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THE LOGISTICS OF WAGING WAR 1982 - 1993

THESIS

Alan J. Will  
William G. Wheeler, Captain, USAF

AFIT/GLM/LSM/93S-40

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# **The Logistics of Waging War 1982 - 1993**

THESIS

Presented to the Faculty of the School of Logistics and Acquisition Management

of the Air Force Institute of Technology

Air University

in Partial Fulfillment of the

Requirements for the Degree of

Master of Science in Logistics Management

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September 1993

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# Preface

The primary objective of this paper is to relate significant elements of U.S. military logistics during the period of 1982 to 1993. This period has seen United States military involvement in conflicts centering on Grenada, Panama, and most recently, the Persian Gulf. During this period, the geopolitical structure of the world has changed markedly. There is little resemblance between the world order that existed at the beginning of the decade of the 1980s and that which inaugurated the 1990s. Such drastic changes not only make it imperative that we seek to understand the military's rapidly changing role in the face of such monumental shifts in global perspective, but that the practitioners of the logistics art seek to understand the lessons of the past as well as the ramifications of more recent developments on future military campaigns.

Reflecting on the most recent U.S. military experience, when the gulf conflict abruptly ended after a 100 hour ground war on 8 March 1991, public and media attention on U.S. military operations in the region quickly waned. As far as the general public was concerned, the U.S. had pretty much won the war, the troops were on their way home, the United Nations mandate had been

achieved, Iraq had been defeated, and more important matters related to the domestic economy were looming on the horizon. In the mind of the average American, Desert Storm was over.

Operations Desert Shield and Desert Storm, and the media attention that accompanied them, introduced the U.S. populace in general to the notion of logistics and its importance in modern military conflict. The commander of Operation Desert Storm, General Norman Schwarzkopf, touted the role of logistics in the success of Operations Desert Shield and Desert Storm. Thus, the importance of the notion of logistics, if not the very word, logistics itself, became ingrained in both the media's, and correspondingly, the public's perceptions of the war even if they did not fully understand the immense spectrum of activities encompassed therein.

When combat ended, the majority of Americans assumed that once the troops came home, the logistics effort, like the war itself, had ended. Of course, this was far from the case. Not only was the U.S. faced with the need for a substantial retrograde operation to remove equipment from the theater and return it to home base locations, but a substantial reconstitution effort was also required to return equipment and supply stockpiles to necessary readiness levels. As such, the logistics effort was actually far from over. The fact that few people, apart from those actually participating in the operation, either within the military or the general populace, have even heard of Operation Desert Farewell, reflects the somewhat

myopic general perspective regarding the requirements and repercussions stemming from U.S. involvement in a major military campaign.

Whereas the general public can probably be excused for its ignorance of the logistics activities accompanying the Gulf War, the logistics professional can ill-afford such a limited perspective. Involvement in Operation Desert Storm severely tasked the majority of U.S. operational military assets, and until these assets are fully reconstituted -- a process that will in itself take years, U.S. readiness for future conflicts will be severely degraded. When this is added to the fact that the U.S. military has no significant experience (some would argue *no* experience) with the complete close-out of a wartime theater, the importance of and opportunity for discerning significant lessons related to combat logistics, theater support, and asset reconstitution is seemingly immense. The myopic perspective regarding the extent of the Gulf War logistics effort cannot be allowed to take hold and survive in the heart of the community that can least afford not to learn from the experience -- the U.S. military itself.

Extensive literature searches to uncover information relevant to U.S. operations in Grenada and Panama uncovered a dearth of any substantial body of material related to the associated logistics efforts. Some sources do in fact exist, and their treatment of the subject is excellent, but is, of course, limited in scope to the intended subject areas of the authors. We found a substantial

portion of the Desert Storm logistics effort is largely undocumented outside of a few internal reports and agency-specific analyses. While we amassed a vast array of material on the Gulf War, we were surprised and dismayed at the limited support for the project we received from many of the agencies and military logisticians we contacted in our search for information. Of 59 specific written information requests sent to Air Force agencies, only eight were returned. U.S. Army agencies returned nine of 11. Navy organizations answered 4 of 5 requests and the U.S. Marine Corps provided a complete and detailed response to each of our five queries. In each case, these requests involved a very specific letter addressed to the appropriate person in a specific office. Each letter was accompanied by at least two and often four or more phone calls to coordinate the request. There may be many reasons for this low level of support. In some cases, requested information may simply not have been available or access may have been restricted due to security classifications. It may be that we have been over saturated with logistics "lessons learned" or that political and budgetary developments have organizations more concerned with evolving and plotting a new course for the future. However, it is imperative that military logisticians strive to eliminate roadblocks to knowledge whenever possible and do their utmost to disseminate the key elements of the experiences gained through the crucible of genuine wartime environments.

Every attempt must be made to ensure that the greater logistics community develops a vital understanding of the requirements and

critical dimensions of logistics operations. The condition of U.S. war fighting and sustainment assets following Operation Desert Storm directly affects U.S. military readiness for involvement in future conflicts. Given the present drawdown in the U.S. military force structure and annually decreasing military budgets, the true effects of involvement in the Gulf War are likely to be a logistics fact of life for years to come. As such, attention to the importance and difficulties of both combat logistics and retrograde and reconstitution activities should be of substantial interest to U.S. military planners and logisticians. The real danger of failing to educate the greater military logistics community of the facts and information surrounding our military logistics efforts is that still-to-be-learned lessons from the Gulf War will go largely unrecognized by those who will most need such knowledge in planning and executing future conflicts. To the extent that Operation Desert Storm represents the model for future U.S. military actions based on a regionally oriented conflict perspective, the need to fully understand the ramifications of our involvement in the Gulf War is all the more pressing. Maintaining combat capability in the face of a significantly reduced availability of resources is a daunting challenge. Success in this challenge is vital to the maintenance of the United States' position as the only remaining superpower. We have no doubt the U.S. military and its logistics professionals will persevere.

We wish to acknowledge the great assistance we received in the preparation of this work. Many individuals and organizations assisted us by providing materials or comments as we sought to gather the data and information required to support this thesis. While there is insufficient room to recognize everyone who assisted us, there are a few who merit special thanks. Specifically, we wish to thank our primary advisor, Jerry Peppers, for his insight, guidance, and unending patience. We also wish to thank the members of our committee, Major Jannett Bradford and Colonel Pat Bresnahan, USAFR, for their encouragement and support. We also wish to recognize Ms. Annie Deatley, Mr. Michael E. Buchanin, MSgt James Ferguson, and particularly Mr. Lin Moore for their outstanding assistance in locating and researching the photographs accompanying this work. In addition, we feel compelled to thank our wives and families for their patience and perseverance during the many months and long hours they were forced to accommodate our attention to our studies and this thesis.

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# Abstract

This research effort provides material for use in updating the book *The Logistics of Waging War*. This particular book gives a logistics overview of past American military conflicts but has not been updated since 1982. Our objective was to research the logistics aspects of the major military operations since 1982. These operations include: Operation Urgent Fury in Grenada (1983), Operation Just Cause in Panama (1989), Operation Desert Shield in Saudi Arabia (1990), Operation Desert Storm in Iraq and Kuwait (1991), and Operation Desert Farewell in Saudi Arabia (1992). Also included in this study is a review of Air Force logistics doctrine in light of United States military experience since 1982. This document had undergone several major changes and we attempted to bring these changes to light and show what, if any, impact could be expected as a result of the new revision. The bulk of our research effort concentrated on the Air Force logistics scenarios but we also included many examples from the other services as well. A large collection of photographs has been included to help the readers gain a perspective of the many different activities encompassed in the area of logistics.

# 1

## Introduction

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### Specific Problem

The purpose of this research is to update *The Logistics of Waging War: American Military Logistics 1774-1985, Emphasizing the Development of Airpower* in order to determine the significant logistical developments of each major conflict and inter-conflict period from approximately 1982 to present with emphasis on the impact of logistics on strategy, tactics, and the outcome of campaigns.

---

## Background

In the early part of 1986, printing was complete and distribution begun on an outstanding text whose purpose was to "identify the most significant characteristics of logistics support as the American military grew from militia to worldwide power projection force" (1: ii). *The Logistics of Waging War: American Military Logistics 1774-1985, Emphasizing the Development of Airpower*, was the product of a research project undertaken in 1983 by students of the Air Command and Staff College, Air University, Maxwell Air Force Base (AFB), Alabama. The research work of the original authors, representing an extensive compilation of information from original sources and highly experienced logisticians and historians, became the basis of a text that, while still in its first edition, has been reprinted at least a dozen times with total copies produced numbering in the tens of thousands.

In its original form, the text essentially concludes with a brief commentary on the Falkland Islands War (1982) between Great Britain and Argentina and a short forward look at the future of logistics as the United States and her military forces prepare for operations in the twenty-first century (1: 192). As such, the time frame of the text ends at approximately 1982; no significant logistical developments between 1982 and 1985 are included and the implications of the conflict in the Falklands are treated to only a minor degree. Given the events that have transpired, the period between 1982 and the present, and certainly after 1985,

represents a demarcating period for the U.S. military as delineated by the number of military operations and political developments with pertinence to the evolution of logistics doctrine and operational military employment. Given the scope and nature of military operations conducted during this period, and the unparalleled changes wrought by the dissolution of the former Soviet Union and the Warsaw Pact, fertile ground exists for investigation and definition of the long-term implications of these events on the application of logistics doctrine and the conduct of military operations in a post cold-war world military and political environment.

In light of these developments, the Air Force Logistics Management Agency (AFLMA), Gunter Annex, Maxwell AFB, Alabama, recognized the need to update *The Logistics of Waging War* to reflect more recent military operations, changes in world affairs, and the corresponding changes in U.S. military, and particularly Air Force, structure, doctrine, and capability as they impact the application of military logistics. To this end, AFLMA is sponsoring a project to serve as the groundwork for a revision of *The Logistics of Waging War* for the purpose of including more recent military and political developments and their realized and potential impact on military logistics.

---

## Scope

Despite numerous reprintings, the text has not been revised since its original edition. Thus, potential areas for investigation related to military logistics include a lengthy roster of candidates from an extensive list of military operations and significant world developments. Areas to be included in this investigation are:

- Operation Urgent Fury - Grenada (1983)
- Operation Just Cause - Panama (1989)
- Operation Desert Shield (1990)
- Operation Desert Storm (1991)
- Evolution and Developments in Logistics Doctrine

Potential areas relevant to the study of military logistics during the period include, but are not limited to, the following (2: TOC):

- Logistics Problems
- Industrial Mobilization
- Logistics Planning and Manpower
- Medical Support
- Procurement
- Transportation

- Communication and Data Processing
- Supply/Resupply
- Munitions
- Petroleum Products
- Maintenance
- Construction
- Subsistence
- Salvage and Disposal
- Security
- Morale Logistics
- Other Logistics Support
- Airlift
- Equipment Prepositioning

Additional areas for study include the more general areas of mobilization and post-conflict demobilization and reconstitution, retrograde lift and resupply during conflict, and post-conflict restoration of forces and conflict areas.

---

## Objectives

The general objective of the study is to determine the significant logistical developments of each major conflict and inter-conflict period from 1982 to present with emphasis on the impact of logistics on strategy, tactics, and the outcome of campaigns. Specific objectives include determination of the preeminent logistics developments related to military operations and deployments since 1982 and the realities and constraints associated with logistics operations under a post drawdown force structure. Focus will be on the effects of military and political developments on the employment of airpower as related to logistics with an eye towards definition of future logistics developments and challenges including threats to worldwide United States interests from potential third-world adversaries.

Specific objectives related to the proposed research include:

- (1) Develop criteria to ascertain which conflicts should be included in the update.
- (2) Develop criteria to ascertain which inter-conflict events should be included in the update.
- (3) Ascertain the effects on logistics of selected conflicts or significant world events on logistics.
- (4) Ascertain the effects of logistics, by conflict or significant event, on strategy.

- (5) Ascertain the effects of logistics, by conflict or significant event, on tactics.
- (6) Ascertain the effect of logistics, by conflict or significant event, on the outcome of given campaigns.
- (7) Assess the effects of military and political changes during this period on military logistics support in general and airpower in particular.
- (8) Based on the results of objectives one through seven, above, contemplate the role of logistics in future conflicts.

For the purposes of this work, subsequent chapters will be organized by major topic area. Chapters two and three will contain the literature reviews and research methodology, respectively. Chapters four and beyond will contain information organized by each topic area covered. The final chapter will introduce findings and potential conclusions to be drawn in association with the logistics of the major conflicts studied in this thesis. Due to the historical nature of the subject matter of this work, the literature review at chapter two is essentially an elaboration of the general topic outline covered. Subsequent chapters are devoted to detailing specific conflicts and their associated logistics efforts.



# 2

## Literature Review

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### General

The nature of this research study is such that the primary research activity required was an exhaustive search of relevant literature related to military logistics during the period 1982 to present. An outline of potential areas of concentration was provided in chapter one and with further refinement serves as the basis for this literature review. It should also be noted that the ultimate presentation format for this research study deviates significantly from the traditional format favored for AFIT theses. In addition, given that the primary focus of this project is an accurate portrayal of historic events related to military logistics, the literature review

embodies the largest portion of the required research effort. As a result, each major topic is addressed in a separate chapter.

---

## **Planning Outline**

The following outline, although not significantly different from the list of potential research areas provided in chapter one, provides a basic conceptualization of the structure and organization envisioned for the final report.

- Introduction
- Before the Storm
- Operation Urgent Fury - Grenada (1983)
- Operation Just Cause - Panama (1989)
- A Line in the Sand
- Operation Desert Shield (1990)
- Operation Desert Storm (1991)
- Aftermath
- The Rebuilding of Kuwait/Cleansing the Desert

- Recovery and Reconstitution of U.S. War Fighting Assets
- Evolution and Developments in Logistics Doctrine

# 3

## Methodology

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### Introduction

This chapter outlines the design methodology and general parameters for the requisite research supporting this project. Included are a description of the primary methods used in data collection, the general population under study, the selection of representative sample material from the population, a description of the general analytical approach to determine the pertinence of specific data and materials, and an inclusive summary.

---

### Research Approach

The research represented by this study was almost entirely historically based nature. The task at hand was to accurately

portray past events in their correct historical context primarily through a process of descriptive research. The specific historical events included in this study as they reflect upon military logistics, be they changes to the world political environment or United States participation in significant military actions, were in part dictated by the scope and focus of the original text. That is, in order to fulfill the stated purpose of the research, namely, to provide an update to *The Logistics of Waging War*, the research had to be true to the intent and purpose of the original text.

Initial areas of concentration for this study were provided by the Editor-in-Chief of the Air Force Journal of Logistics, and represent key areas for research consistent with the purposes of the original Air University study that spawned *The Logistics of Waging War*. The list provided represents a compilation of topic areas consistent with those found in the original study, or that were submitted by journal contributors or recommended by eminent military logisticians. Additional areas for inclusion in the study were provided by faculty research advisors and the research process itself was expected to yield additional, historically relevant elements for inclusion in the study.

To this end, the primary data gathering technique, and indeed, the primary focus of the research was an exhaustive review of relevant literature. The available information was garnered initially from secondary sources, including logistics journals, official military and government reports, news articles, books, and periodicals. These

materials, in turn, allowed for the acquisition of original source materials used by other authors as appropriate to this study. This use of the bibliographies compiled by other researchers to identify some of the available primary sources was undertaken as a time-saving process and the relatively short time available for completion of this project given the extent of the research effort required.

The search for material included available library resources, the U.S. Library of Congress, the Air Force Office of History, CD-ROM indexes, On-line Computer Library Center (OCLC), Defense Technical Information Center (DTIC) - Defense RDT&E On-line System (DROLS), the DIALOG Information Retrieval Service, and interlibrary loans. Unclassified sources were used exclusively due to the inherent restrictions and limitations of classified materials. Some use was made of primary data in the form of personal interviews with individuals knowledgeable in/of specific areas under study as appropriate.

---

## **Material Availability (Population)**

The amount of material available for study was extensive. The population of available material included both written material, video tape, and personal interviews. The relative overabundance of materials related to many of the areas of contemplated study, particularly operations Desert Shield and Desert Storm,

established a singularly immense pool of potential research materials. However, the extensive availability of materials regarding the Gulf War was more than offset by a dearth of materials relating to U.S. operations in Grenada, Panama, and Operation Desert Farewell, particularly sources reflecting an Air Force perspective.

---

## **Selection of Materials (Sample Selection)**

Given the potential size of the research population, that is, the sheer potential volume of materials available for study, it was necessary to reduce the mass of sources to a workable number through the use of a generalized sampling technique. For the purposes of this project, an extensive bibliography of available sources was developed and, through the use of abstracts or article descriptions, the materials most appropriate to this study were further reviewed. As the objective of this research was to provide a factual account and historical record of logistically significant events, the sampling of available materials had to be accomplished on a non-random basis. As such, the sample of materials used for this effort represent a biased sample in that only material which stands out as factual and itself unbiased could be selected for use. However, as the research effort unfolded, instances where no significant sources could be identified resulted in extensive efforts, often unsuccessful, to identify any reasonably reliable source capable of providing historical insight. For example, the media was

deliberately excluded from in-theater reporting during the initial phases of Operation Urgent Fury. This, coupled with the less than favorable public image of the operation that developed in the months following its conclusion, led to little public or written comment by the military on any aspect of the operation, including logistics.

