

[30] *Editor's note: See* Map No. 45, "Borneo Landings, 1 May–1 July 1945," Vol I, this series.

tralizing effects of heavy naval bombardment although the Japanese did attempt an ineffectual defense about 1,500 yards inland on Tarakan. Swampy, boggy beaches at Tarakan and at Brunei Bay, and a heavy surf at Balikpapan caused some difficulties. Initial delays were encountered in rehabilitation and construction at Tarakan because of numerous land mines and the ineffectiveness of detectors in probing the large areas impregnated with numerous bomb and shell fragments. Difficulties notwithstanding, the engineer missions were accomplished and Allied bases established. Moreover, the seizure of these strategic oil-producing areas, if the war had continued, would have cut off Japanese oil reserves besides disrupting enemy communications with the Netherlands Indies and would have contributed important resources for the Allied war effort.

PALAWAN, 28 FEBRUARY 1945

Balanced Boat and Shore Team. The missions of the 2d Engineer Special Brigade Task Group in support of the regimental combat team comprising the Palawan Force (see Map No. 12) were so representative of those charged to engineer special brigades that the Chief Engineer, GHQ, SWPA, considered the observer's report on these operations of special interest to general staff officers concerned with engineer special brigade operations and forwarded copies to the Chief of Staff, G-3, and G-4, GHQ, SWPA.[31] Copies of this report were likewise transmitted to the Engineers, Sixth and Eighth Armies, by the Chief Engineer with instructions that every effort should be made, whenever an engineer special brigade or its elements were employed in support of landing operations, to provide a similar well-balanced boat-shore team with organic maintenance support and medical, ordnance, signal, and quartermaster units integrated. His instructions also specifically directed that arrangements be made for appropriate reinforcement of such a team by labor troops from the task force.

The engineer special brigade provisional unit (532d EBSR Task Group) which supported the 186th RCT at Palawan was the smallest self-sufficient landing team in the engineer special brigade, and was basically a boat company-shore party team with necessary brigade attachments. The balanced composition of men and equipment within this team was the key to its particular effectiveness. Moreover, the Palawan Force commander reinforced it with appropriate service elements in order to increase its capacity for cargo handling, and in this manner all troops involved in any way in the handling of cargo were under the command of the 532d EBSR Task Group commander. In addition, the infantry cannon and antitank companies were made available as labor troops to supplement the engineer shore party.

The commander, Amphibious Group 8, Seventh Fleet, in commenting upon the performance of the 532d EBSR Task Group during the Palawan operation reported: "It was by far the outstanding performance of any Army Shore Party to come under my observation . . . ."[32]

ZAMBOANGA PENINSULA, MINDANAO, 10 MARCH 1945

Use of Combat Engineers. Most of the fighting in the seizure of the Zamboanga Peninsula took place in difficult terrain, yet by attaching a combat engineer platoon to each infantry battalion, supply roads were constructed and maintained to within 400 yards of the leading elements of the advance. These roads greatly facilitated the delivery of rations, the evacuation of wounded, and the resupply of ammunition. Among the conclusions reached by Eighth Army from experiences on western Mindanao and the Sulu Islands (see Map No. 12), was the fact that

[31] *Editor's note: See* appendix, "Report of V-3 Operation," Vol IV, this series.

[32] Ltr, Comdr, Amph Group 8, Seventh Fleet, to CinC, US Fleet, 25 Mar 45, sub: Action Report—Puerto Princesa, Report on Palawan Operation. In Records Section, GHQ, SWPA.

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combat engineers, except in cases of dire emergency, should be used exclusively for the provision of engineer support to the infantry.

At Zamboanga, engineer operations included the construction of 49 miles of combat roads over terrain with elevations ranging from sea level to over 2,000 feet, rehabilitation or construction of sixteen 35-ton bridges, removal of approximately 2,000 mines, and demolition of approximately 50 pillboxes and caves.

Construction. In spite of continual interference from Japanese small-arms and artillery fire, construction of a 5,000-foot dry-weather strip was completed by D plus 5, and a 6,000-foot all-weather, medium-bomber strip was placed in operation on D plus 37. In addition to airfields, construction effort was required for development of a supply point. The existing pier was repaired and 138,000 square feet of covered storage provided. A 55,000-barrel tank in the area was rehabilitated on which 4,000 pounds of welding rod was expended to repair holes and cracks caused by aerial and naval bombardment. The city water system required a dual application of engineer effort inasmuch as it had to be utilized initially for accomplishment of an early engineer mission by improvisation. Because such improvisation was so typical of the hard-pressed engineer operations in the Southwest Pacific, a repetition of another instance of its use is justified if only to emphasize the need for versatility in the engineer service. The FS boats carrying bulk petroleum installation material had arrived at Leyte too late to leave for Zamboanga with the initial convoy. The resultant shortage of pipe in the objective area for pumping fuel from barges had to be overcome as rapidly as possible by any means available. The only ready source of pipe had been the city water system, and the engineers had promptly removed some from the system to use in the emergency. Supplemental materials arrived for subsequent completion of the initial fuel unloading mission, but by that time rehabilitation of the city water system had to be added to construction requirements at Zamboanga.

Basilan Island, 16 March 1945

A Brief for Reconnaissance. The Basilan Island operation forcefully demonstrated the urgent necessity of thorough reconnaissance in the selection of landing beaches for even relatively small operations, and the fact that the ESB unit commander can often give valuable advice to the tactical commander on such matters.

The 543d EBSR was alerted for this operation only the day before that scheduled for the operation, and passenger lists and wave formation for its LCM's were not issued until the actual time of departure. The first wave, according to the formation planned by the tactical command, was to consist of one boat and was to be followed at 3-minute intervals by subsequent waves of two boats each. This would have worked out satisfactorily if there had been a beach on which to land. At the actual time of landing, however, the first wave hit a coral reef about 25 yards from the shore and was momentarily stopped. An estimate of the situation at that time revealed that guerrilla reports of a satisfactory beach were erroneous and no beach suitable for landing craft existed in the vicinity. But this time the first three waves, consisting of five boats, had grounded on obstructions with as much as 10 feet of deep water between the craft and the shore. Unloading at this point was impossible. The five boats retracted and proceeded up the coast in search of a possible landing point. In the meantime the succeeding waves had held up at the line of departure. The first wave, after retracting from the reef, had swung broadside to the shore and moved 500 yards down to an existing pier extending from the top of an embankment. The ramp of this LCM was lowered as far as possible against the pier and used as a scaling ladder by the debarking infantrymen. Then the LCM retracted and its place was taken by another, containing a weapons carrier. After much pulling and tugging by the crew and passengers, the weapons carrier was finally hauled onto the wharf. A third LCM came in directly to the embankment with a D-4 aboard. This piece of equipment was pulled up the embankment to the level of the wharf with the assistance of the same infantrymen and the weapons carrier. The D-4 then graded the embankment so that subsequent LCM's, upon landing, could completely lower their ramps on the shore line and unload their cargo and personnel. Fortunately for all concerned, there was no enemy fire on the beach. Had there been, this seemingly simple operation could have proved extremely costly, and conceivably the landing not made at all.

Cebu, 26 March 1945

Necessary Support to Assault Waves. The beach and the roads in the Cebu beachhead area (see Map No. 12) were heavily mined with aerial bombs and artillery shells which were fused with standard contact detonators. Concrete pillboxes with walls 7 inches to 3 feet thick, antitank ditches, *dragon's teeth,*[33] and coconut post obstacles were utilized by the Japanese in an elaborate defense system. However, the fact that the enemy had abandoned and failed to defend these well prepared obstacles under threat of bombardment of the beach area by U. S. ships and aircraft nullified their tactical value. Yet, there was costly delay in passing these obstacles owing to an insufficient provision of engineer troops and equipment in the assault waves.

During the initial landing, eight of the landing vehicles (tracked) were knocked out by land mines. Other amphibious craft in the assault waves were halted outside the mined area. When ramps were dropped and personnel unloaded, however, several men stepped into the mine field and were killed or severely injured by exploding mines. Troops in subsequent waves hesitated to move forward. Along the entire strip of beach soldiers were crowded shoulder to shoulder, two and three deep, between the mine field and the water's edge. Had the installations been defended by even a small, determined enemy force, these massed troops would have been subjected to withering fire and the eventual victory would have been a far more costly one. Yet, there was no evidence of any attempt to breach the mine field except by the Hydrographic Survey Unit of the 542d Engineer Boat and Shore Regiment which began clearing a passage for vehicles and tanks.

In other operational areas little difficulty had been encountered in passing scattered and poorly camouflaged obstacles. Cebu exploded any indifference to the deadly possibilities of well-prepared, mined barriers. Actual losses were small, but the obvious potential of havoc indelibly marked the need for landing sufficient, specially trained personnel in the early waves of an amphibious operation to clear beach mines and obstacles.

Final Operations on Mindanao, 17 April–12 July 1945

Advantages of River Support. The unique use of boat units of the 533d EBSR, supporting the 2d Battalion, 21st Infantry, in the drive up the Mindanao River while the 19th Infantry advanced along the highway from Parang, demonstrated the versatilitiy of engineer boat and shore regiments to such an extent that no critique of Theater experiences would be complete without a review of this operation. This reconnaissance in force eliminated the necessity for maintaining 52 miles of road, and allowed the limited engineer effort to be utilized to full advantage in close support of the rapidly advancing combat troops. (See Map No. 17, "Location Map, Mindanao River Operations, Mindanao, P. I., 17–22 April 1945.")

When the 19th Infantry's southward progress along Highway No. 1 from Parang was retarded by a succession of destroyed bridges, the 24th Division commander decided to seize the Co-

[33] *Editor's note:* Based on combined considerations of resistance against tank charges, artillery, and aerial bombardment, as well as strength against engineer demolitions, dragon's teeth is the most effective reinforced-concrete obstacle. It is constructed of several irregular rows of variously shaped reinforced-concrete teeth cast separately on a common base. Tanks climb or pass the first row of teeth but are trapped or bellied on succeeding rows.

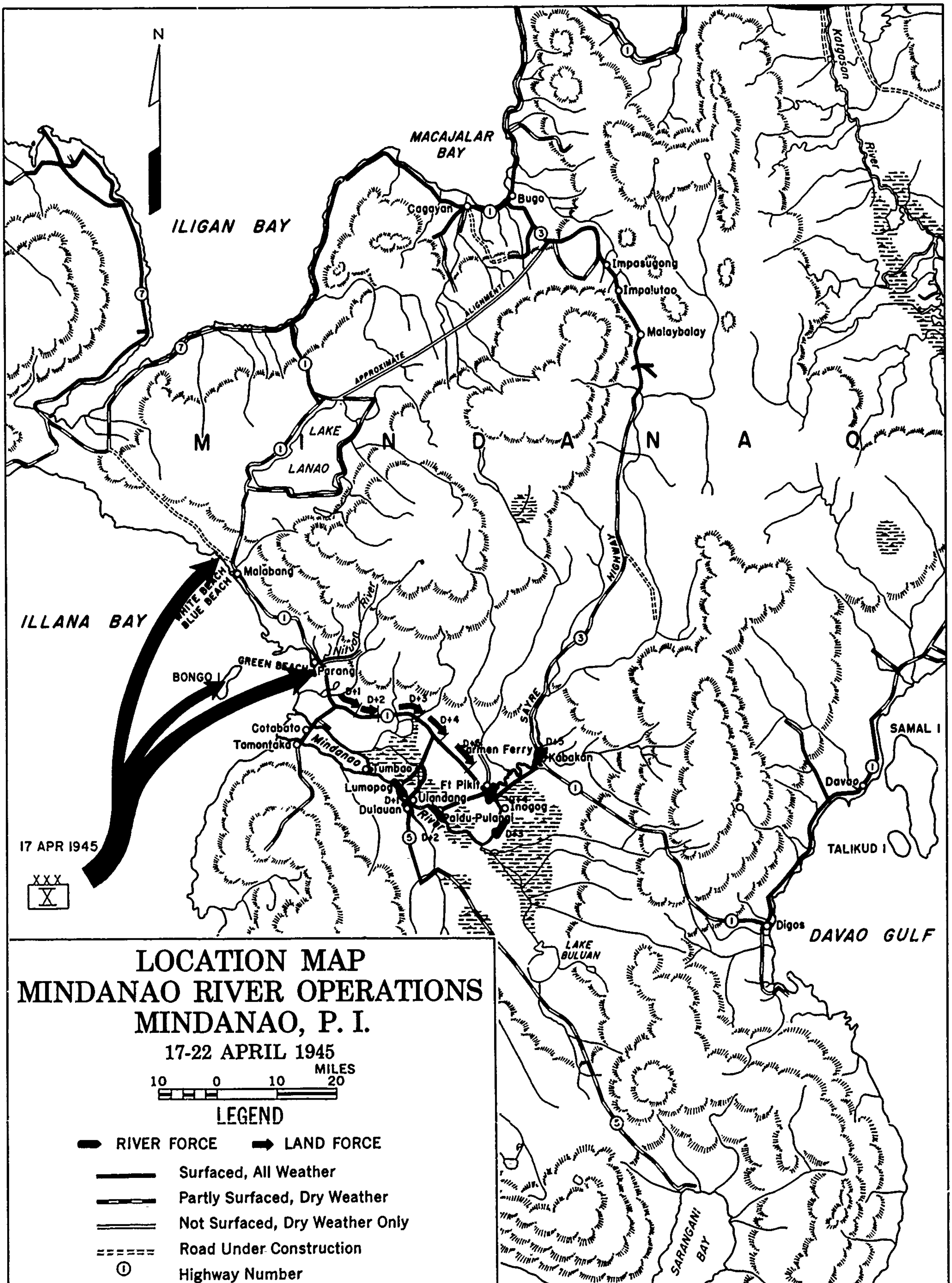
tabato—Tamontaka area by an amphibious assault. The plan previously studied and recommended by the 533d EBSR for an assault on the lower reaches of the Mindanao River was immediately put into effect, and tactical control of the operation was given to 533d EBSR officers. An informal task group was created consisting of the 2d Battalion, 21st Infantry, supported by 5 LCMG's, 1 rocket LCM, and 3 LCS(S)'s (533d EBSR craft) which were organized into two gunboat teams to lead the penetration up river.[34] Twenty-four cargo LCM's and 14 LCVP's for transporting the ground troops were rounded up and the task group started upstream on D plus 1.

The plan of attack was a simultaneous forcing of both river mouths by independent engineer gunboat teams, to be followed by landing one reinforced rifle company at Tamontaka on the south arm of the Mindanao River, and the remainder of the infantry battalion at Cotabato, lying parallel on the north arm. Two LCMG's, the rocket LCM, and an LCS (S) made up the gunboat team for the north branch of the river. The south branch force was led by 3 LCMG's and 2 LCS(S)'s. No opposition was encountered as the two convoys proceeded to their objectives nor when troops were landed and fanned out to secure the area between the two river branches. It was obvious that the enemy was totally disorganized and unprepared for a move up the river. Before the Japanese could react and establish defenses farther upstream, therefore, the Engineer officer designated in over-all command of the task group decided to send the gunboats ahead to the river junction in the vicinity of Tumbao, and notified division headquarters of this contemplated action. Orders were immediately received to transport one reinforced rifle company upstream with the gunboats. Accordingly, arrangements were made for this company and the infantry battalion commander to follow the gunboats in LCM's, and the move was initiated. Only minor opposition was encountered on the south branch of the river where all but one of the handful of Japanese engaging in the brief fire fight were killed. A quick reconnaissance indicated the river junction area unsuitable for establishment of a defensive position by so small a force and a further reconnaissance upstream was ordered.

According to local residents, about 200 Japanese with automatic weapons were dug in above the river junction at Lumopog. Orders were immediately issued to assault this town inasmuch as it controlled the first road-river junction above Cotabato and its seizure would place the amphibian-borne troops behind the Japanese opposing the overland advance of the 19th Infantry along Highway No. 1 from Parang across Mindanao toward Digos and Davao (see Map No. 17). Without air support, and beyond range for support by naval guns, the gunboats were massed in line abreast to bring the maximum number of 40-mm. and 37-mm. guns into action simultaneously. A total of 100 rockets were dropped on the town and automatic-cannon fire was poured into it at a maximum rate. After silencing the machine-gun and knee-mortar fire from the opposite bank, the troops landed. Evidences of the enemy's hasty withdrawal were all they found. Cook fires were still warm, and numerous papers and firearms had been left behind.

Radio orders were issued by the infantry battalion commander, on recommendation of the task group commander, to move the balance of his battalion up stream from Cotabato at dawn for further exploitation of the enemy's lack of preparedness in the river valley. At the same time a radio message was sent to the 24th Division command post outlining the situation and urging that reinforcements be dispatched immediately so that the drive could continue without

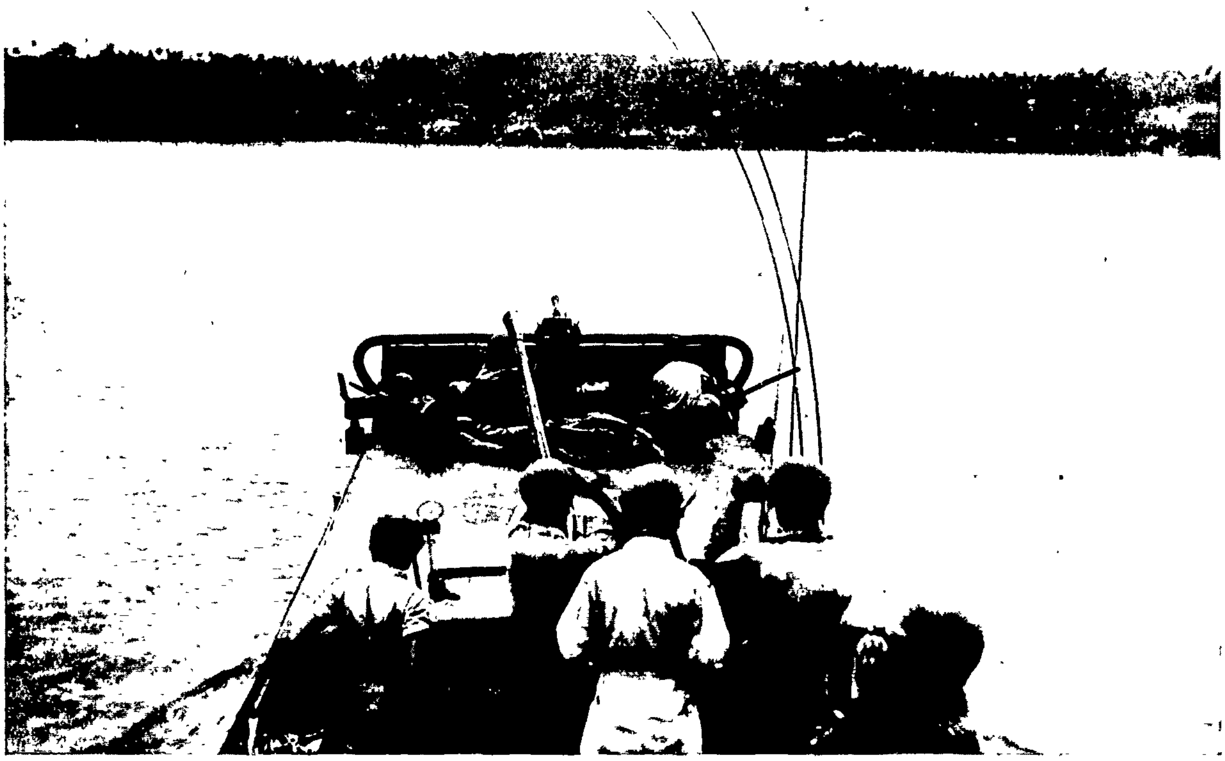
[34] *Editor's note:* (1) LCMG's were combination gun and command and navigation boats converted from 56-foot LCM's, differing in positions and types of cannon carried on each, but all additionally equipped with numerous .50- and .30-caliber machine guns ranged along their decks as well as 4.5-inch rocket launchers. (2) The rocket LCM was the standard landing craft, mechanized, converted to hold rocket launchers in the well of the craft. (3) LCS(S), landing craft, support (small), was an armored craft equipped with .30- and .50-caliber machine guns and rocket launchers.



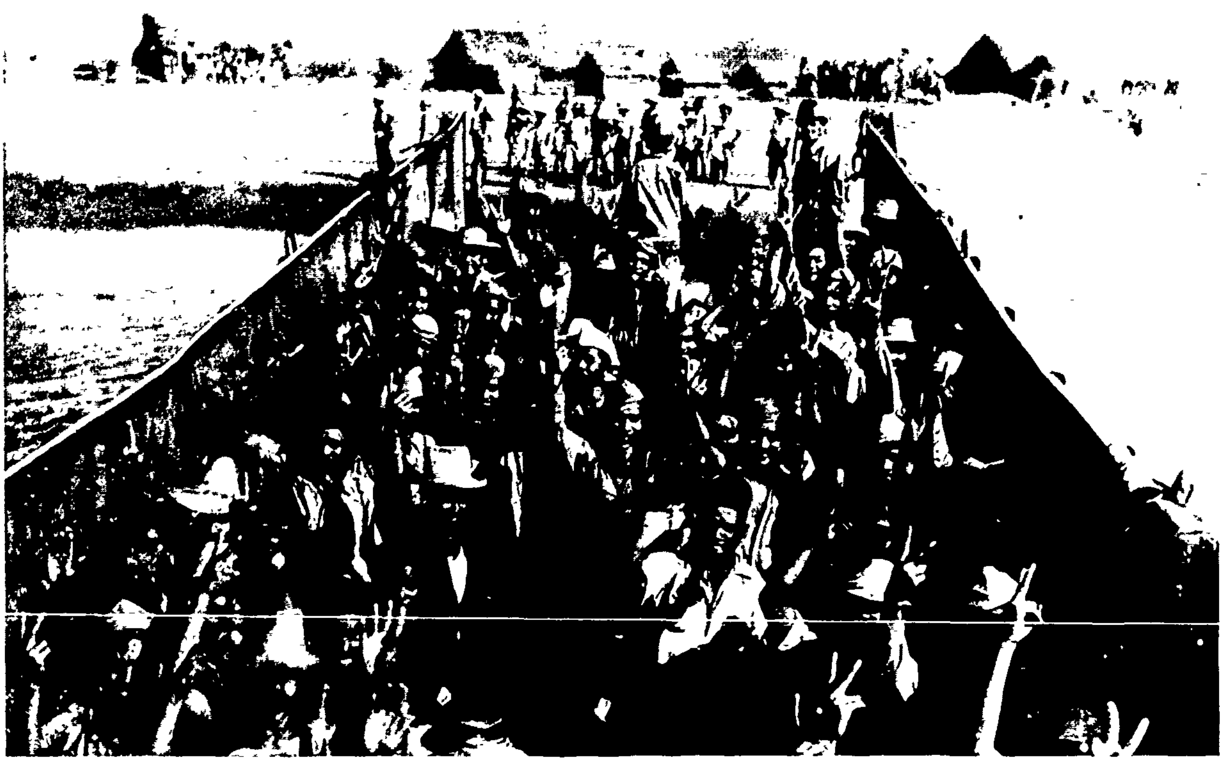
LOCATION MAP
MINDANAO RIVER OPERATIONS
MINDANAO, P. I.
17-22 APRIL 1945

SOURCE: Hq, 533d EBSR, n.d., Operations Report, V-5, 1 Mar-7 Apr 45.

MAP NO. 17



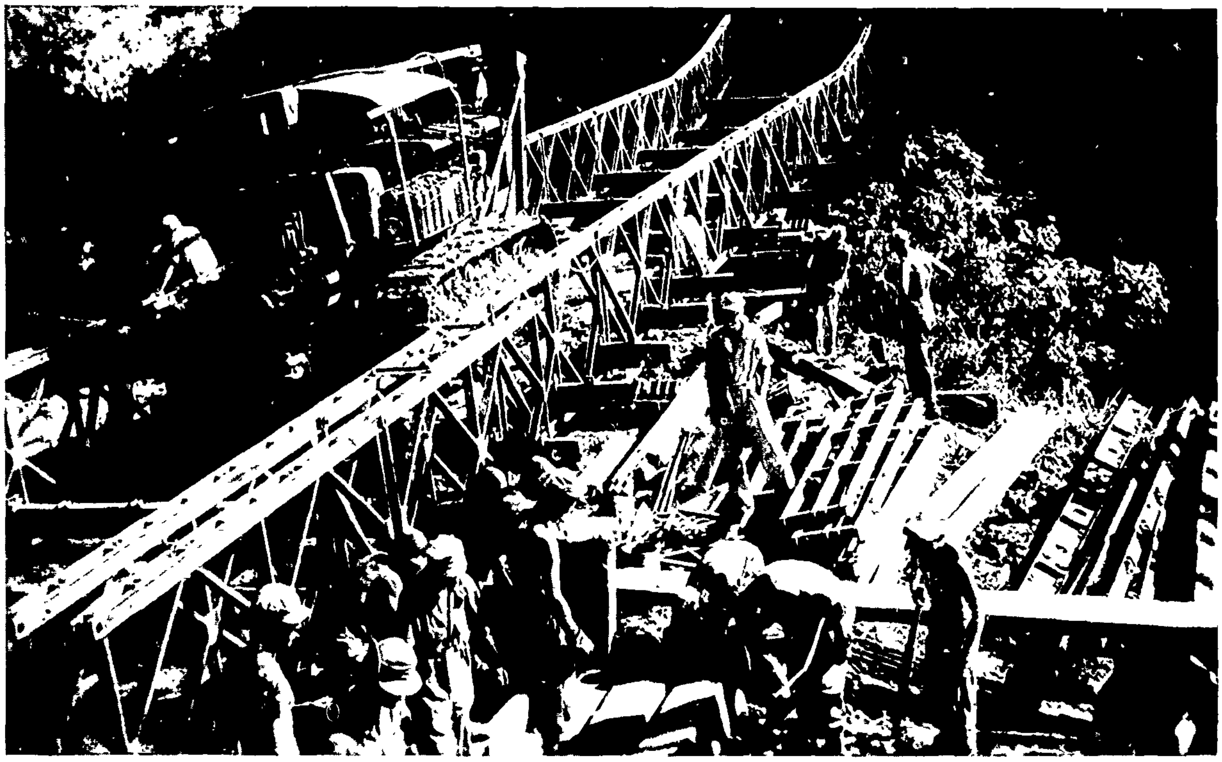
Crew of an Engineer gunboat scans the shore of Mindanao River for concentrations of Japanese troops.



Part of a force of 600 guerrilla fighters evacuated from enemy territory by Engineer LCM's on Mindanao.

Two Americans inspect a captured Japanese pillbox that temporarily blocked their advance along the main road south of San Jose, Mindanao.

Engineers cautiously remove a push-type enemy mine that had been placed under the wooden abutment of a bridge near Digos, Mindanao.



Engineers have removed the blade and are using this bulldozer as a counterbalance in launching a Bailey bridge along the Sayre Highway, Mindanao.

Engineers launch a Bailey bridge over a stream near Valencia, Mindanao.

slackening until Fort Pikit could be secured and the enemy along Highway No. 1 completely trapped. The only answer to the latter radio was an order received the following morning to hold Lumopog "at all costs," and for the gunboats to reconnoiter the river to Ulandang. No mention was made of reinforcements nor any indication given that division headquarters was aware of the possibility of exploiting the penetration. As a result, only one platoon of infantry embarked at Lumopog to accompany the gunboats upstream to Ulandang.

Upon arrival at Ulandang, it was found that the Japanese had left 90 minutes previously. Reconnaissance proved Ulandang of little value as a jumping-off point for further ground operations, while the continued demoralization of the Japanese was an invitation to push on to Paldu-Pulangi and secure it as a beachhead for a drive on Fort Pikit. The task group commander, therefore, pursued his advantage and ordered the little force to proceed to Paldu-Pulangi, where, after a brief bombardment, a landing was effected. Here, too, the area was littered with tokens of a hasty Japanese withdrawal. Another radio message was dispatched to the division commander explaining the desirability of holding the beachhead at Paldu-Pulangi and attacking Fort Pikit without delay, but no answer was received. Nor was it possible to move the balance of the 2d Battalion, 21st Infantry, directly to Paldu-Pulangi to hold this beachhead inasmuch as contact with these elements revealed that the assistant division commander had later that morning issued instructions that all infantry elements be withdrawn to Lumopog. This meant that even the advance platoon of infantry which had accompanied the gunboats as far as Paldu-Pulangi had to be withdrawn to Lumopog, 13 miles downstream. Only the gunboat teams were under the independent control of the task group commander. Yet, complete withdrawal from Paldu-Pulangi at this time could readily have permitted Japanese reoccupation of its well-constructed defenses, and its subsequent recovery under such circumstances could be expected to be costly. Temporarily, therefore, unsupported gunboat crews had to suffice. Crews of three LCMG's and two LCS(S)'s were deployed in fox holes and on gunboats to hold Paldu-Pulangi while the task group commander personally proceeded to division headquarters at Parang to present a clear picture of the situation.

Despite 2,000 scattered Japanese streaming east and north throughout the valley from their bypassed and outflanked hill positions, the night passed quietly. The next day the commanders of these gunboat crews ordered aggressive patrols in the interest of disguising their own weakness as much as gaining information on enemy dispositions. At the same time they dispatched two gunboats 18 miles upstream to Inogog to contact a Filipino guerrilla battalion there for reinforcements if possible. As a result, arrangement were made for a joint operation against Fort Pikit if the U. S. infantry units did not arrive next day.

Meanwhile, at Parang, the task group commander learned that the 24th Division was rushing reinforcements upstream as fast as they were disembarked from D plus 2 shipping, and plans were made to concentrate these troops at Paldu-Pulangi during D plus 4 for an attack on Fort Pikit the following day. A brief conference with the amphibian garrison which had remained at Paldu-Pulangi established that the river was clear of the enemy as far as Inogog and that the road at least halfway to Fort Pikit was not defended. Consequently, it was decided to make a simultaneous overland and amphibious attack on Fort Pikit by moving one company by boats and the balance of the battalion overland from Paldu-Pulangi.

From Fort Pikit a joint ground and amphibious attack was launched the following day on Kabakan. During this operation the infantry battalion's overland advance was halted by enemy action with the result that the gunboats reached Carmen Ferry ahead of the infantry and found themselves behind the Japanese forces and across their line of retreat. (See Map No. 17.) A perimeter defense was immediately established and again maintained overnight by cooks, radio operators, enginemen, and official observers from higher headquarters aboard the gun boats. Infiltration attempts here were successfully repulsed with commendable coolness. Three Japanese were killed by the unsupported and exposed detachment which fired only 18 shots throughout the entire night, and, of these, 17 found their mark in the three enemy soldiers. As the river was unnavigable beyond Kabakan, the infantry's occupation of it the next morning concluded the tactical phase of the river operation.

The strategic importance of this move upstream can readily be appreciated upon reference to a map of this area. (See Map No. 17.) A comparison between the progress of the amphibian engineer column, carrying the 21st Infantry, and the road column of the 19th Infantry, building its way slowly overland with inadequate materials, speaks for itself. Eighth Army planners had predicted 14 to 30 days would be necessary to dislodge the Japanese from the Mindanao River Valley and secure the critical Kabakan area. The aggressive and effective engineer advance upriver accomplished the seizure of Kabakan in 6 days. Enemy forces in central Mindanao were split into three isolated pockets and a base secured for the succeeding overland operations to Davao Gulf and up the Sayre Highway days ahead of schedule in spite of the forbidding road conditions encountered.

Roads and Bridges. The overland engineer problem on the island of Mindanao began with bridges and ended with roads. Elements of the 3d Engineer Combat Battalion, which landed on D Day at Parang, were promptly stopped on Highway No. 1 toward Cotabato by the still burning remnants of the bridge over the Nituan River. (See Map No. 17.) By midnight the wreckage had been cleared away, the undamaged portion of the bridge strengthened to carry division loads, and a 90-foot double-single Bailey bridge thrown across the gap. From this point on until the 3d Engineers reached Davao on Highway No. 1 (dividing Mindanao north and south) their story was one of bypassed bridges, rebuilt bridges, and newly constructed bridges, of frantic efforts to move bridge timber and Bailey bridging forward, of racing around the clock to keep up with the fast moving infantry.

The 106th Engineer Combat Battalion supported the 31st Division's northward advance to a juncture with the 108th RCT which had landed at Bugo on Macajalar Bay. (See Maps Nos. 12 and 17.) This engineer combat battalion, together with various other engineer units, worked sometimes knee deep in mud to open and maintain the Sayre Highway (dividing the island east and west, north of Highway No. 1) for division traffic.[35] Working their way south on the Sayre Highway, Company C of the 115th Engineer Combat Battalion and the 865th Engineer Aviation Battalion (less Company C), which had landed with the 108th RCT, ran into the problem common to all engineers: an immediate need for bridges, and more bridges, particularly in the Bugo–Impasugong–Impalutao sector.

Sixteen Bailey bridges, with a total length of 1,010 feet, and 65 wooden bridges, with a total length of 2,486 feet, were erected on the Sayre Highway. Because of restricted assembly areas at the crossing sites of several rivers, field expedients were employed to emplace the Bailey bridges. Erection was started simultaneously on both banks where successive panels were assembled and launched by counterbalancing with D–8 tractors until the span met in the center and could be joined. Through such improvised measures, engineer units were able to construct 100-foot, 130-foot, and 150-foot Bailey bridges in restricted launching spaces of 30 feet, 25 feet, and 63 feet, respectively.

From 2 June to 1 July the difficulties of maintaining communications over the northern portion of the Sayre Highway shifted from bridges

[35] *Editor's note:* Other engineer units employed on the Sayre Highway with the 106th Engr (C) Bn consisted of the 96th Engr GS Regt, the 1874th Engr Avn Bn, the 506th Engr Light Ponton Co, and Co C, 865th Engr Avn Bn.

to surfacing of roads. The rain which had been severe in the latter part of May became daily deluges during June. The combined efforts of five engineer battalions just managed to keep the road open to traffic.

If much is made of the road and bridge problems in this operation, the emphasis is correctly placed. Nowhere in the Pacific had so rapid and so sustained an advance been made as that of the 24th Division in the first 11 days of the Mindanao operation. It is a fitting and deserved compliment to these capable engineer units to note that never during that foot race from Parang across the island was the infantry delayed through a lack of engineer support. The 31st Division's wild 10-day race to close with the 108th RCT which was moving south on the Sayre Highway owed much of its impetus to exceptional engineer support. Often under fire, wallowing in mud, and grimly carving footholds on towering precipices, these engineers wove a network of roads and bridges that enabled the infantry to sweep the fanatical enemy into pockets of impotence.

Brunei Bay–Borneo, 10 June 1945

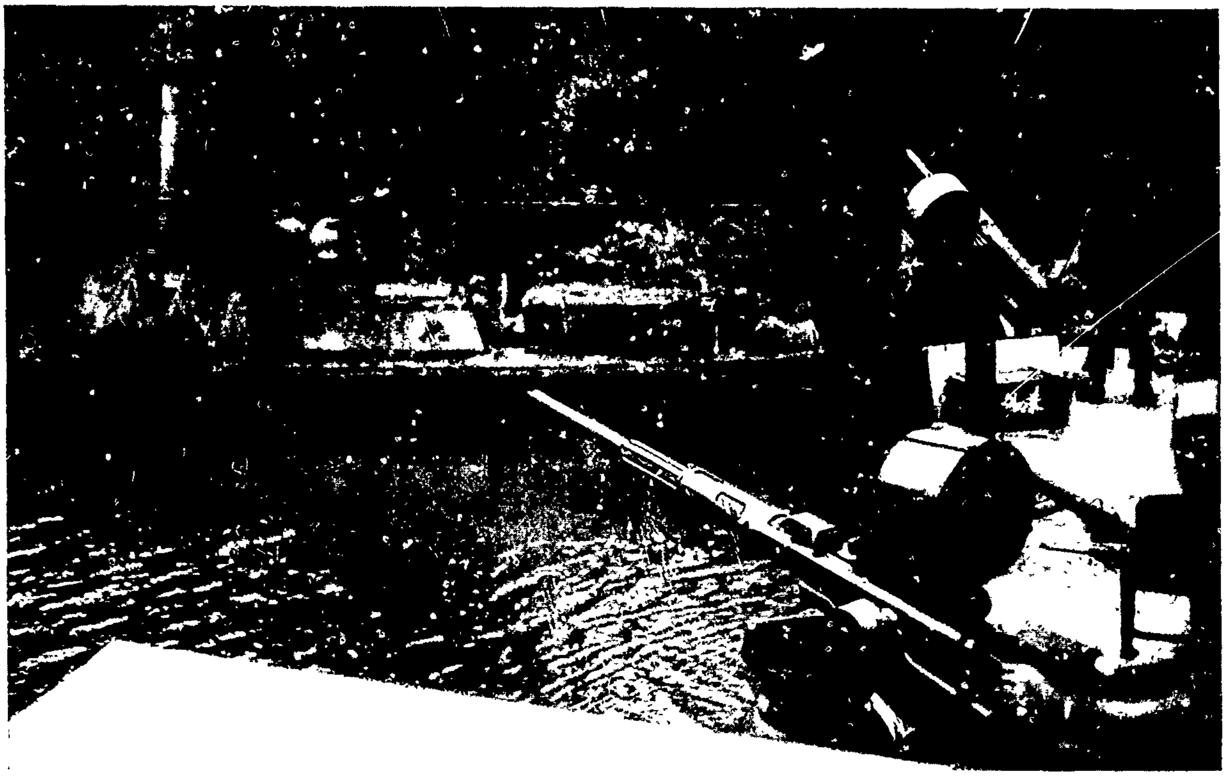
Advantages of River Support. The Brunei Bay operations were of particular interest as further demonstrations of the extent to which engineer special brigade landing craft could be employed by a task force commander in carrying out his tactical plan. Using the rivers as routes of approach and landing craft as vehicles, the commander was able to achieve mobility, speed of movement, and surprise that in an overland advance through the jungle would have been impossible. Such employment of ESB craft allowed elasticity of plan and assured mobile artillery, an unfailing supply line, and a rapid means of evacuating wounded.

An example of the elasticity of plan was evidenced when the 2/43d Australian Infantry Battalion plus attached units was moved to Takuli via the Klias River with the objective of joining the 2/32d Australian Infantry Battalion located nearly 5 miles below Beaufort on the Padas River.[36] To accomplish the joining of the two forces, the 2/43d had to travel the distance between the Klias and Padas Rivers overland. However, the terrain proved suitable for foot troops only. Vehicles and heavy equipment were, therefore, left aboard the craft and moved back down the Klias River, across Brunei Bay, and then 30 miles up the Padas River to Karang, the junction point of the two battalions. This amphibious movement of heavy equipment was accomplished by seven engineer-operated LCM's in 2 days. No attempt to move the vehicles and heavy equipment overland between Takuli and Karang could have met this time schedule which was of importance to the operational plan.

Armament. The network of riverways in the Brunei area was completely exploited by ESB craft to advance and resupply the infantry elements. From experience gained with the craft available in these river operations it was recommended by the 593d EBSR that the armament on gunboats should not be limited only to 20-mm. and dual .50-caliber weapons but that .30-caliber machine guns should also be distributed advantageously to vital covering positions for river operations. The Browning .30-caliber machine gun with its cyclic rate of fire (450 to 625 rounds per minute) definitely proved a formidable weapon when the enemy was engaged at close quarters in river missions.