In determining particular elements or events for inclusion in the study, the general preponderance of materials related to a given specific event, element, or action was deemed significant. That is, the inclusion of the same events, elements, and actions in several sources was taken as highlighting that area for potential inclusion in the finished research study. Using a "pyramidal approach" sources were culled from the broadest possible base relevant to given research areas to the specific requisite sources required to support our research in a given area.

---

## **Data Analysis**

The initial phases of the research involve defining the appropriate criteria for and subsequently determining the major conflicts, developments, and inter-conflict events to include in the study. The resulting list of areas and topics was further refined as additional areas were included or deleted as a result of the findings of the literature review. The extensive search of available information sources facilitated the building of a comprehensive



bibliography of potential materials pertinent to the study of military logistics during the period 1982 to present. This list of potential sources was culled to support the corresponding acquisition of specific research materials reflecting the focus of the study and providing the most complete and accurate portrayal of historical events as they transpired during the period under study. Potential biases as reflected in source materials were evaluated to ensure an historically accurate representation of the events portrayed in the study.

Following a thorough review of applicable sources, a written, historically accurate, and chronologically ordered synthesis of the significant trends and developments pertinent to the subject of military logistics during the period from 1982 to present was developed.

---

## **Additional Considerations**

The nature of the proposed study, specifically, providing a research basis to facilitate the update of an existing published work, is a significant departure from the thesis work typically undertaken and supported by AFIT. The very nature of the research task is wholly different from that usually required in that the majority of the research effort is directed at an exhaustive review of pertinent literature versus the more typical focus on research results and conclusion drawing. Indeed, it is imperative

that this study effort seek to draw no inferences on the historical events summarized herein as history should be told as it occurred with little or no embellishment by the authors of this study.

In addition, the format of the original *The Logistics of Waging War* is itself somewhat unique. To best support the requirements of this study's sponsor, the Air Force Logistics Management Agency, a departure from the traditional AFIT thesis format was warranted. The original text is in part a collection of articles and essays, interspersed with scattered photographs, tables, figures, and short anecdotes and illustrations. It is, in part, this rather unique format, coupled with the select choice of key materials, that has lead to the highly acclaimed success of the original edition. In as much as the layout and format of the original work are vastly different from the traditional layout typical of government reports and publications in general, the present research project has the additional task of presenting its results in a format aimed at its eventual inclusion in the revised text with as little additional transformation as possible. This was no small challenge. A major portion of the research task was to serve in an editorial capacity by compiling complete original sources and photographs for use by the Air Force Logistics Management Agency in preparing the revision and update of the original *The Logistics of Waging War*. In this respect, this research study is vastly dissimilar to the majority of AFIT theses that precede it. In as much as the Air Force Logistics Management Agency is sponsoring this research and has indicated its strong

desire to publish the results of this work in an updated *The Logistics of Waging War*, it was necessary to establish a mutually agreed upon medium between the requirements of AFIT and the requirements of the end-user of the research. The format adopted is loosely based on the format used in formal reports of the U.S. General Accounting Office (GAO). Working with the research sponsor, the GAO format was tailored through an iterative process to best meet the goals of a clear and readable presentation format.

---

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# 4

## Operation Urgent Fury: Grenada

In 1983, the United States led a military operation in Grenada to restore a viable Grenadian government. Urgent Fury came about as a response to a request by the Organization of Eastern Caribbean States (OECS). Cuban military units had established fortifications, arms caches, and military communications facilities on Grenada (1: 3). The OECS became concerned that the political institutions in place represented a threat to the security to the region.



---

## **Objectives**

Included in the objectives of Urgent Fury was the evacuation of U.S. medical students along with any others who wanted to leave. The evacuation of Governor General Sir Paul Scoon was also part of the initial objectives.

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## **Logistics Considerations**

To meet the objectives for this operation, many different areas of logistics had to be identified and planned. One area was to decide how to secure the airport and what would be needed to do this. How many men would be needed and what type equipment, ammunition, and support would they need? Other areas to be thought about included how to round up the medical students and get them off the island without casualties. What type of airlift could handle this? Food for the students would need to be supplied but also for any prisoners of war that might be taken. All of this would have to be accounted for and brought into the island. Another consideration was who would do what in the operation? The Air Force, the Navy, the Army, and the Marines were all included and given specific missions. Each service had its own logistic problems to handle. All of this and much more had to be thought out prior to starting the operation.

During the morning of the first day of the conflict, an airfield at Point Salines was secured by the Army Rangers. This was the only runway which could accommodate a C-141. The runway was still under construction at that time. A large number of troops and corresponding supplies needed to be brought through this one airfield and only one large aircraft could be handled at a time. This required an extremely fast turnaround time to unload and get the plane airborne again. During the early part of the operation, ground support would turn around the aircraft within 30 minutes (2:4). The first troops on the scene brought with them the equipment needed to off-load the aircraft that would be following. These people needed to determine where to put all of the boxes and vehicles to maintain the landing strip's availability while keeping it easy to find and use the equipment when it was needed.



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## Constraints

With the limited runway capability, landings were made on a first-come, first-served basis. Each service requested strategic airlift directly from the Military Airlift Command, circumventing the Atlantic Command J-4 (logistics division). No one command had

control over the airflow. This meant that logistics aircraft carrying essential supplies were not given any priority over other type aircraft. Amount of fuel on board dictated if an aircraft would stay in the queue for landing or if it would be diverted to other airfields for refueling. Getting the necessary supplies to the theater was difficult (3: 59).

Additional jet fuel shortage problems occurred when the reserves located at Seawall International Airport in Barbados were depleted through use of airlift refueling at this location. This forced a reduction of the allowed payload from 50,000 to 35,000 pounds. With reduced load, the aircraft could make the round trip from the stateside locations without refueling (3: 59).

This confusion could have been avoided if the existing logistics doctrine had been followed. The existing doctrine would have had all airlift requirements forwarded to the Atlantic Command J-4. Thus, all the requests could have been reviewed and validated prior to going on to the Military Airlift Command. A priority order could have been developed and a routing of less critical flights could have been accomplished (3: 59).

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## **Deployable Mobility Execution System (DMES)**

The Deployable Mobility Execution System (DMES) was used to support the operation. This system was designed to allow a load planner to build loads of material needed to be airlifted to the

theater based on its weights and dimensions. Load planners were given a list of equipment and personnel requirements and would determine the most efficient load plans to use. In one instance the planning was accomplished in twenty minutes and saved the use of one aircraft by loading all of the required material on only four planes instead of the anticipated five aircraft. Overall DMES was used to plan nearly 7200 short tons of cargo and over 7500 troops for the airlift to Grenada (4: 10+). The use of DMES allowed planners to quickly change loading plans with the ever changing priority lists that came through from field commanders. The system was intended to save deployment of aircraft by more effectively loading the C-141s being used (5: 10).

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## **Maintenance**

A Forward Area Support Team (FAST) was deployed to support the forces. Since maintenance would be required from the beginning of the operation, the FAST was to coordinate the early maintenance problems and help to solve them quickly. They established an operation located at Salines airfield. Their duties were to set up a facility to collect requests for spare parts from all sources until the Division Material Management Center (DMMC) would arrive. The FAST would collect the requests and forward them to Fort Bragg via the Tactical Satellite (TACSAT) or facsimile machine. Once the main body of DMMC personnel set up, all requests would go through them so they could use the information



available through the TACSAT and Rear DMMC to find the most expeditious method of getting the parts (2: 6).

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## Water

Additional logistics problems centered on the resupply of potable water. The island of Grenada did not have a large supply of drinkable water. The logistics intelligence on this matter proved inaccurate. It was initially thought that water would be available but fresh water was low and the water system at St. George was rendered inoperable early in the conflict. Water was resupplied by air until desalinization units could arrive and be put into operation.



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## Lessons Learned

Joint logistics proved a formidable task during Operation Urgent Fury. Each service tended to try to maintain its own logistics system. The issue of logistics was not given proper consideration during the planning stage of the operation. Transferring supplies across service boundaries was not an easy task. All services reported to Vice Admiral Metcalf, the commander of this operation. Since no ground commander was established, a duplication of

effort and lack of mutual support resulted. Again, this was contrary to doctrine (3: 54).

Even though Operation Urgent Fury was a success, the logistics aspects showed some flaws which needed to be taken care of. The Department of Defense Reorganization Act of 1986 placed new emphasis on joint assignments and gave the combatant commander authority in all aspects of logistics. New joint exercise programs also have been implemented to improve the joint logistics (3: 62).

Operation Urgent Fury showed the great advantages of having military bases already located in the theater prior to an operation. The logistics problems that occur when moving into areas that do not have preset locations did not occur in this instance. The use of a large secure runway was a tremendous benefit that will not always be available. Also, the large number of troops already stationed in Grenada and knowledge of the types of opposition they would face allowed easier and quicker implementation of logistics plans. This will not always be the case and should be reviewed carefully before trying to use the benefits of the lessons learned from this operation.

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# 5

## Operation Just Cause: Panama

"Carlos, I've talked to the chief and I've talked to the chairman, and you are my man for everything that has to be done there. I'm putting you in charge of all forces and you've got it: planning, execution, the whole business. I have looked at my staff and I have told the chairman and I have told the chief that it cannot run a contingency operation. He said you can have it and I'm holding you responsible" (1: 55).

General Maxwell Thurman spoke these words to then Lieutenant General Carl Stiner. With these words, a major problem of Operation Urgent Fury was addressed. One of the lessons learned from the military action in Grenada was that a complex, multi-

layered command and control organization, and extremely poor communications between the different forces involved lead to some of the problems (2: 105). General Thurman believed that, by putting General Stiner in charge of the entire operation, problems that had plagued Operation Urgent Fury, such as low priority aircraft landing ahead of high priority aircraft, would be avoided.



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## Background

Operation Just Cause was a military action taken by the United States with several objectives, one of which was to remove General Manuel Noriega from power in Panama. Other objectives were to protect American lives, restore democracy to Panama, and secure U.S. treaty rights in the Panama Canal. To meet these objectives, many different things had to be accomplished. Troops and equipment had to be flown to the theater of operations and set up in secure areas to wait for the operation to begin. Food and medical supplies needed to be sent to maintain the troops. Security guards and locations to keep prisoners of war would have to be in place when needed. Fuel and ammunition to keep the troops working efficiently was required. All of these things, plus

many others, needed to be brought to Panama before the operation could be completed.

General Noriega was the head of the Panamanian Defense Forces (PDF) and effectively the dictating ruler of Panama. He had been indicted by two Florida grand juries for involvement and connections with the drug cartels (1: 21). Noriega was also believed to be the instigator of harassment against Americans and American servicemen stationed in Panama. While tensions were high on both sides, the actions of PDF guards provoked a reaction from the White House approving the use of military forces to remove Noriega from power. U.S. servicemen were being stopped and arrested for no obvious or realistic reason. Some were taken to PDF facilities and verbally abused. Others had assault rifles aimed at them. Still others were beaten. Finally, on December 16, 1989, Marine Lieutenant Robert Paz was shot and killed by PDF guards at a roadblock. On December 17, President Bush ordered the execution of Operation Just Cause. H-hour was set for 0100 Hours, 20 December, 1989 (2: 210).



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## Airlift

The plan for Operation Just Cause was to attack multiple locations at the same time. With the use of overpowering force, it was

hoped that the PDF would give up without much resistance. To accomplish this task, the planners would need to secretly move large amounts of troops and equipment in a short time. The Military Airlift Command (MAC) did just that. Headquarters MAC determined that it would need 60 hours to prepare the crew force needed for the invasion, 36 hours to locate the crews and get them assembled and 24 hours for mission planning, preparation, and flight time (6: 195). In the first hours of the operation, MAC airlifted 3500 Army Rangers and paratroopers along with their cargo to three separate combat zones. This required the use of sixty-three C-141s and twenty-one C-130s (7: 42).



Also helping out in the airlift were the Air National Guard (ANG) and the Air Force Reserve (AFR). 111 aircraft were deployed by MAC from 24 units while the ANG and AFR provided reserve support from 18 units. The ANG provided both strategic and tactical airlift support on C-5s, C-141s, and C-130s. The total number of personnel airlifted on the night of the invasion consisted of 10,000 combat troops. 6000 troops landed for deployment while 4000 parachuted to prescribed sites. These troops were in addition

to the 13,000 troops assigned to duty in Panama at the several U.S. installations located there. The aircraft took off from several bases in the U.S. and flew at low altitudes to avoid exposure to Cuban radar. Panama was considered a secure area for air operations with threats limited to ground fire. Only 14 aircraft reported damage, the majority from small arms fire. No aircraft was lost during the airlift mission. The final success of the operation can be attributed to the effectiveness of the airlift in deploying troops and equipment in such rapid fashion (2: 115-117).

MAC employed 84 aircraft in the initial operation for airdrop operations. These planes had to fly in from the U.S., converge on one of two drop zones about 100 km apart, and drop their loads while avoiding detection by Cuba or the PDF. All of this was happening at 1 a.m. in Panama. This operation was the largest night combat drop since World War II D-Day (3: 30). To make all of this happen, refueling plans were necessary. Since the C-130s could not be refueled in flight, they had to land at one of the U.S. secured airfields to refuel. C-141s and C-5s would meet up with Strategic Air Command (SAC) KC-135 and KC-10 tankers for refueling both going to (if needed) and/or returning from Panama. SAC provided tankers from 26 squadrons from 14 bases located in the U.S. (2: 75-77).



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## Weather

Weather posed some problems for several locations providing the airlift support. Fog at Travis AFB, California, caused the 7th Light Infantry Division to board at Monterey Airport instead of Travis (3: 31). An ice storm at Pope AFB, South Carolina, caused a delay in the departure of paratroopers from Ft. Bragg. The Army Material Command's logistics assistance office (LAO) preparedness was critical for the aircraft even getting out at all. 321 barrels of deicing fluid were needed to prepare the aircraft for flight (8: 6). This delay could have been responsible for the interception of these C-141s by Cuban MIGs. Since these planes arrived well after the assigned starting time, the Cubans may have been alerted and were watching more closely for air traffic. They launched several MIGs from Cuba but did not interfere with the completion of the C-141's mission (2: 91).



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## Air Superiority

Aside from the encounter with the Cuban MIGs, the U.S. had uncontested air superiority. The main reason for this was that the PDF did not have any fighter aircraft and no military aircraft permanently stationed at Rio Hato, the Panamanian Defense

Forces installation on the southern coast (4: 32). This allowed MAC to drop troops where the U.S. commanders wanted. It also permitted the U.S. Air Force and Army aviation to provide close air support as needed. Ground forces operated without fear of enemy air attacks and air supply was uninterrupted(2: 67).



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## Special Operations

Special operations aircraft had a significant role in Operation Just Cause. In the first night of operations, 65 helicopters and 20 fixed wing special operations aircraft flew. This amounted to the largest single employment of special operations aircraft in U.S. history. The helicopters were used to transport troops to their assigned positions and also to suppress enemy ground fire. The AC-130 gunships were used to attack the PDF installation at Rio Hato as well as giving ground support by suppressing other enemy ground fire. With all of the traffic in the air that night, substantial use was made of night vision goggles (NVGs) to allow the pilots to be able to see the other aircraft in the air at the same time. Use of NVGs

by trained pilots provides significant advantages because flying at night reduces the risks of enemy gunfire and anti-aircraft missiles. Losses were kept to a minimum through the night time flights (2:118-120).

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## **Depot Support**

To get the required personnel and equipment deployed, logisticians were assigned to arrival-departure airfield control groups (ADACG's). They developed the plans used to load the equipment to be air dropped or delivered to Panama. Equipment had to be palletized, weighed, measured, and inspected to ensure safety and load restrictions of the aircraft. Support personnel at the depots worked 24 hour shifts to fill requisitions. The Defense Personnel Support Center (DPSC), in Philadelphia, Pennsylvania, processed 95 percent of the supply requirements of the Defense Logistics Agency (DLA). This included more than \$13.3-million worth of food, clothing, and medical supplies. The Defense Fuel Supply Center (DFSC), in Cameron Station, Virginia, arranged for 1 million extra gallons of JP-4 aircraft fuel to go to Barksdale Air Force Base, Louisiana. They also delivered 185,000 barrels of JP-5 fuel to Defense Fuel Supply Point Rodman. Defense Construction Supply Center (DCSC), Columbus, Ohio, supplied spare parts for Black Hawk helicopters, 5-ton trucks, and high mobility, multipurpose, wheeled vehicles. At Defense Depot Mechanicsburg, Pennsylvania, more than 1,328,500 pounds of

material was put together for airlift to Panama. Many other Depots and Centers supplied tons of material in support of the operation (9: 2-4).