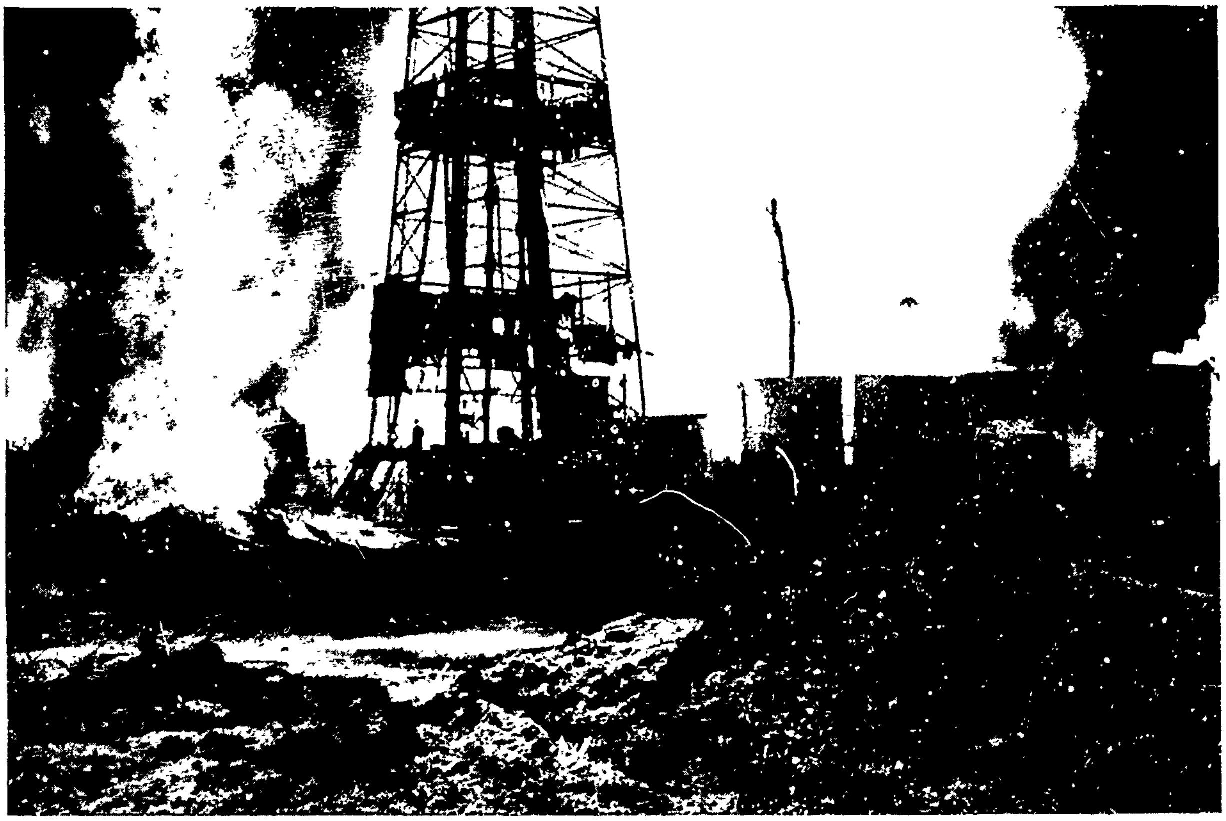
Experience also proved the 20-mm. HE (high-explosive) point detonating round not suitably effective against bunker emplacement where mangrove and swamp penetration to any depth was required. The point detonation feature of the 20-mm. under such conditions was not an advantage but a disadvantage. Contact with any surface while in flight caused premature detonation and rendered valueless the effectiveness of the round against the desired target. For effective destruction of the enemy, requiring mangrove and swamp penetration at close range, the

[36] *Editor's note: See* Map No. 47, "North Borneo Operations, June–July 1945," Vol I, this series.



Japanese patrol boat which was sunk by an Engineer gunboat during the fighting on Borneo.

Photograph showing the stern of an Engineer LCM which was struck by a Japanese artillery shell during the Borneo landings.



Royal Australian Engineers bring up a steam line that successfully extinguished an oil well fire at Seria, North Borneo.

After a courageous battle with flame and dense smoke, this oil well in the Seria field is capped.

.50-caliber machine gun was considered the ideal weapon. For neutralizing fortified bunkers, pockets of resistance, and enemy-held ridges and towns at a somewhat greater distance, it was found that 20-mm. and 40-mm. guns and 4.5-inch HE barrage rockets provided adequate support artillery.

In the Padas River operation against Beaufort, it was definitely obvious that a gunboat operating on river missions required more specialized armament than that installed on landing craft designed for coastal operations. The situation presented a challenge to the resourcefulness of the engineers. A 40-mm. Bofors gun was promptly borrowed from the 2/9th Royal Australian Artillery Battery by Company B of the 593d EBSR for the purpose of testing its adaptability to the standard 56-foot LCM converted as a gunboat. The gun was in no way modified but a few modifications were made to the LCM. This craft was further equipped with two .50-caliber, single mounting, two .50-caliber, twin mounting, and two .30-caliber machine guns, as well as two 20-mm. guns, and 24 HE barrage rocket dischargers—12 on each side, mounted on the ramp externally to build up the gunwale. Tests proved that at a range of 1,000 yards all weapons, including the rockets, could be used with effect. The shallow draft of the craft was an added advantage as the LCM could be brought very close inshore to cover the hinterland with its heavy fire power. The 40-mm. gun could be used for either medium-range shelling with HE or close-range bunker destruction with HE and antipersonnel shot. For the close support required in these river operations, the gunboat, thus equipped, proved effectively armed.

Fire Fighting. It was in the Brunei Bay operation that one of the great Australian victories of the war was achieved *OFF* the battlefield. No report of engineer achievements could ignore the splendid efforts of the Corps of Royal Australian Engineers (RAE) in bringing under control the terrifying opposition of the blazing oil fields at Seria.

At the time of the advance from Brunei towards Seria it was evident that problems other than those of a purely tactical nature were ahead. High, leaping flames and blinding smoke which confronted the troops in the Miri–Seria area indicated that oil fields had been set afire by the retreating Japanese. Thirty-seven wells on the field were ablaze and the enemy had left no power, gas, water, transport, or fire-fighting equipment with which to fight the conflagration.

Since the final objective of the 2/17th Australian Infantry Battalion required a further 8-mile advance and the commitment of all arms, the force commander ordered that the limited available engineer support would take whatever action was possible to extinguish the fires, but that fire fighting was to be considered second in priority to tactical requirements. Under such circumstances only a few sappers were available for the task of putting out one of the greatest oil fires of the war in the Pacific. It was accomplished with equipment improvised on the spot, recruitment of native labor formerly employed on the oil fields, and the later advice and operational equipment of U. S. specialists sent by the oil company to put out the fires. Although the work involved no casualties, these operations called for courage, resourcefulness, and endurance equal to many a military situation on the battlefield. In the early stages bulldozer operators feeding sand over fires had to face the blaze without protection of asbestos suits. Temporary eye troubles and gastric disorders from effects of gas and oil hampered the working force. The heat was so intense men could work only with the wind and, of necessity, in relays.

Many methods were adopted by the engineers in overcoming these fires. Those which seemed easiest to bring under control were dealt with first. Some of the most tractable were very large, horizontal jets, which, with a favorable wind and some small screens, it was possible to bring under control by turning off master gate valves either by hand, or by use of a pipe wrench or a long-handled, fork-shaped tool made to fit between the spokes of the valve wheel. A few of the fires around wellheads were beaten out. A gas well fire was extinguished with water. A few fires were put out by diverting the main oil flow through elbow fittings. Others were overcome with steam. Several wells were sanded up and extinguished themselves. The remaining fires were put out by using patented equipment introduced by American oil field fire fighter specialists who arrived from Texas some 2 months after the Royal Australian Engineers had begun their courageous battle with the flames. This total engineer effort had prevented, not only an enormous loss of vital oil resources, but, possibly irreparable damage to one of the largest oil-producing fields to come under Allied control.

BALIKPAPAN–BORNEO, 1 JULY 1945

Objectives of the Balikpapan operation were capture of the town, the petroleum refinery, oil field, and airstrips.[37] The Allied task force for the mission was comprised of the 7th Australian Division (3 brigades) reinforced by various units including RAE, RAAF, U. S. amphibian tractor elements, and a boat company of the 593d EBSR (3d ESB). Naval support was provided by Amphibious Group 8, U. S. Seventh Fleet, while RAAF and U. S. Army Air Force elements provided air cover and initial bombardment.

Availability of Intelligence. In sufficient time for planning, three engineer intelligence reports, covering all phases of the projected operation, had been published and distributed from Manila by the Engineer Section, GHQ, SWPA. These reports included an industrial study, beach approach photography, and a terrain evaluation report (formerly known as an engineer annex). In order to check the accuracy of these data, a civilian scientific consultant from the Engineer Section, GHQ, SWPA, together with four enlisted men, was directed to land in the operational area on D Day for the purpose of observing the assault landings. At the same time, offshore profiles were to be surveyed and a further study made of the extensive channeled sand flats. These flats were considered to be quite similar to some of the beaches on the western shore of Tokyo Bay, and it was desired to establish well in advance a firm basis as to possibilities and limitations of such sand flats for later amphibious operations against the Japanese homeland.

Landing at H plus 3, this small party began these observations, and further included a check of the accuracy of other data which had been provided the planning staffs on roads, local construction materials, storage and bivouac areas, and airfields. Landing beach conditions were found to be essentially the same as predicted from aerial photographic interpretations, and previous evaluation of the channeled sand flats was confirmed. An appraisal of the availability and usefulness of the terrain evaluation report to the Task Force and its subordinate units revealed that copies of this report had been delivered to the Australian headquarters in the staging area at Morotai in sufficient time to be used for planning. However, it was evident that distribution had not been effected down to subordinate units. When approached on the subject, after landing at Balikpapan, several unit commanders expressed the opinion that the supply of detailed sketch maps, photomaps, and other information contained in the report would have considerably facilitated accomplishment of their missions.

Organization and Control. Shore party and shipping control were organized as two separate agencies. A beach group commander (shore party commander), representing the ground force in the objective area, was responsible for unloading equipment and supplies, for storage, distribution, and cargo priorities. A principal beachmaster, Royal Australian Navy (RAN), with a U. S. Navy group beachmaster acting as liaison officer, assumed those responsibilities related to shipping control. These included the marking of beach limits and boat slots, reconnaissance and hydrographic surveys, marking and removal of obtacles, placing of channel buoys, directing boat traffic, establishing communica-

[37] *Editor's note: See* Map No. 48, "Balikpapan Operations, July 1945," Vol I, this series.

tions afloat, and positioning causeways. Actual movement of all shipping was directed by a senior U. S. naval officer aboard a control boat (in this case a submarine chaser—PC) just off the beach. Thus, each authority had its own sphere of activity, and when required to act in unison, the beach group commander transmitted his requests to the principal beachmaster who relayed them to the landing craft control officer (LCCO), U. S. Navy, afloat.

Army shore party troops, afloat and ashore, were composed of RAE and service elements of the 7th Division, augmented by additional labor from the reserve brigade. Personnel for the naval beachmaster party was provided by RAN Commandos and U. S. Navy Seabees. Control of LCM's organic to Company A, 593d EBSR, was vested in the LCCO during the early phase of the landing. Upon withdrawal of Amphibious Group 8, control passed to the shore party.

This landing offered many worth while object lessons to engineer boat and shore regiments. Through the initial assault phase it was one of the most perfectly executed of any Allied amphibious operations heretofore launched. Component missions were carried out with precision, and responsibilities were equally balanced. Neutralization of the beach area by prelanding bombardment was 100-percent effective. All beach obstacles were removed by RAN Commandos through thorough and effective demolition work prior to the assault. The assault wave landing plan was perfectly executed and close control of LCM operations was maintained. A senior naval officer ashore was designated as beachmaster, and responsibility for marking the beach, directing boat traffic, and other functions often delegated to EBSR shore battalions was assumed by the naval shore party. The organization and control established for the assault phase were conducive to an outstanding performance, and initial results substantiated their effectiveness.

Unloading. Complications, unfortunately, developed in beach management. While not seriously jeopardizing the success of the operation, they nevertheless resulted in a materially reduced flow of supplies from ship to shore. As previously indicated, the Task Force had provided its own shore party, and subsequent activities soon confirmed the importance of an experienced ESB shore party with the know-how and equipment to insure efficient beach management and cargo handling. Practical functioning of the shore party and shipping control organizations, as constituted from Task Force elements, fell far short of expectations for unloading. The number of landing craft for lighterage was ample. The beach was better than average, and dumps were accessible. Labor was plentiful, and a fair amount of beach equipment and cargo vehicles was available. Still, tonnage moved across the beach in the first 3 days was extremely low. Faults observed in all previous landings recurred in this operation although means were at hand to solve such deficiencies.

Landing priorities did not place sufficient bulldozers, cranes, and trucks ashore at a sufficiently early hour to cope with a large volume of supplies. Many LCM's and LCT's, bulk loaded on D Day, were still offshore and undischarged by D plus 2. Labor was not equably divided among various tasks. In general, a surplus of labor remained afloat for transshipment of cargo, while a decided shortage of labor prevailed on the beach and the dump. Besides, transmission of shore party requirements through the naval beachmaster to the LCCO afloat was a somewhat involved procedure and occasioned many delays.

Maximum use was not made of available lighterage. The LST's, unable to land until naval can docks were assembled into a marginal wharf by H plus 48, remained 4 miles offshore rather than beaching close in where they could have been unloaded effectively by DUKW's and LVT-R's. The LSM's on the other hand were able to unload when one finger pier had been positioned by H plus 7. These were shunted into position by LCM's and unloaded of mobile cargo at a rate of two ships per hour. Upon completion of LSM unloading on the morning of D plus 1, however, no attempt was made to transfer mobile loads of LST's at sea to the more maneuverable LSM's which could have been unloaded at the finger pier. A negligible quantity of cargo was subsequently moved ashore by DUKW's because of the extremely long haul from the LST anchorage. A great many LVT-R's remained idle in the beach area after the initial assault landing, and no attempt was made to use them for close-in transshipment of cargo. Eight LCM's were tied up all night with loaded can barges in tow because of instructions not to beach. On D plus 3 these barges were broached on shore, loaded with their original cargo. Beach equipment and men were still aboard the offshore LST's and not available ashore to handle the tonnage.

Net unloading figures reflected the toll of improperly coordinated cargo handling activities and failure to take full advantage of landing craft capabilities. Only 200 tons of supplies and one-half of the Task Force's vehicles moved across the beach during the first 48 hours in contrast to a reasonable expectation of 10,000 tons of supplies and all mobile loads. Such shortcomings in procedures and results could be attributed only to a lack of practical training and to unfamiliarity with the capabilities of landing craft on the part of the shore party.

Landing Craft Activities. The landing craft at Balikpapan encountered problems other than inadequate use of their full capabilities. Towing service on can docks and barges in the prevailing choppy seas proved extremely hard on LCM's. So did improvement of the initial wharf into a U-shaped structure of two double finger piers, four causeways long, which were joined at sea by two more causeways to form a T-head. The surf was so heavy that at the time the first LST was brought against the wharf, the T-head was rising and falling approximately 3 feet. The LCM's assigned to this work were all considerably damaged and a number of them were holed. Fortunately damage was confined above the water line. Much damage to hulls, however, could have been prevented if each causeway section had been provided with suitable fenders. Tire bumpers carried on LCM's worked well against flat surfaces such as ship sides, but it was considered that fenders or bumpers covering sharp contact points on the causeway sections themselves would have eliminated many subsequent welding repair jobs.

Meanwhile it was evident after reconnaissance that not until the harbor area of Balikpapan was secured would heavy boat maintenance work in any quantity be feasible. Not only was the beach area unsuitable for such maintenance work, but the M–20 crane and dozer were still not unloaded from the LST by the morning of D plus 2. By this time approximately half of Company A's 45 LCM's needed maintenance work. Minor repairs were performed by the company maintenance boat at sea, but much welding had to wait until the harbor area was secured. Only then was the majority of boats put in running order.

The issue of allocating a suitable area to boat companies was a vital one. Assigning areas in advance did not prove practical in most cases, as suitability for beach maintenance could, in the last analysis, be determined only by personal reconnaissance. A boat company primarily located its area with boat maintenance in mind. Often an area assigned in the planning stages was found to be unsuitable after reconnaissance, while an area which was suitable was found to be assigned to another unit. To insure 100-percent efficient boat performance, a provision in the field order establishing priority to boat elements for a suitable area was suggested by the ESB unit at Balikpapan. It was pointed out that: [38]

> Boat Maintenance based ashore with good working conditions must be set up immediately in order to provide the task force with the maximum number of operable boats at all times.

At the time, however, Company A, 593d EBSR, at Balikpapan accomplished its mission by playing ball, as it were, with a team which did not avail itself of the boat company's best support.

[38] Hq, 593d EBSR, 10 Jul 45, Participation of 593d EBSR in the OBOE–2 Operation, F Day to F plus 2. In OCE, GHQ, AFPAC.

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CHAPTER VII

Okinawa–Japan–Korea

March 1945–December 1945

Okinawa

17 March – 30 June 1945

During March 1945 forces of the Southwest Pacific Area (SWPA) were still fighting in the Philippines. While the bitterly contested mountain ranges of northern Luzon were being overrun, Manila was being rehabilitated and the islands of Panay, Cebu, and Negros were being liberated in quick order. Meanwhile air and naval bases established through the various Philippine Islands operations were being used to further the battle against the Japanese. Enemy shipping lanes in the South China Sea were effectively blocked, and Philippine-based aircraft were establishing control over Formosa and the China coast. Naval carrier aircraft, as well as land-based superbombers, were delivering aerial strikes at the very heart of Japan. And forces of the Pacific Ocean Areas (POA) were beginning to shake the very bastions of the Japanese Empire by operations in the Ryukyu island chain lying just south of the principal islands of the Japanese homeland.[1]

Under the over-all command of the U. S. Fifth Fleet, preparations had been initiated for seizure of Okinawa, the key island of the Ryukyus. Ground troops assigned for the assault were made up of the U. S. Tenth Army consisting of XXIV Corps (7th and 96th Divisions), III Amphibious Corps (1st and 6th Marine Divisions), and the 27th and 77th Divisions, as well as the 2d Marine Division for use in special operations and as reserves. Also assigned to Tenth Army for defense and development of objective areas were the Tac-

[1] *Editor's note:* Although this operation during the period of organized resistance was executed under POA command, it is recapitulated in the interest of continuity, since subsequent operations on Okinawa became a combined Theater responsibility. On 6 Apr 45 a reorganization of major US Army commands in the Pacific was made. All US Army forces in SWPA and POA were combined as Army Forces, Pacific (AFPAC), under the command of General MacArthur. US Army Forces, Pacific Ocean Areas (USAFPOA), on Okinawa, however, remained under the operational control of CINCPOA, until released to AFPAC. This transfer of troops from POA to AFPAC control on Okinawa was effected on 31 Jul 45.

tical Air Force and the Island Command which consisted of the Army garrison force and U. S. Army, Navy, and Marine Corps task units. Naval support for the operation was the greatest and most far reaching yet assigned in Pacific warfare. Task forces of the Fifth Fleet engaged in aerial search and reconnaissances, submarine warfare, and neutralization of enemy air strength. Preceding the invasion, fast carriers executed forays against Kyushu, the China coast, Okinawa, and adjacent islands. Over 1,200 ships of all types were assigned for assault shipping alone. Other naval task forces were designated to support all landings and provide continuous naval and air support to the troops ashore.

Enemy installations and defenses on the Ryukyus were softened up by naval air and surface strikes, and the offensive was launched on 26 March when the 77th Division landed on the small Kerama Islands. At the same time an intensified bombardment of Okinawa was initiated and continued for the week preceding landings on that island. Aircraft concentrated on targets that could not be reached by naval gunfire and made strafing, bombing, and rocket runs on the beaches. Aided by the 2d Marine Division's realistic feint toward the thickly populated southern tip of the island, Tenth Army troops landed two Corps, each with two divisions abreast, along an 8-mile stretch of Okinawa's west coast on 1 April. XXIV Corps landed to the south of the town of Hagushi while III Amphibious Corps assaulted Hagushi itself and the beaches to the north. The south-central portion of Okinawa was quickly severed from the remainder of the island by a rapid advance of the 7th Division across the island to the east coast. Meanwhile, III Amphibious Corps destroyed all organized enemy resistance in northern Okinawa while XXIV Corps bore down upon the heavier concentrations of enemy forces in southern Okinawa, and subsidiary operations continued against outlying islands.

On 16 April the 77th Division, supported by aerial bombardment, naval gunfire, and artillery previously emplaced on Minna-shima, landed on Ie-shima with two regimental combat teams abreast. Intense fighting continued both day and night until 21 April when that island was announced secured. In subsequent operations outlying islands, considered suitable for emplacement of long-range radar and fighter facilities, were cleared of enemy resistance.

By 21 April III Amphibious Corps had overrun northern Okinawa. During the latter part of April major elements of the Corps moved southward to join XXIV Corps in the fight against the main Japanese forces which were resisting with fanatical tenacity from elaborate fortifications just north of the town of Shuri. Although battered by a continuous hail of machine-gun fire, shells, rockets, and bombs, hunted and routed from one elaborate network of coral caves to another, and all but destitute of the supplies and tools of war, the enemy showed no signs of weakening until the middle of June. Intensive opposition continued without consideration of losses while muddy terrain occasioned by heavy rains hampered all Tenth Army movements and complicated supply problems. Previous experience in the marshes of Leyte now proved a considerable factor in the pace maintained by XXIV Corps. The Japanese fell back but fought until completely disorganized. Front lines had almost disappeared but desperate resistance persisted. Mass surrender did not begin until Tenth Army had crowded the enemy almost to the water's edge on the southwestern tip of the island. Then on 22 June the once potent Japanese *32d Army* was liquidated. Only mopping up of disorganized remnants continued, and on 2 July the Ryukyus campaign was declared ended.

Amphibian Engineer Operations

Elements of the 1st Engineer Special Brigade (ESB), only recently redeployed to the Southwest Pacific from the European Theater of Operations, were assigned to the Okinawa operation. Unlike the 2d, 3d, and 4th Engineer Special Brigades which had been operating in the Southwest Pacific with both boat and shore elements, the 1st ESB was to operate solely as a shore engineer unit and 1st ESB officers were to provide a shore command for the Okinawa operation. This shore command was subsequently responsible for the delivery of personnel, vehicles, and supplies across the beaches in sufficient quantities to meet Tenth Army requirements. All shore installations necessary for debarkation, supply, evacuation, and their security on Okinawa were under the control of the brigade.

Organization and Coordination. The nucleus of a command staff for shore party operations was selected from Headquarters and Headquarters Company, 1st ESB. These officers arrived at Headquarters, Tenth Army, on Oahu, T. H., only in time to enter the last stages of planning shore party support, which until then was being developed by the Engineer, Tenth Army. This planning, which was subsequently adhered to in its entirety, called for assignment of a division shore party to support the landing of each assault division, both U. S. Army and U. S. Marine. In the initial phases these shore parties were to be responsible directly to the respective division commanders, and consisted, in general, of an engineer combat group with attached DUKW companies, port companies, amphibious tractor battalions, and dump operating units for each Army division, and a pioneer battalion with similar attachments for each Marine division. When the two Corps headquarters were established ashore, Corps shore parties were to be established and relieve divisions of beach supply responsibilities. At a later date, corresponding to practical completion of unloading of the assault convoy, all beach supply activities were to become a responsibility of the commanding general, Island Command, as the direct representative of the commanding general, Tenth Army. At this time the 1st ESB, as an element of the Island Command, was to assume command of all troops, Army and Marine, engaged in beachhead supply activities.

Inasmuch as the units composing the shore installations had not previously been under brigade command, many details of operating procedure had to be worked out after assumption of control by the brigade in the midst of the operation. Elements of III Amphibious Corps had been considered excellent amphibious troops as they had engaged in several amphibious operations in the South Pacific prior to Okinawa. In rehearsals for the Okinawa operations conducted by III Amphibious Corps, therefore, shore party participation consisted merely of erecting beach markers and setting up communications. XXIV Corps shore parties had also been considered experienced because of participation in previous amphibious operations and did not engage in any intensified training program or rehearsals prior to the operation. The 1118th, 1122d, and 1140th Engineer Combat Groups, performing shore party duties for the 77th, 96th, and 7th Divisions respectively, had just completed the Leyte operation and were mounted from the Leyte area with a large majority of their attached units. Although these groups took part in no special advance training program, while at Leyte they were afforded the opportunity for intimate planning of the operation with the XXIV Corps staff, and certain elements of these shore parties unloaded ships containing XXIV Corps replacement equipment and supplies just prior to staging for Okinawa. This task enabled the participating units to review and modify unloading methods, but did not provide the advantages of a rehearsal.

Few of the other units of those scheduled for the first garrison echelon and subsequent echelons of shipping had either extensive training or experience in beach service area operations. 1st ESB headquarters personnel were able to contact only a few of the units concerned to acquaint them with the brigade's organization and operating procedures. As a result, when the brigade was committed in the midst of the operation, it was necessary to instruct almost all units in brigade operating procedures at that time or as subsequent units arrived.

It was evident that if immediate coordinated shore effort is to be realized upon landing, a large number of units should be designated for assignment to a brigade in advance of an operation. A brigade commander, who assumes command in the midst of an operation and becomes responsible for a large force composed of many widely divergent units, each with independent training, experiences, planning, and equipment, has forced upon him the same organizational and operational problems that would face a division commander if given command of a large number of separate and varying units of unknown capabilities which were already committed to action. In each case the commander is faced with the necessity of establishing a composite organization under a single command, while attempting to insure successful accomplishment of the assigned mission. Unless the troops, comprising the assault and early echelons of the shore party, are organized into an organic brigade well in advance of an operation, the opportunity for unified training and the procurement of necessary special equipment is lost, and the brigade may be forced to muddle through the operation. If, on the other hand, this opportunity for unified training can be afforded, it should result in coordinated shore party operations. Such coordinated action through previously established procedures could more capably support ground force operations by delivery of supplies when needed and facilitate naval transport operations by prompt unloading and release of ships from the hazards of the combat area.

Shipping Allocation. Inasmuch as shore units were lifted in shipping space provided by the divisions, no appreciable changes in the quantities or types of equipment taken to the objective area in the assault convoy could be made at the time. Many cranes and some tractors, which were needed for development of the beaches after the assault, had to be left behind. The shortage of engineer shore party equipment that resulted made it impossible to lay out an orderly work program and complete any one job. Instead, it was possible to keep only 1 or 2 days ahead of essential operational requirements. This resulted in a wide dispersion of equipment in a frenzied effort to keep all dumps and roads passable.

Once again it was obvious that an adequate allocation of shipping space in the assault convoy should be accorded shore parties by the task force commander in order to relieve the merging of shore party personnel and equipment in space assigned to tactical units.

Shore Party Activities. A fringing reef, paralleling the entire length of the beach, prevented the landing of small naval craft. Personnel and cargo which were unloaded into these craft, therefore, had to be transferred to LVT's and DUKW's at points near its edge. The delay involved in this shift was further prolonged by a lack of coordination in unloading Navy can barges and mounting small cranes on them to establish the necessary cargo transfer line. Moreover, the DUKW's had difficulty in negotiating the edge of the reef until ramps were prepared by combined blasting and bulldozer operations.

As men and supplies surged across the beaches, unloading activities expanded. The rapid advance of the troops and unforeseen changes in the tactical situation required an increased tempo of debarkation. And as the shore parties struggled to meet the heaviest demands, a shortage of labor and motor trucks developed in the sector of III Amphibious Corps, which exceeded even the combined effect of enemy action and bad weather. The Marines had brought in a labor pool of some 5,000 combat replacements to be used, until required by the divisions, as a supplement to an inadequate basic shore party organization. As casualties mounted during periods of more intensive fighting, and as demands on the shore parties increased, these replacements were withdrawn. When unloading requirements were at their peak, manpower available to meet them was at its lowest ebb. The resulting decrease in unloading rates evidenced that employment of replacement personnel for shore parties, while helpful in the earliest stages, was not a complete solution, particularly where heavy casualties might be expected.

Similarly, the motor transport battalion was under III Amphibious Corps. Despite shore party needs, vehicles belonging to the respective tactical units were withdrawn from unloading operations very early to make long hauls to the front lines. This left the shore parties with insufficient vehicles for movement of cargo from the beaches while labor shortages in dumps increased turnaround time of the remaining trucks available for beach clearance. Meanwhile, the available ammunition depot space on North Beach was exhausted, and it became necessary to transport all ammunition, in addition to Army Class II and IV supplies, from North Beach to South Beach dumps. Continued, heavy rains commenced during the last week in April, and the resultant deterioration of beach and dump roads necessitated the diversion of 70 shore party dump trucks on South Beach from hauling cargo to road maintenance. During the first 10 days in May, because of this truck shortage, it was not uncommon for lighters to lay off the beachhead for 3 and 4 days before being beached for unloading.

To relieve the critical labor shortage, civilian labor facilities were established. Through the cooperation of G-4, Island Command, and Military Government, allocations of such labor were furnished installations and units of the 1st ESB according to their requests and needs. These civilians were drawn from various camps under Military Government control and grew to a daily figure of more than 800. As their employment increased, the critical labor shortage was proportionately decreased.

Meanwhile, to increase the availability of DUKW's for unloading, some means had to be provided to decrease the turnaround time on DUKW trips. The establishment of transfer points behind certain beaches for the transfer of cargo from DUKW's to trucks could have approximately doubled the daily discharge rate of a DUKW company. But efficient operation of such transfer points would have required a minimum of three trucks for each two DUKW's. And, sufficient trucks were not available to permit the establishment and operation of these points, with the exception of one provided for the transfer of ammunition, until approximately D plus 45. Until that date it was necessary for DUKW's to make deliveries direct to dumps. This required overland round trips varying from 1 to 25 miles (latter figure involved only North Beach deliveries of ammunition to South Beach ammunition supply points) which decreased the availability of DUKW's and increased maintenance problems.

Obviously, utilization of civilian assistance to improve the labor shortage, and establishment of transfer points to speed up the operations of DUKW's, while effective, were, however, still dependent upon the availability of trucks. But even the subsequent diversion of engineer shore party dump trucks from important road work to assist in hauling cargo could relieve only to a minor extent the existing shortage of trucks. Such diversion meanwhile interfered with the preparation of ammunition depot roads which were highly essential inasmuch as ammunition ships had to be given priority of discharge to meet tactical shortages and to minimize hazards within the anchorage. If only in the interest of keeping roads and dumps clear for uninterrupted movement of unloaded cargo, sufficient truck companies should have been provided at the outset to eliminate the necessity for such diversion. To guard against similar truck shortages in the future, subsequent 1st ESB reports, therefore, stressed again the importance of carefully considering the size and nature of land masses involved and road nets existing in an objective area when determining truck requirements for an operation.

Another limiting factor to unloading at maximum speed was the necessity for selective discharge. Such discharge of certain calibers of artillery ammunition was occasioned by several critical tactical situations and contributed to a decrease in discharge rates. On several other occasions selective discharge of Class I and III supplies was necessitated by the supply situation although ships stocked with general cargo did not carry sufficient amounts of any one type of supplies to materially affect shortages ashore. Nevertheless, it was sometimes necessary to unload a complete ship in order to locate a small amount of supplies urgently needed ashore. This situation was not new. Selective discharge has been pointed out in previous chapters as being highly undesirable not only because of the handicap it worked on unloading operations, but because it delayed turnaround of resupply shipping and involved needless exposure of shipping to the danger of air attacks. A need for balanced, combat loaded ships in the early tactical phases was particularly acute on Okinawa.

Commodity loaded, Class I and Class III ships, when they arrived, were invaluable in relieving critical shortages ashore and provided a considerable saving in shipping. When available, four balanced-load maintenance ships were discharged simultaneously. It was pointed out by the 1st ESB that the shortages of Class I and III supplies ashore on Okinawa during the period D plus 10 to D plus 60, despite the total tonnages landed, might be eliminated in future operations by having available in the staging area two or more commodity loaded ships, one each of rations and of motor gasoline.

Ships' Manifests. According to task force directions, all troop ships were to debark personnel immediately upon arrival off the beachhead. However, since identity of units arriving was seldom known in advance, it was difficult to plan intelligently for their reception. In general, based on whether ships were known to have loaded at an Army, Navy, or Marine staging area, troop ships were berthed to discharge Army and Navy personnel over Orange Beach and Marine personnel over Yellow Beach No. 3. Many inaccuracies occurred in berthing ships on this basis and occasioned considerable cross traffic of newly arrived units. Advance information on the composition of each personnel convoy would have eliminated much confusion, especially if such information had provided the shore party with a list of the number of personnel, vehicles, and weight or measured tons of equipment by unit aboard each ship.

Similarly, documentation of incoming freight was inadequate. Manifests were seldom received in advance or in sufficient quantity. Frequently manifests showed only cargo loaded at the first port of loading, although the ships may have been loaded at several ports. Only one copy of many manifests was available when at least three were required: one each for stevedores, records, and dump operations sections.

Dumps and Depots. Depot operating personnel, installed in temporary dumps established in the area of the southern beaches by the assault divisions, passed to the control of the 1st Engineer Special Brigade on 9 April. Planned consolidation, expansion, and development of Army depots proceeded immediately. Marine Corps dumps on the northern beaches subsequently came under the supervision of brigade headquarters after the 7th Field Depot (Marine) assumed responsibility for their operation. But Class II and IV dumps were not released to this depot by Marine divisions until D plus 19. By this time these dumps had been entirely depleted by issue to the divisions, and the transfer amounted to responsibility for reception of incoming supplies only. However, the 7th Field Depot was basically organized to supply Marine units and very little Army technical supplies were received by this organization. Class I and III supplies were eventually received from the northern beaches through the depot irrespective of designation as Army or Marine Corps supply after redeployment of the 1st and 6th Marine Divisions to the southern sector.

Technical supervision and control of issues were exercised by the staff, Headquarters, Island Command, for the operation of Army dumps, and by III Amphibious Corps for Marine dumps operating under the 7th Field Depot. Reports, equipment, and personnel of the latter, as previously indicated, were supervised by the 1st ESB.

All troops operating Army dumps came under the direct command of the 1st ESB which was also responsible for the operation of Army dumps, for provision of proper storage, for inventory and issue of supplies, and for accomplishment of Island Command missions as announced by supply and operational directives. This latter division of responsibilities—technical control by the staff, Headquarters, Island Command, but direct command by the 1st ESB—allowed the brigade the flexibility of action in the use of troops and equipment necessary to efficient operation of the beaches and dumps during the early phases of the operation.

This phase of operations on Okinawa manifested that the shore party commander should exercise complete command of all units engaged in dump operations and related projects until the dumps and depots pass to the control of their respective services. While it is desirable that the control of issues and technical operations of depots be directed by appropriate service sections of higher [illegible]uarters, any other function that the depot [illegible]g units are called on to perform whic[illegible]es the use of labor and equipment is refl[illegible] [illegible]ate of discharge and should be rig[illegible] [illegible]y the shore party commander throug[illegible] c[illegible]nd channels. This definitely fixes responsibility from the beginning.

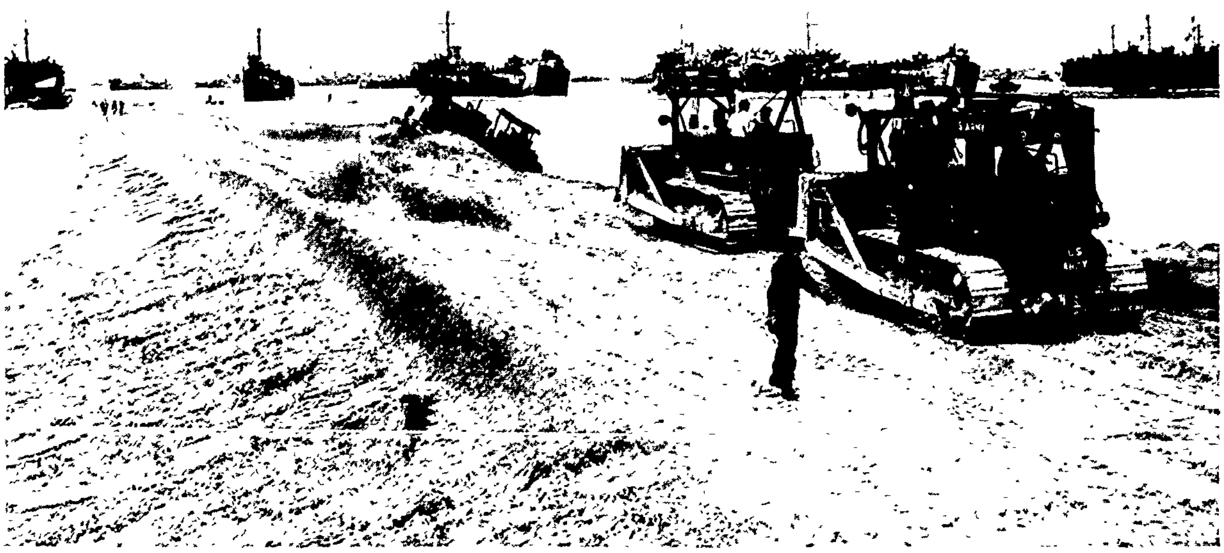
However, dumps and depots should pass to respective service control only when the dump or depot is stable in personnel and equipment. This condition is later than may be supposed because of the surges of supplies which are discharged according to priorities and the arrivals of certain ships in convoys. Until a dump or depot can meet these surges without adversely affecting discharge rates, it should remain under the command of the shore party commander, who can quickly shift personnel and equipment from one dump or depot to another as required. This cannot be accomplished after each depot commences to operate under its respective chief of service. To provide enough personnel and equipment to operate all dumps at expected peak load simultaneously would be wasteful of men and equipment at a time when the waste can be ill afforded. The high order of efficiency in dump and depot operations during the early days of the Okinawa operation was attributed to maintaining centralized control of these installations more than to any other factor. In the critical days of D plus 15 to D plus 45, when demands for supplies were so heavy and personnel and equipment so short, shifts occurred almost hourly somewhere in the area. If this flexibility and rapid action had been prevented by a different command relationship, the 1st ESB might have failed in its mission and deprived tactical commanders of freedom of action through lack of necessary supplies.

Because of the limitation of Marine Corps organization to division or corps level, a recommendation was submitted by the 1st ESB for future operations of army scope involving both U. S. Marine and U. S. Army elements. It was suggested that Marine Corps elements be released to their parent organizations as early as practical for other than service area missions and that Army units be furnished to replace them. Under such circumstances, only small detachments of Marines for supervision of handling technical items of Marine maintenance supply would be required in the beach service area dumps. Army units, meanwhile, because of greater elasticity of organization, could more readily build up and sustain an adequate discharge rate of maintenance tonnage across beaches to meet demands of army scope for 60 days or longer.