A major debate of any logistician during a conflict is whether to push parts and other supplies or wait until they are requested. The logistics assistance offices (LAO) for the Army Materiel Command worked out a compromise. Packages of parts and ammunition were offered to the task force to help streamline the process. The LAO also helped find available seats for defense contractor civilians deployed to Panama. With the limited passenger seats on the aircraft, civilians were strictly controlled.

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## Problems

The logistics system did not operate without problems. In-transit shipments would lose visibility as to their ultimate destination at the ports of debarkation and embarkation. Pallets did not have enough marking and data sheets associated with them to quickly determine the contents and destinations (8: 7-8). These problems occurred from a lack of complete directives given to the personnel who put the pallets together. This is one of the problems that needs to be addressed more clearly for all operations which involve sending equipment to other parts of the world.



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## Theater Support

The 193d Support Battalion supported more than 25,000 troops deployed to Panama. They began a distribution center at Luzon Field, Fort Clayton, Panama. After the first six days of the conflict, the battalion distributed 321 short tons of various classes (I - IX) of material. This included 25 short tons of water. 85 percent of the tonnage went by CH-47 helicopters. They also operated two refueling points that pumped out approximately 110,000 gallons of fuel during the initial eight days. Alpha Company established an ammunition transfer point along with a graves registration point. The Battalion's 1097th Transportation Company supported missions by transporting 2,442 passengers, 848 prisoners, and 738 short tons of cargo. Much of this support came under duress of enemy fire (10: 8).

In support of the overall operation, the Military Airlift Command flew 775 missions to transport 39994 passengers and 20675 tons of cargo. This meant approximately one half ton of cargo for each person deployed during the operation. The special operations units added an additional 796 missions neutralizing PDF resistance. In humanitarian airlift efforts intended to provide for

families of American troops stationed in Panama as well as Panamanian people displaced by the operation, 8 C-5s and 14 C-141s transported three tons of medical supplies, 10,000 blankets and sheets, several tons of baby food and food staples, as well as two million field rations. After the first days operations, MAC aircraft were used to deploy 2500 troops for security. Return trips back to the U.S. were used to evacuate wounded service personnel along with other materiel no longer needed in the theater. The wounded were brought to Kelly Air Force Base, Texas. 257 patients were flown aboard 1 C-130 and 8 C-141s. (6: 197-8)

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## Medical

The mission of Medical Logistics was to provide materiel to care for casualties and ease suffering. The medical logistician must determine the size, location, and duration of casualty flow to determine the scope of support to specify. The medical inventories needed were already in U. S. medical treatment facilities located on the U.S. military bases in Panama. The medical supplies were airlifted to Howard Air Force Base, Panama, to be distributed from there. The medical logistics experts in Panama were not given information about the conflict prior to its occurrence and therefore implemented the medical logistics plan given to them after H-Hour. The plan called for the Joint Casualty Collection Point (JCCP) personnel to bring adequate supplies and equipment stocks with

them as they deployed. Resupply then came from the continental United States (CONUS) pipelines. This method caused a shortage of routine items such as litters, blood expansion fluids, sterile gauze, and other items. Restocking supplies came from the Emergency Supply Operations Center (ESOC) at the DPSC in Philadelphia, Pennsylvania. Requests were made by AUTOVON and FAX to Wilford Hall Medical Center, Lackland AFB, Texas. Medical logistics personnel pulled, packed, palletized and loaded the requested materiel for delivery within 24 hours of request. Medical Logistics system (MEDLOG), an automated supply and equipment inventory transactions system was available on the computer systems, but only after a secure, uninterruptable power supply was established (11: 2-5).

Additional medical logistics were handled using theater army medical management information system for medical supply (TAMMIS-MEDSUP). This is a computer software that automates combat patient records, tracks blood inventories, and manages other medical logistics. (9: 5)

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## **F-117**

The Panama attack was the first combat mission for the F-117A fighter. This aircraft was designed to penetrate radar and air defenses and perform single-aircraft attacks on high priority targets deep behind enemy lines (4: 32). The F-117s were to drop two

2000-lb. bombs near a PDF barracks at Rio Hato to stun the PDF into giving up without a fight. The F-117 was used because of the needed accuracy of the bomb drops. The aim was not to hit the PDF, but to scare them enough to give up. Six F-117s were flown to Panama to drop the bombs or to support other missions if needed and then returned to the U.S. without landing. Refueling in flight was required for these aircraft (4: 32-33, 5: 30).

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## **Enemy Assets**

Another logistics aspect of this type of operation involves the confiscation of weapons and ammunition. Combat service support soldiers had to inspect, classify, and transport more than 700 tons of ordnance including more than 50,000 weapons captured from the Panamanians. They also had to deal with equipment. They sorted, classified, cataloged, and packaged 31 aircraft, 29 armored vehicles, 7 patrol boats, and 20 antiaircraft guns. Decisions had to be made on what to do with the items. If the item had a potential for use by U.S. troops, it was forwarded to units that could best make use of it. Otherwise, all of the materiel had to be packed and removed from the theater (9: 5).

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## **Lessons Learned**

The overall success of Operation Just Cause can be attributed to many things. The efficient nighttime airlift along with all of the



planning and traffic control was one of the reasons. Effective training missions by all of the forces prior to the conflict, especially those already in Panama, was another. Having 13000 troops already stationed there and familiar with the surroundings was a tremendous benefit. Some of these troops were airlifted by MAC between 11-18 May 1989, prior to the start of the operation. A total of 5915 soldiers and marines and 2950 tons of cargo were sent to Panama during this time period. To accomplish this feat, 34 C-5s, 39 C-141s as well as 2 commercial L-1011 missions were flown (6:195). The fact that the PDF did not have an air force to speak of is yet another reason for the success of the missions. All of these facts need to be remembered in considering the overall success and lessons learned from Operation Just Cause. Even though we kept casualties low, and that was one of the objectives going into the conflict, we must consider all of this and more when planning for the next occurrence.

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# 6

## The War in the Persian Gulf

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### Overview

On August 2nd, 1990, Iraqi forces under the command of Iraqi president Saddam Hussein launched an all-out invasion of the neighboring country of Kuwait. At 0100 hours local time, divisions of the Iraqi Republican Guards crossed the Iraq-Kuwaiti border on two separate axes, moving rapidly southward toward Kuwait City in a classic blitzkrieg operation. The initial assault was coordinated with direct attacks by special forces units on Kuwait City, and helicopter and amphibious assaults at key points of tactical significance. The war in the Persian Gulf had begun.

When U.S. forces were ordered to deploy to the Persian Gulf in August 1990, the challenges confronting logisticians were unparalleled since those experienced in World War II. A force exceeding that deployed in either Korea or Vietnam would be deployed half a world away over an exceedingly short span of time. The logistics pipeline supporting the theater would span more than 8,500 nautical miles over an indirect, 17 hour flight from the U.S. to the Middle East via Europe (1: 17-18).

Operations Desert Shield and Desert Storm would involve the largest contingency deployment of troops, supplies, and equipment ever undertaken by the United States military. Commencing on 7 August 1990, Operation Desert Shield set in motion the opening deployment of U.S. forces with elements of the First Tactical Fighter Wing from Langley AFB, Virginia, flying F-15Cs, initiating the U.S.'s forward presence in the crisis area. The primary intention of Desert Shield was to protect Saudi Arabia and U.S. vital interests in the area from the threat of expansion of Iraqi offensive operations beyond the borders of the now occupied Kuwait. Operation Desert Storm would subsequently commence on 17 January 1991, with the unleashing of a massive, unparalleled airborne campaign, assaulting key Iraqi forces and installations with the eventual aim of forcing the complete withdrawal of Iraqi forces from Kuwaiti territory. The ground phase

of operations began on 24 February 1991 and ended exactly 100 hours later in an Iraqi rout.

The scope of the logistical effort necessary to accomplish a coalition victory in the Gulf War was truly massive in extent. The United States military moved a previously unprecedented volume of personnel and materiel across great distances to a geographically remote theater of operations and there successfully employed these forces in the execution of a major military campaign. For the United States military and, indeed, United States foreign policy in general, there were many lessons and implications stemming from the many logistical successes. Recognition of shortcomings and obstacles which had to be addressed and overcome to prevent their hindering the successful prosecution of both defensive and offensive operations also provides critical insight towards the conduct of future theater specific crisis military actions. The exceptionally massive effort necessary to equip, transport, receive, employ, and sustain a force in excess of 500,000 United States military personnel in the face of the geographic distance of the combat theater from the continental United States, the extraordinarily harsh environment in which personnel and equipment were required to operate, and the absence of any preexisting U.S. military forward presence or basing agreement, contributed significantly to the creation of a logistics challenge of phenomenal proportions.

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## Unique Challenges

Operations Desert Shield and Desert Storm would confront the U.S. military with many unique, complex, and wholly unexpected logistical challenges. For example, U.S. Marines found themselves operating well inland with a line of supply stretching from the port of Al Jubail in Saudi Arabia, 250 miles across the desert, to Kuwait City. Army units faced much the same circumstances with the result that a shortage of transportation and related equipment, trucks, trailers, vans, buses, forklifts, and other special purpose vehicles, quickly developed. This situation was exacerbated by the almost continual arrival of additional deploying units until shortfalls could be alleviated through contracted host nation commercial support and the arrival of additional transportation assets from the United States. This heavy demand for vehicles and transportation capability, coupled with the extremely harsh climatic conditions in which equipment was operated, led to a higher than expected load on the forward supply system. Air Force units similarly discovered their demand for consumable items such as oil filters, tires, and batteries was much elevated over levels planned prior to actual deployment.



During the 43 days encompassing Operation Desert Storm, Air Force fighter aircraft would log 34,038 sorties and in excess of 118,000 aggregate flying hours. 45,666 sorties would be flown transporting personnel, supplies, and equipment within the theater of operations, and 17,331 strategic airlift missions would also be flown. Such high utilization levels generated a commensurate demand for repair items and consumables.



Another unique aspect of Operations Desert Shield and Desert Storm which had a significant effect on logistical operations was the employment of certain equipment and weapons systems in roles and missions different from those for which the systems were originally designed. One of the more famous systems participating in the conflict and employed by the Army, the Patriot missile system, was designed to accommodate the threat of high performance aircraft and certain missile systems with non-ballistic trajectories. The system gained notoriety, however, in its exclusive use, with some success, against Iraqi SCUD missiles. The Patriot system was also involved in the first deployment of U.S. ground forces on Israeli soil as a part of Patriot batteries set up outside Tel

Aviv. Similarly, the A-10 found itself servicing an expanded role beyond close air support by providing active battlefield air interdiction prior to the commencement of the U.S. ground assault.

Still another unusual aspect of Desert Shield and Desert Storm operations stems from the unique social and cultural environment existing in Saudi Arabia and into which U.S. personnel were deployed. For the Department of Defense, the challenge was not only to keep the troops in the field equipped and supplied, a daunting task in and of itself, but to do so within a framework of strict local customs stemming from the traditions and tenets of the Islamic faith. Such items as alcohol and non-Islamic religious items were banned outright by the Saudi Arabian government. Strict mores regarding materials which Saudi censors deemed pornographic kept such items as Sports Illustrated's annual swimsuit issue, sent to servicemen by the thousands by a well-meaning American public, out of the hands of U.S. GIs. In a similar vein, Saudi Arabian social beliefs regarding the role and place of women in society created a somewhat unique and challenging environment for the thousands of U.S. servicewomen deployed in defense of a country that does not itself allow women to serve in its military in any capacity.



## **Volume of Requirements**

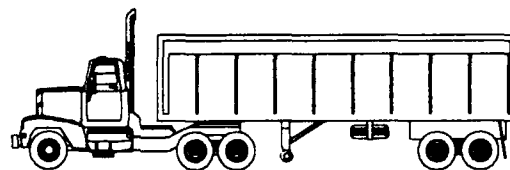
During the first ten days after Operation Desert Shield was announced, the Naval Supply Center at Norfolk, Virginia, requisitioned almost five million pounds of subsistence for deploying ships from the Defense Depot, Richmond, Virginia (DDRV). More than 120 truckloads were required to support the requisition from DDRV, and this represented only the percentage of the Naval Supply Center's total requisitioned requirement supported by the Richmond Depot (1: 18). Such a surge in depot activity was common and only hinted at the truly massive extent of the total logistics effort required.

As of late March, 1991, U.S. transportation forces accomplished the equivalent of moving all the people, vehicles, and household goods of Oklahoma City halfway around the world to the Persian Gulf. That included approximately 547,000 passengers, approximately 2.9 million tons of equipment, 6.5 million tons of refined petroleum products and nearly a million tons of supplies (2: 41). Such comparisons attempted to put the scale of the logistics undertaking into terms that the average person could more readily comprehend. Following a similar line, in less than six months, the population of a major city the size of Louisville, Kentucky, was moved 8,500 miles, accompanied by tens of thousands of vehicles of all types. This population had to be fed, housed, clothed, protected, and entertained. 400,000 personnel ate three meals a

day, seven days a week, amounting to 1,200,000 meals per day, or 8.4 million meals per week. While the Saudi government supplied vast quantities of soft drinks, fresh fruit, and potable water, the requirements on the U.S. logistics system were immense (1: 19).

During a five-day period, 250 18-wheel tractor trailers full of equipment for deploying U.S. Army units inundated Fort Stewart, Georgia. Another 128 truckloads of ammunition were also delivered. The port of Savannah, Georgia, was likewise deluged with an influx of armored, support, and other vehicle types as units prepared for their deployment (3: 10).

In the first 30 days of Operation Desert Shield, New Cumberland Army Depot, Pennsylvania, shipped more than 3,000 tons of repair parts, tool sets, and construction materials to Saudi Arabia via the Port of Baltimore, Maryland, and Dover Air Force Base, Delaware. In contrast to the traditional European war scenario where basic stockage items are already prepositioned in the theater, Desert Shield involved sending troops to a theater with minimal in-place infrastructure whatsoever (3: 11). The Army's Military Traffic Management Command (MTMC) routed over 83,000 passengers, 27,360 trucks and 15,827 rail cars to stateside ports (2: 41).



During the first 30 days of Desert Shield, Army depots throughout the United States shipped more than 45,000 tons of support materiel to the Middle East. Another 6,000 tons of supplies were prepared for shipment and awaiting transport. According to Army Materiel Command officials, the initial loads included more than 30,000 tons of ammunition and explosives, 6,000 tons of major end items such as tanks and howitzers, and another 6,000 tons of repair parts. Another 3,000 tons consisted of clothing, construction and barrier materials and medical supplies (3: 11).

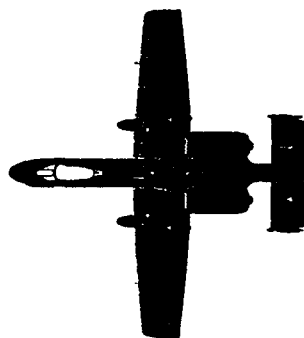


To comprehend the need for such a significant level of depot type supply activity, one must realize that a modern military force operating in an austere theater generates a significant logistics "tail" in the form of its ongoing sustainment requirements. A typical armored division, with some 350 tanks, 200 Bradley Fighting Vehicles and 16,000 soldiers, may consume on a daily basis 5,000 tons of ammunition, 555,000 gallons of fuel, 300,000 gallons of water, and 80,000 meals. In addition to the division's fighting vehicles, nearly 1,000 cargo, fuel, and ammunition trucks are required. Typically, the M1A1 main battle tank consumes between six and seven gallons of fuel per mile. An armored division can go about three to five days without external resupply; about 3,500 of

its troops, or about one-quarter of the division, will have logistics responsibilities of some kind (4: 21).

## **Desert Environment**

The climates of Iraq and Saudi Arabia are determined by two of the great "weather engines" of Asia -- the Great Indian Heat Low low pressure system year-round, and fast-moving Arctic cold fronts from the Commonwealth of Independent States (CIS) in the winter. From May through November, climatic conditions in the theater of operations were typified by high temperatures and a dust haze of varying intensity up to an altitude of several thousand feet. While the ever-present dust creates problems for personnel and equipment alike, the chief hazards to *military operations in the region* during the summer months were towering mile-and-a-half high sandstorms -- great rolling walls of red sand and dust propelled by gale force winds. Add giant dust devils and the pervasiveness of the fine sand of the Saudi Arabian Peninsula and the climatological hazards of summertime military operations are considerable (5: 36). Average noonday temperatures in the shade hovering above 110 degrees take a significant toll on personnel and equipment (6: 15).



December marks the start of the rainy season in the theater. Rain was present intermittently until approximately April, when summertime conditions again began to emerge. The rainy season is dominated by the presence of fast-moving Arctic fronts which cause considerable wind shear and extremely variable weather conditions. Friendly air operations throughout northern Saudi Arabia and Iraq were hampered by extended periods of fog, low ceilings, clouds, and rain during this period. When conditions at friendly airfields were sufficient to support aircraft sorties, conditions at the target often obscured objectives and limited or eliminated both combat and reconnaissance opportunities (5: 36).

The desert environment with its fine, blowing sand and harsh temperatures is hard on man and machines. The demand for air filters and for vehicles and aircraft surpassed all expectations as did the need for more frequent maintenance. Orders for oil filters and the variety of lubricants required to maintain a substantial mechanized force also exceeded expected demand. One newspaper quoted Army officials:

The harsh environment and accelerated training pace is wearing out our parts much more quickly than expected. For example, most filters fail eight times faster; tires, five times. In general, the Army, based on past testing in desert conditions, has been buying parts 3 1/2 times its normal rate for systems deployed in the region and it's proven to be pretty accurate. (1: 19)

The time between overhauls of some Chinook helicopters fell from an average of 300 or more flying hours to about 50 due to dust. The combination of more sorties and fewer maintenance opportunities caused the asphalt-like paving surfaces on several of the flight decks of U.S. aircraft carriers stationed in the region to wear thin prematurely (7: 2). Also, high temperatures rapidly drained batteries and blew electric circuits. Hoses and pumps were found to have an equally limited life in the desert environment. Resupplying these less glamorous, but absolutely essential items, made up a substantial portion of the demand on defense depots and often necessitated emergency shipments to get these critical items to the field. As temperatures in the desert began to drop with the passage of the seasons, demands for other items such as long underwear, sleeping bags, field jackets and night desert camouflage coats soon materialized (1: 19).

Personnel were also exposed to the effects of the desert environment. Health hazards associated with the desert environment vary. Hazards which particularly worried military health officials were onchocerciasis ("river blindness"), bilharzia

(schistosomiasis), malaria, and strangely enough, rabies. River blindness is common in this theater and is caused when an individual is bitten by the black fly; an insect smaller than a common house fly that injects its larva into the bloodstream after which they migrate to the optic nerve and cause irreversible damage. Bilharzia, a form of schistosomiasis, is a liver parasite which annually kills tens of thousands. The flukes of this organism are found in surface waters and are known to penetrate the skin of the feet, legs, and hands and then migrate to the liver where they cause their damage. Two types of malaria, vivax and falciparum, increase in occurrence during the rainy season. Incidents of rabies also tend to become more prevalent with the change of seasons with wild dogs and native fennec foxes serving as carriers (5: 38).

Under the desert climatic conditions of Southwest Asia, water, sanitation, and food preparation techniques differ greatly from those practiced under a more often exercised Defense-of-Europe warfighting scenario. Medical supplies and care must be geared to hot weather and desert peculiar illnesses. The arid climate dictates a supply of specialized equipment: desert camouflage clothing, nets, and flameless ration heaters. Equipment must be tuned and modified to operate more efficiently in the desert. The threat of chemical and biological warfare by Iraq compelled another set of unique requirements: specialized equipment, chemical agent-resistant paint; mission oriented, protective posture (MOPP)

gear; and chemical agent detectors. Because crucial oil stocks are subject to attack, it was necessary to deploy equipment to build and repair pipelines (8: 21).

Saudi Arabia is the home of 23 species of venomous snakes, most of which can cause death. In addition, venomous insects such as the desert scorpion not only are in abundance, but also have a fondness for the same places soldiers will gather -- in and around tarps, under flooring, or where stockpiled crates or boxes can provided concealment (6: 16).

### **Overseas Deployment Requirements**

In addition to the logistics requirements peculiar to a desert setting, there are those required for any overseas deployment: equipment and services for port and airfield operations, personnel and equipment to plan and construct support facilities and depots, and second-destination transportation assets (8: 22). Because only limited stocks for the Army were propositioned in the Middle East, most supply support items had to be shipped through channels originating in the United States and Europe (9: 8).

### **A Complete Team**

While the GIs involved in prosecuting the Gulf War received the bulk of public and media attention, they were only a portion of the total force that made a successful U.S. conclusion to the Gulf War



possible. Defense depots are almost exclusively staffed by civilian personnel, and the dedication of the workforce can never be overstated. Another civilian force, the civilian transportation industry, played a key role in the deployment effort (1: 18) Industry executives estimated that there were about 1,000 contractor personnel at air bases, on aircraft carriers, and at other military facilities throughout the Gulf region. The primary role of the personnel is to assist military technicians in diagnosing and solving problems with weapons systems and in assessing and repairing battle damage (10: D2). Without significant contributions by government civilians, contractors, and the hundreds and thousands of people working at plants and factories supplying everything from bottled water and desert camouflage uniforms to spare parts for the Abrahms main battle tank, the U.S.'s ability to successfully support a major military campaign in the Gulf region would have been doubtful.

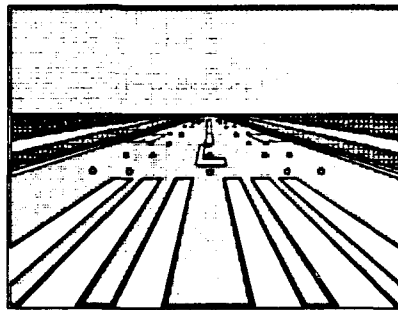
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## **Host Nation Support**

### **Saudi Arabian Support Critical**

Regardless of the presence of culturally based restrictions on the activities of deployed U.S. service personnel, Saudi Arabian support for its allies was generally superb and unqualified. As the host for the allied coalition arrayed against Saddam Hussein and

his armies, Saudi Arabia provided extensive logistics support in the form of basic supplies such as food, water, and fuel. In addition, many U.S. personnel were billeted in quarters or commercial hotel space provided by the Saudi Arabian government. Such support was usually provided free of charge to the United States government. In addition to support provided by Saudi government organizations, many U.S. units actively contracted for commercial type supplies such as tires, batteries, and fuel pumps when these and similar items were not available through available DoD supply channels in a timely manner. Additional services such as transportation, sanitation, and food service were also often contracted from host nation vendors.



### **Host Nation Facilities**

While many U.S. personnel would find themselves bedding down in unimproved remote sites, and ultimately, large tent cities erected by deployed U.S. personnel, troops billeted near large Saudi metropolitan areas were often housed in available and modern

commercial military or civilian apartment complexes located nearby or on existing Saudi air bases. Such was the case for many U.S. personnel deployed near Riyadh and King Kalid Military City. Other housing facilities supplied by the government of Saudi Arabia were often in the form of residential camps built to house foreign nationals employed in support of the expansive Saudi Arabian petrochemical industry. Such facilities generally not only improved the quality of life for the personnel housed therein, but provided a ready means to rapidly billet incoming personnel while arrangements were made for their eventual beddown at more forward operating locations.

Modern port facilities such as those at Al Jubail, which served as the primary debarkation point and theater supply depot for U.S. Marine Corps forces in theater, provided adequate mooring capacity, warehousing, and staging and aggregation areas. Saudi ports were generally well served by modern highways and were usually only hampered by limitations in the number of large cranes and derricks available for unloading bulk and containerized cargo.

Units of the U.S. Air Force were stationed at several Saudi air bases, many of which were built for contingency purposes, and had themselves never been used. Such facilities varied from installations complete with hangars, water and sanitation systems, living quarters, and messing facilities, to more austere locations providing only a serviceable runway and little else.

For the forces deployed in support of Operations Desert Shield and Desert Storm, the range of conditions experienced varied from the austere to the luxurious. For the logistical system, the realities of desert warfare under conditions including the possibility of sustained operations in a chemical or biological threat environment led to many unique challenges that had to be faced and overcome to ensure protection of U.S. personnel and equipment and ultimately provide the coalition victory in the campaign to oust entrenched Iraqi forces from occupied Kuwaiti territory.

### **Host Nation Contractors**

To bolster the small contingent of dedicated logisticians and support personnel initially deployed to the theater, the military turned to local vendors, contracting for billions of dollars worth of truck rentals, food services, and equipment. Because of the urgent need to supply the daily throng of arriving troops, the military initially bypassed normal bidding procedures to purchase items as diverse as rice, Bedouin-style tents, and lumber (7: 2).

Military support personnel were fortunate in that the legacy of the oil boom left huge amounts of construction equipment and trucks which U.S. forces rented, along with hiring hundreds of Pakistani, Filipino, Korean, and other expatriate drivers and operators (11: 1). In addition, our forces received food, water, transportation,

petroleum, and many other assets from Gulf nations involved as members of the multinational coalition (9: 7).

### **Multinational Force and Logistics Requirements**

The largely multinational force deployed in the theater presented numerous logistics challenges in the areas of interoperability, identification of enemy combat equipment, food, maintenance, transportation, and medical services in an arid environment; development and testing of equipment for desert warfare; stress-protective measures; desalination; host nation support; mobile power generation; chemical defense and decontamination; communications for command and control; air traffic control; oil refinery repair; and antiterrorist training (8: 22).



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### **Sealift**

Over 95 percent of the materiel moved to the Persian Gulf was moved by sealift. Assets immediately available to Military Sealift Command consisted of 23 maritime prepositioning ships loaded in

advance with essential cargo and strategically located as well as eight fast sealift ships (2: 41). Throughout Desert Shield and Desert Storm, the Navy operated all 23 prepositioning ships, eight fast sealift ships, six ships chartered prior to Operation Desert Shield, 55 Ready Reserve Force ships, 39 chartered ships flying U.S. flags, 94 ships chartered with foreign flags and seven ships loaned from Japan, Korea, and Kuwait. These ships moved more than 18.6 billion pounds of dry cargo and 12.6 billion pounds of fuel (2: 41).

Once weapons and equipment are rolled onto ships, the ocean journey from the East Coast of the United States to the Persian Gulf averages 21 to 25 days. While the sea journey for European based forces averaged only 17 days, the time and effort spent moving these forces overland to their European embarkation ports was in itself significant (12: 1).

### **Decline of the U.S. Merchant Marine**

Since World War II, the U.S. Merchant Marine has diminished at an alarming rate, both in terms of vessels and in crews trained to operate them. The U.S. Merchant Marine fleet went from 5,000 ships in 1945, to 893 ships in 1970, to 424 ships in 1989. Seagoing jobs dropped from 100,000 to 28,000 during this same period (1: 21). This erosion of indigenous U.S. maritime capability raised serious questions of the viability of U.S. sealift activities

during future conflicts and the vulnerability of U.S. surface movement requirements in a conflict where foreign owned and operated vessels are not so readily available due to either political or belligerent considerations.

### **Ready Reserve Fleet**

The U.S. Maritime Administration maintains a fleet of 96 Ready Reserve Force ships. These vessels are intended to be available on 5-day, 10-day, or 20-day alert status depending on the vessel. During reactivation some ships experienced trouble and delays in getting underway, mainly due to boiler malfunctions. Military Sealift Command had to charter nine U.S. and 10 foreign flagged vessels for Operation Desert Shield to alleviate the sealift shortfall (9: 6).

The Navy's eight fast sealift ships, 1,000 feet long, and able to make 33 knots (around 38 miles per hour), can make the trip from the east coast of the United States to the Gulf in twelve days. Slower ships take at least two weeks, which does not include the time necessary at both the origin and destination for cargo loading and unloading (9: 6).



By 21 September 1990, we had activated eight fast sealift ships and 36 of the 96 Maritime Administration reserve vessels. Retired crewmen manned some of these vessels in many cases because today's modern ships are a drastic change from the World War II era ships comprising the reserve fleet. Today's seaman is just not knowledgeable of the vintage equipment found on these older ships (1: 21). Our ability to man ships in the Ready Reserve Fleet with trained crews was stressed to the maximum and the lack of a viable U.S. Merchant Marine hindered sealift activities (9: 7). The vessels' condition when activated was another problem. Considerable work was required on the vessels and operational problems still restricted their overall effectiveness (1: 22).

### **Container Ships: A New Mode for the Military**

Modern container vessels carry more on each voyage than five of the Victory ships of World War II fame. However, this too offers unique logistics challenges in discharging the larger vessels and finding room to stage the containers before moving them to the ultimate user. A standard container vessel can hold about 2,100 40-foot containers. Containers and the ships that carry them are limited assets as well, and competition for their use is fierce.

Today, the majority of modern cargo ships are container ships. Usually military cargo is not or cannot be shipped in containers. To meet the military cargo lift requirements during Operation



Desert Shield, a large number of vessels of various types were activated: 17 roll-on/roll-off ships, 13 cargo ships, five barge, two aviation logistics supply ships, and two crane ships used to offload container ships that do not have cranes or a self-unloading capability (9: 7). Before August 1990, defense depots rarely, if ever, shipped using containers. With Desert Shield, container shipping became relatively commonplace. The Defense Depot, Richmond, Virginia shipped 379 containers during the last three months of 1990. Just DDRV's part of a massive shipment supporting Christmas dinners for deployed troops -- canned and dried food such as sugar, flour, and cookie mix -- required 38 containers. One shipment of special food for hospitals comprised 130 containers. One of the most unusual shipments sent from Richmond was two container loads of Internal Revenue Service tax forms and booklets. Along with the requisitioned supplies, defense depots routinely shipped books, tapes, and care packages by adding them to containers on a space available basis (1: 22).

### **Sealift Problem Assessment**

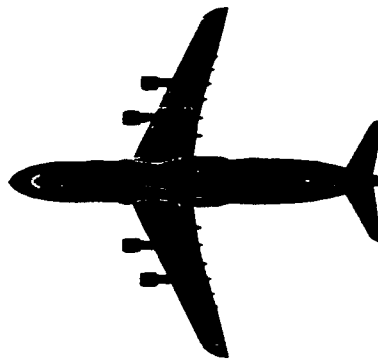
Questions raised relative to sealift by the U.S. experience in the Gulf War are as much political as they are logistical problems. Solving them will be far from easy. In 1989, Congress authorized the U.S. Navy to spend \$1.3 billion to buy fast-moving cargo ships to carry weapons and supplies quickly to worldwide trouble spots.

The ships were never purchased. In fact, the Navy tried to divert part of the funding to other programs (13: 21).

Problems relevant to sealift and effecting logistics capability identified by the General Accounting Office and which the war in the Persian Gulf has brought to the forefront include (9: 7):

- the distance to the area of operations,
- the lack of a sufficient number of qualified personnel capable of manning the ships of the Ready Reserve Fleet,
- the type of ships maintained in the Ready Reserve Fleet,
- and
- the condition of the ships available.

Addressing the full extent of the issues and problems associated with U.S. sealift capability is a major challenge which the United States must address. The bulk of the ability of the U.S. military to move supplies and equipment to distant theaters of operation lies in the surface movement of warfighting assets. Airlift provides for rapid movement of a force of limited size, but it is sealift which gives a combat force its staying power.



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## Airlift

Over the course of the first five weeks of Desert Shield, the tactical air power assembled in the Gulf region, comprised of USAF, USN, and USMC squadrons, would exceed more than 400 combat and 250 support aircraft, a force roughly equivalent to the force deployed in Europe during the Cold War. As a logistics case in point, each 24 plane fighter squadron that deploys requires the equivalent of 20 C-141 airlift cargo loads of over 70,000 pounds each to support the initial deployment and operating capability (14: 19).

During the first 12 days of the deployment, Military Airlift Command (MAC) delivered 19,000 tons of cargo to the theater of operations, including three tactical fighter wings and most of the 82nd Airborne Division. When Desert Storm ended on 28 February 1991, strategic airlift had conducted approximately 15,800 missions and transported over 501,000 passengers and 544,000 tons of cargo to the Middle East (15: 8). As the network news so aptly illustrated,

air assets were extremely limited throughout the deployment. In what became a somewhat routine camera shot of a busy Saudi Arabian flight line, Federal Express and Burlington Air Express were shown side by side with Air Force C-5s and C-141s (1: 18).

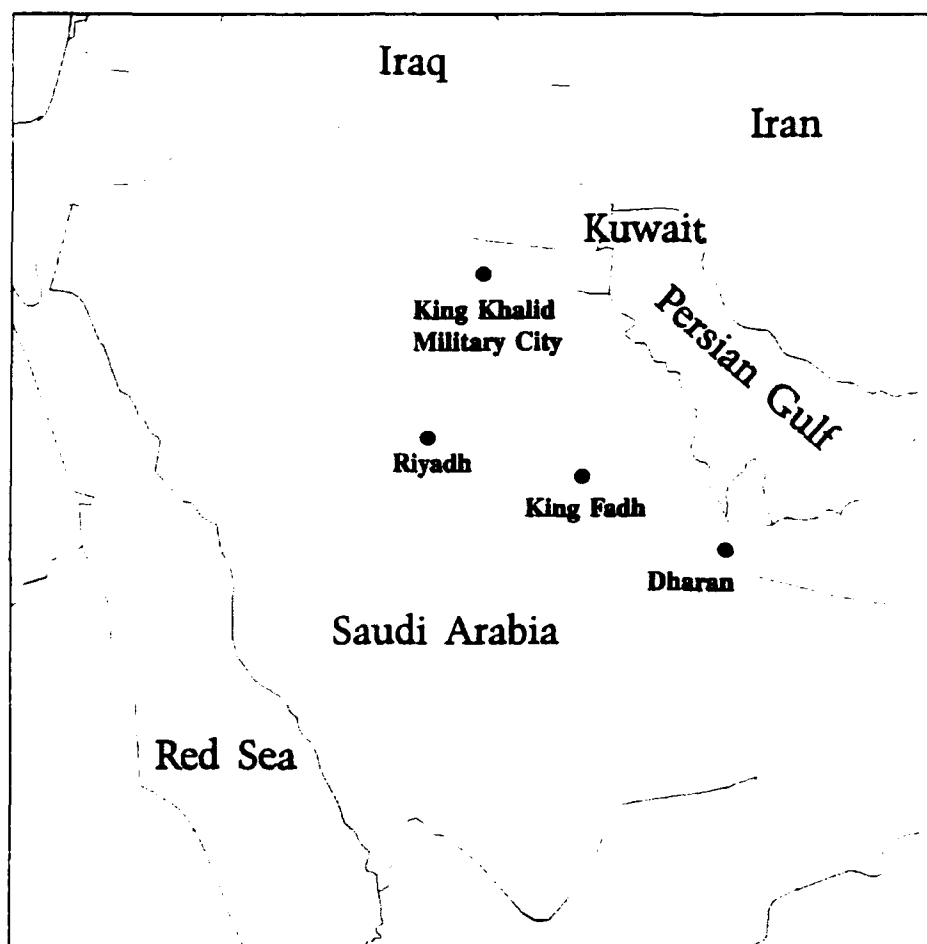


### **Desert Express**

For the majority of items requisitioned by forces deployed in the theater, at least ten days was required for the order to begin wending its way through the supply system from the United States to the end user in Saudi Arabia. Given the congestion at the aerial ports and the fact that 10 days is simply too long to wait for mission critical items, a daily Desert Express cargo service was initiated. Operating between Charleston AFB, South Carolina and eastern Saudi Arabia, Desert Express reduced the time from the moment an order is placed to the time the needed item arrived in Saudi Arabia to as little as 72 hours (16: 46).