Task Force Engineer Operations

Planning. In planning for the Okinawa operation, the Engineer Section, Tenth Army, had one considerable advantage over SWPA engineers engaged in similar preparations. Time. Tenth Army engineers began to function as a planning agency on or about 3 September 1944, approximately the same time that SWPA engineers were planning the Luzon operation which can be used as a parallel example of SWPA engineer planning. Landings on Okinawa were

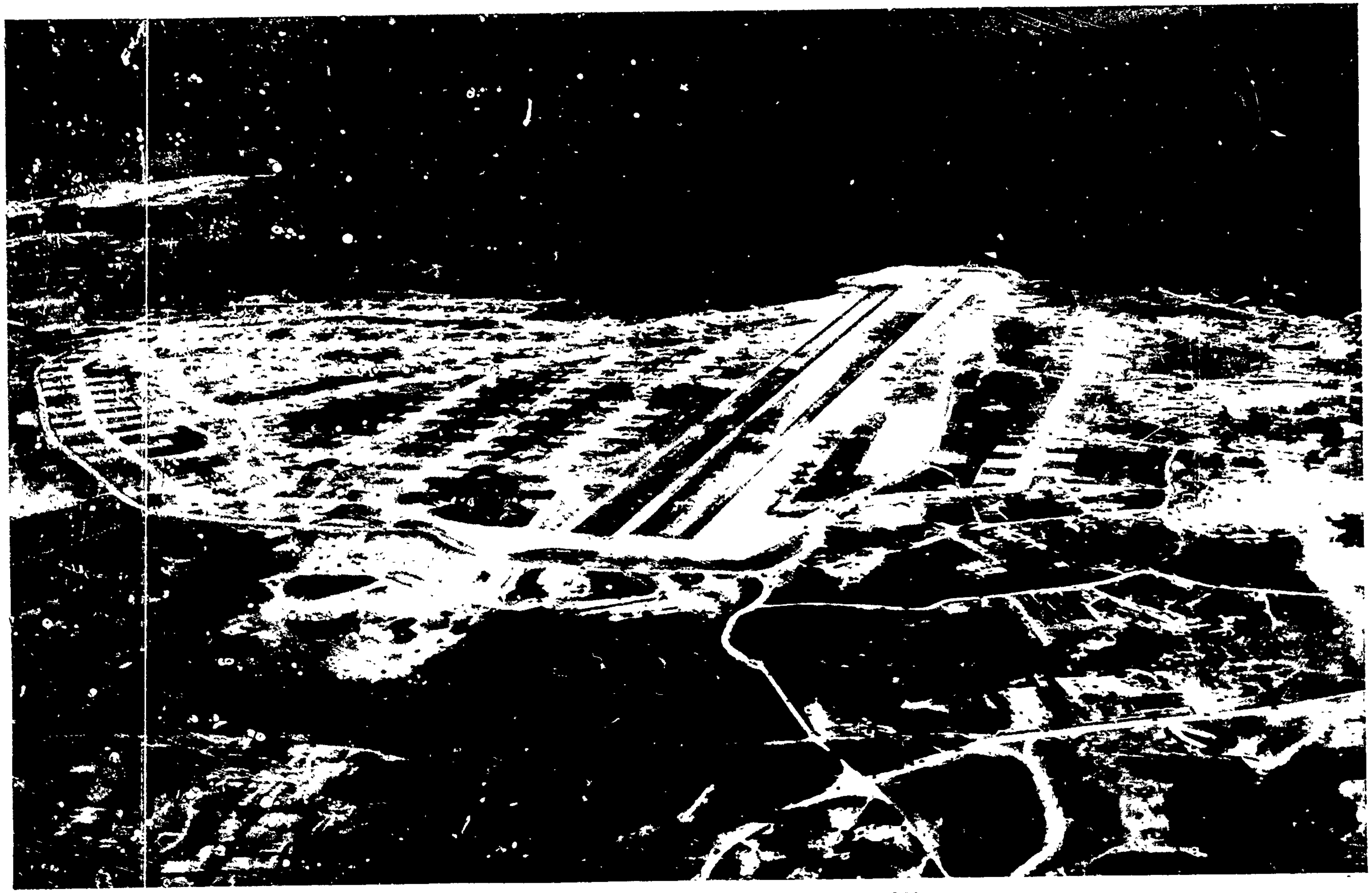
Aerial view of landings on Okinawa showing the large amount of shipping waiting to be unloaded.



Engineer bulldozers extend a sand causeway from Okinawa beachhead to expedite unloading of LST's.

Engineers of Tenth Army build a heavy ponton bridge under fire on Okinawa.

Engineers place chess on a ponton bridge built in Okinawa prior to the assault against Machinto.



Yontan Airdrome: One of the Engineer projects on Okinawa.

View of a large open storage area at Okinawa.

not made until 1 April 1945—7 months from the start of initial planning. The scheduled date for the Luzon assault, on the other hand, because of swiftly changing tactical concepts which affected practically all engineer planning in the Southwest Pacific, was advanced from 20 February to 9 January, and permitted only 4 months' preparation instead of an anticipated six—and even this was more than normally available.

While favored with time, Tenth Army engineers, nevertheless, still shared many of the disadvantages which hindered SWPA engineer planning. Their original planning was based on the occupation of Formosa to be followed by operations against the Ryukyus and Bonins or against the China coast. Shortages of supporting and service troops in the Pacific Ocean Areas and the planned invasion of Luzon, however, resulted in a development intimately familiar to engineers in SWPA—a change of plans. When the decision was announced by Admiral Chester W. Nimitz on 5 October 1944 to seize Iwo-jima and establish positions on the Ryukyus after the invasion of Luzon, instead of the expected assault of Formosa, Tenth Army engineers had to file their original plans and concentrate on full-scale planning for the Ryukyus operation. The original planning, however, could not be considered entirely as time lost. Much experience had been gained by the staff in planning procedures, and many of the earlier approaches had their counterpart in the planning of the new operation.

Requirements for combat, construction, and service engineer units were carefully considered and requests for engineer troops were based upon such estimated needs. Here again, problems parallel to those in the Southwest Pacific occurred. Because of nonavailability of certain type units and the limitations of shipping, compromises had to be made both as to the number of certain type units and the dates of arrival in the objective area of others. It was obvious that these adjustments as reflected in the final plan would adversely affect the engineer support afforded the operation—and they did.

Availability of Engineers. There was a considerable shortage of engineer troop strength on Okinawa even before base development plans were expanded. And as evidenced during the planning phase, limitations of shipping and unloading imposed a further tax on the inadequate strength of engineer units assigned. For example, the engineer combat group headquarters requested as a staff for the XXIV Corps shore party commander could only be scheduled for arrival in the sixth echelon of garrison shipping. This was much too late for the mission intended inasmuch as garrison troops and combat replacements arrived at Okinawa in convoys scheduled once each week, and these took from 5 to 9 days to discharge. Only one engineer combat group was available of the two requested to function as Corps and Army engineer units, and that one arrived after the completion of the assault phases in the tenth echelon of garrison shipping. Original estimates indicated a need for three engineer construction groups of three battalions each and an additional group headquarters to provide the construction force of the Engineer Section, Island Command. Only one engineer construction group of four battalions and one additional group headquarters proved available. This group headquarters, augmented by 15 officers and 43 enlisted men functioned as the Engineer Section, Island Command, until the greatly expanded base development program required the approximate doubling of this staff. The construction group, in the initial absence of Corps engineer combat troops, was necessarily employed initially as a corps combat group. This situation was subsequently remedied somewhat by enlarging the zone of responsibility of the Island Command to include routes of communication originally maintained by Corps troops. Only two topographic companies (corps) could be assigned for services originally estimated to require an engineer topographic battalion (army) plus a photo-mapping platoon. Of these, one arrived in the fifth and the other in the eleventh echelon of garrison shipping. Dates of arrival of these units placed an excessive burden on the provisional topographic detachment (3 officers and 60 men) of XXIV Corps, and caused serious delay in the production of essential operations maps. The petroleum distribution company requested in the assault, or first echelon, shipping was not available until the fourth echelon. Engineer troops urgently needed elsewhere had to be diverted to provide storage for petroleum products. None of the seven engineer light equipment companies requested was available. While additional engineer equipment was provided, this did not compensate for the lack of operators. The provision of one light equipment company to each engineer combat group would have greatly facilitated and increased the rate of operation of these groups.

There was in this operation a serious shortage of corps engineer combat troops, a total absence of army engineer combat troops, and a mere token force of engineer service units. The Island Command had to divert construction troops for support of combat units and scheduled base construction was proportionately delayed. The consequence of this lack of engineer troops might readily have been disastrous had the campaign been handicapped by more than 2 weeks of bad weather.

According to the Engineer, Tenth Army, an effective engineer organization for each Corps would have been an engineer headquarters with one engineer topographic company attached and two engineer combat groups of three combat battalions each. Each group, in turn, should have been assigned one light equipment company, one Bailey bridge company, and one dump truck company. In addition, one engineer maintenance company should have served both groups through attachment of the company less one platoon to one group and the maintenance platoon to the other.

While the Army engineer force is dependent to a great degree upon the type of operation and area involved, it should obviously be a well-balanced one of suitable strength to perform the missions assigned. The desirable minimum in the opinion of the Engineer, Tenth Army, was three combat groups and three construction groups to provide Army support to the Corps, besides the necessary special and service units. In addition, a topographic battalion (army) with a photomapping platoon was suggested for attachment to the Engineer Section, Army.

Meanwhile, strategic plans on the Theater level for future operations occasioned increased requirements for engineer effort on Okinawa. The Commander in Chief, AFPAC, considered it desirable to concentrate the maximum Allied air power on Okinawa which could be supported there prior to the planned invasion of Japan. As a result, immediately following the initial landings on Okinawa, the Chief Engineer, GHQ, AFPAC, made a personal reconnaissance of the island, and, after thoroughly inspecting numerous sites for adaptability to airdrome construction, determined that air facilities and base development planned could be expanded considerably. This information enabled the Commanders in Chief, AFPAC, and POA, to consummate arrangements in May 1945, for increasing development of Okinawa into a major base to support virtually the entire Far East Air Forces, consisting of the Fifth, Seventh, and Thirteenth Air Forces. Only complete coordination of activities and cooperation between the two theaters of operations could now meet the augmented airdrome construction requirements. Air garrison, combat, service, and engineer forces had to be provided from AFPAC to assist in the program, and AFPAC engineers immediately began diverting engineer effort from Philippine air facilities projects to speed construction in the Ryukyus. Eight engineer aviation battalions plus certain auxiliary units were quickly moved to Okinawa, and by July 1945, 108 engineer units of all kinds were employed on the expanded construction program.

Mapping. Of the several maps supplied for use in the operation, the basic map chosen was one on a 1:25,000 scale compiled by Army Map Service and reproduced by an engineer topographic battalion stationed in the Hawaiian Islands. These maps were distributed via air from Oahu, T. H., to corps, divisions, and units up to and including those mounted in the fourth echelon of shipping. Maps for later echelons and reserve stocks were shipped forward with the map depot detachment assigned to XXIV Corps. This detachment landed during the assault phase and promptly joined the Engineer Section, Tenth Army. During the operation the 1:25,000 map, which covered areas in the southern part of Okinawa where tactical operations proved heaviest, had to be revised. In effecting these revisions, advantage was taken of a captured Japanese topographic map and of multiplex studies of aerial photographic coverage of February 1945. However, topography was lacking on many areas and a shortage of reproduction facilities proved a distinct handicap. The early echelonment of a topographic unit reinforced by photomapping facilities to the Engineer Section, Tenth Army, would have proved invaluable.

As the operation progressed, the need for many minor improvements in mapping became obvious. Bold marking to distinguish revised copies and new editions of maps issued earlier would have eliminated many possibilities of confusion. Pronounced indication of place names and subordinate indication of political subdivisions would have contributed to ease of reading. Since fast moving operations involved quick changes, enemy installations would better have been delineated only on maps issued initially. Legend tables overprinted on land areas sometimes proved troublesome. A need for greater care in packaging maps to insure waterproofing and for more rugged cases to prevent damage to maps was evident. Recommendations were subsequently submitted for packaging the assault echelon shipment of maps in cases of 1,500 sheets and those for later shipments in cases of 2,500. An increase in enlisted personnel of the engineer map depot from 11 to 20 was likewise suggested. The standard request of Southwest Pacific engineers for an increase in aerial photography to insure more complete and early coverage was reiterated by the engineers of the Pacific Ocean Areas.

Combat Operations. Engineer support was provided by both combat and construction engineer units to the tactical elements on Okinawa through a battle raging to unprecedented heights of fury and fanatical resistance. The Japanese launched their deadliest weapons in devastating profusion. Suicide boats crashed with ferocious abandon into Allied ships. Full-scale suicide tactics by enemy aircraft in force were unleashed against surface forces. There were bombings and torpedo attacks both by day and night, but it was soon apparent that the enemy had designated the *Kamikaze Corps* of suicide pilots to deliver the most telling blows with their "one-way" ramming tactics. The Baka plane, new and deadly, appeared. This small, short-range, rocket-accelerated aircraft carried more than a ton of explosive in its warhead. Slung beneath a medium bomber, it was transported to the attack and directed in a rocket-assisted dive to its target by a suicide pilot. By the middle of June, 33 U. S. ships had been sunk and 45 damaged, principally by aerial attacks. By the end of June, 39,000 U. S. casualties were suffered which included losses of over 10,000 marine and naval personnel. By the same date Japanese dead were estimated between 110,000 and 132,000 and prisoners between 7,400 and 7,900.

The ferocity of ground fighting matched the aerial assaults. Between 65,000 and 70,000 fighting Japanese were holed up in the south end of the island and had to be blasted out yard by yard from fortified defenses organized over a long period of time. Over 5,000 pieces of enemy artillery, including 105 caliber or better, were employed against the assaulting troops. Mortars, artillery rifles, some with a range of 27,000 yards, and rockets contested every move.

Through all phases of the conflict, Tenth Army engineer units maintained their support. Engineer shore parties unloaded vulnerable shipping under swarms of diving Baka planes. Di-

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vision engineers initiated rehabilitation of airfields required for immediate operations and constructed roads until relieved by engineer aviation battalions and construction groups. At the same time construction and aviation engineers were employed in support of combat troops and maintained communication routes during torrential rains which turned all roads into quagmires. Maximum use was made of the engineer potential available, and construction and combat engineers were used interchangeably to meet the immediate demands of the situation.

Probably the most outstanding feature of initial engineer operations on Okinawa was the extensive employment of division engineers in assault tactics for the reduction of Japanese fortifications. The enemy made superb use of cover and concealment in the construction of their caves, dugouts, and pillboxes. Neither heavy artillery nor bombing could do more than soften up such positions; their complete elimination required the employment of hand-placed explosive charges. Frequently, engineer squads of only 6 to 12 men undertook responsibility of front-line demolitions for infantry units as large as a battalion. Armed with their satchel charges, these engineers often operated ahead of the front lines in areas not yet secured by the infantry. Assistance by front-line troops was often limited because of high casualties already sustained by the infantry. It was not uncommon to find front-line companies reduced in strength to 1 officer and 20 men. Nor was direct fire support always possible in the rugged terrain where fortifications to be blown were constructed on the open face of a reverse slope.

The standard issue 24-pound satchel charge, prepared while waiting for forward elements to report the presence of enemy field fortifications, was considered the most satisfactory and was most widely employed. Pole charges had proved to be too unwieldly for work that had to be done "on the double" and where cover had to be sacrificed for speed. Likewise, shaped charges were too heavy, except in very special instances. On occasions, improvisation proved effective. Many caves were reduced by pumping gasoline into them with a 1,000-gallon water distributor and two to three hundred feet of hose. As much as 700 gallons were poured in each cave before the gasoline was set off by tracer bullets or phosphorous grenades. The resulting explosion not only burned out the cave, but completely sealed it. Complete destruction or sealing of fortifications had to be assured to prevent the Japanese from infiltrating and reoccupying them during the night.

In the course of a single day, engineer demolition teams operating with a front-line infantry battalion often expended 1 ton of explosives in destroying more than two score pillboxes, bunkers, ammunition dumps, and related installations. During a 3-week period 925 such defensive works were destroyed by the 77th Division's combat engineers with an average daily expenditure of 3,500 pounds of high explosives and a total casualty rate of 20 percent of the engineer battalion. Operating in rough terrain, among hills honeycombed with caves and tunnels, under intermittent small-arms, mortar, and artillery fire, these divisional engineers fought at the side of the infantry in reducing the Okinawan defenses.

Traffic control constituted a major problem during the campaign, particularly in the latter stages when all Tenth Army traffic was moving over the main supply road from Futema to Ginowan and Shuri. Effective control was finally established through a traffic control post, which was operated by the provost marshal, 77th Division, and intermediate control stations operated jointly by the division engineer and the provost marshal. Radio communication, within the 77th Division's engineer battalion net, was set up between all stations, and wire communication was provided between division headquarters and the main control post. All road traffic was carefully screened through the division G–3 to insure that only essential vehicles were allowed to pass. This system effectively disposed of amazing numbers of purely sightseeing vehicles. Traffic was held initially at the control post, and was permitted to move forward only upon call from an intermediate station. This procedure successfully prevented undue congestion, afforded a means of control in the event that the road had to be closed to make temporary repairs, and permitted the highest priority traffic, as determined by G–3, to move without any excess delay. Vehicles hauling road metal were dispatched in groups of five or six rather than individually, and were given road priority to prevent their delay in traffic jams and to assure the timely arrival of an appreciable amount of rock or gravel at any desired spot along the road. During the hours of darkness it was usually possible to close the road to all traffic and permit uninterrupted operation of engineer vehicles. The successful operation of such a traffic control system was, of course, entirely dependent upon adequate and competent military police.

Construction. At the close of this bitter campaign, the full realization of plans for development of major air and naval bases in the Ryukyus still lay in the future. This construction mission of the Engineer Section, Island Command (which was redesignated ASCOM 1 on 31 July 1945 when AFPAC assumed command of ground forces on Okinawa), was predicated on tactical support to future operations against the Japanese home islands. In view of the magnitude of the air facilities[2] required in comparison with the limited materials and troops available for construction, only temporary facilities were being provided for the ground and service forces on the island. Spartan simplicity was the keynote of all construction. But the concept was about to change and engineer plans were to be revised once more.

Air assault on Japan by Okinawa-based units of the Far East Air Forces began during July. Fighters and bombers of the Fifth and Seventh Air Forces concentrated on neutralizing enemy aircraft and air installations, destroying lines of communication on the island of Kyushu, and isolating that island from the remainder of the Japanese mainland. The constant pounding by the U. S. Strategic Air Force and the Far East Air Forces on industrial areas, shipping, and various other military objectives left little room for optimism in the Japanese mind. U. S. engineers had converted jungle areas and barren islands into commanding bases neutralizing Japanese far-flung and once powerful defenses. Japanese shipping had been largely sunk or driven from the seas and its remnants were virtually harbor bound. The U. S. Third Fleet augmented by British units was hammering Japan with its aircraft and guns and sailing boldly into Japanese coastal waters. The imminence of invasion was obvious. It was averted only by surrender.

On Okinawa, after Japanese capitulation, the commanding general, Tenth Army, retained combat responsibility for all areas in the Ryukyus under U. S. control, and prepared to assist the commanding generals of Sixth and Eighth Armies, XXIV Corps, and Far East Air Forces in staging and mounting elements of their respective commands for the occupation. Engineer work was intensified. Many additional facilities of a temporary nature were required to support the airborne movements northward. Troops had to be outloaded for the occupation. Provision had to be made for the needs of recovered Allied military personnel staging through Okinawa after release from imprisonment in Japan. Changes in the engineer mission involved a tremendous recession in supply. At the same time emergency support had to be provided for units of Sixth and Eighth Armies staging for occupation duties in Japan. This meant rapid depletion of island stocks and a loss of service troops. Inactivations and rotations further impaired available engineer strength. These losses were reflected in reduced tonnages discharged across the beaches. Construction effort was limited not only because of insufficient troop

[2] *Editor's note: See* Map No. 49, "Airfield Locations, Okinawa," Vol I, this series.

strength, but through the retarded reception, warehousing, and issuing of supplies. These chaotic conditions were aggravated by three closely spaced typhoons in September, followed by another of even more devastating proportions in October. Practically all temporary structures erected in the early phase were leveled and semipermanent installations recently completed or still under construction were heavily damaged. Faced with requirements for semipermanent hospitals, housing, and depot facilities to prepare for the winter months, the engineers were burdened with restoring the damaged structures. War's beginning or war's end, engineer effort required exceeded engineer strength available.

Occupation of Japan and Korea

30 August–31 December 1945

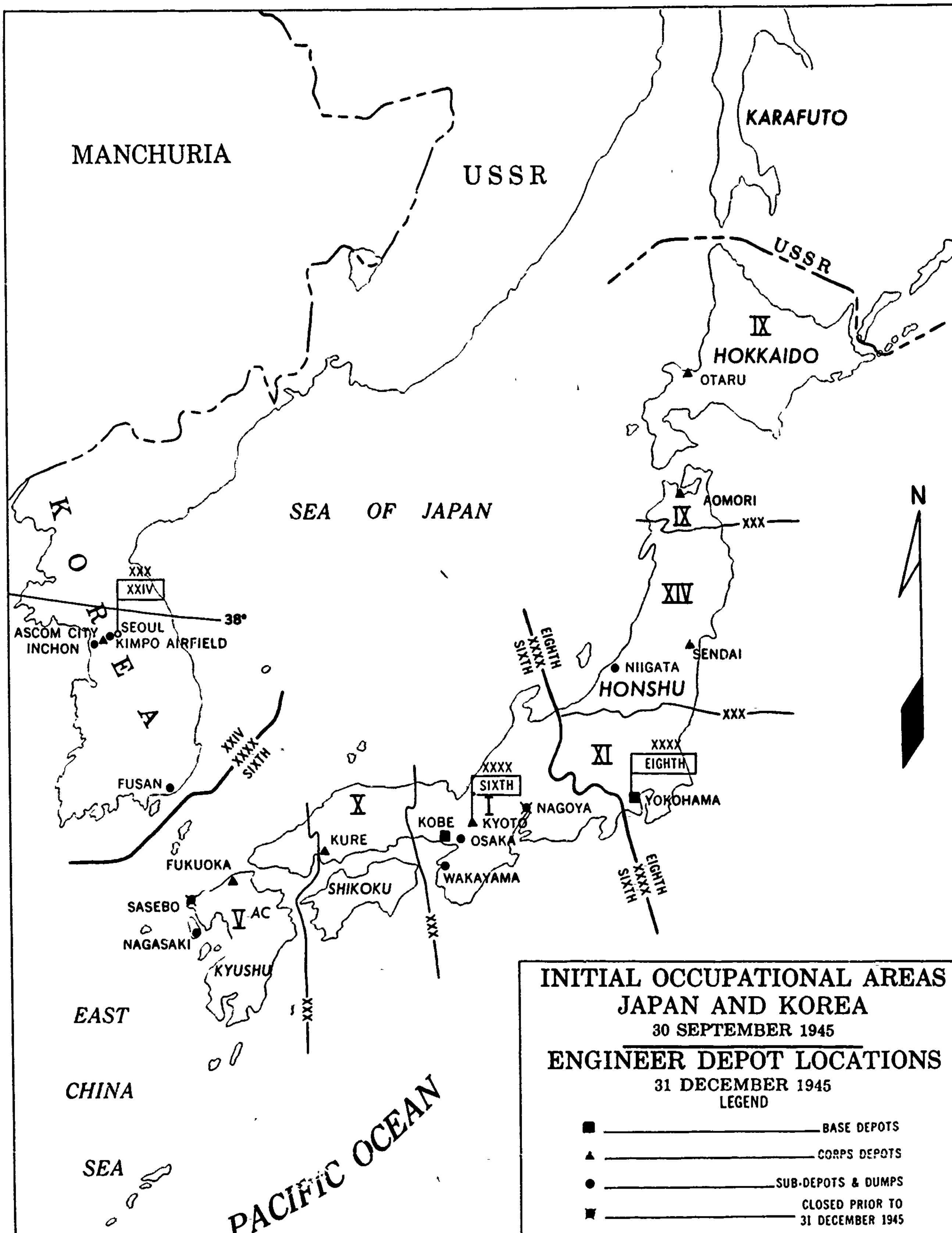
For sometime prior to the enemy's surrender, plans had been under way for the invasion of the Japanese homeland. Based on the possibilities of a suicidal last-ditch stand by the Japanese, all the resources at General MacArthur's command were being readied for the showdown. Ground, air, and naval forces were being massed in the Philippines, on Okinawa, and at bases south of the Philippines. By early August all was in readiness for the OLYMPIC Operation, scheduled for 1 November 1945, against Kyushu, the southernmost Japanese island. This operation was to have been executed by I and XI Army Corps and V Marine Amphibious Corps under Sixth Army. Preceded by preliminary operations against the little islands to the west and a diversionary feint off Shikoku, the three groups were to have landed at Miyazaki in the Ariakewan (Bay) area, and on the beaches west of Kagoshima to isolate Kyushu and destroy the defending forces there. At the same time tentative tactical plans were being prepared for the CORONET Operation which was to have followed on 1 March 1946.[3] These plans called for the assault of the Kanto or Tokyo plain of east central Honshu by three armies, the Eighth, Tenth, and the First, which was being redeployed from Europe for the final battle of the Pacific. The mission of the three armies would have been the destruction of Japanese forces on the principal home island and occupation of the Tokyo–Yokohama area. Operations following the seizure of Kyushu and Honshu would have involved fanning out to the north and neutralizing the remainder of the Japanese home islands.

By the first week in August, General Headquarters (GHQ), AFPAC, had also already prepared and issued the basic outline plan for the BLACKLIST Operation predicated upon an uncontested occupation of Japan. On the day of surrender, 15 August, therefore, GHQ, AFPAC, was able to issue operations instructions specifying rapid occupation of the four major Japanese islands and that portion of Korea south of 38 degrees north latitude.

Assigned to the occupation were Eighth Army (IX, XI, and XIV Corps) for northern Honshu and Hokkaido, Sixth Army (V Amphibious Corps, I and X Army Corps) for Kyushu, Shikoku, and southern Honshu, and the XXIV Corps for the part of Korea south of 38 degrees north latitude. Logistical support for the occupation forces was provided by Army Service Commands: ASCOM-0 (redesignated ASCOM-6 for Sixth Army; ASCOM-C (redesignated ASCOM-8) for Eighth Army; and ASCOM-24, newly organized for the logistic support of XXIV Corps in Korea. (See Map No. 18, "Initial Occupational Areas, Japan and Korea, 30 September 1945.")

The first tactical unit to go into Japan was the 11th Airborne Division which landed at Atsugi airdrome, 30 miles southwest of Tokyo, on 30 August 1945. Engineer support, in addition to the 127th Airborne Engineer Combat Battalion, organic to the division, was supplied by the 872d Engineer Aviation Battalion. Other forces followed. By 8 September, Tokyo was occupied in strength. By 9 September, XXIV Corps had

[3] *Editor's note: See* Map No. 55, "Planned Assault on Japan," Vol I, this series.



SOURCE: OCE, GHQ, AFPAC (Historical).

MAP NO. 18

completed unloading at Jinsen, Korea, and movement by rail to Keijo (Seoul) had begun for the establishment of U. S. control over southern Korea. By the end of September, Eighth Army had completed the occupation of northern Honshu and was preparing for the occupation of Hokkaido. And by the end of October, Sixth Army had completed occupation of its assigned areas in Kyushu, Shikoku, and southern Honshu.

Mapping

At the May mapping conference in Hawaii attended by representatives of GHQ, AFPAC, CINCPOA, Strategic Air Force, Chief of Engineers, Army Map Service, Hydrographic Office, U. S. Navy, and Headquarters, Army Air Forces, exact delineation of mapping requirements and division of mapping responsibilities for the OLYMPIC and CORONET Operations were effected. A seemingly remote decision at that time but which, however, proved of great subsequent importance was also made. As a precaution against a sudden capitulation which might find the OLYMPIC and CORONET mapping projects in a partial state of completion, it was decided to stock some 10,000 copies of an over-all map coverage of Japan. Immediately following the surrender, which had been preceded almost entirely by mapping efforts concentrated on the specific operational areas involved in the OLYMPIC and CORONET Operations, stocks of this over-all coverage in depots in Manila, Oahu, and Guam, available for immediate issue, were of inestimable value. Many gaps existed in their compilation, but their ready availability outweighed their shortcomings at the moment.

The only part of the mapping for the CORONET Operation which could be applied to occupation requirements was that covering the Tokyo area. Production of manuscript by the Army Map Service was in progress and three mapping agencies were doing the reproduction work, but the deadline date for bulk distribution could not be scheduled until 1 December 1945. To improve this delivery date, GHQ, AFPAC, placed at the disposal of Eighth Army 50 percent of the output of the 29th and 648th Engineer Topographic Battalions, and the three Eighth Army topographic companies were utilized in unison with these battalions in printing the maps.

Meanwhile distribution of existing maps was being initiated by the Intelligence Division, Office of the Chief Engineer (OCE), GHQ, AFPAC. Necessary preparations for the engineer topographic units to accompany the occupation forces had been made during the short, preceding period of planning for the BLACKLIST Operation, and arrangements had been made for the necessary partition of the Intelligence Division to support the forward and rear echelons of OCE, GHQ, AFPAC. Although the ground work had been laid during this same period for map distribution to the various elements of Allied occupation forces, one lesson was specifically illustrated by the scope of coverage available for distribution: mapping plans for future major operations, comparable in scope, must precede the operation by a minimum of 12 months if reasonable assurance of successful coverage is to be expected.[4]

Designation of new areas to be photographed and revised specifications for aerial photography were transmitted by radio to the Pacific Air Command, to the Strategic Air Force, and to CINCPOA. Within a few days a new mapping directive was issued superseding the invasion mapping program and replacing it by a revised program designed to improve upon the preliminary map editions furnished, and to provide adequate tactical maps of all of Japan and Korea. The schedule for terrain studies was modified also to make provision for quick spot area studies of selected features of the occupied territories.

[4] *Editor's note:* As evidence of the mapping activity for the OLYMPIC, CORONET, and BLACKLIST Operations, records of the Manila map depots alone disclose that in the period 1 Jul to 30 Sep 45, 24 million copies were received from the Army Map Service and from theater topographic units. Approximately 10,500,000 copies were distributed during this period for planning, operational, and occupational use, of which approximately 7,500,000 were supplied to units of Sixth and Eighth Armies and XXIV Corps for the various phases of BLACKLIST.

Unlike other supplies, such as construction materials which could be used elsewhere if an operation were canceled or modified, maps of a specific area were excess baggage when plans were changed and objective areas redesignated and expanded. Accordingly, hasty steps had to be taken to prevent delivery of the huge quantities of maps set up for the OLYMPIC and CORONET Operations, and the Army Map Service and others involved were requested to reduce production of these maps to quantities estimated as required for occupation functions.

Upon the cessation of hostilities, and while aerial photographic units were at full efficiency, it was hoped that a vast amount of photography could be obtained. Two phases for this photography were planned: (1) to cover the enemy areas to be occupied by Allied forces; and (2) to extend photographic operations into selected sensitive spots on the Asiatic mainland. Realization of this plan, however, was obstructed. Photographic units were displaced forward to new operating bases and extremely unsatisfactory weather for aerial photographic missions persisted throughout October. Meanwhile the almost immediate application of discharge criteria quickly reduced the photographic units to impotence.

Planning

Analysis of engineer participation necessary in the occupation of Japan and Korea required the most exacting concentration on the limited intelligence available. Pressed for time, all divisions of OCE, GHQ, AFPAC, applied themselves feverishly to the completion of plans for various phases of the engineer mission in the occupation. The first draft of the engineer portion of the staff study for the BLACKLIST Operation was prepared in less than 2 weeks and published by GHQ approximately a week later. In another week GHQ, AFPAC, had issued operations instructions for the operation. Engineer Sections of the major commands executing the occupation made their preparations under similar stress. No complete analysis of the engineering problems likely to be encountered in the occupation could be made because of the scarcity of accurate engineer information and the insufficiency of time for planning. Engineer troops were widely scattered throughout the Pacific, and these units had to be equipped and staged in a very limited time. Lack of information on the internal situation in Japan required that the initial occupation forces be equipped for landings against local opposition. At the same time this obscurity affected planning of port and base development, road nets, and airdrome construction. The limitation on time for preparation required improvisation of a supply plan based on diversion of maintenance shipping destined for Army Forces, Middle Pacific, and Army Forces, Western Pacific, bases until support shipping planned for the later projected OLYMPIC Operation would become available and could also be diverted. Mines dropped by U. S. air units in major Japanese and Korean harbors now proved a boomerang. Their submerged menace closed these ports to Allied shipping and proved a further obstacle to completion of occupation plans. Scheduling early operations and selecting sites for vital installations were impeded by the inability at that time to predict the speed of mine sweeping operations which determined the movement of engineer supply shipping. And construction planning was necessarily contingent upon the availability of engineer supplies. For virtually 45 days after initial landings, Sixth Army had no operating port either in central or western Honshu other than beaches for amphibious landing craft.

The policy of sending advance engineer parties into all proposed landing areas in the interest of engineer planning relieved a considerable number of perplexing uncertainties. Key personnel of the Engineer Section, including the Chief Engineer, proceeded to Japan with the advance echelon, GHQ, AFPAC, for the purposes of surveying conditions to be encountered in that area, gathering technical information, and advising the

Commander in Chief, AFPAC, concerning the engineer aspects of the occupation. Information on Hokkaido, Honshu, Kyushu, and Korea was furnished to the planning sections of G–3 and G–4, GHQ, AFPAC, and to the planning sections of service forces and Army and Corps headquarters. For instance, advance information on the wide tidal range prevalent off of Keijo, Korea, proved of considerable value in the planning of port facilities at that location. Continuous oral reports were made in answer to inquiries on airfields, railroad distances, petroleum storage, water supply, damage to port facilities, and construction materials available in Japan.

Engineer Sections of the major commands also dispatched advance parties into areas designated for occupation to facilitate their field planning. On 18 August, six officers and five enlisted men of the Engineer Section, Eighth Army, departed from Manila for Okinawa as part of the advance echelon of that Army headquarters. At Okinawa this group assisted in procuring equipment and maps and inspecting staging units. They then proceeded from Okinawa to Atsugi airdrome on 30 and 31 August, by air transport. Upon arrival in Yokohama, these engineers began collecting and interpreting data received from engineer units in the field. Numerous failures of the weak 3-inch concrete runway under repeated heavy loads at Atsugi were necessitating extensive engineer maintenance effort. The advance engineer party promptly borrowed naval construction battalion operators and equipment to supplement the work of the 872d Engineers who, together with Company A, 127th Engineers, had been employed on repair and maintenance of the airdrome since their arrival in Japan. Reconnaissances for critical engineer supplies were conducted. Arrangements were made for billeting of Eighth Army units and for installations of chlorinators in municipal water plants. Airfields and POL facilities were inspected in the Kanto plain and along the shores of Tokyo Bay.

Similarly, Sixth Army dispatched representatives from its Engineer Section to accompany advance parties into Japan early in September. This engineer group sent back important information regarding procurement procedures, organization of Japanese administrative agencies, usability of airdromes, existing road nets, railroads, and the inadequacy of Japanese construction equipment.

Through the efforts of these advance engineer teams, subsequent engineer planning for the occupation showed more methodical progress.

Supplies and Equipment

The sudden termination of hostilities and initial lack of sufficient data on the internal Japanese supply situation, as well as construction requirements that would be necessary, affected engineer supply planning for the occupation. As already indicated, initial engineer supplies for all zones of occupation had to be hurriedly obtained by diverting Theater resupply ships, which were loaded for invasion rather than occupation. Such diverted shipping provided supplies, but seldom in the order of priority or in the amounts required. The result was unnecessary handling of excess supplies, and an accumulation of unbalanced engineer stocks. In addition to these supply difficulties, engineer depot units which, during the planning phase, were scheduled in sufficient numbers to maintain a proper balance between engineer construction and supply personnel never materialized in the prescribed strength during the actual occupation. The drastic and accelerated demobilization program further depleted those depot units which did arrive. The subsequent shortage of trained personnel, capable of locating and setting up depots, reflected itself in haphazardly situated engineer supply depots and dumps. Inexperienced personnel at these installations were frequently unfamiliar with the stocks on hand and requisitioning units found it necessary on many occasions to select their own materiel.

The scope of operations necessarily required large stocks of engineer equipment in Japan. In the face of deactivation, however, the need for engineer personnel to sustain operation of this equipment exceeded the authorized troop strength. The only recourse was the gradual employment of Japanese operators. This occasioned an almost immediate impetus in the need for replacement parts. Yet this equipment was above Tables of Equipment authorizations with the greatly reduced troop basis, and replacement factors contained no provision for parts beyond T/E. Deadlined equipment began to accumulate in quite a few depots while parts supply and maintenance units were being speedily deactivated and increasing numbers of inexperienced Japanese had to be utilized to operate the remaining equipment. In view of the diminishing organizations for provision of parts supply and maintenance, the difficulties encountered in issuing U. S. Army engineer equipment for operation by Japanese were only too evident. Yet the alternative—trained replacements for operation as well as maintenance supervision—was not readily available.

A general, over-all shortage of engineer spare parts, however, was prevented during the early days of the occupation by provision of two floating spare parts depots to augment the parts supplied through diverted shipping. One, the *Armand Considere,* a concrete steamer already in the Theater, was stocked with fast moving items for every type of equipment scheduled to go into Japan. The *Blenheim,* which arrived at Nagoya from New York on 20 November, was generally stocked only with 1st and 2d echelon sets in insufficient quantities. Nevertheless, despite a lack of depot and subdepot sets of parts, this captured Diesel-operated German ship met many an urgent engineer supply need. About 400 feet long, with an 8,000-registered-ton capacity, this ship had been altered for spare parts storage. Steel bins had been installed in the between-deck space, and the lower hold was used for bulk parts storage. About 32,000 bin openings were provided, and a dumb waiter and stairways had been installed into each of its four holds. Such floating, itinerant depots were considered, and proved, the only sure method of initial parts supply for fast moving amphibious operations because of the flexibility of operation made possible by their mobility.

Directives, for the occupation, including engineer annexes and instructions, stressed that use of imported materials was to be kept to an absolute minimum, and that Japanese materials were to be utilized to the extent of availability. In view of such planned maximum use of available local resources, including existing installations for the housing of troops, procedures were established for direct purchases from Japanese civilian sources to augment Japanese military resources seized by the occupation forces according to Rules of Land Warfare (War Department, Field Manual 27–10) and to reduce resupply shipping to a minimum. In the interest of accelerating essential construction, GHQ, AFPAC, decentralized procurement authority to the major commands. Only limited amounts of engineer supplies were found in the XXIV Corps area initially, and local procurement was not employed to any marked extent in Korea. Sixth and Eighth Armies, however, although initially handicapped in locating stocks of materials through Japanese reluctance or inability to provide intelligent assistance, soon established individual procurement procedures in their respective zones of occupation. In line with these procedures, Engineer Sections worked closely with Procurement Sections for solutions to problems of procurement, and productive contacts were made for Japanese real estate, utilities, materials, and contractors. These procedures were subsequently systematized by GHQ, AFPAC, through issuance of Procurement Agent Regulation No. 1, dated 27 September 1945.[5] In accord with this regulation, purchases were made through "procurement demands" on Japanese liaison agencies which had been established through activities of engineer and procurement representatives with the advance detachments.

[5] *Editor's note: See* Appendix XVIII, "Procurement Agent Regulation No. 1, 27 September 1945," Vol VII, this series.

Cash purchases were authorized only in emergencies and then limited to 3,000 yen. Procurement in the United States was drastically reduced, and as shortages of construction materials developed in some parts of the Theater while excesses existed in others, the Supply Division, OCE, GHQ, AFPAC, became involved in a number of individual supply actions requiring coordination of requirements and availabilities among the various commands to insure the most effective distribution of supply.

The first emergency of this nature was involved in the "Battle of the Space Heaters." Central heating in Japan and Korea was virtually nonexistent since steam boilers and radiators had been removed from the few modern buildings to provide scrap for the production of Japanese arms. The construction program for the first fall and winter in occupied Japan, therefore, developed into a considerable problem to provide comfortable shelter for the troops during the approaching months of cold weather. Every type of locally available heating unit was pressed into service while supply agencies in the Theater and the United States concentrated on coordinating requirements, determining availability of various types, and arranging for early shipment to the occupation areas.

Meanwhile, to assure full exploitation of locally available supplies, the Chief Engineer, GHQ, AFPAC, through numerous conferences with leading Japanese governmental and industrial officials, evolved all data possible on the location of existing stocks of construction materials and on factories producing such materials. Any information obtained in this manner was then passed on to the major commands and the interested staff sections of the Supreme Commander for the Allied Powers (SCAP).[6] When supplies in excess were located in occupational areas through technical engineer channels, other areas were immediately notified to assure availability of such excesses to all who might need them. Gradually, however, the procurement program was to change from collection of already available stocks to establishment of a long-range program involving production of materials by Japanese industry. Rough materials estimates were being prepared by the end of 1945 for troop and dependent housing by the Engineering Division, OCE, GHQ, AFPAC, for delivery to the Japanese Government in initiation of the new procedure. These estimates when completed in detail were to be presented to the Japanese Government not as procurement demands, but as production guides.