Crews scurried onto a nearby parking apron, stripping plastic wrap off pallets and sorting dozens of IBBs and GBBs -- Itty Bitty Boxes and Great Big Boxes, in the parlance of the unloading teams (16: 46). Desert Express could put a package or pallet of high priority materiel in Saudi Arabia as little as 16 hours and 15 minutes after

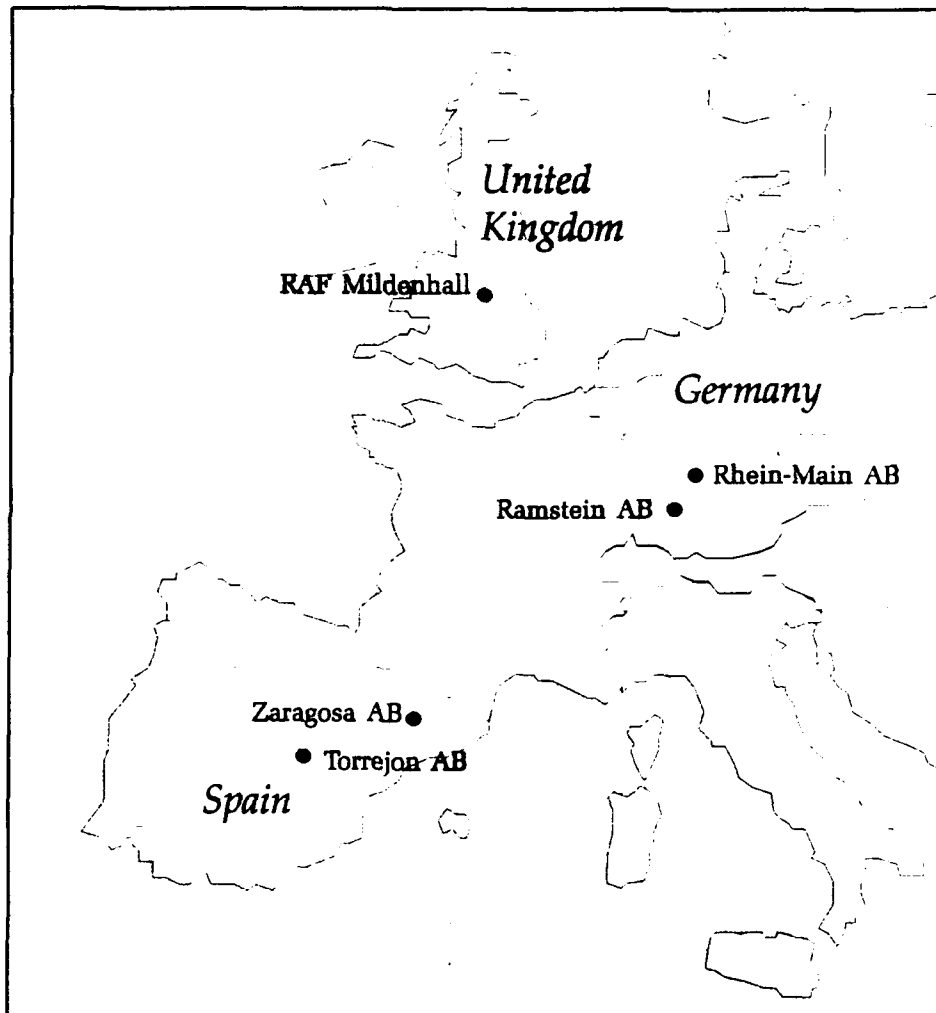
takeoff from the U.S. (17: 20). The daily flight did not carry a great deal of tonnage, less than 40,000 pounds per flight. The biggest users of Desert Express were Air Force and Army aviation units (17: 20).



**Figure 1. Major Desert Shield and Desert Storm Aerial Ports of Debarkation (APOD).**

Operating from 30 October 1990, to 31 May 1991, Desert Express flew more than 200 missions to the theater of operations (15: 26). In addition to Desert Express, on 7 December 1990, U.S. TRANSCOM established a European Desert Express. This daily

flight, like its U.S. based counterpart, provided express service of high priority cargo from Europe to the Gulf theater. The European Desert Express flew 92 missions before it ended operations on 31 March, 1991 (15: 26).



**Figure 2. Major Desert Shield and Desert Storm En Route Locations.**

Each shipment was carefully monitored to prevent abuse of the priority system. Items being shipped had to meet the criteria for priority treatment, otherwise they were diverted to the regular airlift

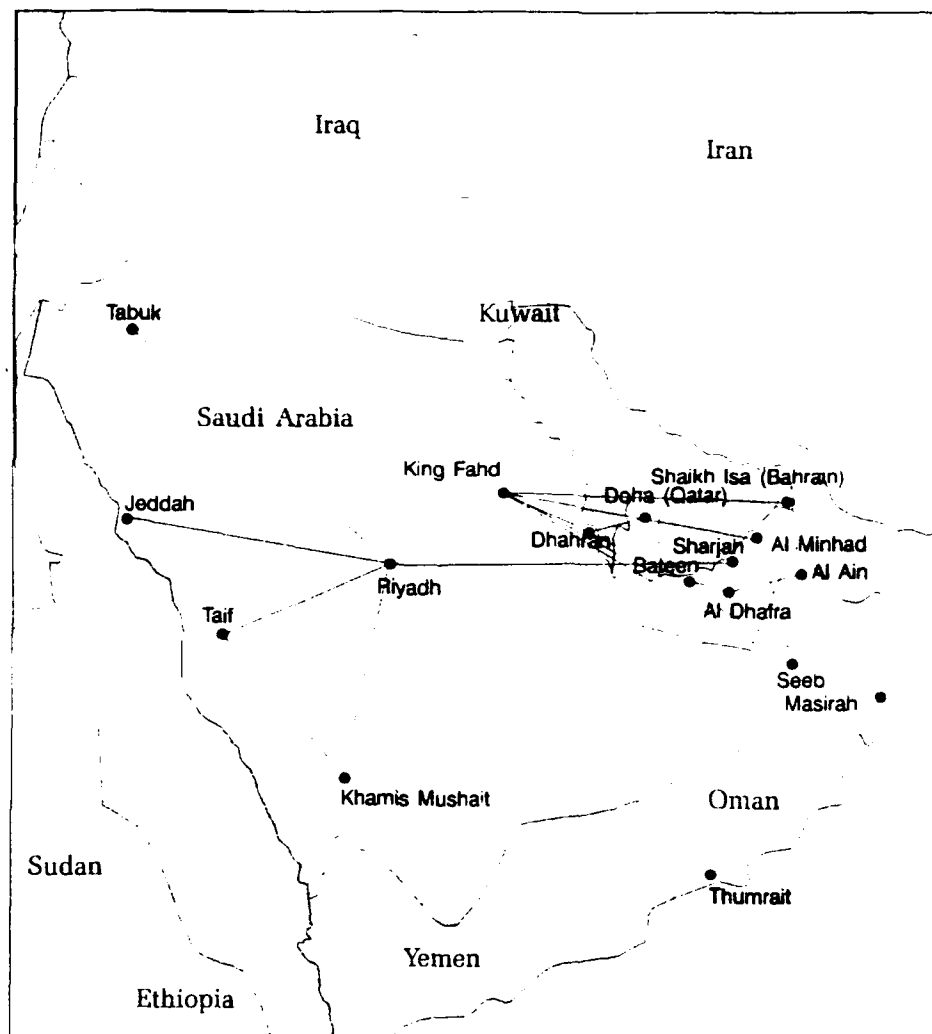
stream (17: 20). Once airborne, there was only a single, 1 1/4 hour stop at a staging base in Southern Europe. Upon arrival, Desert Express aircraft go to the head of the service queue while the aircraft's crew is swapped out with fresh personnel. A second aircrew and a backup aircraft were kept standing by in the event of a problem that would otherwise delay the mission. As few as 15 minutes were required to shift palletized loads from one aircraft to another when the need arose (17: 20).

Reliability of military airlifters averaged about 85 percent for the C-5 and 91 percent for the C-141 through November 1990. The only chronic problem attributable to Desert Shield were problems with the main landing gear struts associated with the heavy loads and sand working its way into the seals. Sand abrasion on the strut's piston caused the seals to wear out prematurely, requiring repacking at staging bases on an accelerated schedule (17: 21).



### **Intratheater Airlift**

Once in the theater, Desert Express materials were quickly transferred to any of up to seven C-130s available to fly short-haul Camel Express (cargo) or Star Route (personnel) flights to the various bases in the Persian Gulf Region (17: 22).



**Figure 3. Intratheater C-130 Camel Routes (27: 9)**

Cargo arriving in theater was broken down and distributed to holding areas maintained by each of the services. Incoming personnel were likewise directed to one of three "circus tents" for processing and transportation to their units (17: 22).

Although several thousand C-141 sortie equivalent loads were positioned within the area of operations, the downside was that

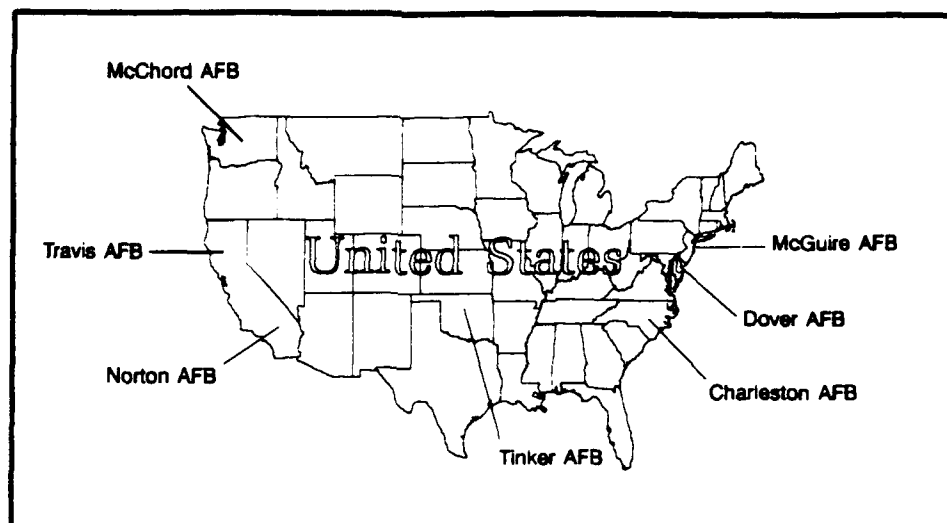


much of the equipment was centrally stored, and not located at the point of intended use (9: 8).

Military Airlift Command flew more than 16,000 missions from 7 August 1990 to 19 March 1991: the equivalent of conducting the Berlin Airlift every six weeks. In addition, more than 100 commercial aircraft and their operating personnel took part in the first ever activation of the Civilian Reserve Air Fleet (CRAF). Together, the two fleets carried more than 544,000 passengers and 562,000 tons of cargo to the Persian Gulf theater (2: 41).

## **APOEs**

The demand for air shipment direct to Saudi Arabia grew as more units arrived in the theater. Aerial Ports of Embarkation (APOE) such as Dover AFB, Delaware, McGuire AFB, New Jersey, and Charleston AFB, South Carolina, soon approached gridlock. Each service operates an airlift clearance authority (ACA) to control its respective service's allocation of theater bound military airlift. Shipments from the depots were forwarded to the designated APOE for entry into the allocation and prioritization system. Because of the overwhelming volume of air-eligible shipments, U.S. Transportation Command (TRANSCOM) established a fixed set of prioritization criteria to expedite the decision process. These criteria automatically downgraded a large volume of shipments to surface (sealift) mode (1: 20).



**Figure 4. Major Desert Shield/Desert Storm Aerial Ports of Embarkation (15: 13).**

By October, the situation at the APOEs, while somewhat improved, still found the APOEs overwhelmed by more tonnage than they possibly could move quickly on available aircraft. Critical repair parts were not getting shipped quickly enough. Desert Express was initiated to bypass the regular APOE backlogs. Charleston AFB, South Carolina, was selected as the APOE, and each service was allocated space for "the highest priority, not-mission-capable supply (NMCS)" items. Desert Express freight was restricted to repair parts and medical items only (1: 20).

### **Constraints**

A number of factors which adversely affected airlift operations were identified in a General Accounting Office study published in the aftermath of the Gulf War. These factors included the limited number of locations initially available in the theater of operations

for strategic airlifters to unload cargo, the general failure on the part of the services to regulate their requisitions for high priority airlift, insufficient cargo airlift capability to meet Central Command's requirements for sustainment cargo, and Central Command's constant and rapid shifts in airlift priorities (15: 18).

During Desert Shield and Desert Storm there was a high incidence of poor service discipline in the assignment of priority codes to nonpriority cargo. Cargo coded "999" is recognized as the highest movement priority and is intended to consist of items such as medical supplies, critical spare parts, or other items which may tend to seriously degrade the mission if not delivered quickly. However, on numerous occasions the "999" code was assigned to large volumes of inappropriate items. As a result, the volume of high-priority items being placed in the airlift system over-stressed the system's ability to accommodate the number of requests. This had the result of effectively eliminating the priority system. As more and more priority-coded cargo jammed the system, items not coded as priority in many cases ceased moving all together. As units awaiting requisitioned items in Saudi Arabia grew frustrated with the long delays experienced in receiving their orders, they exacerbated the situation by submitting new requisitions with a higher priority in an attempt to "game the system." The result was even more congestion at the ports. The priority system rapidly degenerated until, in essence, no priority system existed. Cargo

was simply moved in a first-in, first-out procedure that left real priority shipments on an even par with less crucial items (15: 20). Many units failed to realize that not only is airlift a scarce asset, but it is almost unbelievably expensive (1: 18).

Backlogs of cargo at the aerial ports of embarkation (APOEs) grew to staggering proportions. Military Airlift Command's (MAC) ability to move cargo out of these bases did not exceed 1,300 tons per day during either Desert Shield or Desert Storm. Backlogs were at their worst in January 1991 when the APOEs found themselves saturated with over five times the amount of cargo MAC could accommodate (15: 18). As sustainment cargo backlogs began to swell significantly in January 1991, MAC's cargo airlift capability was insufficient to meet the movement requirements for sustainment cargo being levied on it by U.S. Central Command. One factor in this shortfall worth noting is that even in a time of crisis such as the Gulf War, MAC still had to devote some organic airlift missions to support other critical operations. In addition, DoD was hesitant to activate additional Civil Reserve Air Fleet (CRAF) aircraft due to the potential adverse economic impact of such an action on U.S. carriers (15: 21).

Advanced planning for the region called for the utilization of at least 34 off-load locations in a Desert Shield/Desert Storm type of scenario. However, due to the physical and political restrictions that existed in the theater at the time, MAC was limited to no more

than 10 locations throughout the entire Gulf deployment (15: 19). While U.S. airlift planners were pleased to recognize that Saudi Arabia has several sites with large runways and good surfaces, the majority of these airfields lacked the necessary infrastructure such as refueling capabilities and the facilities required to support maintenance and aerial port personnel (15: 20).

### **Airlift Shortfalls**

The 1980 congressionally mandated mobility study (CMMS) conservatively estimated that the United States requires a 66 million ton/miles per day airlift capacity to meet its global strategic airlift requirements. Even with its complete strategic fleet of 283 transport aircraft, and with full mobilization of the entire Civil Reserve Air Fleet of 506 commercial aircraft, the U.S. faces a shortfall of roughly 18 million ton/miles per day of capacity (14: 20).

The rapidly changing nature of Central Command's requirements, in part as a result of the lack of a developed operational plan for conflict in the region, caused Military Airlift Command to operate in a reactive mode to users' widely ranging airlift priorities. Instead of being able to anticipate its taskings, MAC found that any efforts to schedule its airflow more than a few days in advance were largely a waste of effort. These abrupt changes in airlift priorities and requirements also played havoc with the users. On more than one occasion, MAC was tasked to have C-141s at an aerial port to pick

up a unit only to discover upon the plane's arrival that some or all of the scheduled unit's cargo was outsize and would require a C-5 rather than a C-141 to move. On occasion, airlift arrived at a base, but the unit for which the airlift was designated had not itself received orders to deploy. Under such circumstances, aircraft either moved what cargo was available or were diverted to other bases which had cargo ready to move (15: 22-24).

To alleviate the congestion at the aerial ports and the abuse of the priority system, Military Airlift Command initiated a number of practices. Cargo teams were established at the two major APOEs, Dover AFB, Delaware, and Tinker AFB, Oklahoma, to prioritize cargo and divert nonpriority items to sealift as appropriate. Each service was given, and limited to, a fixed airlift allocation for its sustainment cargo requirements. Requests for airlift support were made to members of the North Atlantic Treaty Organization (NATO). As stated previously, the daily express cargo service which came to be known as the "Desert Express" was implemented as a way to move the highest priority cargo from the U.S. to the theater of operations in minimum time (15: 24).

Initial allocations totaled 1,250 short tons per day. Later, this amount was raised to 1,600 short tons as the number of initial unit moves diminished and more airlift became available for sustainment operations (15: 25).

**Table 1. Daily Cargo Allocations in Short Tons (15: 25)**

User	Initial Allocation	Revised Allocation
Army	425	655
Air Force	190	240
Navy	105	175
Marine Corps	40	110
Defense Logistics Agency	40	5
European Command	150	215
Mail	300	200
<b>Total</b>	<b>1,250</b>	<b>1,600</b>

This system, while generally effective, was not without its problems, however. The services actual requirements for airlift still exceeded available capacity. The Army's allocation, for example, was usually fully allocated within the first three hours of the day. Once the allocation limit was reached, no additional cargo could be designated for air movement by the service's Air Clearance Authority on that day. Units and shippers frustrated by their inability to have their cargo scheduled for airlift bypassed the established control procedures and forwarded their cargo directly to the aerial ports. Once cargo was at the ports, handling personnel and Military Airlift Command had no way of actually determining that the cargo being prepared for airlift did or did not actually exceed a given service's allocation for a specific day. Thus, while the system helped somewhat, it was relatively easy for units and shippers to bypass the controls if desired (15: 26).

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## Civil Reserve Air Fleet (CRAF)

Operation Desert Shield was the first ever implementation of the CRAF. Commercial aircraft in stages one and two transported about 64 percent of the troops and 27 percent of the cargo airlifted to the Middle East (15: 16). Stage I of CRAF was activated on 17 August 1990. The primary airlift requirement at the time was to support the movement of troops. The activation made a total of 21 cargo and 17 passenger aircraft available to Military Airlift Command (15: 22). This provided strategic lift capability that would not otherwise have been available and without which the U.S. would have been unable to complete its force buildup in time to meet the United Nations imposed deadline for Iraq to withdraw from Kuwait.



Stage III CRAF activation was briefly considered for a time in January 1991. However, it was believed that full activation of all of the reserve air fleet would severely disrupt the commercial airline industry. As a result Stage III of CRAF was never implemented (15: 22). The chief concern of airline managers was the loss of



market share because of the diversion of aircraft to the military, particularly among cargo carriers as the holiday season approached (18: 31).

While, for the most part, implementation of CRAF was an unqualified success, several areas raised serious questions about the fleet's use and role in future U.S. crises. For example, a shortage of ground support equipment delayed delivery and unnecessarily lengthened aircraft utilization times at many locations (18: 31). In addition, many carriers were forced to operate for a time with no insurance for either their aircraft or their crews. Aircraft called up for use sometimes sat idle for days before they were utilized, but the carriers are only reimbursed for the time the aircraft is in flight, not the time it sits idle. Problems of this nature and others are leading to calls for an overhaul of the CRAF concept. No one is overly critical of the success of the system, but adjustments aimed at fairness and better flexibility are being implemented.

In the first phase, CRAF-activated civil transports operated 1,237 flights through November 26, 1990, at a total cost of \$267.4 million. These aircraft moved 126,451 passengers, approximately 60 percent of the total deployment, and 25,226 tons of cargo, about 20 percent of the total. Another 36 missions were flown as passenger and cargo mixed flights (18: 32). The original call-up activated 21 cargo transports. Through 26 November, 717 cargo missions and

432 passenger missions had been flown. Passenger missions averaged 292 passengers per flight, reflecting the heavy use of wide-body transports. Aircraft use ranged from as few as 10 per day to a high of 50 during stage one of the activation (18: 32).

The USAF canceled 37 missions at a cost of \$1.49 million and reawarded 15 missions that were counted in the total of 1,237 flights flown during stage one. Approximately 1.67 billion ton miles, comprising the weight of passengers and cargo, were flown as of November 27, far exceeding the 697.5 million ton miles accumulated during the Berlin Airlift. Stage two of the CRAF call-up involved 17 percent of the passenger capacity of the U.S. fleet and 30 percent of its long-range cargo capacity (18: 32).

### **A Change of Plans**

Military Airlift Command war plans at the time assumed that an in-theater crew recovery base would be available soon after the onset of operations. In fact, no such base was ever established, and this significantly impacted strategic airlift operations throughout Operations Desert Shield and Desert Storm. Such a base was deemed to be required due to the extreme distance of the theater from U.S. and European recovery bases. Space and facility limitations at the debarkation aerial ports did not allow transiting strategic airlifters or their crews to remain overnight. As such, crews were forced to complete an extended Europe-theater-Europe

flight during a single extended duty day of more than 16 hours. This, in turn, required more crew members and modified flight rules to accomplish. In particular, the lack of an in-theater recovery base forced MAC to rely heavily on volunteer aircrews during the initial phases of Desert Shield and to require an official Reserve call-up much sooner than anticipated.

An in-theater recovery base was a mainstay of MAC planning. Such a base would require adequate facilities for crews including sleeping quarters and meal service, and a substantial aircraft refueling capability of at least 1.5 million gallons per day. U.S. Central Command decided not to provide a recovery base due to physical space limitations at facilities in the theater and the desire to use the available bases for fighter, bomber, and tanker forces (15: 29).

Not only did MAC have to augment aircrews to a greater extent than planned for, but certain flight rules had to be modified or relaxed as well. Flying hour limits were increased from 120 to 150 flying hours per 30 days. Crew duty hour limits of 16 hours for a basic crew and 24 hours for an augmented crew were raised to 20 and 29 hours respectively (15: 33). MAC was also forced to request similar waivers on behalf of the civilian aircrews and airlines supporting Desert Shield and Desert Storm under the auspices of the CRAF program and charter air operations..

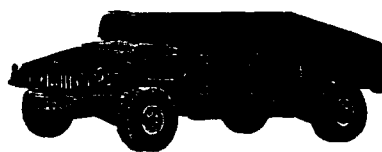
During Desert Shield, Air Force Reserve volunteers augmented regular Military Airlift Command crews from the onset of the operation, more than three weeks before the President formally initiated the call-up of reserve forces. Without these volunteers, MAC simply would have not had enough aircrews to perform the required missions during the first weeks of Desert Shield. During the first few weeks, reservist volunteers flew 42 percent of all strategic airlift missions. Once formally activated, approximately 50 percent of Military Airlift Command's aircrews and aerial port personnel were reservists (15: 36-38).

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## **In-Country Distribution**

Distributing supplies once they arrive in theater is a major logistics challenge. The road network in the region was never designed to handle the extensive volume of traffic generated by the force buildup and rail lines were virtually nonexistent. One Army source called the in-country distribution effort by far the most challenging:

The main reason that distribution is such a problem in the Gulf is that the dense infrastructure of roads, railways, airfields, ports, buildings, and other structures do not, by and large, exist among the Gulf states. In large part, because their populations are fairly small in relation to the land area they cover, these countries have not developed many of these things (1: 22).



The U.S. Army estimates that one division of 350 M1 tanks will consume more than 600,000 gallons of fuel a day, nearly twice the consumption of General George S. Patton's entire 3rd Army in its 1944 drive across France. Moreover, military experts note, the desert moon turns night into day. Coupled with advanced night vision equipment, combat can go round-the-clock, placing an even grater strain on the logistics system (1: 23). Transporting supplies to an armored division by truck would require 98 five thousand gallon tankers and 210 five-ton cargo trucks daily (9: 9). Thus, movement of materiel within the theater was in itself a major logistics effort.

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## **Transition to Offense (Desert Storm)**

Once President Bush directed U.S. commanders to prepare their forces for possible offensive operations, logistics elements in the theater had to be rapidly expanded to accommodate the influx of up to another 200,000 military personnel. Military construction units set about expanding aircraft ramps and parking aprons, building maintenance hangars at airfields and ports and laying roads across otherwise trekless desert. Port capacities were effectively doubled by clearing and preparing huge staging areas

to hold arriving vehicles, containers, equipment, and supplies. Traditionally, the "tooth-to-tail" ratio of combat troops to support troops has been roughly 1-to-3. For Desert Storm, the ratio changed to something more like 1-to-5 due to the distances involved and the duration of the operation (7: 1).

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## Theater Logistics

Due to the pressing urgency of the situation in the Gulf, with a strong possibility that Iraqi forces might move on Saudi Arabia before a substantial U.S. defensive presence could be established, a decision was made early on to deploy combat units significantly in advance of their supporting units. This meant that at the onset of Operation Desert Shield, early arriving U.S. forces found themselves without the established logistical structure with which they were used to operating. Eventually, the size of the U.S. logistics force in the region would grow to in excess of 40,000 with about 60 percent coming from the reserves or the national guard (11: 1).

To facilitate a secure logistics base in the Gulf theater, support personnel built roads and laid pipeline. Supplies needed by combat troops were transported forward to strategic locations near the front lines in order to make them more accessible to the troops that needed them. U.S. forces even went so far as to build a

helicopter refueling strip inside the Iraqi border to provide for faster servicing and turn-times for combat helicopters involved in close air support of allied forces (4: 21).

A critical difference between supporting Desert Shield and supporting a combat force of the same size in a European theater was the road system. The challenge in Saudi Arabia was getting the critical tonnages of food, fuel, and bullets from the APODs and SPODs, forward to the combat maneuver units (9: 9).

### **Food, Subsistence, and Rations**

It is often stated as axiomatic that the quality of the food available to a combatant's fighting forces in the field will create the performance of those forces in combat. While this may or may not be completely true in modern practice, there can be little doubt that assuring adequate rations for military personnel in the field is of paramount concern to the managers of the supporting logistics system. During Operations Desert Shield and Desert Storm, the requirement to assure adequate feeding of the troops was augmented by the need to utilize the ready availability of a variety of quality foodstuffs in excess of the usual combat rations as a positive moral issue in the face of the cultural restrictions imposed by the Saudi Arabian government. Using mobile kitchen facilities, existing dining facilities, and host nation contracted support, the Department of Defense was generally able to meet this goal for the

majority of deployed personnel. Both Army and the Marine Corps, however, had some substantial difficulties with both the availability of a variety of foodstuffs and alternatives to Meals-Ready-to-Eat (MREs) rations.

## **Food Services**

To accommodate the desire of deployed personnel for food other than standard prepared rations, a network of aluminum-sided "Wolfburger" stands were setup throughout the theater. Mounted in trailers similar to those serving fast food at fairs and carnivals throughout the U.S. during a typical summertime, "Wolfburger" stands offered troops hamburgers, french fries, and hot dogs. Named after the Army warrant officer who initiated the idea, the stands were an outstanding success and an instant hit with the troops (11: 1).

Throughout the theater of operations, commanders were given significant latitude to provide the highest quality rations they could obtain given the constraints of the existing environment. The variety and type of rations provided depended entirely on where a given unit was stationed and the type of preparation facilities available in the neighborhood. Air Force units, enjoying the relative benefits of operating from stable, fixed locations, generally enjoyed fresh food supplied by host nation contractors. Army and Marine units, by nature of the constantly changing positions and



tactical environments, had to subsist mainly on MREs and occasionally Tray Pack T-rations. Fresh food was made available whenever the situation permitted, with deliveries of limited quantities of morale boosting favorites such as fresh fruit often being delivered by whatever means of transportation, including the odd helicopter, that happened to be operating in the area.

Less than a month after President Bush committed U.S. troops to Saudi Arabia, the Defense Logistic Agency had shipped 15.6 million Meals-Ready-to-Eat (MREs) and 2.6 million Tray-pack rations to the theater. They also sent 10 million loaves of bread, 6.3 million pounds of meat, 4.9 million pounds of fish, and 2.8 million pounds of fresh fruit and vegetables (3: 12).

All the services did their best to provide fresh or frozen foodstuffs and other supplements such as fruit, juices, soft drinks, and the like from facilities located throughout Saudi Arabia. Each service developed a daily feeding plan intended to determine the types and quantities of the meals to be supplied to its troops in the field. The Army feeding plan called for one MRE and two hot meals be provided to its troops daily. Illustrating the difficulties encountered in theater, the Army was never able to meet this plan due to the inability of producers in the United States to meet the actual demand for T-rations that materialized during the Gulf War. As a result, the Army relied on MREs and B-rations, which, in-turn, prompted a shortage of the components for B-rations, in particular

meats and vegetables. Here again, the cause was the inability of the domestic producers to meet the unanticipated demand requirements for these components by deployed U.S. forces.

In response to these shortages, the Army developed and adopted Meals, Off-the-Shelf, Ready-to-Eat (MREs) -- a product generally well accepted by the troops and often a welcome change from the stock MREs the majority of forward employed ground troops had grown accustomed to.

Recognizing the importance of food to troop morale and the potential ill-effects that limitations in the availability of more diverse rations might create, the so called "Wolfburger" stand was developed. The brain child of a warrant officer aide to Army Major General Pagonis, the Wolfburger wagon was really nothing more than a military adaptation of the portable hamburger and hot-dog stands commonly experienced by the American public each summer at local carnivals and fairs. Towed to forward locations, often in close proximity to the actual front lines, these mobile kitchens provided a variety of short order foods centering on fare such as hamburgers, hot dogs, and french fries. A significant hit with the troops, Wolfburger stands proved an innovative and morale-boosting means of improving the quality and variety of the meals received by Army personnel in the theater.

The Army has recognized the limitations of its current plans regarding troop feeding strategy and, in particular, the very real limitation imposed by the inability of the industrial base to respond effectively to increased demand requirements on short notice. Under circumstances of more direct hostile action by opposing forces, reliance on more traditional prepackaged foods such as MREs might be expected. However, the importance of food to troop morale and in particular to rapid recovery by troops exposed to extended periods of combat means that limitations in the availability of alternative rations will be a significant planning issue for future Army involvement in extended combat operations.

The Marine Corps feeding plan was similar to that of the Army in that it, too, called for one MRE and two hot meals daily. Within one week of its arrival in theater, the Marine Corps was serving its first hot meal. Within a month, the majority of Marine Corps personnel were receiving two hot meals a day.

Air Force personnel soon found that they faced a relatively bountiful harvest compared with the fare most readily available to their Marine Corps and Army counterparts. Relying initially on rations included in prepositioned storage sites, managers had these rations moved to operating locations in advance of the actual arrival of the forces who would consume them. These rations, consisting primarily of MREs and B-rations, provided Air Force personnel with a sizable initial operating stock until other ration

sources became available. Thus, Air Force units never faced any real possibility of a shortage of quality rations. The ready availability of prepositioned MREs, B-rations, and Harvest Falcon kitchen equipment sets provided the Air Force with a substantial advantage in food service capability during the early phases of employment operations.

The Air Force replenished B-rations from theater stocks on an as-requested basis. In addition, the relatively fixed locations at which the majority of Air Force personnel were billeted allowed Air Force food service management to rapidly transition the existing feeding capability to an almost cafeteria style operation using host nation contractors. Such contractors provided fresh-food on a daily basis, a wide selection of beverages, and personnel for clean-up and maintenance of dining facilities. In some instances, host national personnel also provided food preparation and service. While generally allowing for the highest levels of food service and variety of fare experienced during the conflict, reliance on contracted personnel also could lead to unanticipated problems. At several bases, Air Force personnel suddenly found themselves with no way to prepare meals when contracted personnel scattered hurriedly for several days when a warning of impending chemical attack was received. This situation was only alleviated when contractor personnel returned and were provided with appropriate protective equipment.

While there were shortages of certain types of rations during the initial phases of the deployment, and spot shortages at various units owing to their general tactical situation or inability of the domestic production base to meet requirements, one item that was never in short supply was the Meal-Ready-to-Eat or MRE. Due to the relatively short duration of Desert Storm, a surplus of MREs and B-rations soon developed. By April 1991, the Army's Material Management Center at Dhahran, the theater manager for food items, projected that a minimum of 16 million MREs was available in theater. The Air Force found itself with fifty to seventy forty-foot shipping containers containing an estimated one million meals valued at \$4.5 million dollars. The Marine Corps likewise reported it had over 3.5 million MREs available in theater and another 2 million available aboard supply ships in the region.