Availability of Engineers

Following V-J Day engineer troops throughout the Theater continued to be occupied on various engineer tasks of an urgent nature. Topographic units were busily engaged on the post-hostilities mapping program involving coverage of approximately 3,500,000 square miles by aviation charts and 2,500,000 square miles by topographic maps. Construction units were taxed to provide living and operational facilities for the occupation forces. Depot units were attempting to support this construction program, and, in addition, to solve the many problems incidental to disposition of surplus and excess property. All engineer units were handicapped, however, by the demobilization program which steadily deprived them of the trained men and officers essential to efficient operations.

Throughout Japan and Korea redeployment seriously hampered the effectiveness of engineer operations. Engineer units charged with important construction missions were rapidly depleted of practically all skilled and technical personnel. Essential organizations were kept up to near authorized total strength only by transfer of personnel from units scheduled to be inactivated. But too few of the personnel transferred were

[6] *Editor's note:* GHQ, SCAP, was formed on 2 Sep 45 to discharge occupation responsibilities of the Supreme Commander for the Allied Powers while GHQ, AFPAC, remained as Theater headquarters for all US Army forces in the Pacific. AFPAC supplied the US Army forces which SCAP used in conjunction with US Navy units and the British Commonwealth Occupation Force to conduct the occupation of Japan.

skilled craftsmen or qualified technicians. The result was a critical shortage of qualified specialists in essential engineer units not only for operations but for training of replacements.

Skilled operators, mechanics, and carpenters were generally lost through the "over 35" and "over 38" age category because men with such skills were almost invariably found in these age groups. Their qualifications were based not alone on U. S. Army Engineer training but on aptitude and especially on experience in civil life. Meanwhile the number of men with such qualifications received among the young replacements was appallingly low. Beyond reducing engineer unit efficiency, the loss of such men subjected millions of dollars worth of heavy equipment to damage or misuse.

The percentage of Engineer officers available, as compared to the number authorized, was generally considerably lower than the available percentages of officers of other branches. Repeated attempts were made by the Chief Engineer, GHQ, AFPAC, to minimize the effects of the Engineer officer shortage by discouraging the assignment of Engineer officers to duty with organizations of other branches and to staff positions which could be filled by officers without engineer technical training. Special efforts were made to effect reassignment to engineer duties of all officers previously assigned to other missions. In the interest of economical utilization of Engineer officers, informal steps were taken by the Chief Engineer, before issuance of GHQ, AFPAC, command directives, to have all trained Engineer officers who were performing purely administrative functions even within engineer units released for technical assignments by substitution of qualified officers from other branches for such administrative duties.

Local Labor

As engineer troop strength decreased through demobilization, the utilization of local labor increased. This labor was requisitioned from large labor pools and was worked under the direct supervision of the occupation forces.[7] However, it became particularly noticeable as the release of high point engineer specialists increased that a serious shortage of skilled Japanese labor existed. Moreover, procurement of all labor be[illegible]e more and more difficult as the oc[illegible]pat[illegible] progressed. On initiation of civilian rec[illegible]truction enterprises, employment opportunities in private pursuits offered better wages than available from the Japanese Government under Military Government regulations. It was necessary to bring increasing pressure to bear on Japanese agencies through Military Government channels as the filling of labor requisitions became less and less effective. It was not at all uncommon for a skilled Japanese to abandon one project, after benefiting by the necessary training invariably involved, and have him appear at another project with a higher classification. It was becoming almost customary for valuable experience so gained to be promptly utilized in civilian pursuits.

Under pressure of heavy construction requirements, such large labor turnovers and the necessarily considerable supervisory effort required had to be alleviated as much as possible by shifting to the procurement demand system. Under this system a procurement demand was prepared for a specific construction project by the appropriate Military Government office. Served on the Japanese Government through liaison offices, this procurement demand directed the Japanese Government to execute the desired construction. The Japanese Government, in turn, assigne[illegible] project to a civilian contractor who furnish[illegible] [illegible]ecessary labor, materials, and supervision. Theoretically the Japanese Government furnished inspectors and supervisors for projects so that the occupation forces were involved only to the extent of furnishing general construction plans. In actual practice, the Japanese could not provide adequate supervision,

[7] *Editor's note:* Existing directives of the Japanese Government permitted the prefectural governments to conscript labor required to fill demands of the occupation forces.

contractors generally were slow and inefficient by U. S. standards, and it was necessary for the occupation forces to assume close control of many projects. However, the procurement demand-contractor system provided a convenient framework for organizing and directing Japanese labor and increased considerably the scope of work which could be accomplished.

A number of actions were taken by OCE, GHQ, AFPAC, to improve the ability of the Japanese to execute construction work for the occupation forces. Pressure was continually exerted to increase the number of inspectors and supervisors on construction projects. Skilled construction supervisors of Japanese ancestry were obtained from Hawaii to assist engineer units in supervising Japanese labor. By the end of 1945 plans were being formulated for training Japanese in the use of heavy construction equipment and arrangements were effected to lend equipment to Japanese contractors for use on occupation forces projects.

The situation in Korea was complicated by the fact that this was a liberated country. The Japanese in the country had represented all the key supervisory and technical personnel with organizing ability, and their departure had left the Koreans completely unable to handle the operation of any major activity. There were few contractors, and after years of Japanese domination, there was practically no Korean supervisory personnel. While a large labor pool existed, the Koreans initially were not inclined to work. In fact, somewhat of an extended holiday seemed to prevail because of bonuses given to all Korean employees by the Japanese before their departure. As this money was spent and repatriated Koreans arrived from Japan, employment conditions improved. All agencies meanwhile made the greatest possible use of labor details supervised by occupation forces and by local road maintenance organizations. Investigations were conducted to determine if any projects could be handled by local contractors, and the Engineer, XXIV Corps, initiated plans for a program of useful public works which could be prosecuted by native labor construction methods while U. S. Engineer labor-saving equipment was applied to special construction tasks.

Post-hostilities Intelligence

While all available local resources of labor and materials were being exploited for requirements of the occupation, Japanese military engineer policies and equipment were undergoing a technical and technological survey for future consideration by interested agencies in the United States. Operating under the Technical Intelligence Branch, which was formed in OCE, GHQ, AFPAC, on 30 September 1945, officer and civilian specialists from the War Department and the Theater worked in close coordination with G–2, GHQ, AFPAC, and all other survey groups. Engineer technical intelligence teams were assigned to the field armies and assisted in the survey; translators and administrative personnel were assigned directly to the Branch from Theater sources, and particularly valuable assistance was obtained from former Japanese army officers whom the Japanese Government was directed to make available. Japanese equipment considered worthy of detailed study in the United States was evacuated to the Engineer Board, Fort Belvoir, Virginia, and the results of the survey were recorded in 24 formal reports, each covering a specific field of investigation.[8]

Upon cessation of hostilities, appraisals of effectiveness for future guidance were not limited alone to enemy potentials, however. Based on the recommendations of the Chief Engineer, GHQ, AFPAC, the Commander in Chief directed that engineer reconnaissances be made of the OLYMPIC and CORONET landing areas on the exact dates that they would have been assaulted had the Japanese not surrendered. The

[8] *Editor's note:* For a detailed description of activities of the Technical Intelligence Branch *see* Chapter VI and *also* Appendix XLIII, "Summary of Formal Reports by Technical Intelligence Branch, Intelligence Division, Office of the Chief Engineer, General Headquarters, Army Forces, Pacific," Vol III, *Engineer Intelligence,* this series.

purpose of these post-hostilities observations was to obtain data which could be used to evaluate the accuracy of engineer information available prior to V-J Day against actual conditions which would have confronted invasion forces. Engineer specialists were dispatched to reconnoiter the landing beach areas of southern Kyushu which had been designated for the OLYMPIC Operation, on 1 November 1945, and those of east central Honshu, specified in plans for the CORONET Operation, on 1 March 1946. While certain inaccuracies and omissions of important engineer information were discovered, the available data and reports as a whole were remarkably sound and would have been very valuable in the preparation of plans.

The OLYMPIC Operation, as previously indicated, had contemplated the landing of powerful forces in, and the rapid seizure of, an area in southern Kyushu sufficient for establishment of overpowering land-based air forces to cover a final decisive thrust into the industrial heart of Japan. On or about 1 November 1945, a three-pronged landing was to have been made by one corps in the Miyazaki area, one corps in the Ariake Bay area (both on the east coast), and one corps in the Kagoshima area on the west coast.[9] These landing forces were to have isolated southern Kyushu, seized Kagoshima Bay by rapid overland advances, destroyed the hostile forces, and occupied the objective area to the general line Sendai–Tsuno. Reconnaissance on the day the assault would have been made disclosed that engineer intelligence available for planning this operation was generally accurate. The concept of the beaches and the terrain gleaned from prepared studies was for the most part correct. In fact, the impressions of two engineers, who had been engaged in detailed planning of bases from such information, were that they were in familiar territory. Although complete photographic coverage was not available prior to V-J Day, in almost every instance construction sites located from other intelligence sources were found to be workable. However, there were two instances where planned facilities would not have been feasible. The first was occasioned by the bar at the mouth of the Oyobo-gawa (River), at Miyazaki, which would have prevented immediate use of the river for lighter jetty development. Even at high tide, there was only 5 feet of water over the bar. Although it was planned to bring in clam shell dredges very early, the target date of X plus 30 for four fixed lighter berths could probably not have been met. Port development would have had to wait for the capture of the mouth of the Uchiumi River, 14 miles to the south, where lighterage facilities could have been established. This is the nearest port of any size to Miyazaki, but had been considered poorly situated from a tactical standpoint. However, the good weather predicted for November was borne out, and calm surf conditions would have enabled off-loaded tonnage figures to be met through an increased use of landing craft. The second unfeasible site selected was for the three fixed Liberty ship berths at Kashiwabaru on the southern shore of Ariake Bay. Selected as the most adaptable site according to intelligence reports, it was, in fact, a poor one. Access inland was confined to movement over a side hill rock cut where numerous washouts and landslides would have blocked the movement even of jeeps. The generally very rocky coast line in this area severely limited maneuverability and no minor adjustment in location would have been practical. It would have been necessary to initially increase the projected development of lighterage and small ship wharves at Shibushi, on the opposite shore of Ariake Bay, and to transfer Liberty ship wharf development for the area to Furue, across the peninsula and along the eastern shore of Kagoshima Bay.

The general picture of roads in the available engineer intelligence sources was too optimistic. The main national highway was poorly drained, in need of considerable gravel resurfacing, and had numerous bottlenecks. Fortunately, the

[9] *Editor's note: See* Map No. 55, Vol. I, this series.

contemplated operation had been scheduled for the dry season; otherwise the road net would have immediately broken down under the loads and density of military traffic.

In summation, the prospect of success for the engineer mission on the OLYMPIC Operation would have been good. The total absence of evident beach obstacles or defenses would have made the landings comparatively easy. Local fishermen stated that mines or underwater obstacles had never been placed in Ariake or Kagoshima Bays. While the beaches would have required considerable effort to keep them trafficable, gravel was available within reasonable hauling distance. On the eastern shores of Kyushu, at least, there were adequate storage and bivouac areas behind the beaches, and though river valleys were principally rice paddy land, the upland areas were devoted to dry crops and were entirely suitable for base development. The early airdrome target dates for completion of fighter fields at Shibushi and at Miyazaki would have been met. The roads would not have failed before drainage and surfacing were accomplished in preparation for the rainy season. While the terrain of southern Kyushu would have made its conquest possibly a difficult and costly one, the engineers, by energetic execution of correct planning based on the available engineer intelligence, and aided by favorable weather, would have succeeded in their mission.

Planning for the CORONET Operation was still in its earliest stages at the time of the Japanese surrender. Briefly, the plan at that time envisaged simultaneous landings to the south and east of Tokyo on the beaches of Sagami Bay and in the Kujukuri-hama (Beach) area.[10] After consolidation of the beachhead at Sagami Bay, an armored thrust was to have been made to the north to cut the lines of approach to Tokyo from southern Honshu, and an infantry force was to have moved upon Tokyo from either the beachhead at Sagami Bay or from the avenue opened by the armored column. After consolidation of the Kujukuri Beach area, the main body of that assault force was to have advanced upon Tokyo, while a secondary force cleared and secured the Chiba peninsula.

Considerable data pertaining to the areas involved in the CORONET Operation were contained in a study prepared by the Section of Military Geology, Geological Survey, U. S. Department of the Interior, under the direction of the Chief of Engineers, War Department. Published in July 1945, approximately 9 months prior to the projected operation, this study, based on the scope of source material available to the authors at that time, was intended as a means for supplying, as far in advance as possible, those general features of the terrain having a direct bearing on the accomplishment of the engineer mission. Intensive supplementary studies had also been initiated within the Theater prior to the Japanese capitulation. In general, these later studies were discontinued abruptly at the time of the Japanese surrender and no subsequent effort had been made to assemble or consolidate the piecemeal data obtained nor the conclusions reached. Of significance to later evaluation of intelligence available for the CORONET Operation was the fact that neither Zone of Interior or Theater intelligence agencies had been furnished complete photographic coverage of the objective areas at the time these studies were discontinued. Subsequent appraisal of accuracy after a 4-day ground reconnaissance disclosed that previously assembled engineer data as a whole was remarkably sound. Errors and deficiencies of information, in view of the abrupt curtailment of further intelligence activities for this operation, were comparatively minor.

The available data overrated the availability of road materials in the vicinity of the Kujukuri beaches inasmuch as materials suitable for subgrades and base courses, or for repair and maintenance, proved remote from the areas where they would have been most needed. Readily available materials consisted of fine sand and poorly consolidated sandstone. Gravel was conspicu-

[10] *Editor's note: See* Map No. 55, Vol I, this series.

ously lacking except at a few scattered beach locations. On the other hand, the Sagami sector was correctly rated as to gravel being readily obtainable in the Tama and Sagami River valleys.

Trafficability observations uncovered five discrepancies in engineer information: (1) While assembled data considered obstacles in lateral movement on beaches, the concrete walls which lined the wide main drainage ditches in the Kujukuri sector were undetected; they would have been serious obstacles to inland movement. (2) Also in the Kujukuri sector, the scarp-like distribution of hills overlooking the beachhead should have been emphasized more strongly inasmuch as they commanded the beach hinterland at all points, and particularly where roads lead inland from the beach. (3) The beach sand in the Sagami Bay area was of such grain size and moisture content as to render wheeled traffic from the water edge to the first road inland difficult or impossible. Mats would have been required for continued operation over the beach. (4) An area of boggy riceland, approximately 1 mile square, adjacent to the east bank of the Sagami River, near its mouth, was incorrectly labeled as having good trafficability. In this environment, sandy soils could be sufficiently saturated for use as riceland; and such was the case in this particular area. (5) In assuming that wheeled traffic would move along roads only, full cognizance was not taken of the importance of road alinement through hill terrain as a factor influencing traffic flow. In the hill and valley area of the Kujukuri sector, and in the hill area of the Sagami sector, the narrow width, blind curves, and side hill locations of roads would have created serious bottlenecks.

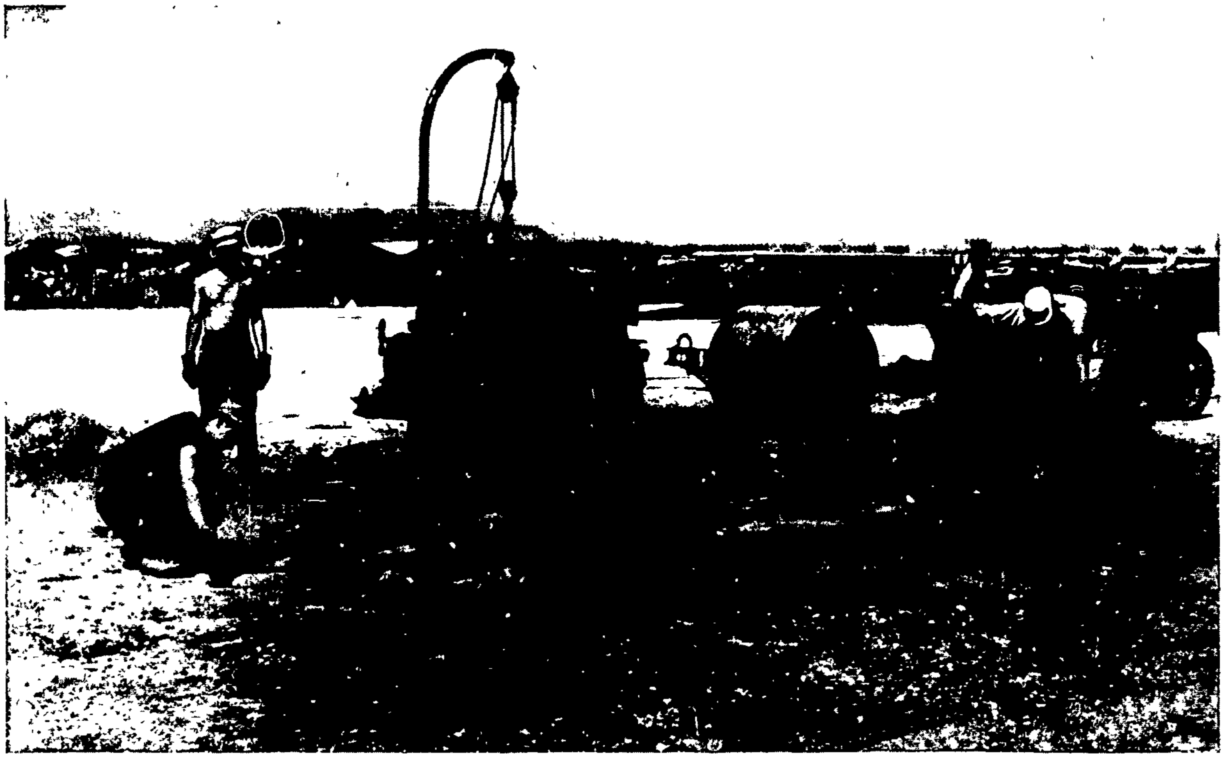
The possibility of tunneling had been correctly indicated, but the actual location and distribution of tunnels could not have been predicted without benefit of large-scale aerial photographs, which, it will be recalled, were not yet available at the time compilation of studies had been discontinued. The magnetite content of the sand on the Sagami Bay beachhead, particularly in the sector west of the Sagami River, had not been mentioned. Yet the sand contained sufficient magnetite to destroy the effectiveness of magnetic mine detectors.

Artificial obstacles and special defenses on the landing areas and in the hinterland had been erected prior to the surrender in anticipation of an Allied attack, but to a limited extent only. Obviously, if World War II had continued, additional measures would have been taken by the Japanese to more effectively prepare these areas for defense against landings and subsequent inland operations. It was likewise reasonable to assume that engineer intelligence data would have been revised accordingly during the planning phase without impairment to the ultimate success of the engineer mission.

Construction

The engineer construction mission in the occupation was the rehabilitation to U. S. standards of those existing facilities required to support the occupation forces. Damaged port facilities were repaired. Road construction and maintenance in and near the cities, initially facilitated by reason of paved highways, soon required extensive effort when heavy military traffic took its toll of neglected maintenance through the war. In rural areas, the existing narrow, winding roads were, if improved at all, mostly graveled and in very poor condition. Complicated drainage systems, adjacent rice paddies, and the narrow right-of-way between buildings practically negated improvement. Widening and improvement undertaken by the occupation forces were restricted to major connecting highways necessary to military traffic. Many flimsy Japanese bridges were reconstructed to withstand heavy military loads. The railroads, in contrast to the primitive roads, were in good condition and required little effort on the part of the engineers.

Considerable improvement was required on the airfields to make them suitable for heavy bomber operations. The construction of a 7,000-foot airstrip on Haneda Island in Tokyo Bay carried the highest construction priority

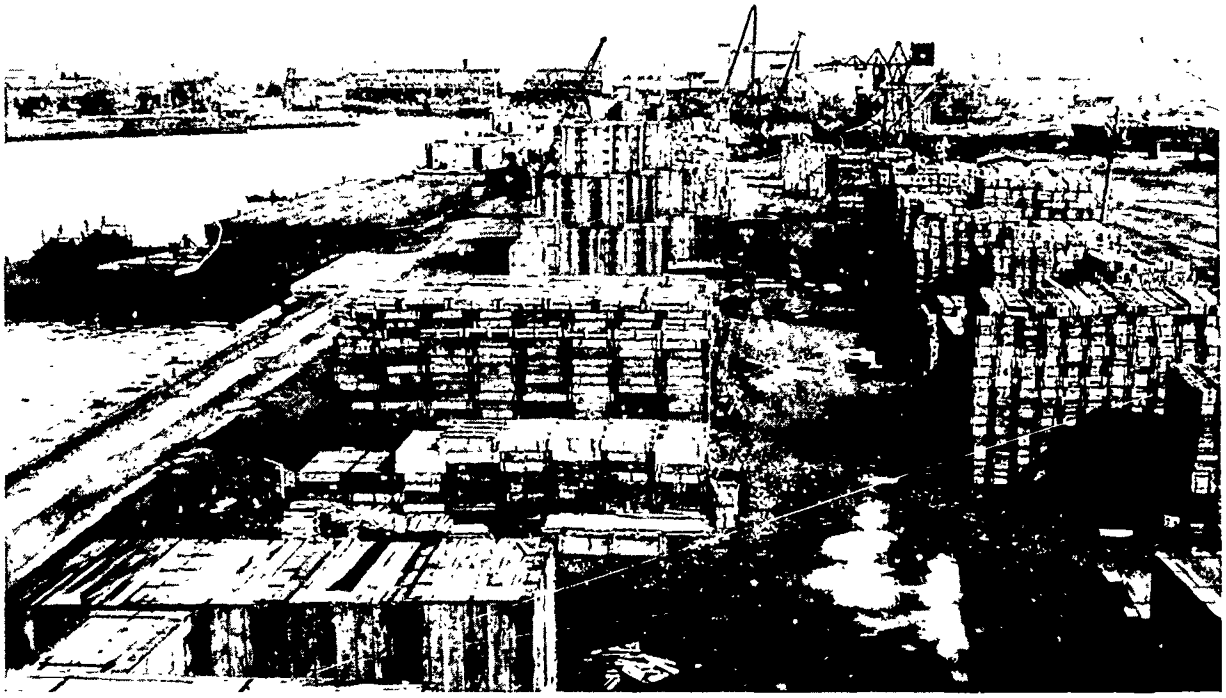


Engineers initally use special airborne equipment in repairing the runway at Atsugi Airdrome, Japan.

Engineer LCVP's in Tokyo Bay form waves prior to effecting the first occupational landing at Yokohama Naval Base, Tateyama, Japan.

Map employed to determine position by an advance cavalry patrol during initial phase of occupation of Japan, 15 September 1945.

Major General C. W. Ryder, Commanding General, IX Corps, employs map to designate an occupational area to aide and military police at Aomori, Japan, 25 September 1945.



Water purification sets and prefabricated structures components at Engineer Base Depot area, Yokohama, Japan.

Lumber, piling, and forest products at Engineer Base Depot, Yokohama, Japan.

Japanese observers are amazed at the power of the Engineer bulldozer clearing rubble from the bombed areas in Sendai, Japan.

Curious Japanese mill about the water point in Osaka, Japan.

Major General Hugh J. Casey, Chief Engineer, GHQ, AFPAC, refers to a map of Japan in coordinating the work of Engineers in the Army of Occupation.

Engineers have just completed this 5,000-foot runway on one of the occupational air bases in Japan, straw has been placed on the still wet concrete to keep it from freezing.

and, except for indirect assistance by the dredge at Tacloban, represented the first hydraulic-fill airdrome job in the history of this theater of operations. The project involved the linking of two small islands by provision of a causeway between the islands which required over 1,200,000 cubic yards of dredged fill.

Employing large forces of Japanese and Korean labor, engineers repaired and renovated existing hospitals and barracks, factories, hotels, and government and privately owned buildings which were occupied. Some additional construction for hospital facilities over and above existing structures was required in Korea. Heating systems, which were wholly inadequate throughout Japan and Korea, required a major effort in the rehabilitation of existing buildings.

Petroleum storage and distribution facilities in Japan were generally adequate after cleaning and minor modification. Some new construction of additional tankage and distribution facilities was necessary, however, especially in Korea. The principal deficiency of POL facilities in Japan was the absence of pipe lines except in storage areas. An outstanding performance, remedying this condition, was provision of the 17-mile pipe line from the Yokohama POL terminal to Atsugi airdrome which the 1383d Engineer Petroleum Distribution Company laid in 3 days. In an additional 48 hours water tests of the line were completed and fuel delivered. This was reputed to be the first liquid fuel pipe line ever constructed in Japan.

By December 1945 most of the engineer troop effort was diverted to maintenance of existing facilities and to supervision of civilian labor which had been employed to partially replace troop labor lost through readjustment. Intensive training was being carried out to provide trained replacements for engineer specialists who became eligible for discharge. Dependent housing plans for subsequent provision of approximately 20,000 sets of quarters began to take the center of the stage, and, as previously indicated, rough material estimates were being drawn up as production guides to the Japanese Government for the necessary construction supplies. Supervision, expediting Japanese efforts, and designing were replacing the former arduous missions of the engineers.

Mission Accomplished

Behind the Engineers of the Southwest Pacific lay Herculean achievements. Solid utilitarian monuments bore testimony to engineer accomplishments prior to the victorious moment when the first battle-hardened engineer had dropped a worn and muddy boot on Japan. Mention of only a few of their undertakings is sufficient to stagger the imagination. For example, in the engineer wake were runways, taxiways, and parking areas that chronicled their airfield construction as more than that of an area for a two-lane road from San Francisco to Hollandia and on to Tokyo. Their record was inscribed with the provision of POL storage totaling more than 4 million barrels, or the equivalent of a tank more than 50 feet in diameter and nearly 2 miles high. Main POL pipe lines constructed exceeded 500 miles without taking into consideration pipe lines within petroleum terminals. Facilities for more than 100,000 hospital beds, enough for every inhabitant of Duluth, Minnesota, bore affidavit to their industry. Berths for 120 Liberty ships and 150 small vessels had been provided in port facilities constructed by the Engineers. These berths represented an unloading capacity of 100,000 DWT of cargo per day. It would require 4,000 standard railway freight cars or 40,000 2½-ton trucks to transport the cargo that could be unloaded over these berths each day. Camp facilities to their credit would have housed the entire population of the city of Los Angeles; they housed more than 1,500,000 troops. The roads the engineers blazed and maintained in sometimes impassable terrain would have provided a two-lane highway from Brisbane to Tokyo to San Francisco.

The bases constructed by these Engineers were the springboards which finally launched Allied armed might to the home islands of

Japan. Without them the shield could never have been wrenched from the Empire's hand. A delay in their scheduled dates of completion would necessarily have postponed the day of victory. Yet this scroll of proud achievement was not written in unruffled routine with sufficient men, equipment, and supplies always readily available. Areas for construction of most bases were not purchased or leased through routine business transactions. For the most part, they had to be wrested from a fanatical enemy, and the engineers had not only been among the first to hit a hostile beach, but had carried other fighting forces into the assault in their blunt-nosed little landing craft. The cry for engineers and more engineers had reverberated with the constancy of the gunfire in the Southwest Pacific, and the supply had not been equal to the demand. Equipment and supplies, though frequently in inadequate amounts for the task, had to be propelled across thousands of miles of contested seas and all too often had arrived with little regard for priority. Initial construction of practically every base was begun under gunfire, over mined areas and rigorous terrain. The conditions under which construction progressed were unprecedented in the experiences of service troops in earlier conflicts. Highway surfaces and runway surfaces were often mixed with the blood of engineers. Engineers had died violently through every campaign from the last-ditch stands on Bataan and Corregidor to the occupation of Japan and Korea almost 4 years later. Other engineers had taken their places, and with sweat and blood and incalculable ingenuity had raised the monuments of engineer achievement in honor of their dead and to the everlasting glory of the Corps of Engineers.

The heroic efforts of the Engineers of the Southwest Pacific are best interpreted by their Chief who guided and directed their endeavors and knew them best, to whom their success was of personal concern. His commendation of that success immediately followed his own arrival with the Engineer spearhead into Japan:

GENERAL HEADQUARTERS
UNITED STATES ARMY FORCES, PACIFIC
OFFICE OF THE CHIEF ENGINEER

APO 500
31 August 1945

TO THE OFFICERS AND MEN OF THE CORPS OF ENGINEERS:

To you belongs a full measure of the victory attained by our forces.

Your task has been not only vitally important to our combined operations but also a difficult, hazardous and gruelling one.

Our amphibian engineers have performed gallantly and outstandingly in landing our assault forces and effecting their subsequent close combat support on over 150 successful major and minor amphibious operations in the Southwest Pacific.

Our combat engineers have, often under fire, ably assisted the operations of our combat forces in mine clearing, combined attack on enemy defensive positions, rapid construction of roads and bridges, and on all other types of engineer work.

Our basic construction units have performed miracles in transforming virtually overnight, jungle, swamp and mountainous terrain into depots, airdromes, hospitals and camps. Aladdin-like, you have created major ports and bases, without which our air operations and forward movement would have been impossible.

Our engineer supply forces have, under greatest difficulty, surmounted the impossible in procuring, handling and providing the millions of tons of hundreds of thousands of items of engineer equipment and supplies, required for this gigantic engineer effort.

Our maintenance units have kept this vast engineer work potential functioning by efficient maintenance of many millions of horsepower capacity of engineer equipment, without which our task could not have been performed.

Our topographic units have charted a vast, relatively unknown section of the world and provided hundreds of millions of maps to guide our forces through what otherwise would have been a dark unknown.

Our engineer planning and supervisory headquarters have, with high success, borne a heavy responsibility in their planning and subsequent, continued supervision of these difficult tasks.

Each of you has done his part well. With a failure or omission of any of these important cogs, our entire machine and the operations they support, would not have functioned.

And let us all pay a silent tribute to those of our ranks who gave their lives in the execution of these tasks.

To each of you of all ranks I tender my deepest appreciation for your magnificent effort, my pride in you for your outstanding performance and my best wishes for your continued well-being and success.

HUGH J. CASEY
Major General, U. S. Army
Chief Engineer

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CHAPTER VIII

Conclusion

The peculiar geographic and physical characteristics of the Southwest Pacific and the limited Allied military potential available there dictated a pattern of strategy unique to that theater of operations. The Southwest Pacific Area (SWPA) as established in 1942 consisted primarily of 13 million square miles of ocean, containing one continent, two mountainous islands of major size, and innumerable scattered tropical islands and island groups. Except for Australia and the south coast of New Guinea, these seas and islands were controlled or occupied by Japanese forces. Allied bases in Australia averaged 8,000 miles from the United States with further distances of 1,500 to 3,000 miles from such bases to beaches in New Guinea and the Philippines. The terrain of the land masses within SWPA was in most cases entirely undeveloped and usually unexplored. Dense jungles, swamps, and precipitous mountains made overland movement and supply of large forces impracticable. With the limited weapons and forces then available to the Commander in Chief, SWPA, only a strategy of island hopping could succeed. And only rapid engineer construction of essential, modern facilities on these islands could support this pattern of offense across such distances.

In this pattern air and naval forces were the Theater's primary weapons of offense. Until the Allied landings on Leyte, tactical operations by ground forces were mostly auxiliary to those of the other two combat elements; the ground forces' mission was the seizure and retention of bases from which air and naval forces might sally forth in order to strike and return. And in the establishment of these bases the work of Allied engineer troops was not only important, but in most instances the key support upon which overall strategical success depended. The lack of existing ports and airfields presented a problem to the surface or air transport of troops and supplies which could be solved only by major construction effort. The need for such development in some of the most primitive areas of the globe under stress of war transformed this theater of operations into an engineer proving ground of the most severe and exacting standards.

Until the arrival in early 1944 of more adequate naval surface and air elements, air operations against the Japanese were limited to the ranges of available land-based aircraft. Heavy bombardment missions from advanced airdromes were carried out to destroy principal Japanese ground installations, enemy aircraft on the ground, and shipping of reinforcements to their forward garrisons within Allied bomber range. Even with maximum fuel overload, however, available bombers at that time did not have sufficient range to cover the vast distances to and from major target areas. Allied ground forces, under cover of fighter aircraft, would, therefore, attack and seize one or more of the forward Japanese-held areas for development of farther advanced airdromes. Lacking heavy antiaircraft artillery, the attacking ground forces were limited in their overwater advances by the short range of the fighter aircraft providing cover. Subsequent maintenance of such fighter cover for the security and development of these newly acquired areas was, in turn, dependent upon immediate engineer construction of airstrips adequate for use of fighter aircraft. Under the air protection made possible by engineer construction of such fighter facilities and ground protection provided by combat troops, ports and major airdrome installations were subsequently built by the engineers not only for the immediate supply of the troops stationed at that point, but also for the staging and resupply of tactical elements scheduled for the next objective area.

Assisting or handicapping such engineer support to the operational pattern were many factors not under engineer control but having an important effect on the accomplishment of the engineer mission. The shortage of shipping and convoy vessels, and the inadequacies of air transport made supply to the wide dispersion of Theater forces exceedingly difficult. Control of these widespread forces was a considerable problem under a complete lack of telephone, telegraph, and cable lines. These factors, together with the low priority accorded the Theater in the allocation of the available sinews of war—men, materiel, and transport—contributed to the overall engineer problem in the war against Japan.

Principles of strategy, tactics, and technology established under the normally accepted doctrine of modern ground warfare across a land mass proved ill-adapted to the geographic conditions existing in the Southwest Pacific. However, although the engineers were inadequately prepared initially for the type of military operations to be encountered, yet peacetime professional experiences in civil works of world-wide scope enabled the relatively few key engineers sent to the Southwest Pacific to foresee at an early date the engineering needs existing. Unfortunately, however, the recommendations of these early engineers were not acted upon within reasonable periods of time because of the inability of various planning agencies, including engineers, in the United States to visualize the situation fully. Although many individuals were sent to the Theater on inspections, few, if any, with ability, power, and prestige sufficient to act, visited the Southwest Pacific early enough and remained long enough to really get the picture.

Thus, World War II in this theater of operations was fought and won with the engineer means available, but it might have been won even more efficiently and, possibly, at an earlier date if it had been possible to capitalize on many of the lessons learned in the early days of the conflict. The following comments, most often stressed by Engineer officers participating in Southwest Pacific operations, are, therefore, included in *Critique* as recommended factors for consideration in future planning to provide more effective engineer participation.

Construction

The incessant need to advance the bomber line by provision of airdromes made the construction mission in the Southwest Pacific of primary importance. As each strategic area was seized for an advance base, selected airdrome sites were developed step by step through engineer effort. From clearing and leveling of sod runways for transport aircraft carrying initial supplies, engineer construction progressed to establishment of facilities for fighters, followed by provisions for bomber operations, with subsequent accommodations for depot and major overhaul units. Upon completion of each of these steps, the new type of aircraft, for which provision had been made, moved onto the field and the bulk of the preceding type moved forward to another site where the same sort of coordinated development was taking place to extend the bomber line still farther into Japanese-held rear areas. Typical of this development was the operation of heavy bombers from Dobodura while, at the same time, medium bombers were based at Nadzab, fighters at Saidor, Finschhafen, and Cape Gloucester, and transport aircraft moved in supplies to the newly seized runway on Los Negros in the Admiralty Islands. This pattern of operations, repeated in practically every instance until the advent of naval surface and air support, limited over-all Theater advances to the rate of air base advances. This rate, in turn, was entirely limited by the rate at which engineers could construct and establish airdromes, ports, and other major facilities for the supply of such bases in the undeveloped areas of the Southwest Pacific.

While Japanese troop concentrations, rarely numbering a division, had been confined generally to coastal areas during earlier operations, in the Philippines the island masses were overrun in their entirety by enemy forces consisting of many divisions. In the Philippines, therefore, Theater ground forces entered into a major combat effort, and the construction of roads and bridges to support their advances placed new demands of high priority on the available engineer effort. The necessity of providing and maintaining communication routes in the Philippines, however, in no way decreased engineer responsibility for construction of airdromes on Leyte and Mindoro from which to stage air elements for the establishment of local air superiority and the softening up of Japanese defenses on Luzon. Instead, construction and maintenance of routes constituted an additional, urgent engineer mission upon which the speed of the overland advance of the tactical forces was dependent. The rate of engineer progress to meet tactical demands now required exhaustive efforts. Heavy rains and narrow roads which broke down under heavy traffic impeded engineer construction on Leyte. On Luzon the pace of engineer support was gauged by their dexterity in replacing or repairing the many destroyed and damaged highway and railway bridges in addition to construction of new roads leading into the mountainous areas occupied by Japanese forces.

Preceding chapters have stressed the difficulties under which this vital over-all construction program operated: the lack of appreciation by many task force commanders of the engineer mission—the inadequate time allowed for engineer planning—the limited shipping available for the transportation of engineer supplies and problems of diverted shipping—the insufficient and deadlined engineer equipment—the inadequate stocks of engineer supplies and spare parts—and particularly the serious shortage of engineers, especially those properly trained for construction missions, as well as engineer depot and maintenance troops. Yet centralized control of the available engineer construction units for flexible employment wherever the need was greatest was retained only by taking a stand against the demands of the Allied Air Forces for the permanent assignment of engineer aviation battalions to that command. Strong representations were made to the Commander in Chief by the Chief Engineer, GHQ, SWPA, who pointed out that the loss or divorcement of these engineer aviation battalions from centralized control would cripple the operations of the limited pool of engineer construction units struggling with the ever increasing over-all Theater construction program. Although engineer control of the limited units available was retained, however, other problems prevailed.

Further augmenting the burden of engineer construction forces were the repeated demands for types of construction beyond the requirements of bare essentials established in existing Theater construction policies. Restricted in training and experience to their own particular branches of the service in peacetime, certain commanders, with little appreciation of the extent of the engineer mission in the Theater, arbitrarily specified improvements such as waterborne sewage systems and types of structures generally far more elaborate than the authorized theater of operations types. Buildings rather than tents were sometimes specified despite the fact that other commands in the same area were being quartered satisfactorily under canvas. Covered walkways between headquarters buildings and provisions of officers' clubs were authorized on occasion without consideration of the higher priority of all urgently needed facilities to such construction.

The Chief Engineer, GHQ, SWPA, continually strived for adherence to the basic engineer doctrines of "First things first," and "Build only the basic minimum." In view of the limited engineer forces and supplies available, concentration of engineer effort on essential construction projects was not only a proven principle, but the only practical procedure under the circumstances. Sound engineering judgment was required to select the first essential tasks and rather ruthless adherence to the resulting program was necessary despite all pressure for early construction of projects of secondary importance. When such a policy was preceded by detailed planning of the work to best organize and handle the large force of engineer troops and equipment involved, the significant amount of progress made each day was plainly discernible to even an inexperienced observer while peak efficiency and interest of the construction troops were maintained. Such concentration of manpower and equipment, made possible the most efficient application of the limited available supervisory personnel and engineer equipment to the most urgent projects. One hundred-percent completion could not always be achieved, but one hundred-percent usability of interdependent installations at the earliest possible date was the goal.

Two elements of good construction procedure which, though repeatedly stressed, did not receive the attention they deserved in all operations were, first, advance planning and scheduling of operations, and, secondly, continuous inspection and analysis of the work in progress to eliminate inefficiencies. These elements merit consideration and emphasis in postwar engineer studies and training programs.

Under pressure of strategic considerations, higher commands were sometimes forced to make rapid changes in plans and time was not taken for engineer estimates of the situation. Under such circumstances, it was often necessary for engineer organizations to begin construction without sufficient time to properly plan or prepare schedules in advance; the all-important factor was to get physical progress started at once. Starting under these conditions is poor practice and should be avoided whenever possible; however, once construction was initiated, there was no excuse for laxity in planning and scheduling future progress. Even on operations initiated after due consideration of an engineer estimate, the relative importance originally accorded respective projects of the over-all program planned often changed with the tactical situation and disrupted previously well-planned schedules. Obviously a schedule was not only necessary, but had to be prepared with careful consideration of variable elements. In the absence of such a schedule, any change in operations must be premised on snap judgment instead of on a careful plan for effecting changes with a minimum dislocation of effort. It is impossible to visualize completely the ultimate results of a contemplated change unless the proposed alternate schedule, as well as the present status of the work to be affected, is available.