Given the abundance of MREs, Army Support Command actively encouraged soldiers being rotated back to the U.S. at the conclusion of hostilities to carry home at least a 3-day supply. This not only helped to eliminate the immediate stocks of forward deployed rations, but also minimized the need to feed large numbers of transiting Army personnel during sometimes lengthy delays at intermediate points on the route back to the United States. The remainder of food in country was designated for transfer to the World Bank for redistribution to needy countries. The majority of B-rations were used to feed Iraqi refugees during

subsequent humanitarian assistance operations. The U.S. Marines, ever resourceful and recognizing the Army's responsibility for overall management of food within the theater, simply transferred its stocks to the already ration-gorged Army and was done with it.

When it came to the actual preparation of field rations by military food service personnel, members of the various services experienced varying degrees of success with existing field kitchen equipment. The Army relies heavily on a mobile field cooking trailer that proved extremely fragile and worked well only in the most ideal of circumstances. The trailers offered only limited protection from the environment and sand was constantly finding its way, not only into the internal workings of the unit but, to the dismay of the troops, into the food being prepared. Often, the food heaters were ineffective or failed to work at all.

The Air Force's experience with its mobile field kitchens was somewhat better. Relying heavily on Harvest Falcon field kitchens, the Air Force's main problems stemmed primarily from a shortage of readily available spare parts for the units. When equipment on the units failed in the field, replacement parts, readily available in the States, were difficult to obtain as they had to be procured through regular supply channels and then compete for transportation among the plethora of higher priority cargo moving to the theater. In this vein, the Marine Corps had a similar

experience as field kitchen equipment failed at higher than anticipated rates due to the unaccustomed length of use and the degradation induced by the blowing sand and generally harsh climatic conditions in which the equipment was utilized.

## **Water**

Distributing water beyond central water points to individual units and soldiers is a transportation-asset intensive operation. In addition to water intended for consumption, water to support laundering of hospital linens generated a considerable additional demand. For example, a 400-bed evacuation hospital has a 28,000 gallon per day water requirement. (9: 8)

The U.S. Army served as the chief water bearer for the four services. That responsibility ultimately required the Army to provide 20 gallons a day per soldier, sailor, airman, and Marine, as well as for on-site civilian advisors and contractors. The per-person daily allotment includes six gallons for drinking, plus water for cooking, washing, hygiene, and vehicle radiators (3: 12).

In addition to water obtained from approved host-nation supply sources, additional quantities were obtained through the use of reverse-osmosis water purification units capable of producing potable water from fresh, salt, brackish, and chemically contaminated water supplies. Production capacities for these units range from 9600 gallons per day for smaller units to 110,000

gallons per day from the largest. Local distribution was provided through an intricate network of water "buffaloes," drums, bladders, and miles of hose (3: 12). Long-haul trucking of potable water was used where no local source of supply existed or could be developed. Because movement of potable water is a transportation intensive operation, in many cases the need to use portable water purification units was more a matter of minimizing transportation requirements than a lack of sufficient potable water supplies in a given area.

### **Medical Support**

One of the most prevalent complaints encountered by deployed medical service personnel were various intestinal disorders associated with acclimatization to the unaccustomed food and environmental conditions found in the theater. Occasional incidents of heat injury and dehydration were also encountered as well as several run-ins with venomous insects and snakes found in large numbers throughout the region. (6: 16)

### **Mail**

The public outpouring of support for U.S. forces was unlike anything in recent memory. Schoolchildren, veteran's groups and ordinary citizens were writing letters and sending care packages, tapes, and magazines that were shipped by military aircraft through the already congested APOEs. Postal authorities reported that



more than 30 million pounds of mail were shipped from the beginning of Desert Shield until Christmas. On 30 November, 617,000 pounds of mail was airlifted. Assigning priorities became a much more difficult task. Which should receive priority, the morale-building letter from home or the repair part for a non-operational tank?

The defense depots routinely utilized express mail to ship thousands of small parcels to the theater. The Desert Express route solved much of this dilemma, but the logistics of moving hundreds of thousands of pounds of mail remains a major challenge. In response, on 19 January 1991, the Department of Defense requested that well-wishing troop supporters at home stop sending packages to deployed forces, just letters instead (1: 21).

On the average, it took 13 to 17 days for a piece of mail to reach troops in Saudi Arabia from a post office in the U.S. As of 5 February 1991, the postal service handled 273,300 pounds of mail per day to Saudi Arabia. At an average of five pieces per pound, that comes to well over 1.3 million items per day. That volume was down from the January high of an average 419,000 pounds per day over one week. As if the sheer volume of mail flowing to the Gulf region were not enough, the constant movement of troops and their units significantly increased the difficulty of forwarding the mail for the hundreds of Army, Air Force, and Fleet post offices scattered throughout the theater (19: 4).

In addition to mail handled through formal postal channels, airline flight attendant and pilots began collecting magazines and books to bring over with each flight. Volunteer groups back in the U.S. at units' home stations gathered books and magazines and collected board games and playing cards to be sent over with unit cargo whenever space would allow (6: 17).

To maintain the morale of deployed troops, especially during the Christmas season, mail was first on U.S. Central Command's priority list. In one mid-December 1990 report, the cargo diversion team at Tinker AFB reported that over 50 percent of all aircraft departing were loaded with mail (15: 24).

### **Petroleum, Oil, and Lubricants (POL)**

The Gulf War was unique in the fuels arena in that the war against Iraq was the first conflict in which any significant percentage of U.S. tanks, ground vehicles, aircraft, and ships were powered by the same type of military jet fuel. While common use was far from universal, JP-8, a kerosene based fuel was used in a diverse range of vehicles. Included were the Army's M1A1 Abrams main battle tank, self-propelled howitzers, and Bradley Fighting Vehicles. The fuel was also used to power Army helicopters and at least one Navy ship with a gas-turbine engine plant. The majority of Air Force aircraft used JP-8 as well (20: 6). The ability of systems to use a common fuel was not used as a means to simplify the

logistics of fuel distribution so much as it provided commanders of affected units with some flexibility in obtaining fuel from the most immediately available source. Since it was left to the individual commander's discretion as to which fuel to use, the decision largely rested on what fuel of which type was most readily available in the immediate area. The use of a single fuel, while not essential to the successful outcome of the Persian Gulf War, provided an opportunity to test a concept that could conceivably be vital to future U.S. operations in more fuel-critical theaters.

### **Harvest Falcon**

Initial Harvest Falcon deployments of the USAF included items to support housekeeping and mission-support operations: lighting sets, washers, dryers, shower and shaving units, portable latrines, and electrical cable, for example. This equipment provided for immediate needs and aircraft support. Harvest Falcon assets were designed to support up to 750 aircraft and up to 55,000 personnel (21: 23)

### **Morale, Welfare, and Recreation**

Once the immediate support needs of U.S. forces were basically attended to, the services took active steps to improve the quality of life of deployed personnel. The Air Force Commissary Service deployed over 100 personnel to distribute food and run tactical field exchanges. Essentially mini-exchanges stocking a limited

supply of toiletries, writing supplies, and comfort items, they were stocked and operated by the Army and Air Force Exchange Service while manned by the commissary service as a part of its wartime mission (21: 22).

### **Packaging for Shipment**

One of the first lessons learned, passed along from the desert, is that the fine sand of the Saudi Arabian desert can get into repair parts and supplies unless the packing level is the equivalent of waterproofing.

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## **Shortages**

It is important to note that as supplies moved to the Persian Gulf, depots also received new supplies from vendors and manufacturers at an almost equal pace. Shortages of some items such as Meals-Ready-to-Eat (MRE) sometimes required depots to adopt innovative solutions through the use of similar alternative items. For example, Hormel's Top Shelf prepackaged meals were issued until MRE stocks could be replenished (1: 24).

There is one major problem area for concern in this sector. Modern sophisticated weapons such as laser-guided antitank missiles (like the Hellfire for U.S. AH-64 Apache attack helicopters) and sophisticated antiaircraft missiles, are not produced in real

large quantities. Increasing production rates would prove difficult. Production lines are limited for major components like complex electronics; skilled workers who assemble components and weapons cannot be trained easily; and some of these components and weapons require special materials or ingredients for which supplies are limited (1: 25).

This twin problem, of limited initial stocks and low production rates, means that it is possible for U.S. and allied forces to run out of certain items. In the event of a long Gulf war (one that lasts, say, longer than 60 days), and even with restrictions in effect, it is unlikely that production could begin to meet demand and permit restoration of stocks, until the war is over (1: 25).

On 9 January 1991, President George Bush issued an executive order compelling civilian manufacturers to give first priority to the military. At the start of Operation Desert Shield, some government planning experts believed that the U.S. possessed less than a ten day supply of certain critical munitions stocks. The reasons given for such shortages included the services' preference for high-tech weaponry over the last 20 years, a sharp reduction in orders during the year prior to Operation Desert Shield due to the belief that the Cold War was over, and the fact that the commanders of forces in the Gulf were requesting more ammunition than Pentagon planners had anticipated.

Items in short supply included some varieties of tank and artillery shells, machine-gun rounds, rickets, mortars, and other "dumb" munitions with high expenditure rates during combat. In an interview before Operation Desert Storm, Army Major General Paul Greenberg, commander of the Armament, Munitions, and Chemical Command, the agency which buys munitions for all of the military services, reported that shortages existed or were anticipated in numerous ammunition categories. The general went on to state that ammunition requisitions from Central Command forces were averaging about 125 percent of the expected and planned for consumption rates for a typical ground war (22: 1).

In the short run, Gulf forces' commanders were able to get around these shortages by turning to NATO allies for access to their stockpiles of munitions designed to be interchangeable with U.S. weaponry. While NATO allies were generous in their willingness to provide such support, technical problems stemming from the environmental differences between Saudi Arabia and Western Europe, coupled with the fact that, for many systems, the Gulf War represented the first widespread fielding of U.S. equipment with allied ammunition, were many (22: 1).

By the end of November 1990, the Army had dipped into its European stockpiles for 1,000 Hellfire antiarmor missiles, 3,000 Tow II antiarmor missiles, 4,000 105mm artillery shells, and 900,000 rounds of 25mm machine gun ammunition. During the

first weeks of Desert Shield, the Air Force requested and received from Congress an extra \$40 million dollars to buy 600 additional GBU-27 laser guided bombs for immediate production (7: 2).

The reason for such shortages will no doubt be the subject of much controversy and debate for years to come. However, one aspect of the problem widely agreed upon is that the services' preference for high-tech weaponry over so called "dumb" systems has promoted inventory shortages of the less sophisticated, but still vital weaponry. The ultimately successful employment of many high-technology weapons systems in the Gulf War is seen by many as vindicating the services' desire for more expensive, higher technology systems. The fact that the U.S. has never succeeded in building up a planned 60 day wartime operating stock of required ammunition should be a prime logistical concern inherent in the planning for any future military campaign. Clearly, a mix of both "smart" and "dumb" systems is required due to the wide range of target types and mission profiles encountered on the modern battlefield. The critical question for logisticians will be whether the "correct" balance of weapons types is available and whether the stockpiles of each are sufficient to support protracted combat operations as opposed to the limited combat phase encountered during Operation Desert Storm.

## Uniforms

An item that proved to be of significant concern to deploying troops and in short supply throughout DoD supply channels was the desert camouflage battle dress uniform (BDU). Many servicemen headed to the Middle East found that the desert BDU was unavailable through military supply channels and not stocked in military clothing sales stores. As such, many servicemen were forced to do their own shopping at military surplus stores for such items as the basic desert BDU ensemble, hats with wide brims appropriate for the desert environment, and lightweight desert boots designed for the sandy environment of the Saudi Arabian peninsula versus the swamps of Southeast Asia. Service members really had little choice. They could either choose to buy the uniform themselves or go without. Given the high degree of uncertainty during the initial phases of Desert Shield as to specific threats an individual was likely to encounter and which personnel were likely to become actively involved in a combat environment, a large number of personnel chose to use their own funds to purchase this "issue-item" that was otherwise unavailable through DoD supply channels (23: 10).

Both the Army and the Marine Corps also had some difficulty with availability and sizing of uniforms, boots, and, particularly, chemical defense ensembles. The Air Force experienced many of the same types of problems, but experienced the additional



limitation that desert camouflage uniforms were available to only approximately twenty percent of its personnel in theater.

### **Scavenging War Supplies**

To front-line officers, the most adept scavengers have become vital to the task of getting needed supplies that were bogged down in a saturated logistics system. Scrounging and scavenging, as in so many wars before, evolved to a vital art during Operation Desert Shield. Seen as a way around the long delays associated with massive requisition backlogs, units of all the services found themselves in the business of "appropriating" or "liberating" needed materials to meet unit needs. Units were as apt to "borrow" what they needed from other units of their own service as they were to commandeer materiel from elements of the other services. In addition to the outright covert raids carried out to obtain needed items, units became involved in an unofficial system of barter and exchange to meet their mission requirements. Thus, unit supply personnel might hold or obtain items needed by other units in order to gain an advantage during future negotiations. While the costs and benefits tradeoffs of this informal logistics system may be debatable, the existence of such a system has been an inseparable part of military campaigns throughout history (24: 1).

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## Observations

The fact that the U.S. was able to successfully deploy the necessary forces and equipment to the Gulf should not be taken as an across-the-board proof of the notion of an acceptable U.S. force deployment capability for future conflicts. Operations Desert Shield and Desert Storm were unique in a number of respects. First, U.S. forces had an unprecedented amount of time, 161 days, to set up the theater in preparation for combat operations. Setting up the requisite logistics infrastructure and positioning and posturing U.S. forces in the face of active enemy resistance would have been considerably more difficult. In addition, in spite of limitations in certain elements of the existing theater infrastructure, many modern bases, ports, and airfields existed throughout Saudi Arabia. In fact, the Saudi Arabian ports utilized during Desert Shield and Desert Storm are some of the best in the world. The Saudis also provided fuel, water, ground transportation, as well as some housing and provisioning support (25: 8).

Says military analyst David Isby, paraphrasing a German general who served in Rommel's African desert campaign, "They always used to say the desert was the tactician's paradise -- and the logistician's hell (25: 8).

"Everybody has done a superb job" in getting the troops and materiel to the other side of the world, said Vice Admiral Paul D.

Butcher, deputy commander of U.S. Transportation Command at Scott AFB, Illinois, and a veteran military planner. "But we ought to keep in perspective that we've had the luxury of time -- 161 days to land all that stuff with nobody firing a shot" (26: 7).

Other lessons learned conclude that Desert Storm has demonstrated that the United States is dangerously short of cargo ships and aircraft needed to get troops and their weaponry from the United States to distant trouble spots in a hurry. As Admiral Butcher further stated, "it's dangerous to use Desert Shield and Desert Storm as a good example of what we can do in sealift because 47 percent of it came from foreign ships, which might not be available in the next emergency." Another advantage that the U.S. could not count on in a future conflict, he said, is the use in Saudi Arabia of "the best seaports, the best airports." The foreign support, he stated, brought out not only the help of their cargo ships and planes, but permission to fly through their airspace (26: 7).

Additional logistics trouble spots which will garner much attention in the aftermath of the Gulf War: armored forces rapidly outran their fuel trucks, satellite radio links were vulnerable to disruption, and minesweepers had trouble finding World War II era Iraqi mines (13: 21).

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# 7

## After the Storm

Operations Desert Shield and Desert Storm represented the largest movement of men and materiel since World War II. With the successful conclusion of operations, the focus of the logistical effort shifted from supporting combat and sustainment-related activities to redeploying personnel and recovering and redistributing the materiel from the Southwest Asia theater of operations (1:34).

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### Desert Shield

On 7 August 1990, six days after the Iraqi invasion of Kuwait, the deployment phase of United States operations in Southwest Asia, shortly to become known as Operation Desert Shield, began with a

decision by President George Bush to commit U.S. combat forces to an international effort to force occupying Iraqi troops from Kuwait. As members of the First Tactical Fighter Wing, flying F-15C aircraft, began preparations for immediate deployment to Saudi Arabia, they represented the first element of a U.S. combat force that was to exceed well over 500,000 personnel by the time hostilities would conclude seventeen months later.

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## **Desert Storm**

The transition to active combat operations began in tandem with expiration of a United Nations imposed deadline for Iraq to *withdraw its troops from Kuwait of 15 January 1992*. By 17 January, it had become evident that no movement of Iraqi forces was underway, and that Iraq was failing to heed the U.N. deadline. Just after midnight local time, Operation Desert Storm was launched. Consisting of a coordinated air attack by coalition air forces, the assault delivered over 2500 tons of ordnance in the first 24 hours of the campaign. Continuing for the next 38 days, the air campaign pummeled entrenched Iraqi positions as well as strategic and tactical targets in Iraq and Kuwait.