It was believed by some that the establishment of a target date for completion of a project constituted all the advance scheduling necessary, and that a periodic computation of the percentage of completion would show the progress of the work. This conclusion invariably resulted in inefficiencies. A project must be broken down into component parts and those parts fitted together into a chronological plan if a project is to be *engineered* and not *master-minded.* Only a graphic, chronological record can present visually the over-all problem. As the number of projects multiply, the use of progress schedules becomes increasingly valuable. Such schedules make it possible to predict when engineer materials, equipment, and labor will be needed and facilitate checks on supply requisitioning, transport, and essential expediting. They also provide the means of following progress continuously and allow readjustment in disposition of labor and equipment to meet changes in the progress of the work. These graphic, chronological schedules can and should be simple, and the paper work involved in keeping them up to date kept at a minimum consistent with control. Complicated schedules of too much detail defeat their purpose. The form is not important, other than the essential need of a graphic scheduling of key component operations, but the immediate availability of the information is essential.[1]

The second element of good construction procedure which was not always followed as conscientiously as necessary was continuous inspection and analysis of the work in progress for maximum efficiency of production. It was constantly directed, but reports indicated that only major factors and their subsequent correction received adequate personal supervision while minor details were frequently passed over as too unimportant to warrant attention. Yet every engineer knows that each project should be viewed as a composite of many simple operations. The cumulative effect of inefficiency in any one controlling feature can seriously affect synchronization of operations and retard accomplishment of the over-all mission. For example, the efficient operation of a gravel pit depends largely upon keeping the shovel operating. If a shovel was deadlined a day a week, great concern was evidenced, but little attention was paid to the fact that poor operating procedures might have caused it to waste one minute per truck, which amounted to a loss of time per week in excess of that caused by the mechanical breakdown. Yet a slight change in the way trucks maneuvered under the shovel, a man assigned to direct them, the shovel set differently, or an occasional pass with a road grader to improve the condition of the hauling surface within the pit or under a loading chute might have corrected the situation. Similarly, conditions of sections of haul roads were ignored because of a loss in travel time of only a few minutes per trip. Yet the cumulative loss through such indifference far exceeded the time that would have been required to repair the road section. Boulders lying around, top soil and humus which got into open work, improper arrangement of lights for night work, all caused efficiency to be reduced.

Among construction operations requiring inspection and correction was one which could by no means be considered minor. That operation was drainage. Yet, all too frequently it did not get the close attention its importance merited despite repeated stress from the highest engineer staff level for the provision of adequate drainage as one of the earliest features of any construction project. The futility of trying to build roads and airdromes on a soft and unstable foundation should have been obvious. Countless days of manpower and equipment were wasted in hauling and placing thousands of cubic yards of selected materials to build up above the water table. Yet the resultant construction on such a foundation was characterized by poor quality and always required inordinate maintenance and repair. In almost every case it would have been far easier in the earliest stages of construction to find the best potential drainage channels initially and to apply original efforts to opening and cleaning them out. Lowering the water table by such provision for easy run-off and drainage of the subbase would have required relatively little

[1] *Editor's note:* The difficulties of initial engineer operations in the Southwest Pacific are well illustrated when this element of good construction control had to be considered an unattainable luxury and replaced by verbal agreements on principles and details between commanders responsible for various elements of work in forward areas. These officers had no previous experience on such terrain as encountered upon which to base an estimated time of completion for any operation. Moreover, the construction troops available varied tremendously in their ability and in their equipment. The incidence of deadlined equipment because of shortages of spare parts and repair personnel negated any possibility of accuracy in progress schedules if they could have been prepared. But they could not be prepared without engineer staffs, and engineer staffs in forward areas were not initially available.

effort as compared to attempting to establish roads, airdromes, and hardstandings on a bed of muck. The savings reflected not only in the initial over-all construction but in subsequent maintenance cannot be overstressed. All engineer headquarters should check specifically during inspection of work under their jurisdiction to see that adequate drainage is provided in the earliest stages of all construction projects.

In all construction it has long been recognized that orderliness increases efficiency. If materials are not delivered at the right spot, if waste material is allowed to accumulate underfoot, and suitable and clear means of egress and ingress are not maintained, then efficiency is reduced. Orderliness also implies attention to first things first, and if adequate drainage is not provided initially, undue effort and waste of equipment hours for repairs and maintenance will be required. All of these things are but details that are part of the whole. To be in a position to see them all and to effect correction requires personal observation. Without constant personal inspection too often their relative importance is overlooked, and the attitude that only big things count and cost is unimportant becomes prevalent. The necessity of saving accumulated minutes for conservation of man and equipment hours is too rarely considered. Such waste can be corrected only by personal inspection, study, clear thinking, and the application of common sense. Above all else, there is no substitute for continuing personal inspection.

In summing up, during World War II fundamental engineer doctrines were proved correct. The utter dependence of tactical success on the construction program in modern warfare emphasizes their importance. These doctrines cannot be overstressed; therefore, they are repeated. Plan thoroughly and base decisions on engineer estimates of the situation. Build only the essential, basic minimum. Concentrate effort on first things first. Adhere to simplicity and utility of design. Effect economy of effort. Observe the necessity for centralized control of engineer units under direct channels of engineer command. Maintain continuing personal inspection.

Personnel

The shortage of engineer troop units was the greatest engineer problem encountered, and affected the progress of every operation. There were not only insufficient units of certain types, but during the early phase of operations in the Theater some types were absolutely unavailable for assignment to field operations. Yet, the success of a tactical operation was often determined by the dispatch with which the engineer construction missions were accomplished; and the progress of engineer construction missions was determined by the adequacy of engineer troops and supplies, especially as to their time of arrival in the objective area.

In addition to the general shortage of engineer units in the Theater, however, too often in the early days of the war in the Southwest Pacific task force commanders and their planning staffs neglected construction requirements in favor of their combat missions. On their task force operations, they brought in excessive tactical units, quantities of food, ammunition, and petroleum products in early echelons. But, more often than not, engineer units, in insufficient numbers, were brought in late and without the heavy construction equipment needed to meet the target dates of their high-priority construction missions. However, field commanders who were able enough to retain their fighting commands soon discovered the vital need of adequate engineer means. This was enhanced by the fact that construction missions, particularly airdrome construction and initial port development, were given as important a status in operations instructions as tactical missions. So it was not long before demands for engineer troops and supplies were made and reiterated very strongly even by these same tactical commanders, but the supply was far below the demand. Combat divisions had been sent to the Theater actually in excess of the logistic support planned or provided for them. And the efforts of the engineers available in the Theater had to be spread even thinner to meet the increased logistic demands occasioned by these unbalanced increments. The initial preference of tactical commanders in the Theater for excessive combat units, however, could not be held solely responsible for this situation, because planning staffs in the United States, as well, had failed to balance logistic troops with the combat troops they organized. In substance, it was a question of planners on all levels, calling principally for fighting men, because conceptions of military requirements were based on a lack of previous experience in this part of the world where the urgency for adequate logistic support was parallel to the need for tactical troops. This placed upon the Theater engineer organization a burden considerably out of proportion to that borne by other services.

As indicated heretofore, after the defeat and mopping up of Japanese forces in each campaign, infantry and other tactical units enjoyed periods of rest and recuperation. But engineer units slogged on, 24 hours a day, establishing the newly won base and building it. In addition, they very frequently had to unload ships and carry supplies to dumps, from which they subsequently had to move and outload them aboard air and surface transport for succeeding operations. Without pause, these same engineer units had to be catapulted into the next operation and the procedure repeated time after time, because there was no alternative if existing needs were to be met by the number of engineer units available. The effect of this on the engineer troops in the Theater was, of course, debilitating, particularly to those units continually so engaged for 2 years or more. Leaves of absence for engineer soldiers in forward areas were all but impossible. There was only enough shipping for a very small percentage of a unit to return to rest camps in Australia. Those few soldiers who did go were often lost for months over their allotted time because of shipping difficulties when returning. Some were picked up by hospitals, base headquarters, and other installations, and detained to assist these rear area organizations at the expense of units at the front. Finally, adoption of a no-leave policy was necessary in justice to all men and units. Replacements in the early days were practically nil, and the Military Occupational Specialty (MOS) system, permitting identification of men with a skill, was, at most, only partially effective.

Representative of the shortage of engineer troops was the situation initially existing at Milne Bay where one company, later increased to a battalion, had to construct a major port and air base. Engineer availability throughout the Theater gradually improved thereafter until the occupation of Japan, although there still remained, even then, a shortage of engineer depot companies and spare parts units. Engineer maintenance companies were inadequate in numbers until after the liberation of Luzon. Engineer heavy construction units were always insufficient prior to the occupation of Japan. This was rectified insofar as practicable by utilization of engineer aviation battalions on all types of engineer work, instead of placing them solely on construction and maintenance of air facilities, and by reorganization of some combat battalions into construction battalions. Because of the nature of warfare in the Southwest Pacific, little need was found prior to the Leyte and Luzon operations for combat groups, nondivisional combat battalions as organized, or camouflage companies. These units were, therefore, reorganized or assigned to other types of work suited to their training. Shortages in supervisory headquarters units were partially corrected by the activation of several engineer construction brigade headquarters within the Theater during 1944 to provide suitable command headquarters for the considerable number of engineer units then being committed to certain operations. Floating bridge units available were adequate for the operations on New Guinea and adjacent islands, but were not sufficient for the subsequent Leyte and Luzon operations.

Hand in hand with unit deficiencies was the shortage of officers capable of supervising engineer operations. Far too small a percentage of Engineer officers was comprised of qualified engineers or men with a background that would enable them to adapt themselves to the engineer problems encountered. Far too few of them understood the fundamentals of operation and maintenance of heavy construction equipment. Efforts to obtain officers qualified for this type of work from the United States met with so little success as to have almost negligible effect. In the over-all strategic plan of operations against all the armed enemies of the Allies, the needs of the Southwest Pacific Theater were necessarily accorded second priority. An extremely heavy burden, therefore, was placed on the few officers with proper background available in the Theater. The success of operations was largely attributable to the energy and abilities of these relatively few officers, and to the ability of the average officer of the United States Army to grasp new ideas quickly and improve them with his own initiative and intelligence. Not only was it almost impossible to obtain trained construction officers for the units, but it was also extremely difficult to obtain Engineer officer replacements of any kind. One method of filling officer shortages was the promotion of enlisted men from the ranks. But not nearly enough of the enlisted men qualified from past experience for engineer operations. While some experienced bulldozer operators, drafted into the U. S. Army Air Forces and assigned to air units in the Southwest Pacific, were serving as tail gunners, for instance, champion wing shots and trap shooters were laboriously trying to run bulldozers. Similarly, during the early phase of Southwest Pacific operations, Ordnance, Signal, Quartermaster, and various other services, as well as the arms, received officers with engineer education and experience but did not capitalize on their full capabilities. In the future greater effort must be made to see that all individuals especially qualified for engineer operations find their way to Corps of Engineers organizations. The Corps of Engineers must fight for the assignment of higher caliber, technically qualified officer and enlisted personnel and must increase the percentage of qualified technical men over the nontechnical among their appointees to Engineer officer candidate schools.

Undoubtedly the over-all shortage of engineer personnel in the Southwest Pacific arose in part because of the inability of the Engineers to campaign as successfully as other services for inclusion of adequate engineer strength in the over-all troop basis. Signal and Ordnance, for example, appeared to be far more successful in obtaining their shares of troop allotments as their troops were generally furnished as requested. Engineer troop authorizations within the Theater, however, exceeded the quota provided on the U. S. troop basis and could not be made available to the Theater. More aggressive repetition and persistent stress of needs by higher Engineer staff officers are obviously required.

Only maximum effectiveness of the engineer personnel available could offset to some extent the effects of the shortages prevailing in the Southwest Pacific. This was particularly true of staffs below Theater level which were responsible for planning and supervising accomplishment of engineer missions. However, the War Department restriction on requesting or suggesting a specific individual by name for a definite assignment often prohibited the most advantageous organization of such staffs. For future consideration it should be pointed out that the top engineer team in the Southwest Pacific worked so well together because of long previous acquaintance and mutual respect. Engineer operations in the future, and, for that matter, operations of all arms and services, could benefit materially if recognition was accorded to the expedience of personal appraisals based on past experience. In the Southwest Pacific a staff of strangers, made up purely on a MOS basis, required considerable integration before they could function as smoothly and efficiently as a staff organized on a basis of long and mutual acquaintance.

Tables of Organization

While reports of individual operations on which the preceding chapters are based may not have stressed the importance of Tables of Organization, nevertheless, their proper balance carried considerable weight in the over-all picture. Thus, it is considered pertinent for purposes of future study to include in this final chapter the major recommendations pertaining to organization which were proposed from the Southwest Pacific.

In this theater of operations most commanders expected their staff engineers to direct the activities of the engineer units assigned or attached even though they were not usually specifically announced as commanding the units. It was customary with few exceptions, therefore, for task force engineers to exercise much more than general technical supervision of units without following command channels. That the procedure was effective was evidenced by the indirect vindication sometimes accorded it when a commander issued instructions without the advice of his engineer, or contrary to it, and achieved only generally unsatisfactory results. Engineer sections of major commands for the most part, however, were not of sufficient strength to handle the multiple engineer missions. This was due in part to a shortage of qualified personnel within the Theater, as well as to limitations of Tables of Organization.

Not only engineer sections but many units of standard War Department Tables of Organization (T/O) strength proved inadequate for the type of operations encountered in the Southwest Pacific. During the war these deficiencies were corrected within the Theater by authorizing additional equipment for units, by reorganizing within units, and by providing provisional organizations from Theater overhead. Following the end of hostilities, the War Department requested Theater recommendations, based on Theater experiences, for permanent changes to Tables of Organization and Equipment (T/O & E). In compliance, the Chief Engineer, GHQ, Army Forces, Pacific (AFPAC), obtained recommendations from the major commands for study and submission to the War Department. These recommendations developed many organizational factors for future consideration.

Army Engineer Section

The approved T/O for an army engineer section was reported as being quite inadequate to handle the many logistical and base development problems encountered in addition to the normal engineer combat missions. The army engineer staff, in addition to its normal functions, was also responsible for the formation of numerous task force engineer staffs which on many occasions could be organized in time for specific operations only by assignment of essential personnel from the already understaffed army engineer section. The required supervision of engineer special brigade operations and the extreme distances involved in inspection and supervision of engineer activities further burdened the understrength staff available. Meanwhile, the problems of exhaustion and high sickness rates resulting from intensive and continuous work of engineer units in the tropics had to be solved; the inexperience of most engineer personnel with the heavy construction required also had to be overcome.

The recommended T/O & E for an army headquarters which was submitted by Sixth Army included an increase in the authorized engineer section from 28 officers, 1 warrant officer, and 43 enlisted men to 49 officers, 2 warrant officers, and 62 enlisted men. Besides providing additional personnel to permit special attention to planning, construction, and supply, in addition to handling of normal missions, the recommended T/O & E provided for the operation of an engineer section motor pool, an engineer radio communications net, a historical section, and a maintenance section. The recurring need for all of such augmentation during actual operations was met only by carrying the additional personnel on temporary duty with the engineer section.

Corps Engineer Section

In most Southwest Pacific operations, corps operated separately with responsibility for logistical and combat missions not unlike those of a task force operating on its own. Efficient execution of the corps engineer missions, therefore, required the engineer section of the corps headquarters to act as an operating element rather than merely a special staff section, and to exercise effective control and coordination of the large engineer force and tremendous quantities of materials and equipment involved. Concentration of the engineer potential at the corps level, rather than inclusion of larger organic units in the division, made the corps engineer responsible for direct control of the bulk of operations by field engineer units. Increments of organic mobile equipment of modern design in division and corps proportionately increased engineer work necessary for provision of corps communication and supply routes. Adequate and timely provision of such roads, in turn, required widespread coordination for efficient employment of the engineer effort available. Staff planning was not limited to combat alone. Nor was the corps engineer section's responsibility for directing and supervising engineer missions limited only to combat missions. Engineer construction, maintenance, supply, and reconnaissance and intelligence functions were all a part of its missions. These responsibilities of the corps engineer sections in the Southwest Pacific were far in excess of the capabilities of the totally inadequate section authorized by T/O. To enable them to discharge their duties, these sections, therefore, had to be reinforced by the addition of temporary duty personnel. However, in the continued absence of an upward revision in personnel authorizations contained in T/O's, virtually permanent assignments of engineer construction or combat group headquarters had to be made to augment these sections sufficiently for accomplishment of the missions charged to them. There was no other satisfactory solution. Only by such supplementation could the wholly inadequate corps engineer staffs authorized execute their assigned functions. The urgent need for an adequate control unit for the engineer troops of a corps was real and unquestionable, and its future development was considered essential.

Task Force Engineer Section

The provision, without T/O & E, of engineer staffs for several task forces operating simultaneously on varying missions often presented a serious problem. Many task force operations were conducted for the sole purpose of seizing ground for the construction of airdromes to advance the striking radius of the air arm, and the selection of a capable task force engineer and staff to initiate such construction was almost as important as the selection of a capable task force commander and staff. It was, however, impracticable to set a standard T/O & E and operating procedure for a task force engineer staff. The organization had to be determined by the scope of the engineer missions involved. Generally, it was found desirable to provide an engineer construction group or engineer construction brigade headquarters as the engineer staff section with the group or brigade commander acting as task force engineer. Even when contemplated operations were so limited in scope that one of these headquarters type units was not justified, it was determined that a provisional engineer staff should be provided rather than utilizing the senior engineer unit commander as task force engineer and detaching personnel from within his unit for supervision of task force engineer operations.

Army Service Command

The provision of an army service command to an army to handle its logistic and construction

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missions on operations of army scope proved invaluable. The early release of army engineer units for more effective support to combat operations was one of the valuable by-products. To facilitate this turnover, it was recommended that the army service command should be organized well in advance of an operation in order to participate fully in planning and to take over logistical and construction responsibility from army at the earliest possible date. Although basically not strictly an engineer command, the engineer logistical and construction responsibilities with which the army service command was charged determined its importance in engineer considerations. This command was organized from various staffs and units under United States Army Services of Supply (USASOS) control in the Theater for the logistical support of army task force operations. Its establishment succeeded the earlier procedure of hastily improvising such a service command group by detail from various elements forming part of the task force. Aside from immediate tactical gains realized by the assignment of an independently organized army service command, disruption of future logistical operations at an otherwise critical period of turnover of responsibility was obviated. Upon subsequent transfer of logistic responsibility in the objective area from army to USASOS, the existing support of an army service command permitted an equable and serviceable transition to be effected. Staffed with USASOS personnel rather than details from army elements, such a service command operating under army could revert to USASOS control and eliminate any need for replacing staffs and commands at the time of turnover by newly assigned USASOS personnel unfamiliar with local conditions.

Engineer Special Brigade

Since the use of this type of unit had been limited to training prior to arrival in the Theater, the development of standard operating procedures and proper T/O & E had required close attention. Immediately upon arrival of the 2d Engineer Special Brigade (ESB), which was the first to be employed in the Southwest Pacific, reorganization of the brigade into a more flexible organization had been necessary to meet Theater requirements. The former sharp delineation between boat operations and shore operations was removed by organizing three regiments, each consisting of boat and shore battalions, with a separate maintenance battalion of three boat maintenance companies. The boat maintenance battalion was later strengthened by the addition of a heavy shop company to handle the more difficult maintenance problems. Brigade communications were continuously improved to meet the increasing need for communications between widely separated units. Heavy engineer equipment of the shore battalions was greatly increased to permit more effective handling of cargo and more speedy development of roads and beach dumps as well as to equip these units for heavy engineer construction when not engaged on their basic shore party functions.

These brigades were unquestionably the best means available to the ground and naval forces for beachhead operations, and played an extremely important part in all amphibious operations undertaken. No other unit or combination of units was so well organized and equipped to supervise and carry out shore-to-shore or ship-to-shore movements, and shore party activities. What heavy cargo trucks were to the campaigns of World War II on the continent of Europe, the ESB LCM's and DUKW's were to operations on the islands of the Southwest Pacific. In this theater water transport largely took the place of overland delivery, and the amphibian engineers, in accord with their motto, "Put 'Em Across." The port facilities readily available in the European Theater of Operations were initially bulldozed from coral and built on barren beaches in SWPA largely by these seagoing engineers.

The road back from Australia to Japan was principally a nautical course between islands which were barricaded more often than not behind fanatically defended reefs. Across these reefs and through plunging surf, the engineer special brigades carried men and supplies into Nassau Bay, up the coast of New Guinea, through bloody Arawe on New Britain, the Admiralty Islands, Wakde, Biak, Noemfoor, Cape Sansapor, and Morotai Island into the Philippines and then Japan. Their rocket-launching, provisional support batteries provided the close-in fire support for landing troops; their small craft, remaining in the objective area under ground force control, afforded mobility to the tactical troops heretofore impossible when naval elements returned to rear bases. Across the beachheads established by shore battalions of these engineer special brigades ran the life line of the fighting forces advancing against inland enemy defenses. It was with full justification, therefore, that General MacArthur recommended "that careful consideration be given to the perpetuation and expansion of such units in the future Army set-up." [2]

Headquarters and Headquarters Company, Engineer Construction Brigade

Organized initially after repeated recommendations from the Theater, this headquarters unit proved extremely useful for wartime operations where assumption of responsibilities above group level for planning, supervision, and coordination of extensive engineer construction operations was required. Early in 1944 two such units were organized provisionally in the Southwest Pacific to plan employment of and to supervise engineer units which were assigned or attached to an army for development of lines of communication and initial base establishment in support of combat elements. These two brigade headquarters and headquarters companies were so successful that four additional provisional units of this type were organized in the summer of 1945 to participate in the planned operations against the Japanese homeland. In planning for operations, in undertaking major construction, and in coordinating the many and complicated engineer tasks of armies, task forces, and bases, these units thoroughly justified their organization. Subsequent recommendations strongly advocated formal recognition of the need for a unit of this type as a standard engineer unit, and a proposed T/O & E for a headquarters and headquarters company, engineer construction brigade, was prepared by the Office of the Chief Engineer, GHQ, AFPAC, for future consideration of the War Department.

Engineer Construction Group

Comments received from major Theater commands regarding employment of the engineer construction group pointed out several undesirable features of this organization. First, the group headquarters lacked the personnel to properly administer and supervise the many types of engineer units operating under its control. This is a weakness that should be avoided in any military organization. In addition, group commanders without an adequate staff had little time for an appreciable interest in the welfare and administration of personnel of the various units temporarily attached to the group. The group itself, as constituted, became involved in complicated shifting in the attachment and movement of engineer units which tended to cause delay in operations. Recommendations, therefore, advocated elimination of the group as established and its replacement by an engineer regimental organization of two battalions with a strong headquarters company and a service company capable of administering and supplying all elements of the regiment as well as units attached from time to time. It was considered that a regimental organization with a headquarters company would eliminate any laxness in supervision and would insure the command's familiarity with the personnel and abilities of the elements of the regiment.

After considerable study of recommendations received from subordinate commands, the Office of the Chief Engineer, GHQ, AFPAC, submitted

[2] Ltr, CinC, SWPA, to CofS, WD, 19 Mar 45, sub: Engineer Special Brigades. In Records Section, GHQ, SWJA.

its conclusions to the Chief of Engineers, War Department. The proposals of the major Theater commands were concurred in, and the engineer construction organization recommended as most suitable to conditions encountered in the Pacific was based on a regimental pattern consisting of a headquarters and headquarters company, a supporting company (designated as an equipment and maintenance company to adequately indicate its desired functions), and two construction battalions. It was pointed out that such an organization with permanent assignment of a limited number of construction units and a specialized supporting unit to a supervisory headquarters is essential for continuity of command relationships and maximum working efficiency. Still it was not contemplated that all construction battalions should be included as fixed components of a larger organization. Some should necessarily be separate to permit flexibility for attachment to other higher engineer echelons.

Controlled flexibility had proved essential for construction on the scale and in the manner which conditions in this theater required. It was, therefore, suggested that the designation of "group" rather than "regiment" be retained since the concept of the proposed organization was not a return to the relatively inflexible regimental organization in contrast to the flexible group, but, rather, an intermediate between the two. To the permanently assigned units, it was suggested that attachment as needed be made of construction, aviation, and general service battalions, equipment and maintenance, dump truck, maintenance, petroleum distribution, and port construction and repair companies, as well as teams under T/O & E 5–500. Upon adoption of this type of construction organization it was recommended that general service and special service regiments, headquarters and headquarters companies of aviation regiments, and the separate battalion be eliminated in the interest of reducing the diverse types of engineer construction and service units to the minimum essential to operational requirements.

Headquarters and Headquarters Company, Engineer Port Construction and Repair Group

This unit was not employed in this theater of operations as a supervisory headquarters with specific supporting units attached to provide additional personnel. Instead, it functioned as a specialized port construction company under the control of the construction group or similar agency which controlled all other construction in the area. Its mission consisted primarily of the construction of fixed and floating wharves and rehabilitation of existing facilities. The necessary earthwork involved in the development of the wharf areas was effected by other construction units. Employment of units in this manner resulted in an efficient and expeditious wharf construction force. It was, therefore, considered that the most desirable type unit for such port construction as was required in this theater would be a separate company, organized and equipped for wharf construction and repair, which could be attached to a construction group when needed.

Engineer Depot Group

While experience with the engineer depot group was limited, it indicated a need for continuance of this type of organization for base operations. The weakness of the engineer supply system was a hindrance to engineer operations throughout the war and one of the greatest contributing causes of this weakness was the lack of skilled and trained engineer depot units with the rank, interest, experience, and ability required to pull the complex engineer supply activities together. The unanimous and ultimate conclusion was that the engineer supply set-up must be greatly strengthened, and that one of the best means of accomplishing this end was by centralizing control of depot units through use of a strong engineer depot group headquarters to coordinate supply activities and related functions of maintenance, repair, storage, issue, and transportation of engineer equipment within the group.

Engineer Combat Battalion (Divisional)

One of the most important and most frequently recommended changes in organization involved augmentation of the engineer component of the infantry division. The divisional engineer troop component of one combat battalion proved without exception to be incapable of providing sufficient close support for a division. It was grossly inadequate to meet the requirements imposed upon it by the tactical and technological demands arising from modern warfare in the terrain and climatic conditions faced in the Pacific. First, the mechanization of forces had increased the dependence of combat elements upon engineer construction of roads. The movement of all mobile equipment, whether self-propelled guns, tanks, or vehicles, is dependent upon approach routes and bypasses around obstructions. Concurrently, increased mobility of advance increases the length of supply lines. The early forward displacement of self-propelled field artillery guns, for example, would have been ultimately useless unless their fire power was maintained by prerequisite tons of ammunition which could only be supplied over an engineer constructed road net through the mountains and across the jungles of this terrain. Second, the average weight of vehicles had greatly increased. The M–4 tank was habitually used well forward with the leading combat troops, and as a result the mission of the divisional combat engineers was no longer confined to provision of small bridges of the light pioneer type, but involved instead the construction of 30-ton bridges over which almost all army loads could later pass. Then, adding to the missions of the combat engineers, the rapid construction of all-weather landing strips for aircraft engaged in artillery observation and evacuation of casualties became essential to divisions.

Moreover, since it was standing operating procedure to attach one engineer company to each infantry regiment, there were no divisional engineer troops left to build and maintain the main supply route and support the service functions in the division service area. To provide the required engineer support, therefore, it became standard practice to augment the engineer component of a division by attaching an additional engineer battalion from corps troops. This standard practice was followed, not alone in the interest of the engineers, but in compliance with the direct requests of army, corps, and division commanders who repeatedly recommended that a definite provision be made within the authorized organization of the division for this additional engineer battalion to permit continuity of training as well as employment. When submitting Theater recommendations for permanent changes to T/O & E's following the close of hostilities, therefore, it was strongly advocated to the War Department that the organic engineer component of the infantry division be increased to an engineer combat regiment composed of a headquarters and headquarters and service company, and two engineer battalions, each consisting of a battalion headquarters and three lettered companies.

Airborne Engineer Combat Battalion

This unit was considered inadequately equipped and manned for the construction missions encountered. Subsequent recommendations suggested that future organization of airborne divisions provide an engineer component almost double the size of the battalion then authorized and equip it with ample heavy construction equipment. Even disassembled equipment of heavier design, involving the expenditure of effort to reassemble or even reweld it, proved more useful than the light airborne engineer construction equipment. Since at the time of recommendation the means available for air movement of the heavier items did not exist, it was pointed out that heavier equipment can generally be delivered to the unit overland or by water soon after the initiation of an airborne operation. Experience proved that such heavier equipment with its faster rate of performance could spell the difference between success and stalemate by insuring timely establishment of air facilities for reinforcement and routes for forward displacement.

Airborne Engineer Aviation Battalion

In every instance where an airborne unit of this type was used, the unit was almost helpless until heavier and more equipment could be provided. Morale of the units suffered accordingly. Based on experiences in this theater of operations, it was not believed that this type of unit should be contemplated for future warfare, since almost without exception elements of a regular aviation or construction battalion can be moved by air to accomplish the same results more efficiently. Instead, consideration of developing special airborne equipment was suggested, and continued study proposed for modifications to standard equipment which would permit disassembly and rapid reassembly to facilitate its movement by air in the larger transport aircraft expected to be available.

Engineer Aviation Battalion

This type of battalion was used for heavy construction of all varieties in the Southwest Pacific without regard for the fact that it was a unit organized primarily for construction of air facilities. Conversely, it should also be kept in mind that the heavy engineer construction units of the ground forces were engaged a great part of the time on airdrome construction, the employment of either being dependent on the situation and relative priorities. While the engineer aviation battalion was the best equipped of all engineer units, the tables of organization and equipment still did not provide sufficient equipment for the heavy 3-shift operations involved nor sufficient grades and ratings required to handle the maintenance and operation of this additional equipment on a 3-shift basis. Equipment allowances were progressively increased by provisional or supplemental allowances within the Theater, but little change was effected by the War Department in the Tables of Organization of this unit. In addition to an increase in grades and ratings, subsequent Theater recommendations regarding the engineer aviation battalion suggested that if extensive use of this type of unit was contemplated for support of both air and ground forces in the future, the unit should be designated as a construction battalion and not as an aviation battalion, since the latter designation complicated administration and flexibility of control.

Grades and Ratings

Occasioned by the greatly increased construction responsibilities placed on most engineer units upon reaching operational areas of this theater, one of the major problems was the necessary conversion to a 3-shift, 24-hour work day. This conversion involved not only a need for additional operators and supervisory personnel, but expansion of repair, maintenance, and mess operations, and provision of enough illumination. Authorizations contained in official Tables of Organization for engineer units, however, were not adequate, and in far too many instances it was impossible to give an enlisted man the grade and pay commensurate with his assigned responsibilities. The inadequate allowances of top grade enlisted personnel were notably conspicuous when compared with grades or ratings allotted to naval construction battalions. (See Table, "Comparison of Enlisted Grades Authorized Selected Engineer Units.") The greatest disparities evidenced were in the most essential first 3 grades. While the total authorizations in the first 3 grades allotted to an engineer construction battalion approximated 10 percent of its enlisted strength and those allotted to an engineer aviation battalion averaged only 6 percent, comparable ratings in a naval construction battalion approximated 50 percent of its complement. In the absence of revision, the solution recommended during operations was provision of an elastic T/O which would grant authority for increased personnel and ratings through organization of an operator implementation team that could be added to units in operational areas to permit a 3-shift work day.

TABLE

Comparison of Enlisted Grades Authorized Selected Engineer Units

Grade or Rating	Percent of Aggregate Enlisted Strength of Unit by Grades (Ratings)		
	Engineer Construction Battalion*	Engineer Aviation Battalion**	Naval Construction Battalion***
1	1.9	0.4	8.5
2	4.7	1.1	20.0
3	3.8	4.8	21.6
4	16.2	14.6	8.1
5	41.4	40.6	18.2
6-7	32.0	38.5	23.6
Total	100	100	100

*WD, T/O & E 5-75, 23 Dec 43 (C1, 8 Sep 44).
**WD, T/O & E 5-415, 15 May 44.
***ND, Standard Construction Unit, 10 Mar 43.

Training

The general lack of training, other than on the job, within engineer units in the Southwest Pacific during World War II was primarily due to the shortage of engineer troops in the Theater. Those engineer units that were available had to be assigned to the urgent construction requirements existing which, considering their scope and widespread dispersion, left little time or opportunity for training. While other troops were training and preparing for projected operations, the engineers, as previously pointed out, were busy establishing the camps to stage such troops, shifting without pause from base to operational area, and breaking their units into scattered elements in an effort to meet the highest priority needs at various points. Yet all too many of these limited engineer units were unfamiliar with heavy construction operations when first assigned to the Southwest Pacific. The XIV Corps, for example, reported the necessity of training 95 percent of its engineer equipment operators while engaged in operations overseas. Basic military training and discipline of outfits was good, but they knew practically nothing of sawmilling, logging, construction of airfields or of asphalt and concrete pavements, erection of warehouses, hangers, and other large buildings, removal of mine fields, operations of quarries, and, especially, of the operation of heavy construction equipment. The results were poor initial planning and layout of work by engineer unit commanders, insufficient and inefficient equipment operators, and a general lack of understanding of equipment maintenance and of the fundamentals of earth moving, drainage, and compaction. To get the work done under such circumstances increased further the engineer effort necessary, and as a result, while every engineer soldier available was absorbed in operations, engineer training was arrested. The situation was an emphatic lesson for future consideration: more effort should be made to chann[illegible]n with engineer skills into the Corps of Eng[illegible]rs, and greater stress should be applied to technical training of engineer units in the Zone of Interior to prepare them for theater of operations type of construction.

The most critical training need was that required by heavy equipment operators. As already indicated, soon after arrival in the Theater, all units were required to undertake 2- to 3-shift operation with much more equipment than authorized in the United States, and with little or no change in Tables of Organization. The average unit lacked many of the operators required for this system of operati[illegible], although the speed and readiness with which the units adjusted their organizations to meet the new requirements were outstanding proof of the ingenuity and adaptability of the American soldier.

Other training deficiencies were found, but none was nearly so evident or important as the training for heavy construction operations. The problems of living in undeveloped tropical areas, overcoming the unfavorable conditions of weather, heat, and sickness, and making maximum use of local materials required as much or more attention from engineer unit commanders as from other commanders. The difficulties of operations in these primitive areas, common to all units, were magnified in dispersed engineer operations which were necessarily performed on a 2- to 3-shift basis and involved maintenance of a greater variety and number of machines. All training possible was normally obtained on the job, and was almost entirely the responsibility of the unit commander. However, the shortage of officers with the necessary engineering background to conduct this training capably was evidenced by failure to maintain a continuous program of instruction in the use of new equipment, and by neglected indoctrination in old and new techniques so vital during a long war. Junior Engineer officers were relatively overindoctrinated with combat engineering principles as normally prescribed for divisional engineers with a corresponding lack of training in the basic construction responsibilities that confronted practically all engineers in the Southwest Pacific. Yet despite such overindoctrination for combat responsibility, many engineers, corps and divisional, knew nothing about erecting Bailey or M–2 Treadway bridges when they landed on Luzon, and actually had to learn how to use this equipment while in operations against Japanese forces. Notwithstanding the fact that most units committed were veterans of from 1 to 2½ years' service overseas, the need for their continued employment on heavy construction had been so great that they had had practically no training or experience in supporting the type of warfare that included extensive overland tactical movements on a broad front.

Efforts to conduct schools met with small success because of the extreme distances and delays involved in moving personnel to and from schools, and because of the rapidly changing construction problems. Once an organization becomes involved in actual, active overseas operations, no major separate training program is feasible unless there are sufficient engineers available to allow force and time to spare for training. In the Southwest Pacific Area where such a condition did not obtain, the best solution proved to be on-the-job training of new units by working them on the same project with a veteran outfit.

In view of the difficulties of supply encountered in this theater of operations and the obvious lack of training in use of echelon parts sets as well as unfamiliarity with requisitioning, receipt, storage, and issue of spare parts by using units, a sound recommendation for unit preparatory training which was made in the Theater merits mention. It was suggested that during some period of intensive training activity, the unit be separated from a convenient parts supply source and be required to estimate, procure, store, and transport quantities of spare parts sufficient for the entire maneuver period.

In further pursuance of engineer supply training, the appalling lack of appreciation for the importance and complexity of engineer supply prevalent during the war indicated a need for training along these lines not only by units, but by officers as well. All too often officers were assigned to supply duties because they could not be used elsewhere. The best Engineer officers avoided supply duty almost fanatically. Much discussion and careful selection were usually accorded to the assignment of officers commanding a construction or combat group or battalion, but in many cases very little consideration was given to choice of a commander for a base depot group or the most important of the supply installations. It took constant effort on the part of the Chief Engineer, GHQ, SWPA, and the Engineers of the principal commands to keep the engineer supply situation in hand. The inadequacies of supply resulting from the casual regard given this important function amply demonstrated the urgency of assigning superior officers to supply activities in accordance with their availability during wartime. The frequent bottlenecks occasioned by poorly qualified personnel in key positions throughout the supply framework highlighted the postwar need for training a specialized nucleus of the best Engineer officers in supply operations for any future crisis. It should be recognized that a good Engineer will usually be a good Engineer supply officer, but that rarely will a poor Engineer be other than a poor Engineer supply officer.

It was evident that training, including training on maneuvers in the United States, should take into consideration the terrain and related conditions to be encountered in a theater of operations. One phase of engineer training considerably affected by local geography was that applicable to amphibious operations. Practice landing beaches in the United States had not presented conditions comparable to the coral shelves and narrow, jungle-hemmed beaches with no existing means of access to the hinterland which were prevalent in the Southwest Pacific. Rehearsals for projected operations, under such circumstances, were necessary, but not rehearsals on a large scale without regard for their timing prior to an operation, nor without consideration for the condition of equipment necessary for the actual operation. Unfortunately, tactical commanders seemed to have little appreciation for the damage done to landing craft in full-scale rehearsals. Prior to the initial landing near Lae, New Guinea, the tactical command insisted on moving an amphibian engineer unit approximately 250 miles back from Oro Bay, where it was preparing for the actual landing, to Milne Bay for an almost complete rehearsal. This would have constituted such a setback to the engineer special brigade's plans for the combat landing that an appeal to the Chief Engineer, GHQ, SWPA, was necessary to have the scope of the rehearsal reduced in order that the actual combat operation could go on with full force at the time scheduled. While strenuous landing exercises in rough surf and the coral infested waters of the Southwest Pacific were necessary to familiarize amphibian engineers with obstacles to be overcome even at the expense of some equipment, their timing was an important factor. Casualties to landing boats and mechanical equipment of engineer units resulting from such exercises had to be anticipated and time allowed for replacements and repairs so that all equipment would be in suitable condition for the real landing. The underlying restriction to the practicability of such allowances in the Southwest Pacific, however, was the limited availability of such replacements and spare parts.

Tables of Equipment

Many deficiencies were manifest in established Tables of Equipment during engineer operations in the Southwest Pacific. The most frustrating to efficient completion of the various engineer missions were the short allowances of transportation, construction equipment, and maintenance equipment, as well as the inadequate capacity of the heavy equipment issued. Some of the engineer units arriving in the Theater during the early phase of hostilities were much too lightly provided with equipment. This was especially true of construction units. Revisions were made in Tables of Equipment as rapidly as time and experience would permit, even to the extent, in some cases, of overloading units with equipment without commensurate adjustments in their personnel strength and ratings or their maintenance capabilities. In addition, little consideration could be given to the availability of higher echelon maintenance within the Theater because the allocation of engineer and ordnance maintenance units to the Southwest Pacific was inadequate throughout the war.[3] Moreover, the maintenance units available were not equipped with the additional maintenance equipment required to take care of the added transportation and construction equipment furnished. Despite incre-

[3] *Editor's note:* Some serious consideration might well be given to comments arising within the Theater which did not follow the concepts of higher echelon maintenance in a theater of operations as established by the Quartermaster Corps, Ordnance Department, or Corps of Engineers. It was pointed out that any engineer organization, above battalion level, which has to operate separately should be entirely capable of performing all of its own maintenance through the scope of repairs covered by the established "4th echelon" maintenance. The ability to maintain its equipment in operating condition determined a unit's productive capacity. Inasmuch as engineer equipment is generally so heavy and difficult to transport, it was considered that maintenance and major repairs should be done *on the job* and adequate personnel and equipment provided *on the job* for such repairs.

ments of equipment to initially underequipped construction units, however, the short issue of motor transportation to major engineer units was never entirely overcome during the period of hostilities. It was partially corrected as operations progressed to assist the major units in completing necessary reconnaissances while simultaneously administering and supplying their subordinate elements. But even by the time of the Japanese surrender the transportation made available was still not sufficient to permit major engineer units to accomplish all the required reconnaissances. For future planning it was, therefore, recommended that consideration be given to extensive use of aircraft to supplement ground transportation for reconnaissance purposes.

An example of deficiencies in Tables of Equipment was the original issue of water supply equipment. Pumps, purification sets, and other miscellaneous supplies, which were needed for water supply, were not authorized as T/E equipment to units serving under stabilized conditions. This was particularly true of Tables of Equipment for base and service troops. No water supply companies were obtained until the last year of operations. As a result, frequent supplementary changes in tables were necessary which involved subsequent difficulties of trying to secure this class of supply from the United States or by local procurement. Temporizing, nonuniform methods generally sufficed for a stabilized situation, but during combat this was not the case. The number of sets available to engineer combat battalions of divisions, for instance, was not sufficient to meet the demands of the division in a widespread operation. Experience proved that battalions should be equipped with approximately 7 of the 15-gallon-per-minute units under open warfare conditions such as existed throughout the Southwest Pacific where careful treatment of water was constantly necessary because of the prevalence of waterborne diseases, and where water consumption was naturally high owing to the climate. Many small installations were preferable to one or two big ones. It was pointed out that operators for each installation should be provided on a 3-shift basis and that a water testing laboratory and personnel to operate it should be made available. Moreover, provisions for replacing operators and equipment were considered essential. When an organization is displaced forward, water supply equipment at already established water points generally has to be left in place. With provisions for replacements the operators of these installations could be replaced by new personnel from the rear, the equipment left in place, and new equipment issued to the organization.

Recommendations varied regarding well-drilling equipment which was also issued in inadequate quantities during operations in the Southwest Pacific. One suggestion proposed the organization of water supply battalions with well-drilling units as integral parts thereof. In the interest of keeping diverse types of engineer units to a minimum, another proposal advised against organizing a well-drilling unit as such, but recommended instead that well-drilling equipment be issued to a general construction organization and two or three trained drillers be assigned for its operation. It was considered that certain phases of the whole water supply mission of the engineers required careful study and possible formulation of new methods. In this connection, it was suggested that a thorough, joint study of this problem should be undertaken by the Medical and Engineer Corps.

While many small units rather than a few large ones were preferable for water supply, experience proved the reverse true with regard to heavy construction equipment. The inadequate capacity of the heavy equipment issued for the type of engineer missions encountered in the Southwest Pacific meant that such equipment had to be almost constantly overloaded and overtaxed. Frequent breakdowns and rapid deterioration resulted. Many more operators of the already insufficient number available had to be assigned to missions which could have been accomplished by expenditure of many less man- and equipment-hours had equipment of heavier and more adequate capacity been issued. One man could operate a 4-ton truck as readily as he could a 2½-ton truck. The road speed of both vehicles was identical. The maintenance required for each would have been generally the same under ordinary conditions; under excessive overloading and use, however, the lighter equipment inevitably required inordinate repairs. The respective output, of course, could never be the same. An organization equipped with 4-ton trucks could haul much more dirt per man-hour and per equipment-hour than could an organization equipped with an equal number of 2½-ton trucks. The same criteria applied to the heavier road graders, bulldozers, shovels, and other heavy equipment. Because of the inadequacy of the small so-called "mess kit" shovel, which took entirely too many hours per day to load a small number of trucks, chute loading into trucks was utilized wherever practicable in this theater of operations rather than attempting to load them by shovel. And the D–4 or small tractor was, almost without exception, actually productive only when used in the operation of such chutes. However, had 4-ton trucks been available for such operation, the D–8 tractor could have been used to push the larger load through the chute much more readily and quickly. In brief, the largest equipment that can be stowed by ship's tackle into the hold of a Liberty ship or moved over the ramp of an LST should be available for engineer construction missions. Not only would efficiency on the job be assured and savings in critical manpower effected, but the deadweight tons of equipment that have to be transported in order to achieve a certain hourly output would be materially decreased.

Supply

Providing units with the bare necessities of engineer supply for accomplishment of the tasks assigned was a continual struggle. It was a fight of inadequate forces against great odds. Never during the entire period of hostilities was there a sufficient strength of engineer supply units and personnel. On the other hand, demands for engineer supplies and engineer-constructed facilities, occasioned by operations in undeveloped and difficult terrain, were unprecedented in scope and exceeded all previous estimates.

Faced with such demands, engineer supply personnel had to operate under difficulties involving more than just their own understrength forces. Many supply ships were necessarily diverted from original destinations while en route and discharged at ports throughout the Theater where little or no engineer depot personnel or facilities were available. Yet, these ships were packed and loaded in the United States for receipt at a central depot in the Theater. But no central engineer depot could be maintained in this theater where fast, widespread movements scattered operational areas across vast distances. Such conflicting factors contributed to the development of further difficulties. Large excesses of some engineer supplies accumulated at certain points while critical shortages of the same items existed at others. Almost without exception, stocks were unbalanced at all locations, and information on such supplies as were available in the Theater was incomplete. The filling of even small requisitions often required shipments from several separate bases.

Influence of Ship Loading on Supply Operations

The efficiency of supply was seriously affected by the unmethodical loading of ships. During early operations it was practically impossible to obtain shipment from the United States of all component items of an assemblage on one ship. Under circumstances necessitating frequent diversion of vessels from original destinations, the subsequent assembly of components carried by various ships sometimes presented insoluble problems. A classic example which occurred in 1944 was the receipt of parts of a hospital assemblage on 44 ships at every port in the Theater plus 2 in the South Pacific Theater. Similarly, component parts of an asphalt plant were delivered at ports ranging from Melbourne, Australia, to Oro Bay, New Guinea. Inter-Theater reshipment to obtain needed components was necessary in many such cases and in some instances the missing components were never found.

Moreover, cargo carried was not loaded for proper order of discharge, nor for selective discharge. Often, critical items were stowed under large tonnages of low-priority supplies. A large proportion of tonnage on diverted ships consisted of supplies not wanted in early phases of an operation, or not wanted at all. It may be contended that operationally loaded ships, tailored to fit operational requirements, result in inefficient use of shipping. From a tonnage standpoint that may be true. From a tactical standpoint other factors enter into determination of efficiency. Operationally loaded ships, in contrast to nonoperationally loaded vessels, would have eliminated the time-consuming necessity of hunting and picking for the discharge of critically needed items by overworked shore parties and inadequately developed and manned depots. Moreover, operationally loaded vessels would have obviated the delays incident to intermittent discharge. It was felt, therefore, that every effort must be made to load the items and quantities of supplies in the manner prescribed by the tactical commander even at the expense of a reduction in total tonnage per ship.

Experience highlighted the need of carefully loaded ships for prompt and selective discharge where early unloading was essential to operations and where personnel and unloading facilities were lacking or in short supply. It was evident that supplies to accompany assault units and early phase service units should be combat loaded. Reliance cannot be placed on diversion of shipping for engineer supply in a fast moving series of amphibious operations. Component parts of engineer assemblages, such as rock crushing plants or prefabricated hospitals, obviously must be grouped together in their entirety and then carefully loaded on the same ship. Shipping procedures during wartime must be based on the provision of certain logistic support to tactical and strategic operations; they cannot adhere strictly to peacetime practices of merchant shipping. Under conditions of warfare, the most efficient shipping operation is that which places the required supplies at the place and time needed with the least work required at the *receiving* end. The expenditure of several man-days at the port of embarkation to eliminate even one man-hour of extra effort at the port of debarkation in the combat zone may save many hours and lives.

Ship loading was the subject of much discussion with the War Department. It was not until late 1944 and early 1945 that material improvements were made. Then hospitals were assembled in the United States before shipment. Component items of such equipment as large rock crushers, asphalt plants, and concrete plants were generally shipped on the same ship. Palletization of cement and bundling of lumber was tried to save loss and facilitate handling for use in operations. Contrary to the contention of some shipping experts, by actual test, the bundling of lumber increased the amount which could be loaded on a ship. Ships were block loaded with a given quantity of specified sizes of lumber as well as essential nails and bolts. These and other attempts at block loaded ships so facilitated the immediate use of engineer cargo at its destination that block loading of ships was extensively planned for the OLYMPIC and CORONET Operations against the main islands of Japan.

Liaison

Frequent difficulties in the provision and movement of engineer supplies for SWPA operations could have been prevented by more thorough and continuing follow-up and liaison all the way from the Office of the Chief of

Engineers, War Department, in Washington, through suppliers, depots, and ports to SWPA bases. The U. S. Army Air Forces major commands in the Theater and, later, USASOS made good use of their liaison officers, both in the Zone of Interior and in the Theater. But Engineer liaison officers were not assigned to the San Francisco Port of Embarkation (SFPE) until early 1944. The efforts of these few evidenced that a system of engineer liaison officers, with particular emphasis on liaison at ports of embarkation, will pay dividends in a future emergency.

Packaging

Besides factors of dimensions and weight, which necessitated the stowing of much engineer equipment in special holds or by use of certain booms, the manner in which an item was prepared for movement often contributed to requirements for special handling. Packaging of the many types of engineer supplies definitely needs further study. Greater standardization in packing and crating is essential. Notable advances in this regard were made during the war. Among those successfully improvised in the Southwest Pacific and recommended as standard procedure for the future by the Chief Engineer of this theater of operations was the provision of fittings on heavy equipment to facilitate its lifting. Further improvement, by similar application of a little imagination, is possible. In this connection, careful analysis of the pros and cons of palletizing should be made. It should not be forgotten that the allocation of shipping space to engineer equipment and supplies by tactical commanders was frequently prejudiced, often unwisely, by the unwieldiness and handling problems of engineer materiel.

Stock Control

All planning, requisitioning, distribution, and issue procedures are predicated upon accurate up-to-date records of stock on hand, due in, and being procured for pending projects. Without detailed advance information on cargo en route to the Theater, the insufficient number of trained personnel in administrative units labored under a considerable handicap while endeavoring to establish a system of accurate stock control. The receipt of shipping notices improved considerably by the closing days of the war, but experienced stock control personnel were never available in adequate numbers. Initially USASOS attempted to exercise stock control for the entire Theater with a few personnel in Sydney and Brisbane. Later this activity was moved to New Guinea and was sustained by the utilization of Women's Army Corps personnel. Spare parts stock control was not even started until late in 1944. Then, after continued pressure by the Engineer Section, GHQ, SWPA, it was effected only by the diversion of two parts supply platoons which were trained for the operation of a spare parts warehouse.

A recommendation worthy of consideration evoked by this situation proposed the organization of stock control teams under T/O & E 5–500 for engineer stock control functions. Two types of teams were considered necessary: one for general engineer supplies, and one for engineer spare parts. It was further suggested that the teams be so organized that they could be combined into units of a size commensurate to any specific situation.

The "Project System"

If problems of handling supplies after they were available to the Theater seemed overwhelming, the difficulties involved in obtaining them all but undermined the foundations of the supply system in the Southwest Pacific. Originally, requisitions on SFPE were limited by the critical trans-Pacific shipping situation, the low priority accorded the Theater, and by requirements of higher authority that the majority of supplies be procured direct from Australian sources. Upon initiation of the "project system" for the procurement of Class IV supplies on 20 September 1943, however, the already overburdened supply personnel found themselves under the further handicap of having to anticipate itemized requirements months in advance of operations—operations not yet specifically contemplated—to insure receipt of supplies in subsequent objective areas in time for their use on assigned engineer missions. Before requisitions on the SFPE could be filled, it was required that a bill of engineer materials necessary for a proposed operation be prepared together with supporting information outlining the tactical plan and justifying the installations and facilities planned. Such data then had to be forwarded as a project through various and numerous channels in the United States for review. Many queries, radios, and, sometimes, resubmission, were involved before approval was finally routed back through the same channels and a project number assigned. Requisitions, with the designated project number affixed to indicate the supply credit established by approval of the project, could then be prepared and forwarded to the SFPE.[4]

Since no important deletion or change was ever made in any project submitted by the Theater, the procedure merely served to further delay obtaining supplies in the Southwest Pacific. A project for a special installation, such as a large central power plant, involving nonstandard equipment, might justify submission of a bill of materials for review and special coordination of component items by technical experts available in the War Department. For ordinary requirements of standard Class IV equipment and supplies generally used in wartime construction, however, a study of procedures made by the Office of the Chief Engineer, GHQ, SWPA, indicated that the same War Department control could be maintained by submission of an advance estimate once a quarter covering 4 quarters' requirements (or 5 or 6 quarters', as desired) of items anticipated to be necessary each quarter for contemplated construction projects, normal repairs, and maintenance. A summary of the operations contemplated and projects to be established could support the quarterly estimates and contain as much detail as desired by the War Department. Succeeding estimates could reflect all existing approved projects having unshipped balances which would be required for the period covered, changes in requirements, phasing, and all new project requirements. Such estimates could be reviewed within the War Department in the same manner as was prescribed for operational projects under the project system. Upon completion of review and any necessary changes, the requirements of the first 2 quarters could be approved for supply, and approriate War Department agencies, ports of embarkation, and the Theater informed of the action taken. The requirements of the last 2 quarters could be used for future procurement purposes in the United States. Requisitions against the approved quarterly estimates could then be filled by ports of embarkation without further approval. Flexibility could be provided for unforeseen requirements between submission of quarterly estimates by radio requests, which, when approved, could be added to the appropriate quarterly requirements.

It was considered these steps would eliminate the undesirable features of the project system, would permit the same control by the War Department, and provide valuable data for procurement planning. With this in mind, the Chief Engineer, GHQ, SWPA, submitted the proposed procedure to the War Department in February 1945, and it received the approval of the Army Service Forces and all technical services. For obscure reasons it was disapproved by the Operations Division, War Department General Staff. However, it is still strongly recommended that in future emergencies any procedure similar to the project system used in World War II be avoided, and that in its place the quarterly forecast system as generally described herein be employed.

Corollary thereto, definite authorization

[4] *Editor's note:* Although the project system has been discussed under difficulties of planning the Luzon operation in this volume, the reader is recommended to see Vol VII, *Engineer Supply*, this series, Chapters IV and VI, for a more detailed account of the project system and the difficulties of its application to operations.

should be made for a theater stock pile of reserve equipment and supplies to meet emergencies and to tide over requirements between varying or lost shipments. Such a stock pile or reserve is essential although its establishment and maintenance were not favored by the Army Service Forces of the War Department.

Class II Supplies and Spare Parts

One of the most difficult problems was the supply of engineer spare parts. The almost complete failure of parts supply at times occasioned a large percentage of critical equipment being deadlined and jeopardized progress in the whole Theater. An effort was made to concentrate spare parts stocks at Milne Bay (U. S. Base A), New Guinea, but the manner of loading in the United States, coupled with the port situation in the Theater, resulted in shipments of parts being discharged in practically every port in the Theater. It was not possible to effectively transship these parts to Milne Bay, and, consequently, there was no single depot carrying representative Theater stocks of spare parts. As a result, it was often impossible to more than partially fill a requisition from Milne Bay stocks.

This situation was particularly acute in view of other conditions which frequently prevailed. Although engineer troop units generally arrived in the Theater equipped with 1st and 2d echelon spare parts for the make of heavy equipment originally assigned to them, they usually found themselves operating an entirely different make of equipment for which no parts were available in their immediate area. This anamolous predicament was a development directly attributable to shipping procedures practiced in the United States. When a troop unit was shipped out, the 1st and 2d echelon spare parts applicable to its equipment had to be taken along with the unit's baggage and all other impedimenta on the same ship or in the same convoy. The unit's heavy equipment, however, might leave from an entirely different port of embarkation on many ships. The troops and their spare parts would debark at one port and their equipment would be off-loaded at one or more different ports (and on occasion even in another theater of operations). Then, being without heavy equipment, the unit would be issued equipment available in its immediate area, the majority of items being of an entirely different manufacture from its original issue. And the new equipment would usually be without spare parts. The echelon sets already carried by the unit and designed for the unit's original equipment, which by this time was off-loaded at another port, would be all that was available. Spare parts lists, when they were included with the new equipment, could be of no value to the unit, even if some of the parts would have been common and interchangeable, because the parts had entirely different manufacturer's part numbers from those carried by the unit. The result was a complete breakdown of the 1st and 2d echelon system immediately upon the arrival of engineer units in the Theater before any mission had been accomplished. This situation, fortunately, improved as equipment became more standardized.

During operations, adequate resupply of using units with Class II supplies and spare parts proved extremely difficult. Tactical commanders frequently sent depot and parts supply units into operations without any accompanying stocks of supplies. Although using units were normally directed to take with them a total of 30 days' supply of Class II and spare parts, they were not always able to obtain these stocks in the time available between warning orders and departure for the objective area. Moreover, many units arriving in the Theater were poorly trained in preparation of requisitions and in estimating future requirements. Although administrative orders prescribed a 30-day supply of spare parts, using units had little data except individual experience upon which to requisition. This experience was naturally limited; requirements of parts for heavy equipment used in combat operations on an unprecedented 3-shift schedule with inadequate maintenance were necessarily much greater than requirements for similar equipment used for training in the United States. As a result, shortages frequently occurred in the objective areas and could not be relieved by the unequipped depot and spare parts units. Resupply shipments, requisitioned in the short planning period available to task forces, on the other hand, could not be collected from various depots and delivered in time to offset such shortages. It was obvious that if resupply is to be effective, reasonable stocks must accompany depots and parts supply units on assault shipping.

When stocks were available to depot and parts supply units, storage facilities and transportation to handle the stocks were usually inadequate. The need for organizing and adequately equipping depot companies and parts supply units to store and transport a suitable stock of Class II supplies and spare parts was all too evident.

It was also obvious that a tremendous reduction in the stocks of parts to be stored and supplied could be effected by compilation of a comprehensive list of common and interchangeable parts. For example, an engineer mechanic at Port Moresby (U. S. Base D), New Guinea, solved the problem of replacing a broken thrust roller bearing in a motor grader by locating the same type of bearing in the wheel assembly of a wrecked aircraft (B–24). This was accomplished only after measuring all kinds of bearings until the mechanic found the one that would fit. Had a list of interchangeable parts been available, the solution to the problem would have been simple. Once such a list was established, keeping it up to date would be comparatively simple by placing a contract requirement on all manufacturers of equipment for Army, Navy, or Air Force agencies that Government part numbers only be used in describing component parts of equipment manufactured.

Factors such as the extent of automatic supply, revision of replacement factors, type of organization, and the over-all plan for delivering spare parts to the using or maintenance units definitely need review and study, so that any future combat requirements can be met in a more effective manner. The following recommendations regarding solutions to the spare parts problem warrant serious consideration: (1) Provision must be made in any future operations for the establishment of a few parts depots, and drastic action, if necessary, taken to insure the assembling of the best possible stocks of parts at these few points. (2) Adequate, qualified parts personnel must be available to handle the quantity of parts involved. This is true of base depots, subdepots, maintenance units, and using units. (3) The use of small shipments of spare parts as filler cargo for general supply ships must be stopped. (4) Facilities for parts supply should be given high procurement and construction priorities; adequate bins and transportation must be provided field depots, maintenance units, and using units. (Many units in the Southwest Pacific converted 16- or 20-ton trailers to parts trailers in an endeavor to overcome the shortage of bins and transportation.) (5) Studies should be made to reduce the variety of stocked parts, to establish comprehensive lists of common and interchangeable parts, and to perfect means of completely filling quantities specified on requisitions. (Short shipments caused 90 percent of equipment deadlines.) (6) Because of their mobility and ability to accompany an assault force, floating spare parts depots proved exceptionally satisfactory for fast moving amphibious operations and were recommended (preferably on a self-propelled vessel) for similar operations in the future, although the risk of loss by enemy action must be recognized and contingent measures provided.

Standardization of Equipment

The issue of special, varied, nonstandard, and noninterchangeable equipment in the Theater greatly handicapped maintenance and parts supply not only in using units, but in every echelon in the Theater. Tractors in the same horsepower range were of at least three different makes, bulldozer attachments of two different makes, motorized cranes of three different makes, and crawler cranes of five different makes. Such varieties not infrequently appeared in one battalion. Every action possible was taken to improve the situation. Nonstandard items were turned in for base use while task forces were given precedence in the allocation of standard units available. Exchanges between units were effected to concentrate particular types. It was found actually preferable to standardize on a slightly less desirable or efficient piece of equipment in order to profit by the improved service possible through uniformity and interchangeability. Standardization of equipment was strongly recommended, as well as keeping the number of sizes of a given type to a minimum in order to obtain the maximum practicable interchangeability. For example, standardization of Diesel engines in construction equipment appears possible. One theater might have equipment with Caterpillar Diesels, while others might be supplied with International or General Motors Diesels.

Standard Lists of Engineer Supplies

For solution of supply problems, the time interval between receipt of warning orders for an operation and D Day was always short. Task force engineer sections were seldom completely staffed more than a few days before embarkation, and under such circumstances it was impossible for them to execute the necessary planning in time. Leyte, Luzon, and Japan were the only operations of army scope. Of the remainder, the initial supply was largely planned and executed by the engineer section of the army whose elements participated. Usually these army engineer sections were engaged in the supply of several operating task forces at the same time they were planning for one or more future operations. Conditions in the Theater made it virtually impossible to deliver supplies on the schedules necessary to permit completion of construction by the target dates established. Poor communications, dispersed stocks, inadequate depot facilities and personnel, port congestion, and lack of shipping waged a war of their own against the efficiency of all supply operations. In time for the Leyte operation, however, an attack on these difficulties was launched by preparation of a set of three standard lists of engineer supplies based on missions for establishment of airdrome, bulk petroleum, camp, dock, and supply point facilities. The first provided materials for a typical task force operation involving a reinforced regimental combat team, and the same list was used for the initial shipment to either division or corps operations. The other two lists covered the additional supplies required for division or corps operations. Thus, it was possible, even before an operation was announced, to submit a requisition for the initial 6,000 tons of engineer supplies. These supplies could be located, assembled, and possibly loaded by the time the size or specific mission of the task force became known, at which time either of the other two standard requisitions could be placed, along with requisitions for supplies peculiar to the particular operation.[5]

Service Centers

All separate task forces involving corps or divisions needed engineer depot, parts supply, and maintenance units. This was also true of the several corps operating directly under army command. A similar need existed for the support of army troops. Engineer service centers were organized to meet this need when personnel became available, and consisted of one or more engineer depot platoons, an engineer maintenance company, and a spare parts supply detachment. The various components of each service center were physically assembled in a given area, where practicable, and in the absence of a supervisory service center headquarters, operated directly under

[5] *Editor's note:* The first ships loaded on the basis of these lists were employed at Leyte and constituted the only "operationally loaded" engineer supply ships available during that operation.

the corps or army engineer supply officer. The centers attempted to maintain a stock of fast moving Class II items, spare parts, and appropriate Class IV items to give complete engineer supply and maintenance service to the units supported. These organized engineer service centers were recommended for study as a means of providing a well-balanced and effective organization with suitable supervision for the future support of separate task forces.

Supply Personnel

Many of the complications of engineer supply were directly attributable to the shortage of Engineer officer personnel trained and experienced in the handling of engineer supplies and equipment. As previously indicated, and it cannot be stressed too often or too emphatically, foremost attention should be given to this situation in connection with engineer postwar planning. Most Engineer officers will avoid assignment of responsibility for engineer supply operations whenever they can because they have not been indoctrinated with its vital importance to the success of engineer operations during war. This attitude must be changed by official recognition of the importance of engineer supply through more proper rewards than have been available to officers and enlisted personnel engaged in engineer supply activities.

The importance of engineer supply must not be overlooked because it lacks the glamour and action associated with combat and other engineer operations. In the Southwest Pacific, or in any theater for that matter, neither successful action nor glory could have been achieved by unequipped troops. All operations, whether combat or service, depend basically on supply. Despite the shortages and difficulties which impeded the performance of supply forces throughout the campaigns in the Southwest Pacific, the ultimate victory was due in no small measure to the outstanding efforts of the supply personnel in accomplishing their tremendous, seemingly prosaic, and too often unappreciated tasks.

Engineer Intelligence

Terrain Studies

The preparation of terrain intelligence for military operations, especially for amphibious operations, was never definitely assigned as a specific function in the way, for example, that the preparation of maps had been assigned to the Corps of Engineers. Instead, when needed, any one of a number of different groups at different levels of command, both in the Theater and in the Zone of Interior (ZI) prepared intelligence reports differing in purpose, scope, and content.

In the ZI, terrain intelligence was initially prepared for the U. S. Army by the G–2 Section of the General Staff, for the U. S. Navy by the Office of Naval Intelligence, and for all groups by the Office of Strategic Services. In each case, the terrain information was incidental to other intelligence, and was largely the result of library research; consequently treatment of the relatively unexplored and undeveloped areas of the Southwest Pacific in reports prepared in the ZI was necessarily broad and generalized.

In an effort to reduce duplication, and to incorporate the best of the available intelligence on enemy-held territory, not only for terrain intelligence but for other kinds as well, the Joint Intelligence Studies Publishing Board (JISPB) was created to prepare a single, uniform series of intelligence reports, called Joint Army–Navy Intelligence Studies (JANIS). Chapters were assigned to each of the ZI agencies already mentioned and also to the A–2 Section, Headquarters, U. S. Army Air Forces. The agencies primarily responsible, in turn, reassigned selected chapters to certain of the technical services; for example, the chapter on beach intelligence was prepared by the Beach Erosion Board and the chapter on ports and harbors by the Board of Engineers for Rivers and Harbors. Naturally, assembly and integration of the various chapters and parts of chapters from these several sources was difficult, and duplications, discrepancies, and contradictions still resulted.

Nonetheless, these studies, to the extent that they were available, served as an excellent basis for the more detailed terrain analyses required for the actual planning and conduct of operations. Unfortunately, owing to the late initiation of the JANIS plan and to priorities established for preparation of the studies, these comprehensive reports pertaining to Southwest Pacific areas did not become available until late in the war. Consequently the Theater had to rely largely on its own resources for both general and detailed terrain intelligence.

In the interim, the Corps of Engineers, U. S. Army, had foreseen a requirement for specialized terrain intelligence in addition to that usually included in military geography. To meet this need, the Chief of Engineers in 1942 had started publishing terrain intelligence reports on enemy-held territory in a series of Strategic Engineering Studies (SES). These studies, which included information on terrain appreciation, water supply, airfield and road construction problems, soil trafficability, and availability of construction materials were prepared by the Military Geology Unit, U. S. Geological Survey, which was assigned to duty with the Office of the Chief of Engineers, War Department. Because of the specialized nature of the topics covered in the SES reports, their publication was continued even after JISPB was established to reduce duplication by preparing the consolidated JANIS reports. Also, the concurrent issue of SES reports was maintained because there was a decided difference in the manner of presentation; the SES reports consisted primarily of maps with overprintings and accompanying tables which served as expanded legends.

To meet the detailed requirements within the Theater, most intelligence for planning specific operations had to be compiled locally. Although basic data were obtained from a variety of Theater and ZI sources (including JANIS and SES reports when they became available), much additional information of a special nature, such as acquired through aerial photography, was more quickly available in the Theater and could be more readily focused on the problems facing the planning staffs. However, the initial terrain studies released through the G–2 Section, GHQ, SWPA, although a helpful reference for tactical troops, were too general in coverage to satisfy the special terrain intelligence requirements of the engineers. Terrain intelligence as prepared by the G–2 Section, GHQ, SWPA, was also only incidental to the preparation of other intelligence and dealt solely with terrain appreciation and military geography. Then, too, considerable material was reproduced from existing JANIS or SES reports without benefit of more recent aerial photography. Sources were often not given, and the omission was misleading because data compiled from a ZI publication issued months beforehand were often misinterpreted as a study based on the most recently available information. These difficulties were later corrected by the preparation of Engineer Annexes to the Terrain Studies by the Research and Reports Branch, Engineer Intelligence Division, Office of the Chief Engineer, GHQ, SWPA, utilizing original data obtained chiefly from recently acquired aerial photography.

The Engineers' need for terrain intelligence of special kinds, such as water supply, trafficability of soils, and availability of construction materials made it necessary for them to call on personnel specialized in such fields, not only for the preparation of advance reports, but also for on-the-spot investigations during the progress of tactical operations. Moreover, the preparation of terrain intelligence on forward areas required these specialists to maintain close liaison with other engineer elements, including mapping units, if the intelligence collected was to be based on up-to-date maps. Since such specialist personnel was also competent to produce terrain intelligence of the more general type compiled by the G–2 Section, GHQ, SWPA, and joint intelligence groups for general staff planners, there was reason to believe that, if the preparation of all kinds of terrain intelligence was made a specific mission of the Corps of Engineers, inconsistencies and duplication of effort could be eliminated and adequate terrain intelligence could still be supplied to all branches of the service.

In substantiation of this conviction, during World War II, the Corps of Engineers became one of the principal agencies preparing beach intelligence: the Beach Erosion Board prepared beach intelligence for the JANIS reports; the Chief Engineer, European Theater of Operations, U. S. Army, prepared beach intelligence for the Normandy and associated ground operations; the Engineer, United States Army Forces, Pacific Ocean Areas (USAFPOA), through his Engineer Technical Intelligence Team (ETIT), undertook similar work for POA; and the Chief Engineer, GHQ, SWPA (later AFPAC), prepared beach intelligence for the many invasion landings projected throughout the Southwest Pacific. While the preparation of beach intelligence involved some factors not relevant to ordinary terrain intelligence, it could have been combined readily with adequate terrain intelligence of the land behind the beaches, and the value of the composite intelligence reports greatly enhanced. It is believed, therefore, that not only beach intelligence, but all other terrain intelligence could be most efficiently included as a specific mission of the Corps of Engineers.

Whether or not terrain intelligence in general or in a theater of operations is an engineer function, careful thought must be given to the personnel and organization problems involved. From experience in the Southwest Pacific, it was concluded that teams of specialists, made up of experts in the several fields of terrain intelligence, are essential elements of the appropriate planning staff. In a theater of operations these teams of specialists should be assigned to the engineer section of the major headquarters for the preparation of detailed and coordinated terrain intelligence studies in support of the theater's plans and operations. They should also be available for assignment of selected individuals or teams to subordinate commands to render on-the-ground assistance in connection with specific operations.

During World War II in the Southwest Pacific, most of these specialists were civilians, and it was found that they operated best within a unit patterned after the Research and Reports Branch, Engineer Intelligence Division, OCE, GHQ, AFPAC, as it existed just prior to the capitulation of Japan. At that time the civilian specialists were headed by a civilian research director, who, in turn, was responsible to a commissioned officer thoroughly trained through years of experience in these same scientific fields. One possible improvement for future employment of such specialists would be the direct commissioning of all scientific personnel, thereby gaining increased flexibility of administration, more freedom of movement for the individual, and more efficient liaison with other military agencies. This would also eliminate the possibility of friction that is occasionally generated by placing matters within a military organization under civilian control.

Under direction of the Chief Engineer, GHQ, SWPA (later AFPAC), over 360 engineer reports augmenting intelligence available on various operational areas were prepared for contemplated combat operations. These reports, giving details of prevailing climate, tides, currents, landing beach conditions, suitability of terrain for military operations, and local resources were compiled under rigorous limitations of time and means which were essential characteristics of this theater of operations. Innumerable special reports were also published on miscellaneous topics such as industrial facilities and sites for airfields, ports, camps, and storage areas. The information they contained was vitally important, but, unfortunately, many of these reports did not reach the task forces in sufficient time for complete planning purposes and internal task force distribution so that much of their effectiveness was lost. Almost invariably defeating the best efforts of the Engineer Intelligence Division, OCE, GHQ, SWPA, were delays in accomplishment of aerial photography which retarded adequate interpretations and analyses. The necessarily rapid changes in strategic plans to catch the Japanese off balance invalidated much material already accumulated for contemplated operations which were no longer feasible under new tactical concepts. And in the early operational periods particularly, the shortage of qualified engineer intelligence personnel in the Office of the Chief Engineer, GHQ, SWPA, would have delayed the compilation of these reports even had all other factors been perfectly synchronized. By the time operations reached Sansapor and Morotai, however, the Chief Engineer had at long last, succeeded in securing the assignment of almost sufficient, thoroughly qualified personnel to this exacting and highly important work. Thereafter, Engineer Annexes to Terrain Studies were available to task forces in ample time to facilitate the planning of projected operations.

Mapping

Mapping operations in the Southwest Pacific Area were initially handicapped by the curb on obtaining suitable aerial photographic coverage. Photographic missions by the limited number of reconnaissance aircraft in most cases were flown primarily to obtain air combat intelligence, and the mapping photography was considered only incidental. Continued difficulty was experienced in securing execution of directed aerial photographic mapping missions and command action was required to improve the situation. This condition could have been remedied to a large degree had an organization for aerial mapping photography been placed under engineer operational control.

Additional difficulties were encountered because little mapping had been accomplished prior to the war of the remote and undeveloped regions in which most operations took place. The few existing maps and charts were usually unreliable and poorly controlled as to scale and position. Yet, since there was practically no existent ground control, it was necessary to depend to some extent on such inferior maps as were available to give over-all scale for the new maps. This practice resulted in many unavoidable discrepancies, some of which were very important.

Very little surveying for establishing ground control could be attempted. This was due to several reasons, the most obvious being that the areas to be mapped were occupied by the Japanese prior to the landing of Allied combat forces. After an island or area had been seized from the enemy, the desirability of improving the ground control for future mapping was apparent, but there was seldom time to accomplish any appreciable amount of work before the next operation and at the same time provide fire control data to artillery units and land surveys to engineer construction units. Some new positions were established by astronomic observations, and a number of short traverses were run. Nevertheless, while survey elements of topographic units rendered valuable service in providing construction survey parties and in assisting the artillery on fire control problems, their contribution to the actual mapping program was negligible. This condition, however, will probably always hold true when ground forces are continually leapfrogging considerable distances from one isolated enemy occupied position to another.

Training of combat troops in the preparation of field sketches, meanwhile, proved markedly inadequate. This was undoubtedly due to the fact that during training and maneuvers the availability of very accurate and complete maps of terrain back in the United States had been allowed to minimize practice in field sketching. Omission of training in this respect considerably reduced a potential source of topographic information in the Southwest Pacific where much of the map information consisted of photomaps or maps made from aerial photography with roads, tracks, creeks, ravines, and other terrain features obscured by dense jungle growth. In one of the isolated instances where field sketching by combat troops was practiced, the task force commander reported: [6]

> One of the most helpful things I have learned about jungle fighting is how to make a map. I had each of the platoon leaders make a rough sketch of the terrain to the immediate front of their platoons. These sketches were consolidated by company, and then the battalion consolidated the companies' work. I do not believe it practicable to have maps consolidated by units larger than the battalion. We found these consolidated sketches to be of more value than airplane photos, which usually just disclosed a mass of trees, or the map issued which gave little detailed information. These consolidated sketches gave me valuable and necessary information for employment of tanks and other troop units against the enemy.

In an endeavor to amplify information available, the Engineer, Sixth Army, recommended that units should be required to send sketching parties out to secure missing information, and that the results obtained be correlated by submitting copies promptly to the task force engineer who could incorporate the changes so determined in existing maps by overprinting. To facilitate adoption of this recommendation, a program of training selected personnel of all troop units in military sketching was established by Sixth Army.

Reproduction elements of the topographic units, in turn, met all requirements as to deadline, quantity, and quality of work. This was achieved despite numerous technical difficulties encountered with photolithographic processes in the area occupied. These difficulties occurred not through any technical deficiencies in operating personnel nor through any major deficiencies in equipment, but were a direct result of unfavorable climatic conditions. The combination of high temperature, high humidity, fungus, and swarms of insects occasioned various setbacks throughout the reproduction processes. Rapid oxidation and fungus spoiled press plates, photographic chemicals, and paper. High temperature enormously increased the activity of the photographic and photoengraving chemicals and emulsions, softened and changed the scale of film negatives, and coupled with high humidity, led to scum on the press. By exercising ingenuity and a free exchange of information for a solution to these problems between organizations, most of the difficulties were alleviated to a sufficient extent to permit satisfactory operation and to meet all demands for reproduction. Only complete air conditioning of the mobile units, however, would have completely eliminated all the difficulties encountered through heat and high humidity.

The Harris presses (LTE), which had been especially designed for mobile reproduction trains, proved highly successful as to mechanical reliability and printing quality, but a larger sheet size (approximately 22 by 29 inches) would have been desirable to permit equal coverage by fewer sheets and reduction of press impressions. Also, particularly for maps of the larger scale, a larger sheet was desirable from a tactical viewpoint. The adoption of such a larger press would have required other major changes in equipment, however, and was out of the question during hostilities from the standpoint of supply.

Despite difficulties of aircraft availabilities, insufficient personnel, lack of adequate supplies, adverse climatic conditions, and shortages of time for mapping widespread, little known, and often unexplored regions, more than 3,300 diverse maps were compiled in the Theater, and of these approximately a third were on a large scale. This large-scale mapping was, of necessity, confined to important military objective areas usually located near the coast line. Complete mapping of large land masses was an impossible task for the facilities available in the time required. Nevertheless, these figures assume a respectable significance when it is remembered that these maps were not limited to coverage of small platoon areas as applied to tactics over large land masses, but, instead, covered several hundred thousand square miles of this vast and dispersed Theater.

[6] Quoted in AGF Board, SWPA, 12 Feb 44, Report No. 8, Report on Military Mapping and Sketching. In Records Section, GHQ, SWPA.

The distribution of these maps, produced on a scale which contemplated issuance to every officer and noncommissioned officer above the grade of corporal, required incredibly detailed supervision through all echelons of command down to final delivery of the map to the soldier who was going to use it. The setting up and coordination of large numbers of shipments to various units staging from many widely separated locations involved uncommonly painstaking arrangements. Coupled with the necessity for maintenance of security which required these packages of maps to be marked in code, not only shipments, but receipt and subsequent distribution developed into a problem of major proportions. Because of the ever existing limitations of time, air transportation was the only practical means of shipment and was used almost invariably.

Large-scale distribution for an operation of the scope of Leyte would have been impossible without special assistance, particularly since the advance in D Day occasioned the diversion of one Corps at sea from an entirely different operation, while units of another Corps, also scheduled for Leyte, were staging from widely dispersed areas. Map distribution for this operation under such circumstances was carried out successfully only through release by the Engineer Section, GHQ, SWPA, of the 1679th Engineer Survey Liaison Detachment and the 1603d Engineer Map Depot Detachment for assignment to Sixth Army. Considering that tables of issue included every armored vehicle for a complete set of maps and every truck for an issue of road and smaller scale maps, it was concluded that every organization down to and including a division should have an adequate map distribution staff. By employing every expedient possible, however, distribution of copies produced in this theater of operations reached 20 million plus an additional 50 million copies received from the Army Map Service, Washington, D. C.

Resolution

Engineer policies, procedures, equipment, and men were thoroughly tested in the severe and rigorous proving ground of the far-flung Southwest Pacific Theater. Of these, the one determining the ultimate effectiveness of all the others proved to be—the men. The long stressed requisite caliber of the Engineer soldier was confirmed. These men, who were among the first ones in and the last ones out of this vast and sprawling theater of war, accomplished the almost impossible because of technical talents coupled with good soldiering. General MacArthur's statement in 1943, "We are doing what we can with what we have," fit no branch of the service as factually as it did the Corps of Engineers. Equipped to engage in a very slightly modernized version of World War I, these Engineers were catapulted into the Southwest Pacific and found themselves in the middle of an "Engineers' War" with no ports, no roads or bridges, no quarries or sawmills, no structures, utilities, airdromes, nor even maps. Everything had to be built, and space cleared out of the jungle in which to build it. They not only had to do, but there was no choice but to do, the best they could with what they had. And it is fortunate indeed that these Engineers had, in some measure at least, technical training, versatility, ingenuity, and exceptional physical endurance. (See Appendix IV, "Military Engineers in War" by Brig. Gen. Hugh J. Casey.)

The record of the Engineers in the Southwest Pacific left no doubt of the dual role required of each Engineer. They had to be, and always shall have to be, men of destruction as well as construction. In combat, the roads and bridges of the engineers paved the way of each advance after their demolitions had cleared it. Upon completion of the tactical phase of an operation, when combat troops retired for needed rest and recreation, the real engineer mission just began. Every contested island in the Southwest Pacific bears testimony to the technical ability of the Engineers—airfields extending the bomber line—

ports supporting the supply line—bases advancing the range of air, ground, and naval operations to the ultimate goal of Tokyo.

Since World War I the Engineer branch of the service has repeatedly stressed its need for intelligent, physically fit, technically trained men. World War II, besides justifying that need, further emphasized the requisite qualifications of adaptability, resourcefulness, and imagination. The combination calls for men of high caliber. Such men cannot be developed solely through the limited training facilities available to the service; they must be recruited. But recruitment and retention of such men can be accomplished only by making the service attractive through possibilities of fitting recognition, promotion, and compensation. It will depend entirely upon the quality of the men in the Corps of Engineers whether the standards of Engineer service set in the Southwest Pacific are maintained and, it is hoped, surpassed.

Essayons.

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Appendices

[*Editor's note:* The documents contained herein have been downgraded from their original security classification to UNCLASSIFIED by Department of the Army or Far East Command actions prior to publication of this volume.]

APPENDIX I

Engineer Reports and Recommendations on General Deficiencies in the Bataan Defense, United States Army Forces in the Far East, 31 January–8 March 1942

Source: Journals, 1941–42, Engineer Section, Headquarters, United States Army Forces in the Far East.

ENGINEER
USAFFE
Advance CP
Bataan

31 January 1942

Subject: Engineer Operations ending 31 Jan 42.
To: Chief of Staff.

* * * * *

F—General

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4. *I Corps Sector.*

As covered informally in staff conference January 30 this section is considered the critical one. Its west coast is exposed to enemy naval action without protection of the Corregidor guns. This coast also is the only open sea approach. Most of its front is difficult jungle country with poor field of fire and hence less difficult of penetration by the Japanese. It is also less organized than the East Sector. It has but a single supply route, the West Road, which is exposed to naval fire as well as to being cut by any successful landing operation on the west coast. The situation here indicates that serious consideration should be given to:

a–Increase of strength of I Corps.

b–Provision of this increase as a strong mobile reserve which can be applied against any local penetration, rather than by reinforcement or strengthening of present front line units.

c–Provision and maintenance of say 4 to 5 days reserves of rations and ammunition behind the I Corps front line units to tide them over in the event their supply route is temporarily cut, to prevent their forced withdrawal because of supplies being cut off.

5. *Strengthening of Combat Units.*

It is believed that combat units can be further strengthened by two measures:

(a) Transfer to weak PA units of a framework of additional American officer and P. S. NCO personnel.

(b) Resurvey of Service Command units and transfer of excess personnel to combat units.

With respect to (a) the provision of additional American officer personnel is dependent on (b). There are several objections that will be raised to the transfer of PS personnel to PA units. One is that it would destroy the combat efficiency of the P. S. units. It is believed however that if only a small percentage say of 10 to 20% were initially detached and PA replacements substituted, the unit would still function comparably to its former organization, similarly to the experience with old regular units in the states which are gradually broken up to form new units. The provision of relatively few trained and experienced men to the uniformly untrained and inexperienced PA units would have a marked effect on improving combat efficiency of hundreds of men per few men so made available.

This procedure would create certain administrative difficulties by mixing of PS and PA personnel. However, the *minor* obstacle of administrative difficulties should not hold up the *major* objective of organizing effective combat units.

It is recommended that an experiment be conducted in any case by assignment of certain selected PS personnel to a specific unit now deficient in organization and training and considered non- or partially effective to determine whether the increased effectiveness of several hundred men will not compensate for the partial loss of a few men from a 100% effective unit.

With respect to (b) reconnaissance thru the Service Command Area indicates that in general there appears to be a surplus of personnel for the present reduced area of activity. A great amount of resting and sleeping is noticeable, some of which is due to night operation. A thorough investigation of each activity would no doubt show that 10 to 20% or more, could with some difficulty of operation, possibly requiring greater hours of work, etc., on reduced forces, be made available to bring front-line units & beach defense units up to strength. A similar close check on allocation of weapons among these service units could also uncover additional needed weapons for front units. A similar review of commissioned personnel on the various staffs and service agencies could no doubt furnish additional officers.

It is believed that the 10 to 20% or more increased combat effectiveness so attainable warrants special measures to exploit this matter to its full possibilities.

6. *Training.*

Additional and special measures appear necessary for increased training. Training may and undoubtedly is underway but it is difficult to see.

Definite training of service command units which might be used in combat should be underway in scouting and patrolling special training in jungle warfare, etc. All front line units need continued training in these features. Beach defense units should be kept continuously engaged during their spare time in patrolling, jungle warfare and on assumed landing operations.

Superficial inspection indicates that not sufficient time is spent on training. Additional training will not only reduce casualties but instill greater confidence in the troops in their ability to take or hold a position.

7. *Reserves.*

Both Corps have placed almost their entire strength in their respective fronts. In this terrain, the enemy, by a concentration of strength at any point decided upon by him, can force a penetration of either position. As pointed out in weekly report of Jan 24 commenting on this deficiency, a strong mobile reserve must be kept available to meet this penetration as otherwise the adjacent units will feel they have been outflanked and cut off and force their withdrawal. No wire is available to organize any further rear positions. They must hold the present one, but by an *elastic* defense, requiring adequate reserves. If our strength is all tied down, it is bound to fail.

8. *Command.*

In general, there is a continuing need of follow through in command in almost all units to include *personal* reconnaissance and following up of orders and instructions, status of training, status of improvement of defense positions, etc. The tendency to issue orders assigning units to defend a position, or issuance of corrective instructions and then to assume that specific situation is corrected should be resisted and overcome. Commanders and their staffs should continuously be on the move inspecting personally the activities and units under their jurisdiction, encouraging and assisting their subordinates, clarifying difficulties and getting thoroughly acquainted with the actual conditions in their respective areas by personal observation rather than reported information.

HUGH J. CASEY
Brigadier General, C. E.,
Engineer.

Incl:–Overlay, taken from
Trail Map of Bataan.

[*Editor's note:* Inclosure not available for reproduction.]

HEADQUARTERS
United States Army Forces in the Far East
Office of the Engineer
In the Field

8 February 1942.

Subject: Engineer Operations Report for Week Ending 7 Feb 42.

To: The Commanding General,
United States Army Forces in the Far East.

A. Engineer Operations & Training.

1. *I Corps.*

a. Field Fortifications.

Protective wire was placed and improved on the BRL and around the centers of resistance in the 1st Division Sector. The 91st Engr Bn placed wire around beach defense guns. The 1st Engr Bn, 11th Engr Bn, and 91st Engr Bn constructed portable obstacles and concertinas and felled trees for abatis and obstacles.

b. Beach Defense.

Company A, 71st Engineer Bn has been assigned to General Pierce as Engineers for the South Defense sector.

An inspection from Aglaloma Bay to Vigia Pt by a representative of this office and Major Cogswell, Engr of South Defense Sector, revealed that beach defenses in this sector occupied by the 2nd Phil Constabulary are generally unsatisfactory. Automatic weapons are not placed for maximum field of fire, fields of fire are not cleared, damaged barbed wire is not repaired, large areas are masked from gunfire when present foxholes are occupied, the constabulary regiment is *not* continually improving their defense, the troops are generally asleep, husking rice or taking a rest.

This most important stretch of beach, regardless of the fact that the enemy has already landed on West Coast and it is apparent that attempted landings will continue, has and is being neglected. Continual inspections by the staffs and commanders concerned are necessary and positive corrective action should be taken where subordinate commanders fail to improve their positions, if satisfactory results are to be expected.

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2. *II Corps.*

An inspection of Engineer activities in this Corps was made by the Army Engineer during this period. Units are active and morale is fairly high with the exception of the 51st Engineer Battalion. This unit, 180 strong, with no machine guns and only 3 automatic rifles has been on the OPLR of the 51st Division since 26 January. It has made three attacks and suffered 25% casualties. Ten percent (10%) of those on the line are suffering from malaria and dysentery. Three infantry regiments of this division, equal to three Bns, are occupying the MLR but the Division Commander will not relieve the 51st Engrs from Combat reportedly until sufficient stragglers are assembled. Periodic reliefs should be provided and these Engineers released for Engr missions. The 21st Engr Bn constructed field fortifications and obstacles and salvaged barbed wire in Sectors A & B. The 31st Engr Bn built trails, placed field fortifications on the RRL, cleared fields of fire in *front* of OPLR, without any covering force except themselves, buried dead Japanese, were engaged as Infantry and took a strongly entrenched enemy strong point and guarded the Sector C. P. The 41st Engr Bn worked on roads and trails, placed field fortifications on MLR & RRL and packed in ammunition for Sector D.

* * * * *

b. Beach Defense.

The beach defense from Lamao to KM 142 was inspected by a representative of this office and the Corps Engineer, and those from Lamao to Gorda Pt by a representative of Corps Engineer. In general the beach defense was unsatisfactory. Wire where placed was generally inadequate, knocked down by wave action and not being continuously repaired; automatic weapons were not located properly; men and officers were either absent or sleeping. The 31st Inf (PA) Sector shows the influence of an American officer. If the other Sectors had American officers assigned to them and the interest of these officers was stimulated, the beach defense would improve immediately. Near KM 149 one platoon leader of the Anti-Tank Bn with a 50 cal. gun on a *ground* target mount on the edge of a bluff about 20 feet above the water stated that his primary mission was strafing planes and not boats. The beach defense in this sector has been neglected. Little interest has previously been displayed by the staff of this Corps in this phase of their defense. Reports of these inspections were made to the Corps Commander by the Corps Engineer. An inspection service has now been established for the complete system, one officer will take the northern half and one the southern half.

* * * * *

g. General.

The Corps Engineer is making excellent progress in performing his mission, in the face of difficulties with respect to the proper use of Engineer units. Engineers of this Corps are used for every conceivable purpose; burying dead, packing ammunition for artillery, establishing and holding the OPLR, guarding C. P.'s and clearing fields of fire beyond OPLR without infantry covering forces as well as performing in a creditable manner their normal missions.

* * * * *

4. *Miscellaneous.*

a. Road discipline is still poor. The regulations are satisfactory and would solve the problem if enforced. G–4, HPD was contacted and a check up initiated, results of which have not been reported yet. At present only spot parts are maintained by the MP and as each vehicle approaches it slows down, gets checked, and then resumes its speed as soon as it is out of sight. The difficulty in maintenance of the roads is increased immensely by these practices, and the consumption of *gasoline* rises rapidly for speeds from 25 MPH on up.

b. Labor continues to be an increasing problem. Although requests were made for laborers last Monday, not a single laborer was furnished from the source established therefor. These laborers secured were obtained direct by individual effort. The formation of the civilian refugee camps has proven to be a false hope. The people in these camps are paid and fed regardless of whether they work or not. With their families there, they will *not* work at any distance away. In fact very few show any inclination to work at all. It seems that as long as these camps remain in the hands of the civil government, there will be no relief from the situation. It is suggested in the event no improvement is effected, that Martial Law be declared on Bataan and the entire control be made a military one.

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HUGH J. CASEY,
Brig. Gen., U. S. A.
Engineer.

Incls:–Overlay from Trail Map of Bataan showing corrections & new trails in I Corps.
–Overlay, Trail Map of Bataan II Corps.

[*Editor's note:* Inclosures not available for reproduction. *See* Maps Nos. 2 and 3, Vol III, this series.]

HEADQUARTERS
United States Army Forces in the Far East
Office of the Engineer
In the Field

HJC/pn
8 March 1942.

Subject: Inspection of MLR, Bataan.
To: Commanding General, USAFFE.

1. Between March 3 and March 6 accompanied by Major Gay, assistant, I made an inspection on foot of the entire line MLR position from the west to east coast of Bataan. The Corps Engr and his Asst as well as representatives of Subsector Commanders in the I Corps, and representatives of the 41st and 21st Divisions in the II Corps, as well as some of the Regimental Bn and most of the company and platoon commanders joined and accompanied us on the inspection over those reaches in their respective fronts.

2. In general the degree of improvement varied inversely with accessibility to the respective positions indicating that positions easily inspected by the higher commands were inspected and improved and stretches difficult of access had not been adequately inspected nor improved.

3. The positions organized by the U. S. Air Corps and by the 11th Infantry were outstandingly excellent. Other positions were reasonably well prepared. On certain positions, the type and extent of improvement are inexcusable, considering the time available for their improvement. It is not intended for this report to criticize specific positions in which a number of defects occur as such defects were pointed out during the inspection. It is desired however to secure general corrective action on the following general deficiencies observed.

4. The following are general findings applicable to many positions.

A. *Fire positions.*

(1) In numerous cases (at least 300 personally so observed), the foxholes or trenches with such shelter as is provided, are so constructed as to prevent the soldier from giving *aimed* fire to his front. Restricted clearance space below the overhead cover interferes to such a degree that the soldier, when sighting, can only aim and fire at an upward angle at and above tree tops to his front. If he fires at all, generally parallel to the ground to his front, he can do so only without aiming.

(2) This indicates two things: (a), that certain soldiers are concerned far more in their own cover protection during combat than in dealing effective fire on their enemy (which is actually their best protection in an attack) and (b) that platoon leaders, company commanders and other officers have not checked individual shelters and trenches with their troops in fire position to ensure the effectiveness of the preparation and defense of the position.

(3) Even in many cases where no overhead cover was provided and only open fire trenches or foxholes were utilized, numerous instances were noted where positions were constructed on downward sloping terrain and long parapets were constructed horizontally such that aimed fire could not be delivered parallel to the ground over which the enemy could advance but only above the heads of the enemy.

(4) In numerous other cases, long firing grooves were cut thru the parapet in a straight rather than flaring direction so that the soldier could fire only to cover a few yards of his front rather than targets to his right and left front as well.

B. *Machine Gun positions.*

(1) The principal basic errors with respect to machine guns consisted of:

(a) Faulty location whereby plunging as compared to grazing fire was secured.

(b) Frontal rather than enfilading fire.

(c) Inability to secure aimed fire from a number of the positions.

(d) Lack of continued training in the operation of their weapon instructions and directives to MG personnel relative to their functions on final protective line, failure to provide definite steps to mark traverse limits or final protective line for night firing.

(e) Carelessness in the construction of the emplacement and failure to provide adequate mount foundation such that the machine gun (many of which had not been test fired at all on their present positions) would jar loose due to failure of its inadequate foundation, at the critical moment when it would be vitally needed.

(2) With respect to (a), there are many cases where the forward movement of a machine gun 10 to 50 yards would increase the effectiveness of the gun from 200 to 500 times. The importance of grazing as against plunging fire is apparently not fully appreciated. If the trajectory is parallel to the ground the bullet is effective over the entire 300 to 600 yd. reach in front of the gun whereas when the gun fires from an elevation onto flat ground in front, the bullet is effective only over the few yards immediately adjacent to where it strikes. This is a most important factor in night firing where the enemy cannot be seen. Inasmuch as most attacks will occur at night, it seems vital that every effort should be made to secure grazing and effective fire, including giving greater priority and consideration thereto than to how readily a machine gun can be most easily evacuated. A machine gun well located will not need evacuation. A gun poorly located will have to be evacuated due to its ineffectiveness during attack.

(3) With respect to (b), insufficient effort has been made to get the best enfilading fire possible. In a number of cases all organizational machine guns are distributed generally uniformly over the front, firing (except for some small horizontal traverse) solely to the front. If these weapons were placed with respect to certain topographic features, bends in the front or in coordination with those of adjacent units so as to attain enfilading fire, a far greater and more effective coverage of the front could be secured—particularly so for night defense. If the trace of the barbed wire were varied more to conform to the bands of enfilading fire from such machine guns, delaying the enemy in passing thru such bands, an almost impassable position (until such guns are destroyed) is assured. Marked improvement in the defensive strength of certain positions can be so secured.

(4) With respect to (c), it was found that in some machine gun positions, the clearance to overhead cover was so restricted as to prevent delivery of *aimed* fire, even without a helmet. This was particularly the case in a number of instances where the gun had to be depressed to give grazing fire over downward slopes in front of the position. In other cases it was impossible to traverse the weapon with its rear sight up or to correct stoppages because of inadequate vertical clearance. Because of the lack of a few inches of excavation or raising of head cover, and failure of adequate inspection, vital machine guns would be ineffective in combat.

(5) With respect to (d), it was found that a number of machine gunners are not adequately instructed and trained in their duties, with insufficient or no information on their "final protective line", limits of fire, ranges to known points. Written or typed instructions and sketches should be furnished to each gun position showing sector of fire, protective line, etc., and definite stops or marks established for critical limits. Closer supervised training appears desirable.

(6) With respect to (e), mount foundations should be checked preferably by test firing, to assure that guns will function when needed, including careful inspection of mount foundations to assure that foundations won't fail (as they would in several guns inspected) at the first firing. In some cases only an inch or so of clay, easily broken off, supported the rear tripod leg.

C. *Location of trenches.*

(1) Serious errors have been made in many cases in the location of the trenches with respect to the terrain and potential field of fire. In numerous cases, trenches are located as close as 5 to 20 yds behind the military crest, limiting the field over which men can fire to this short distance, with the major distance over which the enemy must approach left defiladed. Relocation of these trenches a short distance further forward (utilizing existing trenches for support trenches or for better shelter) will immeasurably increase the defensive strength of the position.

(2) In certain cases the enemy is permitted to come down the opposite slope, cross a stream, climb the near slope and get to within hand grenade distance of the trenches without coming under fire, a dangerous situation for any night attack. Relocation of the trenches to where this defiladed approach area would be under continuous fire would greatly strengthen the position and make it almost impossible to take under any determined defense.

(3) Officers responsible for the siting and construction of such defense positions should critically review present locations from in front of and also from within the actual or proposed trench positions and select and develop that position which they can visualize would be the most difficult to approach and take.

D. *Coordination between Adjacent Units.*

(1) From Corps, thru Divisions, Regts, Bns down to Platoons there appears to be a lack of sufficient coordination and cooperation in connection with the mutual supporting action of adjacent units, insofar as the organization of the ground and disposition of units are concerned.

(2) Each unit commander should know and confer frequently with the corresponding adjacent unit commander with respect to coordinating their positions for best mutual support.

(3) There is a strong tendency particularly in the lower units, to be concerned solely with its own unit and front, without recourse to mutual supporting action of adjacent guns or units. In numerous cases unit commanders did not know and had not consulted with commanders of adjacent units. There are many cases where a unit can do its most effective defense by covering by enfilade fire the front of an adjacent unit rather than its own, securing similar coverage of its own front from the adjacent units. In some cases the defensive strength can be increased manyfold by such action.

(4) It is recommended that closer coordination between units be effected to include the tie-in between I and II Corps on the Pantingan River, the closure of the gap between the 51st and 21st Divns, as well as numerous smaller cases throughout the front.

E. *Shortening of line.*

(1) In a number of cases, the line appears to be unduly extended, requiring greater forces or a thinning of the line, because of the tendency to follow back up river valleys, edges of recessed wood clearings, etc., rather than generally straight across such features. On the Pantingan River Valley, for example, the line extends well back up the valley and back again whereas a shorter line (keeping present line as a support or reserve line) would release men for reserves, prevent an infiltration in force by the enemy to the unprotected corridor, and permit a stronger defense of the shorter line, leaving auxiliary positions (the present one plus additional lines constructed across the valley) for successive defense in depth against any strong penetration.

F. *Reserves and development in depth.*

(1) Greater effort should be made to provide more reserves and to develop the position in depth. The 41st Division is well organized insofar as this feature is concerned. Reserves can be made available by a shortening of the line, as above indicated, and by a thinning out of those portions of the front of great natural defensive strength. The distribution of men along the front appears almost uniform, in a continuously occupied trench line clear across the front. Not sufficient attention has been given to the organization of strong points, combat groups, etc., which by proper utilization of terrain features and without continuous occupation of the front, can by mutually supporting fire, cover adjacent unoccupied reaches. It is appreciated that in the jungle, the occupation must be relatively uniform and continuous but even there greater strength should be given to natural avenues of approach (ravines, trails, etc.). However, in open areas, mutually supporting combat groups rather than continuous occupation should be employed.

(2) It seems important to again stress the urgent need of an *elastic* defense. The enemy by a concentration of strength and fire at a point of his choosing can force, at a price, a penetration of the position. Reserves must be available to eject him. If they are all on the line, they cannot be withdrawn. The greatest assurance of having the maximum strength where and when most critically needed is by assurance of a mobile and adequate reserve. It is felt that in both Corps, greater reserves (Bn, Regimental and Divisional) can be built up by better utilization of combat groups rather than continuous front line occupation.

(3) The positions for Bn and Regt Reserve lines should be built up (now generally underdeveloped or not provided) to provide auxiliary positions against any local infiltration.

G. *Barbed Wire.*

(1) Wire is in many cases located too close to the trenches or machine guns. It should generally be beyond hand grenade distance from the line protected. Greater care should be placed in its location with respect to automatic weapons so that a band of fire can be placed down and along its front, so that the enemy is subjected to enfilading fire while delayed in getting through the wire.

(2) Stakes or pickets should be solidly emplaced so that the wire cannot be readily pushed down or removed.

H. *Clearing Field of Fire.*

(1) Fields of fire should be cleared to attain the maximum possible range of aimed fire in front of the position. This does *not* mean however in the jungle or heavily wooded areas that every tree and all brush must be removed. Only that portion of the underbrush, lower branches, etc., as furnish concealment 5 to 6 feet above the ground should be removed, leaving the overhead cover untouched. If the entire belt is cleared of all trees, vegetation, etc., the enemy from the air can readily see the *exact* location of the position and more easily bomb and strafe or give aerial observation and more accurate fire direction to artillery fire against the position, with resultant greater casualties to our forces.

I. *Communication Trenches.*

(1) Greater effort should be placed on the construction of communication trenches to the position so that protected approaches are available for supply of rations, ammunition and replacements or reinforcements during an attack. A few hours of work now will save lives and the position later.

J. *Sanitation and Health.*

(1) Greater control is necessary on sanitation. A command with 10 to 25% sick is reduced in combat efficiency to an even greater degree.

(2) Latrines should be adequate in number (1 per squad for convenience where unit is spread out). Discipline should be improved to ensure that latrines are used, and that feces are covered and not exposed to flies. (A number of latrines were observed with thousands of flies in them, which could migrate between latrines and soldiers' food contributing to sickness.) One unit's latrines were located in advance of the front lines. Insufficient attention is given to boiling water. Many organizations reported they boiled their water but inquiry developed that this was to be done by the individual soldier rather than the organization. That is laziness or neglect on the part of the unit Commander. A Filipino who is thirsty is not going to start a fire, boil his water 20 minutes, wait for it to cool and then satisfy his thirst. All organizations, by company or platoon, should be provided boiled water from a central source to their men to assure that they will drink only safe water.

(3) Sickness varied from little to as much as 25% or more of a command dependent on location, type and health resistance of soldiers, and efficiency and energy of the commanders. In most of the units, it was reported that *no quinine* is being furnished, except to those actually sick with malaria. In view of the small bulk of quinine and relative ease of getting quantities in, and its vital importance in the prevention of malaria, it is not believed we should run out of quinine. It is recommended, if combat efficiency is to be kept up that quinine issues be resumed, particularly to units having present high malaria rates and that first priority be given to replenishing and *keeping up* adequate stocks.

(4) Few of the troops have blankets. Special effort should be made to provide them before the rainy season. In order to make something available, I have directed that the remaining burlap in Engr Supply Depot be used for blankets rather than for camouflage or sandbags.

K. *Rations and Cigarettes.*

(1) Some special measures appear desirable to make at least occasional special ration issues to the units and the American officer personnel with them. It would appear possible to make a special issue to some unit, even if only once each week or two, to give them a little pick-up from their daily routine, rotating the units to which such issues are made. It would also be a welcome change to many to get a hash or part hash issue occasionally in place of canned fish each day. Special consideration should be given to interior front divisions which cannot supplement their ration by fresh fish or other items available to coast and rear units. There is no question but that there is a marked difference between rations issued and available to front line units, who are in probably greatest need of them, as compared to the Service Command and Ft. Mills units, a situation which occasions some dissatisfaction and loss of morale.

(2) There is a dire lack of cigarettes among the front line units. Soldiers will pounce upon any discarded cigarette stub for a single puff. There is, in time of war no difference between the physical needs of smokers as between front and rear echelon units, unless the need at the front is greater. It would appear only just to make an equal allocation insofar as issues and the privilege to purchase are concerned, between all officers and men, at the front, in the rear echelon and at Ft. Mills. Troops should not be in the position of paying 2 Pesos per package of cigarettes, and even then being unable to get them when those in rear can secure them in plenty at 10 centavos.

(3) It is recommended that a uniform quota be established of present available stocks for the entire command, in the interest of improving morale in our most important elements, the front line units.

L. *General.*

(1) It is not intended to convey the impression that everything is wrong as might be inferred from reading general deficiencies listed in the foregoing report. Much good work has been done, and the units, now better seasoned, are determined to hold. The deficiencies indicated are pointed out with suggested corrective action only in the hope and with the objective of improving to a far greater degree the defensive strength of our position. Much of the foregoing improvement is already under way as when these deficiencies were pointed out to the respective unit commanders or the representatives of higher echelons, immediate corrective instructions were issued.

(2) The accomplishment so readily and quickly attained dictates one final recommendation, namely, that higher commanders and their staffs execute frequent personal reconnaissances on foot of their respective positions, personally checking units, training, defensive organization, etc., and not rely solely on subordinate reports or inspections of next lower echelon CP's. Nothing takes the place of *personal* reconnaissance.

HUGH J. CASEY,
Brig. General, U. S. A.
Engineer

[*Editor's note:* It is interesting to note that the Japanese attack of 3 April 1942 was concentrated generally against that part of the defensive position described in paragraphs 4D(4), 4E, and 4F of the document dated 8 March 1942; also note, Map No. 4, Volume I, this series.]

APPENDIX II

Personal Reconnaissance, Headquarters, United States Army Forces in the Far East, 13 February 1942

Source: Journals, 1941–42, Engineer Section, Headquarters, United States Army Forces in the Far East.

(1) To: C/S, thru ACS, G–3 Engr, USAFFE 2/13/42
HJC/pn

Recommend dispatch of attached draft of letter stressing the need of additional *personal* reconnaissance thruout the command. This condition has been reported on in reports previously submitted but without satisfactory results. It is felt that a directive should be issued officially to ensure this essential objective.

H. J. C.
Engr

Incl: Draft

HEADQUARTERS
United States Army Forces in the Far East

RKS/pn
13 February 1942.

Subject: Personal Reconnaissance.

To: Corps, Sector and Division Commanders.

1. Continued inspections and reports indicate that as a general situation there is woefully insufficient personal reconnaissance by commanders concerned.

2. Such instances include outpost companies which have been on the line for long periods without visits or inspections by their battalion, regimental or subsector commanders. Front line companies have not been inspected sufficiently by their higher commanders. Locations of lines have been faultily shown and reported by unit commanders, indicative of the fact that higher commanders and their staffs have not exercised sufficient personal inspection.

3. In numerous instances, it has been noted from inspections made by representatives of this Headquarters, that automatic weapons and barbed wire obstacles have been faultily placed, fields of fire are not cleared, defense positions are not being improved beyond the foxhole stage, communication trenches are not being developed, secondary positions on battalion and regimental reserve line are not being developed, all largely due to the failure or deficiency of responsible commanders and their staffs to reconnoiter and inspect personally the sectors for which they are responsible.

4. It is desired that Corps and division commanders not only arrange for adequate personal reconnaissance by their own headquarters but also ensure that appropriate *periodic* inspections are made by subordinate commanders within their organizations.

By Command of General MacARTHUR:

RICHARD K. SUTHERLAND,
Major General, U. S. A.
Chief of Staff.

APPENDIX III

Use of Engineers, Headquarters, United States Army Forces in the Far East, 9 February 1942

Source: Journals, 1941–42, Engineer Section, Headquarters, United States Army Forces in the Far East.

HEADQUARTERS
United States Army Forces in the Far East

RKS/pn
9 February 1942

Subject: Use of Engineers.
To: Corps & Division Commanders.

1. Recent inspection and reports disclose faulty use of Engineer units. Among such examples are the employment of Engineer units as guards for Division CP's, guard for an Infantry CP, carrying parties for rations for other units, employment in attack in place of available Infantry units, burying details, etc., during periods while other urgent engineer missions had to be neglected.

2. It is important that the supply routes to Corps & Division units be improved and maintained by proper utilization of the Engineer units assigned, if the supply system of the affected unit is to function properly. Technical assistance, tools and supplies are available from the engineer units in preparation of defense positions. This does not mean however that the Engineers are to dig the foxholes, erect the wire, clear the fields of fire for the Infantry units in that position, excepting where reserve positions are being prepared in rear of Infantry units actively occupying the front. Necessary demolitions, bridge construction, construction of special fortification items such as extensive dugout shelters, special emplacements, etc., requiring special technical knowledge and equipment are proper assignments for engineers. Engineers should be utilized in assisting the artillery into difficult positions. Engineers may also be used to assist the Infantry forward in an attack by elimination of obstacles, destruction of mine fields and entanglements, or to delay the enemy in a withdrawal by necessary demolitions but adequate Infantry covering forces, equipped with suitable weapons, should be furnished. Such functions are over and above normal camouflage missions, preparation and supply of maps, provision of water supply, utilities, etc.

3. Engineers can and should be used as Infantry when the emergency dictates. Such emergency use however does not embrace, as had been done, sending engineer units into an attack to advance our lines when other Infantry units are available. Engineer units have not had the special training and in particular are not equipped with suitable weapons for such tasks. Engineer units should be considered as a combat reserve to be withdrawn from their prior and normal engineer missions only when the emergency dictates and when infantry units are not available.

By Command of General MacARTHUR:

RICHARD K. SUTHERLAND,
Major General, U. S. A.
Chief of Staff.

APPENDIX IV

Military Engineers in War

HUGH J. CASEY

Source: Brig Gen Hugh J. Casey, Chief Engr, GHQ, SWPA, "Military Engineers in War," *The Military Engineer,* XXXV (February 1943), 57–62.

Our Society publication is The Military Engineer. We members are Military Engineers or are interested in promoting the efficiency of the military engineering service. It seems appropriate at this time, in view of the thousands of Military Engineers now engaged in and continually joining our forces, to define and analyze the specifications for a Military Engineer and by critical introspection to X-ray ourselves to determine to what degree we meet these specifications.

As Engineers we accustom ourselves to ensuring and enforcing compliance with specifications and terms of any contract. It is essential, therefore, that we define and know that contract and do all humanly possible to meet its terms.

The characteristics and requirements for a Military Engineer given here are based on recent observations of our military engineering activities in the Philippines and in the Southwest Pacific Area. It is hoped that their enunciation may prove of some value to our Military Engineers already in the Service and the thousands of others who are joining our ranks.

Modern warfare is highly mechanized. It has placed even greater demands than ever on our Engineers. Engineers are required for the design, production, and upkeep of our tanks, planes, ordnance, and numerous other technical requirements of National Defense. Our planes are heavy and fast, requiring extensive airfields through all types of operations areas. Our tanks are massive, requiring heavy bridges for their movement. Our supply requirements run to astronomical totals, placing heavy demands on docks, railroads, roads, and all transportation arteries. A vast quantity of storage for these supplies is also needed. Shelter, water supply, and utilities must be furnished for our men and for hospitalization. Millions of copies of maps of all types must be produced and furnished to our military forces. The job of the Engineer is to provide all of these facilities *on time* with whatever limited forces, plant, and materials are available. To perform that task the Military Engineer must be an animal possessing the following general characteristics.

He must have ENERGY. He should have the ability to carry on continued hard physical effort, oftentimes with lack of sleep, and still remain mentally and physically active. He must have the ability to pick up quickly in relatively short periods of rest after a period of hard exhaustion. This means that our field engineers particularly, must be young, able to climb mountains and tramp through tropical swamp and jungle with heavy equipment, live in wet clothing, without exhaustion and undue lowering of resistance, and still carry on.

He must possess INITIATIVE. A Military Engineer without initiative cannot perform his job. It is impossible for higher headquarters to assign to all lower echelons the many engineering tasks which must be performed. The Engineer in the field and on the job must be continually seeking out and executing those tasks essential to advance the whole show.

The Military Engineer should have IMAGINATION. This factor is very important. Our Engineer must have the ability to visualize a situation which has not yet happened, but which may occur, and outline plans and measures necessary to meet it. He must be able to put himself in the position of those whom he and his unit are to assist. He must visualize their needs and requirements. He must be able on occasion to detach himself from himself sufficiently to review critically his own operations instructions, plans, and directions in order to ensure that they are what are needed and that they are understandable and clear to those to whom directed. Instructions issued which may initially appear perfectly clear to himself with his full background of information on the particular situation, may not be sufficiently complete and understandable to those to whom issued. He should, therefore, be able to put himself in the position of the other man and critically review his possibly incomplete opus to check if it will be clearly understood by the man to whom directed. He should, in any case, have sufficient imagination to visualize the numerous problems and difficulties which may and will arise, and check that appropriate planning or procurement measures are being taken to meet these contingencies.

He should have INTELLIGENCE. He should be capable of quickly grasping a situation and be alert in his mental processes and reactions to determine promptly a reasonable solution and measures necessary to handle the problem.

He should be capable of reducing any problem to its BASIC FUNDAMENTALS. Too often the average individual becomes so enmeshed with the mass of detail pertaining to any problem that he loses sight of the two, three, or four basic fundamentals of that problem. He should exercise great care to determine what these basic fundamentals are and to stick to them.

He should be capable of SEEING THE BIG PICTURE. As our Commander-in-Chief has so aptly put it, he should not lose sight of the forest for the trees. His perspective should be such as to ensure a proper balance of effort commensurate with the real importance of each task. On a construction job it is not enough to see that every man is busily engaged. He should constantly review that construction job to determine the bottle-neck which is the control on total output and concentrate his energy on opening up that bottle-neck control for greater production results. When that bottle-neck has been cleared, he should determine the next controlling factor and concentrate on it until it in turn is cleared if maximum production is to be attained.

He should have a proper sense of BALANCE. He should not regard each man, problem, and piece of plant as a routine succession of items for equal consideration and treatment. He should appreciate, for example, that if a D–8 dozer can perform the output of 200 men, the care and nursing of that individual piece of plant merit a degree of consideration comparable to the thought applied to the care and handling of the equivalent 200 individuals, rather than as merely another single item to add to the 200 individual cases. Too often our engineers regard their plant, which, in the final analysis, may be the key to their productive capacity, as an inanimate something unworthy of their keen personal interest. A marked difference in production results will be noted between those units where balanced consideration is given to the varying importance of the individual problems which constantly prevail.

The Military Engineer must LOOK AFTER HIS MEN. He must defend them against all others. He must look after their wants and requirements. He should give them the praise that is their due. He should exercise special effort to get them such food, comforts, and whatnot as can be procured. He should let them know that they are the best working outfit in the forces, in which case they will strain themselves to merit the confidence placed in them and perform a job of which we shall all be proud. Men will take any degree of driving from their officers and leaders if they in turn know that they and their interests are being taken care of by those in their charge.

Our Engineers, in addition to their normal engineer functions, may also be engaged in COMBAT. They represent a strong potential combat reserve which has been and will be utilized in critical phases of the operations. The situation is always critical when a commander has to pull his Engineers from their normal engineer mission into combat. A Military Engineer must, therefore, ensure that his men have been given a sufficient degree of combat training to give his men a reasonable chance for their lives, wholly aside from the fact that such training may represent the difference between success and defeat or failure.

The Military Engineer must be able to WORK. Just as nothing beats fun, so nothing takes the place of work. I repeat, nothing takes the place of WORK. There is always far more to be done than can be done within the time, with the forces, plant, and materials available. No Military Engineer can say at anytime during an all-out war effort that he has nothing to do. He should have plans on tap for the utilization of his men for many jobs ahead. Whenever he and his unit are seen, outside of their limited rest periods, they should be seen actively at work. They should engender the thought in the commands of which they form a part that Engineers and Work are synonymous.

A Military Engineer must have a SENSE OF HUMOR; otherwise he is likely to go mad. Blunders are going to be made, confusion will be met and untold difficulties will be encountered. A major league batter who makes three successful hits out of ten times at bat, not to count the strikes called against him, is considered an excellent performer and big-league caliber. Perfection in any human field is not attainable. Errors will be made. Impossible, unintelligible, and conflicting orders will occasionally be received. Tough situations will be encountered. In such situations, the Military Engineer must not lose his sense of humor. A joke or laugh in a tight spot may save the day. A message to the President: "Please send us a new P–40 as ours is full of holes," relieved the nervous strain and tension in a tight situation. Similarly, a message to the Governor of California from Bataan, when it was learned that an enemy submarine had shelled a small dot on the thousand miles of California coastline, urging them to hold on until the BBB's could send him aid, gave some hard pressed boys a pickup when they needed it most. A Military Engineer taut with nervous tension under difficulty is unqualified to perform his task. Turn that hang-dog expression in for one of good cheer. It will help both you and your men.

A Military Engineer must have the ability to IMPROVISE. He will have to do his job with what is available on the spot. There is no corner hardware shop to get the supplies, or industrial establishment to turn out the tools that he needs for the job immediately ahead. He must do it with what is on hand. If hand grenades are not available, a cookie (most appetizing to serve) can be made from a piece of bamboo, a stick of dynamite, some nails, mud, a cap and fuse with cellophane-wrapped match attached. A larger cookie with a piece of automobile spring for a catapult or with a bow and arrow arrangement made of discarded inner tubes may make a workable even though less capable substitute for lacking mortars. In the absence of tank mines, a tiny wooden coffin with ten pounds of dynamite, an electric cap, a flashlight battery with contacts operated by crushing in the top, secured by only sufficient brads to sustain a 400-pound load, will give reasonably satisfactory results. At least the tanks don't like it. The use of boiler plate properly emplaced will make a small cruiser out of a large-size row boat. Piers and bridges can be built out of discarded gasoline drums. The job, no matter what it is, must be done with whatever is available. The Military Engineer will never say he can't do the job because he lacks the means.

COOPERATION is another essential characteristic of the Military Engineer. He must be ready in every way to help our troops advance or hold. He should never fail to do any job required merely because it is the responsibility of someone else, if that someone else is not there. If other service elements are not forward at the site, the engineers should take on the job within the relative priority of importance of the various tasks to be performed.

ADVANCE PLANNING is most important. A Military Engineer should never be caught with his "trousers drooping" (a more elegant expression for "pants down"). He should constantly be visualizing his future problems and requirements and making necessary provision therefor. His tools, plant, men, and materials should be provided or arranged for insofar as possible well in advance to ensure that they will be available at the point where needed, when needed. Relatively little effort expended on advance planning will save much effort and frantic confusion later in trying to procure the means which, if properly planned for in advance, would be already available. If these requirements have generally been adequately provided in advance, additional emergency needs will be relatively few and will actually receive more prompt and complete consideration with greater assurance of their being furnished than if they form part of a vast number being screeched for. The need for careful advance planning can not be overstressed.

The Military Engineer should be possessed of a reasonable degree of PROFESSIONAL OR TECHNICAL KNOWLEDGE. What is even more important, he should be currently and continuously improving himself in learning what he can from the various references and training literature available on the problems he is currently meeting. He should observe and profit not only from his own experience but also from that of others. He should exercise special pains to cull out the basic fundamentals of each subject rather than to overtax his mind with a vast accumulation of detail. He should, for example, with respect to the construction of a landing strip, appreciate that sufficient drainage must be provided around the island strip to prevent water entering the subgrade as well as to afford drainage relief to what water does get through. If, because of lack of drainage the subgrade to a landing strip is soup or mud, a surface layer of 6-inch steel would still sink and be incapable of supporting planes. He must also appreciate that a surface of such lateral strength must be provided as to distribute the 20-ton-per-square-foot impact of heavy bombers over such 10 or 20 square feet of area as would reduce the unit loading to one which the subgrade can support. As a final desirable element, a raincoat or seal coat which would prevent surface water from penetrating into the subgrade will further protect the strip from deterioration. These are the basic essentials which he should keep in mind. It is of course essential that he also know the limitations of slope and crown and degree of variation in longitudinal slope as dictated by the operating characteristics of our planes. In any case he should know where he can get this information in the limited reference texts that form his bible. Technical libraries are just out of reach.

His WORK SHOULD BE PLANNED. In the execution of the job he should make such quick preliminary investigations of soil, sources of materials, distance of haul, possible methods of construction, et cetera, as will ensure that the job will be done satisfactorily with a minimum of expenditure of time, labor, and plant. A source of material on a slope where a chinaman can be provided for quick gravity loading of trucks with material fed to the chinaman by a bulldozer will be far more effective than resorting to power shovel loading. A reasonable amount of effort given to the consideration and evaluation of the various possible methods of construction, and determination of the most efficient method, will effect a great savings in time as well as in physical effort on the part of his men and plant. Too often there is a loss of time and effort due to a failure to spend a day on planning the job. A few hours of proper planning may save many days of actual work.

A Military Engineer need not be a reckless hero but should display a moderate degree of COMPOSURE under enemy action. If he himself cannot set such a standard, he cannot expect his men to perform normally under enemy fire and bombing. In the final analysis, it should be relatively easier for an engineer to conduct himself normally under enemy fire. With an analytical mind and a knowledge of the theory of probability, he is in a better position to gauge the relatively slight chance he is taking and control himself accordingly. It is normal and human for individuals to fear enemy rifle and machine-gun fire and bombing activity. The engineer should appreciate, however, that it is most difficult for a bomber moving several hundred miles per hour at great height to drop its bomb at the exact spot at which the pilot or bombardier is aiming. We should also be aware that a bomber is not going to waste an expensive and important bomb on a single *homo sapiens,* irrespective of the high value and importance which we as individuals attach to ourselves. We should appreciate first, therefore, that that particular bomb is not out to get us individually. It is only the one marked "To Whom It May Concern" that we need worry about. If we assume that we occupy a square yard of space, we should appreciate that there are 3,097,599 other similar areas in the square mile surrounding us. If we buy a ticket for a lottery in which that number of tickets is sold, we assume we have tossed that dollar away, as we know we are not going to win. We should similarly feel that the bomb which is dropped into that area is not pointed in our direction and has an insignificant chance of hitting us. This does not mean, of course, that it is recommended safe practice to place oneself in the middle of an airfield when they are bombing a drome; but we should feel that there is a reasonable degree of security in a fox hole or on the ground, even though in the general proximity of the target area, and by our own composure we should be capable of engendering that same feeling in our men.

We should also appreciate the difficulties the average soldier or new recruit has in putting all of his bullets into a fixed bull's-eye at any moderate range even under conditions when he knows the exact range, the windage, and he is in a secure firing position, is merely shooting holes in paper, and with no one disturbing him other than an over-anxious sergeant or lieutenant. We, as Engineers, should, therefore, be able to evaluate the reduced chances of being hit when we are a moving, indistinct target at an unknown range being fired at by a wheezy, little yellow slant-eyed ——— (censorship prevents). We should also appreciate that only a small percentage of those engaged in any combat actually become casualties and that of that small percentage only a still smaller percentage die. In fact if you talk to yourself long enough on these lines, you can feel that war is a relatively safe proposition. But seriously, a full consideration of the probability phases of combat, insofar as fear of our permanent loss to the military establishment is concerned (wholly aside from the natural and selfish instinct for life, family, and the pursuit of happiness and other earthly comforts), can instill in the Military Engineer a degree of composure under fire which others may fail to understand. It will, in any case, be helpful toward adopting that attitude which the Military Engineer must have if his men are to carry on under him under all conditions that will have to be faced.

The Military Engineer must continuously exercise ACTIVE RECONNAISSANCE. He must reconnoiter the area in which he is engaged, evaluate the difficulties which may be encountered, and determine and know the engineering resources that are available in that operations area. He should know the condition of roads, bridges, and railroads and their potential sources of trouble. He should devise plans *beforehand* as to what he must, can, and will do to handle those problems. He should know where sources of timber, gravel, water, barbed wire fences, stocks of engineer tools, plant or supplies are available. Only by continuing reconnaissance will he remain a jump ahead of such problems and contingencies that will be continually arising.

The Military Engineer who is full of "book larnin" but who lacks the personality, vigor, forcefulness, leadership, and driving energy to put that knowledge across will fail.

There is a time and place for everything. In permanent peacetime engineering, the construction of a large bridge, a dam, a power plant, or similar permanent massive structures merits and requires detailed and thorough planning to ensure the most economical and efficient structure. In time of war the relative importance of the various factors entering military construction varies. The most important criterion is to get the job done on time to a degree adequate to meet the requirements of the situation, even though temporarily, irrespective of cost. This does not mean that the cost factor is completely disregarded, as cost is but another measure of materials, plant, and labor which should, of course, be conserved to the greatest degree possible in order to execute a greater extent of work. It is important, however, that the Military Engineer appreciate that high cost or utilization of valuable materials, if such are the only ones available, which must be thrown into a job in order to get it done as and when required, or destruction of valuable installations which might otherwise fall into enemy hands, should at no time bar or handicap his operations. A Military Engineer should be prepared to throw in all of his resources of whatever nature in order to get whatever job is assigned to him done on time. An airfield not available on schedule to meet tactical requirements, or roads, bridges, or trails not provided in time to sustain an attack represent failures of the engineer mission. They must be provided in the face of any obstacle.

The engineers are among the first ones in and the last ones out. The Military Engineer in time of war is rough, tough, and fast. His whole mental make-up and characteristics must be adjusted to that tempo if he is to accomplish his job.

Chronology

(with map)

SOURCE: OCE, GHQ, AFPAC (Historical)

CHRONOLOGY

Southwest Pacific and Related Actions*

1941–1945

1941

26 Jul	United States Army Forces in the Far East (USAFFE) established
7 Dec	*Japanese carrier force strikes Pearl Harbor, Oahu, T. H.*
8 Dec	Thailand surrenders to Japanese
8 Dec	*Japanese bomb Clark Field, Luzon*
9 Dec	*Japanese invade Malaya*
10 Dec	*Japanese land at Vigan and Aparri, Luzon, Philippine Islands*
10 Dec	*Japanese invade Guam*
12 Dec	*Japanese land at Legaspi, Luzon, Philippine Islands*
12 Dec	Task Force, South Pacific, constituted at sea
20 Dec	*Japanese landings at Davao, Mindanao, Philippine Islands*
22 Dec	*Japanese landings at Lingayen Gulf, Luzon, Philippine Islands*
22 Dec	First United States Expeditionary Force lands at Brisbane, Australia
22 Dec	Task Force, South Pacific, designated United States Forces in Australia (USFIA)
23 Dec	Wake Island surrenders to Japanese
25 Dec	Hong Kong surrenders to Japanese
26 Dec	Manila declared an open city
27 Dec	*Japanese bomb Manila*

* *Editor's note:* Japanese actions are italicized for ready differentiation from Allied actions; numerals in parentheses correspond to numbered locations on map, opposite page.

1942

2 Jan	*Japanese occupy Manila*
5 Jan	USFIA designated United States Army Forces in Australia (USAFIA)
22–24 Jan	Battle of Makassar Strait
23 Jan	*Japanese take Rabaul, New Britain*
24 Jan	*Japanese occupy Balikpapan, Borneo*
10 Feb	*Japanese occupy Gasmata, New Britain*
15 Feb	Singapore surrenders to Japanese
19 Feb	*Japanese bomb Darwin, Australia*
20 Feb	*Japanese invade Timor*
27–28 Feb	Battle of Java Sea
1 Mar	*Japanese invade Java*
2 Mar	*Refugees from Java caught by Japanese air raid on Broome, Australia*
8 Mar	*Lae and Salamaua, New Guinea, captured by Japanese*
8 Mar	Rangoon evacuated by British
17 Mar	General MacArthur arrives at Darwin, Australia
21 Mar	United States Forces in the Philippines (USFIP) established
7 Apr	*Japanese seize Buin, South Bougainville*
9 Apr	American-Filipino forces on Bataan surrender to Japanese
16 Apr	*Japanese land at Capiz and Iloilo, Panay, Philippine Islands*
18 Apr	General Headquarters, Southwest Pacific Area (GHQ, SWPA) established
2 May	*Japanese occupy Tulagi, Florida Island*

1942

6 May	*Japanese occupy Hollandia, New Guinea*
6 May	American-Filipino forces on Corregidor surrender to Japanese
7–8 May	Battle of Coral Sea
9 May	United States Forces in the Philippines surrender to Japanese
31 May	*Japanese midget submarines attack Sydney Harbor, Australia*
3–6 Jun	Naval Battle off Midway Islands
6–7 Jun	*Japanese occupy Attu and Kiska in the Aleutian Islands*
20 Jul	GHQ closed at Melbourne, Australia, opened at Brisbane, Australia
20 Jul	United States Army Services of Supply (USASOS) established
20 Jul	USAFIA terminated. Responsibilities assumed by USASOS
21–22 Jul	*Japanese land in the Buna-Gona area of Papua, New Guinea*
23 Jul	Papuan Campaign (Kokoda Trail, Milne Bay, and Buna-Gona-Salamaua area of New Guinea)—terminated 23 January 1943
26–29 Jul	*Japanese capture Kokoda airdrome in New Guinea*
31 Jul	*Japanese seize the Kai, Aroe, and Tanimbar Islands*
7 Aug	U. S. Marines (SOPAC) land in the Guadalcanal-Tulagi area, Solomon Islands (1)
7 Aug	Guadalcanal Campaign—terminated 21 February 1943
8–9 Aug	Naval Battle off Savo Island
23–25 Aug	Naval Battle East of the Solomon Islands
25–26 Aug	*Japanese land at Milne Bay, New Guinea*
26 Aug	Allies repulse Japanese landing at Milne Bay, New Guinea—terminated 7 September
3 Sep	Fifth Air Force established
11 Sep	Australians stop Japanese drive over Owen Stanley Mts. at Imita Range, 28 airline miles from Port Moresby
28 Sep	Australians begin offensive to drive Japanese back across Owen Stanley Mts.
11 Oct	Naval Battle off Cape Esperance, Guadalcanal

1942

14 Oct	American units move by air to Wanigela on the north coast of New Guinea
22–26 Oct	Goodenough Island landings
25–26 Oct	Naval Battle off Santa Cruz Islands
2 Nov	Allies occupy Kokoda Airdrome in New Guinea
12–15 Nov	Naval Battle off Guadalcanal
30 Nov	Naval Battle off Tassafaronga, Guadalcanal
9 Dec	Gona, New Guinea, captured
14 Dec	Buna Village, New Guinea, captured
18–19 Dec	*Japanese occupy Madang and Wewak in New Guinea*

1943

2 Jan	Buna Government Station, New Guinea, captured
18 Jan	Sanananda, New Guinea, captured
22 Jan	Japanese organized resistance in the Buna-Gona area of New Guinea ended
24 Jan	New Guinea Campaign—terminated 31 December 1944
30 Jan	Australians repulse Japanese at Wau, New Guinea
16 Feb	Sixth Army established in SWPA
21 Feb	Russell Islands landing (SOPAC) (2)
22 Feb	Northern Solomons Campaign—terminated 21 November 1944
26 Feb	USAFFE reconstituted
2–4 Mar	Battle of Bismarck Sea
15 Mar	Southwest Pacific Force redesignated Seventh Fleet
11 May	Attu Island, of the Aleutian chain, captured
22 Jun–5 Aug	Woodlark and Kiriwina Islands occupied
22–23 Jun	Woodlark Island, advance echelon lands (3)
23–24 Jun	Kiriwina Island, advance echelon lands (4)
29–30 Jun	Nassau Bay, New Guinea, landing (5)
30 Jun	Main landings on Woodlark and Kiriwina Islands. First operation directed by Sixth Army, operating as Alamo Force.

1943

30 Jun	Rendova Island landings (6)
5 Jul	New Georgia Island landings (7)
5–6 Jul	Battle of Kula Gulf
13 Jul	Naval engagement off Vella Lavella Island
14 Jul	Mubo, New Guinea, captured
5 Aug	Munda airdrome, New Georgia, captured
6–7 Aug	Naval engagement off Vella Lavella Island
15 Aug	Vella Lavella Island landing (8)
17–18 Aug	Fifth Air Force bombs Wewak, New Guinea
21 Aug	Kiska Island, of the Aleutian chain, occupied by U. S. and Canadian forces
4 Sep	Lae, New Guinea, landing (9)
5 Sep	Nadzab, New Guinea, landing (10)
6 Sep	Transport aircraft begin to transport troops to Nadzab, New Guinea
11 Sep	Salamaua, New Guinea, captured (11)
16 Sep	Lae, New Guinea, captured
20 Sep	Kaiapit, New Guinea, captured
22 Sep	Finschhafen, New Guinea, landing (12)
2 Oct	Finschhafen, New Guinea, captured
5 Oct	Dumpu, New Guinea, occupied
6–7 Oct	Naval Battle off Vella Lavella Island
12 Oct	Over 300 SWPA aircraft bomb Rabaul, New Britain
15 Oct	New Georgia Group Operation terminated
27 Oct	Treasury Island landing (13)
28 Oct	Choiseul Island landing (14)
1 Nov	Bougainville Island landing (15)
1–2 Nov	Battle of Empress Augusta Bay
2 Nov	Heavy SWPA air raid at Rabaul, New Britain
3–4 Nov	Marines withdraw from Choiseul Island
5–11 Nov	Third Fleet aircraft raid Japanese naval forces at Rabaul, New Britain
20 Nov	Gilbert Islands landings
25 Nov	Naval Battle off Bougainville Island
25 Nov	Satelberg, New Guinea, captured

1943

15 Dec	Bismarck Campaign—terminated 27 November 1944
15 Dec	Arawe, New Britain, landing (16)
26 Dec	Cape Gloucester, New Britain, landings (17)
30 Dec	Cape Gloucester, New Britain, airstrips captured

1944

2 Jan	Saidor, New Guinea, landing
16 Jan	Sio, New Guinea, captured (18)
23 Jan	Shaggy Ridge, in Finisterre Range of New Guinea, cleared of Japanese
1 Feb	Kwajalein, Marshall Islands, landings
10 Feb	Juncture of Allied elements at Yagomi, New Guinea
10 Feb	Allied patrols establish contact on New Britain
10 Feb	DEXTERITY Operation, Western New Britain and Saidor, New Guinea, terminated
15 Feb	Green Island landing (19)
16–17 Feb	Naval task force strikes Truk Island
17 Feb	Eniwetok landing
23 Feb	Naval task force strikes the Marianas
29 Feb	Los Negros, Admiralty Islands, landings (20)
5 Mar	Mindiri, New Guinea, landing (21)
6 Mar	Talasea, New Britain, landing (22)
8–28 Mar	Japanese assault on Empress Augusta Bay perimeter repulsed
9 Mar	Talasea, New Britain, captured
15 Mar	Manus, Admiralty Islands, landing (23)
17 Mar	Lorengau airstrip, Manus Island, captured
18 Mar	Lorengau captured
20 Mar	Emirau Island landing (24)
30 Mar	Naval task force strikes the Palau, Yap, Woleai Islands—through 1 April
13 Apr	Bogadjim, New Guinea, occupied
22 Apr	Hollandia and Aitape, New Guinea, landings (25)
24 Apr	Madang, New Guinea, captured
26 Apr	Alexishafen, New Guinea, occupied
26 Apr	Hollandia, Cyclops, and Sentani airdromes in New Guinea captured

	1944
30 Apr–1 May	Truk Island raided by naval task force
7 May	Cape Hoskins airdrome, New Britain, occupied
17 May	Arara-Sarmi, New Guinea, landings (opposite Wakde Islands) (26)
17 May	Surabaya, Java, hit by South East Asia Command carrier force and SWPA heavy bomber strike
18 May	Wakde Islands landing
18 May	Admiralty Islands campaign terminated
19 May	Wakde airdrome secured
27 May	Biak Island landing, vicinity of Bosnek (27)
6 Jun	Hollandia campaign terminated
6 Jun	Mokmer airdrome, Biak Island, captured
15 Jun	XIV Corps comes under direct control of SWPA
15 Jun	Saipan invaded (CINCPOA) (28)
15 Jun	Hansa Bay, New Guinea, occupied
15 Jun	Far East Air Forces (FEAF) established
19–20 Jun	Battle of Philippine Sea
20 Jun	Borokoe and Sorido airdromes, Biak Island, captured
2 Jul	Noemfoor Island landing (29)
10–11 Jul–8 Aug	*Japanese attack Drinumor River line in New Guinea*
21 Jul	Guam invaded (CINCPOA) (30)
24 Jul	Tinian invaded (CINCPOA) (31)
30 Jul	Cape Opmarai, New Guinea, Amsterdam and Middelburg Islands landings (32)
31 Jul	Sansapor, New Guinea, landing (33)
6–7 Aug	Mindanao Island. First Allied air attack on Philippines since 1942 at Sassa naval airdrome near Davao
20 Aug	Biak operation terminated
25 Aug	Aitape operation terminated
31 Aug	Noemfoor operation terminated
31 Aug	Sansapor operation terminated
2 Sep	Wakde-Sarmi operation terminated
7 Sep	Eighth Army established
9–14 Sep	Mindanao and Visayan area shipping and airdrome struck by Third Fleet

	1944
15 Sep	Morotai Island landing (34)
15 Sep	Peleliu Island, Palau Group, landing (CINCPOA) (35)
17 Sep	Angaur Island, Palau Group, landing (CINCPOA) (36)
21–24 Sep	Luzon and Visayas in the Philippines struck by Third Fleet
23 Sep	Ulithi Atoll unopposed landing (CINCPOA) (37)
30 Sep	Balikpapan, Borneo, first heavy Allied air raid
4 Oct	Morotai operation terminated
10–21 Oct	Nansei Shoto, Formosa, and Luzon and the Visayas in the Philippines struck by Third Fleet
17–18 Oct	Suluan, Homonhon, and Dinagat Islands in the Philippines occupied (38) (39) (40)
20 Oct	Leyte, Philippine Islands, landings (41)
20 Oct	Tacloban airdrome, Leyte Island, seized
23–26 Oct	Battle of Leyte Gulf
24 Oct	Samar, Philippine Islands, landing (42)
2 Nov	Carigara, Leyte Island, captured
2 Nov	Baybay, on west coast of Leyte, reached by combat troops
15–20 Nov	Mapia and Asia Islands cleared of Japanese. First operations directed by Eighth Army (43) (44)
24 Nov	Limon, Leyte Island, captured
24 Nov	First B–29 raid on Japan from Saipan
26–27 Nov	*First Japanese airborne attack on Leyte Island in the San Pablo-Dulag area*
6–7 Dec	*Second Japanese airborne attack on Leyte Island against the Buri, San Pablo, and Bayug airdromes, with diversionary drops in the Tacloban-Dulag area*
7 Dec	Ormoc, Leyte Island, landing (vicinity of Ipil, south of Ormoc) (45)
10 Dec	Ormoc, Leyte Island, captured
14–16 Dec	Luzon, Philippine Islands, struck by Third Fleet
15 Dec	Mindoro Island, Philippine Islands, landing (46)
22 Dec	Leyte Island, Highway 2 (Limon-Ormoc) cleared
25 Dec	Leyte campaign terminated

1945	
3 Jan	Marinduque Island, Philippine Islands, landing (47)
3–9 Jan	Nansei Shoto, Formosa, and Luzon in the Philippines struck by third Fleet
9 Jan	Luzon, Philippine Islands, landing at Lingayen Gulf (48)
12–22 Jan	French Indo-China and China coasts, Formosa, and Nansei Shoto struck by Third Fleet
15–31 Jan	Camotes Island, Philippine Islands, cleared (49) (50) (51)
21 Jan	Tarlac, Luzon, captured
29 Jan	San Narcisco, Luzon, landing (52)
31 Jan	Nasugbu, Luzon, airborne landing (53)
31 Jan	Mindoro Island operation terminated
3 Feb	Tagaytay Ridge, Luzon, seized
3 Feb	Grace Park, Manila, entered
15 Feb	Mariveles, Luzon, landing (54)
16 Feb	Corregidor, Philippine Islands, airborne landing and amphibious assault (55)
16–17 Feb	Tokyo and the Nagoya-Kobe area of Japan struck by Fifth Fleet
19 Feb	Iwo Jima landing (CINCPOA) (56)
19–20 Feb	Samar, Capul, and Biri Islands landings in the Philippines (57)
28 Feb	Palawan, Philippine Islands, landing (vicinity of Puerto Princesa) (58)
3 Mar	Japanese organized resistance in Manila ended
10 Mar	Zamboanga, Mindanao Island, landing (59)
16 Mar	Basilan Island, Zulu Archipelago, landing (60)
18 Mar	Panay, Philippine Islands, landing (61)
26 Mar	Cebu, Philippine Islands, landing (62)
26 Mar	Kerama Retto landing (CINCPOA) (63)
29 Mar	Negros, Philippine Islands, landing (64)
1 Apr	Legaspi, Luzon Island, landing (65)
1 Apr	Okinawa landing (CINCPOA) (66)

1945	
2 Apr	Sanga Sanga Island, Sulu Archipelago, landing (67)
3 Apr	Joint Chiefs of Staff appoint General Douglas MacArthur Commander of all US Army forces and Admiral Chester Nimitz Commander of all US Naval forces in the Pacific
5 Apr	Soviet Government abrogates Russo-Japanese neutrality agreement
5 Apr	*Japanese cabinet of Premier Koiso resigns, succeeded by cabinet of Admiral Suzuki*
6 Apr	United States Army Forces, Pacific (AFPAC), established
9 Apr	Jolo Island, Sulu Archipelago, landing (68)
11 Apr	Bohol, Philippine Islands, landing (69)
13–16 Apr	Fort Drum and Carabao Island, Manila Bay, Philippine Islands, captured (70) (71)
16 Apr	Ie Shima landing (CINCPOA) (72)
17 Apr	Mindanao, Philippine Islands (Malabang-Cotabato area), landing (73)
26 Apr	Baguio, Luzon, captured
1 May	Tarakan Island, Borneo, landing (74)
2–4 May	Davao, Mindanao Island, captured
8 May	Victory in Europe (V-E Day)
10 May	Mindanao, Philippine Islands, landing (Macajalar Bay) (75)
11 May	Wewak, New Guinea, captured
13 May	Balete Pass, Luzon, secured
17 May	Ipo Dam, Luzon, captured
19 May	Foochow, on the China Coast, liberated
23 May	Sayre Highway, Mindanao, Philippine Islands, cleared of Japanese
29 May	Wama Dam, Luzon, captured
7 Jun	United States Army Forces, Western Pacific (AFWESPAC), established. USASOS terminated
10 Jun	Brunei Bay, Borneo, landings (76)
10 Jun	AFPAC and Headquarters, USAFFE, consolidated
20 Jun	Wenchow, on the China coast, liberated

1945	
21 Jun	Okinawa, Japanese organized resistance ended
21 Jun	Aparri, Luzon, captured
22 Jun	Tarakan Island, Borneo, all Japanese organized resistance ended
26 Jun	Kume Island landing (west of Okinawa) (77)
1 Jul	Southern Philippines campaign terminated
1 Jul	Balikpapan, Borneo, landing (78)
4 Jul	Luzon campaign terminated
14–17 Jul	Admiral Halsey's Third Fleet joined by British naval units in operations against the Japanese homeland from North Hokkaido to Tokyo, Japan
27 Jul	Potsdam Ultimatum issued to the Japanese Government
31 Jul	Tenth Army and all other forces in Ryukyus, except Strategic AF, under command of General MacArthur
6 Aug	First atomic bomb dropped on Hiroshima
9 Aug	*Russia declares war on Japan*
10 Aug	*World receives news of Japan's acceptance of the Potsdam Ultimatum*
11 Aug	General MacArthur acknowledges the news of Japan's acceptance with an impromptu speech from the balcony of the City Hall, Manila, P. I.
15 Aug	Unconditional surrender of Japan formally announced by the President of the United States
15 Aug	General MacArthur named Supreme Commander for the Allied Powers (SCAP)
15 Aug	GHQ issues its final communique
15 Aug	General MacArthur's first message to the Japanese Government
16 Aug	*Japan's first official reply to General MacArthur*
19 Aug	*Japanese delegation arrives in Manila to discuss surrender terms*
20 Aug	*Japanese delegation leaves Manila for Tokyo to carry out orders for signing of the surrender terms*
28 Aug	Eighth Army, advance party, lands at Atsugi airdrome, Tokyo

1945	
30 Aug	General MacArthur arrives at Atsugi airdrome, Tokyo
30 Aug	11th A/B Division lands at Atsugi airdrome, Tokyo
2 Sep	SCAP issues Directive No. 1
2 Sep	Territory of SWPA south of the Philippines turned over to control of the British Empire
2 Sep	Allied Land Forces (ALF), Allied Naval Forces (ANF), and Allied Air Forces (AAF) abolished
2 Sep	*Japanese formally surrender aboard USS Missouri in Tokyo Bay* (V-J Day)
3 Sep	SCAP issues Directive No. 2
3 Sep	*Surrender of Japanese forces in the Philippines at Baguio, Luzon*
4 Sep	Advance party of XXIV Corps lands at Kimpo Airfield, Korea
5 Sep	American Flag raised over American Embassy in Tokyo
9 Sep	*Japanese-held Korea (south of 38° N.) surrenders to Allies*
9 Sep	*Surrender of Japanese Forces in the Netherlands East Indies on Morotai Island*
13 Sep	*Imperial Japanese General Headquarters inactivated*
14 Sep	Headquarters, First Army, closed at Canlubang, Luzon, incident to return to the United States
17 Sep	GHQ, SCAP and AFPAC opens in Tokyo
24 Sep	United States Army Strategic Air Forces (USASTAF) opens in Tokyo
25 Sep	Sixth Army arrives in Wakayama Harbor, Honshu, Japan
1 Oct	*Headquarters, Imperial Japanese General Air Forces, inactivated*
15 Oct	Tenth Army inactivated
15 Nov	Luzon Area Command (LAC) and Southern Islands Area Command (SISAC) discontinued
6 Dec	USASTAF discontinued
6 Dec	Pacific Air Command, United States Army (PACUSA), established
31 Dec	Sixth Army relieved of occupational duties preparatory to inactivation

Glossary

A-2	Intelligence section of an air staff, officer in charge of this section
AA	Antiaircraft
AAF	Allied Air Forces
A/B	Airborne
ACofE	Assistant Chief of Engineers
ACofS	Assistant Chief of Staff
Actg	Acting
Adm	Administrative
Adv	Advance
AF	Air Force
AFPAC	Army Forces, Pacific
AFWESPAC	Army Forces, Western Pacific
AGF	Army Ground Forces
AGS	Allied Geographical Section
AGWAR	Adjutant General, War Department
AIF	Australian Imperial Forces
AKA	Assault cargo ship
ALF	Allied Land Forces
AMF	Australian Military Forces
AMS	Army Map Service
ANF	Allied Naval Forces
APC	Coastal transport
APD	High-speed transport (Destroyer)
ARC mesh	Australian reinforced concrete mesh
ASCOM	Army Service Command
ASCOM-6	Army Service Command, Sixth Army
ASCOM-8	Army Service Command, Eighth Army
ASCOM-24	Army Service Command, XXIV Corps
ASCOM-C	Army Service Command, CORONET
ASCOM-O	Army Service Command, OLYMPIC
ASF	Army Service Forces
Asst	Assistant
Aust	Australian
Avn	Aviation
AWC	Allied Works Council
Bn	Battalion
Br	Branch
Bt Bn	Boat Battalion
Bul	Bulletin
C	Change
(C)	Combat
CAC	Coast Artillery Corps
Cav	Cavalry
CE	Corps of Engineers
CG	Commanding General
CinC	Commander in Chief
CINCPOA	Commander in Chief, Pacific Ocean Areas
CO	Commanding Officer
Co	Company
CofE	Chief of Engineers
CofS	Chief of Staff
Comd	Command
Comdr	Commander
Cons	Construction
COSC	Combined Operational Service Command
CTF 76	Comdr, Task Force, 76
DA	Department of the Army
Dept	Department
Div	Division
DUKW	2½-ton, 6 x 6, amphibian truck
dwt	deadweight ton
EBSR	Engineer Boat and Shore Regiment
EinC	Engineer in Chief (Australian)
Engr	Engineer
ESB	Engineer Special Brigade
Ex O	Executive Officer
FEAF	Far East Air Forces
FEC	Far East Command
FM	Field Manual
FO	Field Order
FS	Fast Supply
G-1	Personnel section of the general staff of a large unit; assistant chief of staff for personnel

G–2	Military intelligence section of the general staff of a large unit; assistant chief of staff for military intelligence
G–3	Operations and training section of the general staff of a large unit; assistant chief of staff for operations and training
G–4	Supply and evacuation section of the general staff of a large unit; assistant chief of staff for supply and evacuation
G–5	Military Government
GHQ	General Headquarters
GMC	General Motors Corporation
g.p.m.	gallons per minute
GS	General Service
HE	high explosive
(Hist)	Historical Branch (Section)
Hq	Headquarters
Ibid.	(*ibidem*), same as preceding reference
incl	inclosure
Ind	Indorsement
Int	Intelligence
Interv	Interview
JANIS	Joint Army—Navy Intelligence Studies
JCS	Joint Chiefs of Staff
JISPB	Joint Intelligence Studies Publishing Board
LCCO	Landing Craft Control Officer
LCI	Landing Craft, Infantry
LCM	Landing Craft, Mechanized
LCMG	Landing Craft, Mechanized Converted to Gunboat
LCP(L)	Landing Craft, Personnel (Large)
LCR	Landing Craft, Rubber
LCS	Landing Craft, Support
LCS(S)	Landing Craft, Support (Small)
LCT	Landing Craft, Tank
LCVP	Landing Craft, Vehicle—Personnel
LHQ	Land Headquarters (Australian)
Ln O	Liaison Officer
LSD	Landing Ship, Dock
LST	Landing Ship, Tank
Ltr	Letter
LVT	Landing Vehicle, Tracked
LVT(1)	Landing Vehicle, Tracked (Mark 1)
LVT(2)	Landing Vehicle, Tracked (Mark 2)
LVT(A)(2)	Landing Vehicle, Tracked (Armored) (Mark 2)
LVT–R	Landing Vehicle, Tracked (Rocket)
Memo	Memorandum
MID	Military Intelligence Division
Mil	Military
MLR	Main Line of Resistance
MOS	Military Occupational Specialty
(Ms)	Manuscript
ND	Navy Department
n. d.	no date
NG	New Guinea
NGF	New Guinea Force
NLF	North Luzon Force
OBASCOM	Okinawa Base Command
OCE	Office of the Chief Engineer
OCE, WD	Office of the Chief of Engineers, WD
OI	Operations Instructions
OPNAV	Operations Naval
opns	operations
Opns O	Operations Officer
Org Br	Organization Branch
p.	page
PACUSA	Pacific Air Command, United States Army
PCAU	Philippine Civil Administrative Unit
PC	Patrol Craft
Pers	Personal
Phil	Philippine
PI	Philippine Islands
POA	Pacific Ocean Areas
POL	Petroleum, Oil, and Lubricants
pp.	pages
Prov	Provisional
PT boat	patrol torpedo boat
RAAF	Royal Australian Air Force
Rad	Radio
RAE	Royal Australian Engineers
RAN	Royal Australian Navy
RCT	Regimental Combat Team
Regt	Regiment
Reinf	Reinforced
Ret	retired
Rpt	Report
Rt. Hon.	Right Honorable
S–3	Operations and training section of a unit not having a general staff; officer in charge of the section
S–4	Supply and evacuation section of a unit not having a general staff; officer in charge of the section
SCAP	Supreme Commander for the Allied Powers
Seabees	Construction Battalions, Civil Engineer Corps, U. S. Navy
Sec	Section
sep	separate
Serv	Service
SES	Strategic Engineering Studies
SFPE	San Francisco Port of Embarkation
SIC	Southern Islands Command

SLF	South Luzon Force
SLOE	Special List of Equipment
SOP	Standing Operating Procedure
SOPAC	South Pacific Force
SORE	Staff Officer, Royal Engineers
sub	subject
Sup	Supply
Surv	Survey
SWPA	Southwest Pacific Area
TAG	The Adjutant General
T/BA	Tables of Basic Allowances
TDY	Temporary Duty
T/E	Tables of Equipment
TM	Technical Memorandum
Tng	Training
TNT	Trinitrotoluene
T/O	Tables of Organization
T/O&E	Tables of Organization and Equipment
Trs	Troops
USA	United States Army
USAAF	United States Army Air Forces
USAFFE	United States Army Forces in the Far East
USAFIA	United States Army Forces in Australia
USAFMIDPAC	United States Army Forces, Middle Pacific
USAFPOA	United States Army Forces, Pacific Ocean Areas
USASOS	United States Army Services of Supply
USC&GS	United States Coast and Geodetic Survey
USFIA	United States Forces in Australia
USFIP	United States Forces in the Philippines
WD	War Department
WPO-3	War Plan Orange-3
ZI	Zone of Interior

Guide to Footnotes and Bibliography

One of the supplementary purposes for the publication of the series, ENGINEERS OF THE SOUTHWEST PACIFIC, 1941–1945, has been to provide those technical readers interested in further research with a valuable introduction to the mass of data available on the various subjects covered, even though it has not been possible to utilize such data in their entirety within the limits of these publications. In all previous volumes of the series, this purpose has been met through the introduction of three supporting features to the text: appendices containing document reproductions, footnoted explanatory statements, and footnoted documentary citations.

The broad coverage of *Critique* restricts the appendices to complete reproduction of only a relatively few source materials. Also, in the preparation of this volume, the policy established has been to include only a minimum of footnoted explanatory statements. Wherever such explanatory statements are deemed necessary but would interrupt the flow of the text, they are made in the form of *Editor's notes* and appended as footnotes. Footnoted documentary citations, on the other hand, while employed in the previous volumes of ENGINEERS OF THE SOUTHWEST PACIFIC, 1941–1945, were found unadaptable to the presentation of *Critique*. The transportation of material from many diverse sources which was integrated to present many individual factors as well as the considerably interchangeability of and repetition in the many records required to substantiate facts would have involved practically more documentation than text. Footnoted documentary citations have, therefore, been eliminated, except for direct quotations in the text, in favor of a bibliography at the end of each chapter indicating the documents used in its preparation.

It is to be expected that some readers will desire to go far beyond the limited appendices and explanatory statements in carrying out their individual research missions. A systematic method of describing references has, therefore, been consistently adhered to for the purpose of furnishing complete identification of the sources used and their location in various repository files.

To conserve space in describing individual sources in the bibliographical lists, certain standard abbreviations have been adopted:

Character of documents: Ind, Indorsement; Ltr, Letter; Ms, Manuscript; Memo, Memorandum; Pers Ltr, Personal Letter; Rad, Radio.

Other abbreviations: Any other abbreviations adhere to the Dictionary of the United States Army Terms (TM 20–205) and the two later publications: War Department Memorandum No. 850–46 and Army Regulations No. 850–150. All abbreviations found in the bibliographic lists and footnotes, as well as in the text proper, are defined in the Glossary.

A few typical document descriptions have been selected at random to explain more specifically the method of documentation:

Engr Sec, Sixth Army, n. d., Engineer History, Chapter VIII (Ms). In Sixth Army files.

The Corps of Royal Australian Engineers in the Second World War, 1939–45 (Melbourne, Aust, 1946).

Pers Ltr, Maj Gen Hugh J. Casey, Chief Engr, GHQ, FEC, to Editor, 21 Jul 47. In OCE, GHQ, FEC (Hist).

The first document listing refers to an unpublished manuscript and gives its location. The second listing appears in *italics* inasmuch as it refers to a formally published document. Since it is available in Department of the Army record depositories, such as the offices of the Adjutant General and the Chief of Engineers, as well as in the headquarters indicated, its location is not specified. The third listing refers to a personal letter, a type of document that is incorporated in the files of either the sending or receiving agency, so its location is given. This reference indicates in order: the type of document, the sender, the recipient, and the date. Had this been an official letter, the subject would have followed the date.

Research for this volume was devoted principally to materials in the record files of the Engineer Sections of Headquarters, United States Army Forces in the Far East, and General Headquarters, Southwest Pacific Area and Army Forces, Pacific. This research was supplemented by resort to the central records files of General Headquarters, Southwest Pacific Area, and General Headquarters, Army Forces, Pacific, as maintained by the Adjutant General of the latter headquarters. The files of the Engineer staff sections, previously mentioned, present a reasonably complete record of engineer staff and command actions as well as of the operations of subordinate engineer units. In general these files contained the following types of documents:

1. Carbon copies of letters, memoranda, and messages prepared by the Engineer Section of the Theater headquarters and dispatched through command or technical channels.

2. Drafts of such letters, memoranda, or messages, sometimes hand annotated, which were not issued or were dispatched in a revised form.

3. Originals or carbon copies of staff memoranda circulated only within the Engineer Section of the Theater headquarters or between it and the General Staff, Chief of Staff, and Commander in Chief. Frequently these papers, annotated by hand, became of invaluable use in determining the ideas and influences that affected command decisions.

4. Originals or carbon copies of letters, memoranda, and messages addressed to the Theater headquarters or its Engineer Section by War Department agencies, or by coordinate or subordinate headquarters.

5. Copies of correspondence received in the Engineer Section of the Theater headquarters for information, concurrence, or action.

6. Carbons or typed copies of correspondence originating elsewhere, received by the Theater headquarters for action, and returned to the sender or addressed to a new addressee.

7. Mimeographed directives, generally letters, issued by the Adjutant General of the Theater headquarters or subordinate commands.

8. Staff studies, the reports of boards responsible to the headquarters, and numerous engineer unit after-action reports and manuscript histories.

These files, together with engineer records of subordinate headquarters which were consulted in the preparation of this volume or were believed to be of value for added research, have been transferred in bulk to the historical files of the Engineer Section, GHQ, Army Forces, Pacific (later Far East Command). Plans have been formulated for their release to the Chief of Engineers, Department of the Army, after the completion of this series of volumes.

The Preface and the text proper of *Critique* indicate to some extent the continuing Theater shortages of time, manpower, and materials. These conditions had a marked effect on the preparation and maintenance of adequate files throughout World War II in the Southwest Pacific and particularly during its early phases. Moreover, there can be little doubt that even some of that technically and historically valuable material which was produced so laboriously has been destroyed and completely lost to posterity.

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