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## **The Ground War**

On 24 February 1992, coalition ground forces launched a flanking ground assault that completely decimated what remained of Saddam Hussein's military might. After only a little more than four days of ground combat, Iraqi forces were in full retreat. In keeping with the United Nations mandate that limited coalition objectives to the removal of occupying Iraqi forces from Kuwait, U.S. and allied forces stopped their ground assault almost 100 hours to the minute after it had begun.

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## **A Logistics Success**

At the height of Desert Storm, over 500,000 U.S. military personnel were stationed in Saudi Arabia and Kuwait (2:2). Over 95 million meals were served, enough to feed the entire population of the State of Rhode Island for one month. U.S. forces consumed almost 1.5 billion gallons of fuel, an amount greater than the annual yearly consumption of 17 U.S. states. U.S. service personnel received over 32,000 tons of mail, not including deliveries made in theater. This amounted to over 8 million cubic feet of mail -- enough to cover 15 football fields to a depth of 6 feet. Supplies were hauled forward using 1,400 U.S. Army trucks and 2,500 host nation vehicles. Over 3,600 convoys traveled almost 3,000 miles of main supply routes for a cumulative distance equivalent to driving around the world 1,800 times -- 64 million

miles. At 60 miles per hour, 24 hours a day, it would take 120 years for a single vehicle to amass a similar mileage. Over 117,000 wheeled vehicles, 13,000 tanks and other tracked vehicles, and 1,749 helicopters were moved to the theater. 350,000 tons of ammunition was forwarded to Southwest Asia (3:8).

Representative of the logistical success story that underlies Operations Desert Shield and Desert Storm, such figures also reflect the truly massive extent of the retrograde logistics effort required to remove the equipment from the theater and ultimately return it to combat ready status. The equipment, materials, and supplies necessary to support effective air and ground combat operations represent the visible manifestations of a logistics effort of unparalleled proportions. Yet, once hostilities concluded, the logistics effort was still unfinished. Arrayed across the desert were hundreds of thousands of U.S. military personnel, immense stockpiles and inventories of munitions, foodstuffs, building materials, vehicles, rations, and spare parts.

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## **Operation Desert Farewell**

The focus of the logistics effort for the previous seventeen months had been moving supplies and equipment to the theater of operations. However, when hostilities concluded on 24 February

1992, the entire logistical machine had to be thrown into reverse to facilitate a rapid withdrawal of U.S. forces from the region. Less well known than Operations Desert Shield and Desert Storm that preceded it, Operation Desert Farewell represents an ongoing logistics effort to return affected materials, supplies, and equipment to pre-war stockage and readiness levels. It also entails the sum of the efforts required to essentially remove all traces of the previous U.S. presence from Kuwait and Saudi Arabia except as provided for in new or existing materiel prepositioning agreements.

## **Redeployment**

The earliest phases of Desert Farewell involved moving as many personnel and as much of their equipment as possible out of the theater in as little time as possible. The need to remove the large contingent of U.S. forces from Saudi Arabian and Kuwaiti soil was fully in keeping with President Bush's pledge at the onset of hostilities to get U.S. forces in and out of the region as quickly as events would allow. When President Bush announced on 6 March that hostilities were over, planes were already winging their way towards Dhahran, Saudi Arabia, to transport U.S. troops back home. By the morning of the 8th of March, 1992, the first contingent of 5000 troops was several hours into the first leg of its flight home. This 5000 person a day stream was to continue until almost the entire 500,000 plus U.S. personnel were back in the

U.S. By 1 April, 165,000 U.S. troops had been sent home. By 1 July, this number had reached 365,000 (4:155).

## **Reconstitution**

By far, one of the most daunting portions of Operation Desert Farewell, reconstitution of supplies and equipment used during the Gulf War, represents a long-term logistics effort not likely to be concluded in the near future. Wartime operating stocks consisted not only of equipment actually used during the war, but thousands of tons of materiel still loaded in containers in Saudi Arabia, neighboring Gulf States, and at ports in Europe and the U.S. Stocks actually issued to units for use, whether vehicles, munitions, equipment, shelters, supplies, or rations, represented even more difficult disposition decisions due to the varying states of deterioration found in the items being inventoried.

## **Plans and Challenges**

Not only were the items widely dispersed throughout the theater, but the rigors of heavy use, combat, and a harsh desert environment left some equipment completely unsalvageable while the remainder had to be collected, packed, transported to a central location, unpacked, inventoried, cleaned, and repaired (6:7). Wherever possible, assets were theoretically supposed to be returned to a 100 percent mission-ready status prior to movement from the Southwest Asia theater. However, this was next to

impossible as items ranging from combat damaged equipment, the ravages of the harsh desert environment, and items as simple as the in-theater supply unavailability of two-ply toilet tissue were sometimes enough to keep specific equipment ensembles at less than mission ready status (6:7; 1:36).

The challenge of the reverse logistics effort known as Operation Desert Farewell was not only to redeploy the personnel, supplies, and equipment that the United States had spent seventeen months moving to the Gulf area, but to return the majority of the assets to a ready-for-future use status. It is this phase of the reverse logistics effort encompassed by Operation Desert Farewell that will preoccupy the military logistics community for the longest period of time as the challenge of returning units to before-the-war readiness levels grows increasingly difficult in the face of personnel drawdowns and budget shortfalls.

## **Redeployment**

The first priority, both politically and militarily, for the United States following the conclusion of the combat phase of the Gulf War, was to bring the troops home as rapidly as possible. To live up to promises made both at home and to nations in the Gulf region, U.S. military personnel were withdrawn as quickly as units could return to their tactical assembly areas and as the availability of transportation assets would allow. This haste in getting the people

out would complicate the retrograde logistics scenario significantly, but it was an unavoidable consequence of the political realities of coalition warfare in the Gulf region.

With the limited exception of the Vietnam War, the United States military does not have recent experience with major retrograde operations. The retrograde scenario encountered in Vietnam in fact differs quite markedly with the situation facing military logistics planners following the conclusion of the Gulf War. The Vietnam retrograde was conducted while a high-intensity conflict was still in progress, and although a great deal of military equipment was evacuated to the continental United States (CONUS) or to other locations away from the theater of conflict, a substantial portion of materiel available in-theater was left for the use and support of the South Vietnamese government after the withdrawal of U.S. Forces (7:38). Ultimately, equipment evacuated from the theater and returned to the U.S. was gradually overhauled over the course of several years and used to minimize the effects of equipment procurement shortfalls that occurred during the lean budget years and military drawdown following the U.S. withdrawal from Southeast Asia (7:39).

### **Changing Logistics Focus**

In the case of the Gulf War, despite victory and the sudden cessation of hostilities, the logistics effort continued unabated.

The logistics focus shifted from active support of tactical combat operations to sustaining the combat forces charged with clearing enemy forces from Kuwait and to redeploying forces out of the theater (3:6). This was to constitute a significant effort in keeping with the promise by President Bush to the world community and, particularly, to the Arab states of the Persian Gulf area, to get the job done as quickly as possible and then rapidly disengage U.S. forces and withdraw them from the region.

### **Redeployment Plan**

During the time the United States was preparing for Operation Desert Storm, agreements were being made between the U.S. and Saudi Arabia. One of those agreements was that the U.S. military would make a quick exit from Saudi Arabia after the war and would remove the equipment and supplies brought in to support this operation. Colonel Randy Geyer, of the CENTCOM logistics staff, had voiced his opinion that the preliminary plans for redeployment were weak. Based on his observations, he was tasked with developing a more comprehensive plan for redeployment. The new plan set up a two stage attack. Stage I would be a personnel redeployment set up to move 365,000 troops in 90 days. Stage II would account for, segregate, and load for shipment all of the supplies left behind by the departing forces. It allowed for a time frame of a year or more in which to accomplish this task (4:150).

From their onset, redeployment operations encompassed the return of both materiel and personnel. Preparations for the redeployment of equipment required all materiel items be thoroughly cleaned and inspected to remove any potential contaminants prior to shipment out of the theater. Staging and wash facilities were established at Dammam, Dhahran, Al Jubayl, and King Khalid Military City -- facilities that were to become the major collection and staging points for equipment and materiel awaiting subsequent redeployment (3:6).

As logisticians struggled to get a handle on the immense quantity of materiel in the logistics system, they came to the realization that while it was next to impossible to determine the overall tonnage or volume of materiel that required retrograde, for the most part it consisted of two broad categories -- undelivered cargo and distributed materiel.

### **Undelivered Cargo**

The majority of undelivered cargo was in 40-foot seavan containers and, for the most part, had never actually been released from the ports to the supply distribution system in theater. In addition, thousands of seavans had been "landed short" in Egypt, Spain, the United Arab Emirates, and several other European countries due to the massive backlogs at the Saudi Arabian Ports. Thousands more were either awaiting unloading or were stacked at the ports of



Dammam and Al Jubayl when hostilities ceased. While the problem of distributed cargo was one that would occupy the majority of the logistics staff's time and effort, the problem of undelivered cargo was much more readily solved. At the direction of the theater logistics commander, Lieutenant General William G. Pagonis, U.S. Army, all short-landed containers coming direct from vendors were returned to their point of origin or to a Defense Logistics Agency (DLA) designated storage facility. Containers destined for units that had already redeployed were forwarded to the unit's home location. This action effectively removed a sizable portion of the logistics overhead from the system with which the theater planners had to be concerned, and in turn allowed them to concentrate on opening and inventorying containers already landed in Saudi Arabia and collecting and categorizing the substantial volume of distributed materiel that was flowing into theater collection points at a steady rate (1:35-36).

### **Theater Transportation**

Of course, actually getting the materials to the collection points was a major aspect of retrograde logistics operations. One solution to this problem was found in the U.S. Army's 711th Transportation Group (Provisional) which was created to address the need for line-haul transportation in support of retrograde materiel movements following the conclusion of hostilities. Consisting of three subordinate battalions, the 711th controlled a

fleet of over 2,500 assorted tractors, flatbed trailers, low-boy trailers, heavy equipment transporters (HETs), and additional miscellaneous light and heavy transportation vehicles. A substantial majority of all the vehicles used to support retrograde line-haul operations were supplied through contracts with host-national companies and their personnel. As retrograde operations moved into full swing, the surface theater transportation plan called for movement of 1,056 flatbeds and 520 lowboys or equivalent HETs on a daily basis. This volume of traffic was heretofore unimaginable to Army planners. The mission called for the equivalent of 22 medium and 12 heavy truck companies, a number almost twice as large as the size of the Army's entire 37th Transportation Command (5:18-19).

The distances and conditions under which trucks and equipment were required to operate were extreme. Vehicles making a typical round trip covered over 600 miles of hazardous roads in extremely high temperatures. Dust, blowing sand, sandstorms, and smoke were daily occurrences. Due to the variety of equipment types utilized, there was little interchangeability among vehicles and a system of trailer transfer points was not possible. Drivers were required to drive entire routes themselves over the course of several days. The majority of drivers provided by Saudi contractors were third country nationals speaking little or no English (5:18-19). Though capable drivers, cultural differences

sometimes complicated the lives of logistics support personnel. Army ordnance personnel were particularly concerned with a typical driver practice of cooking meals on a small propane stove in the area immediately adjacent to the driver's vehicle. Ordinarily not a significant concern, the practice gained considerable attention when the trucks were loaded with tons of high explosive ordnance (5:20).

Despite the existence of a highly detailed transportation plan, limitations in the logistics system were quickly realized. Trucks had to wait daily in long queues at heavily congested loading and unloading sites. Most significant of all, the availability of materiel handling equipment, container handling equipment, and qualified personnel to operate the equipment significantly affected operations. In addition, convoys were extremely large, typically over 100 vehicles spread over 10 miles of difficult roadway. Without the benefit of communications, effective convoy control by the single Army NCO and assistant was more or less a matter of chance during the majority of movements.

Despite such limitations, the 711th Transportation Group achieved the objectives for which it was constituted. From 16 August to 15 November 1991, the 711th amassed over 13,000,000 miles. At this pace, it would have accumulated over 52,000,000 miles in a year. Trucks under the unit's control moved over 260,000 short

tons of supplies, 12,000 tracked vehicles, and 6,400 containers (5:21).

### **Morale, Welfare, and Recreation**

For redeploying personnel, many of whom had been living in extremely austere conditions since their initial deployment to the region, supporting commanders at the staging areas were particularly attentive to the morale and comfort needs of the redeploying personnel. Morale, welfare, and recreation items were made available to redeploying personnel in addition to more basic commodities to provide for their everyday needs while awaiting outbound transportation. Popular wherever they were located, "Wolfburger Stands," or "Wolfmobile" fast-food trailers were no less a hit when made available to troops in the redeployment areas (3:6).

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## **Restoration of Kuwait**

As combat operations ended, the task of attending to the severe damage inflicted on both the people and facilities of Kuwait was begun. Under the auspices of the U.S. Army's 22nd Support Command, Camp Freedom was established in Kuwait to serve as the focal point for theater restoration operations. Humanitarian efforts were expanded to encompass refugee camps operated by U.S. forces in Southern Iraq and to include primarily Kurdish filled

camps in Northern Iraq and Turkey. In addition, the U.S. had to attend to the needs of over 60,000 enemy prisoners of war (EPW) taken during combat and immediately following the cessation of hostilities. Held in four camps, prisoners had to be provided shelter, medical attention, rations, and water, until they could be processed by the International Red Cross for placement under Saudi Arabian control (3:6).

Although the majority of combat forces were redeployed out of theater from March to May, 1992, most of their materiel was left behind in the desert or at the designated staging areas. The U.S. Army alone left behind over 100,000 wheeled vehicles, 10,000 tracked vehicles, and 250,000 tons of ammunition (3:6). The extraordinary task facing logistics personnel was in effectively closing-out the theater by efficiently, effectively, economically, and safely moving this material from where it had been left to the staging areas and subsequently to final destinations. In the words of one Army specialist, this phase primarily centered on "bringing the iron out of the desert." For the U.S. military, this was to substantially represent new logistics ground as never before in this century have U.S. forces actually closed out a theater (3:6).

### **Fresh Forces**

Given the adversity faced by logistics personnel during the seventeen months of operations Desert Shield and Desert Storm,

and the generally austere logistics infrastructure that existed within Southwest Asia both before and after the Gulf War, one of the first objectives undertaken by the U.S. Army's 22nd Support Command was to deploy approximately 6,000 new personnel into the theater to support retrograde operational requirements. Following in a similar vein, the other military services augmented or replaced their existing logistics personnel with fresh, mostly volunteer, personnel from the United States. Not only did these newly arrived personnel provide some badly needed logistics support as the number of personnel available for logistics support duties in theater rapidly decreased as a part of the overall rapid redeployment objective, but they provided a welcome relief for many individuals who had been in-theater for twelve to seventeen months (3:6).

### **Long-Term Vision**

Operation Desert Storm required the use of supply stocks from many different locations around the world. A part of the long term vision guiding the logistics effort was the desire to return equipment from the theater to those facilities that had been depleted over the course of the war whenever possible. Military bases in Europe, Central America, South America, and Asia had sent supplies to help build up the stockage levels required to prosecute the wartime mission. These bases needed to have these supplies replaced and redeployment tried to complete this whenever feasible. Another part of the vision was to help Kuwait

by sending some of the allowable supplies there to assist in sustaining the general populace and repairing the decimated national infrastructure. Additional materiel was repacked onto maritime prepositioning ships which then returned to their ready positions in the Indian Ocean. (4:156)

Another part of the vision was to be able to effectively dispose of dated material such as meals ready to eat (MREs) and similar items. Food, fuel, water, and medical supplies were provided to the Kuwaitis following the war. Operation Provide Comfort, the U.N. relief effort to assist and protect Iraqi Kurds fleeing a hostile Iraqi regime, allowed for the practical disposal of shelf-life limited items that would have been otherwise destroyed. Sending such items such as tents, cots, blankets, water, excess MREs, and tray packs to the Kurdish refugees fleeing Iraq as well as helping other needy populations around the world with surplus food and clothing was practical from the logistics standpoint. This materiel would have to be packed and removed anyway but would have ended up being destroyed if it were returned to the U.S. (4:154).

To support a portion of the Air Force retrograde logistics effort, Air Force Materiel Command formed the 4401st Asset Reconstitution Group (Provisional) for the express purpose of attending to the Air Force's share of the military equipment, supplies, and munitions leftover from the war. For the Air Force, the key collection facility was Al Kharj, Saudi Arabia. Literally hundreds of jeeps, pick-up

trucks, HMMWVs (Humvees), trailers, graders, fire trucks, and cars still formed regimented rows in the blistering desert sun almost two years after the fighting officially ended. In addition to vehicles, Air Force personnel had to contend with portable buildings, hangars, and tents as well. Virtually anything a unit could not immediately take with it when it redeployed eventually found its way to Al Kharj (6:6).

### **Other Considerations**

A perhaps unexpected facet of the retrograde logistics effort, regulations imposed by the United States Department of Agriculture governed the importation of goods into the United States from any foreign location. Found in the Code of Federal Regulations (CFR), these regulations set stringent guidelines that significantly affected the ability to return the massive amounts of equipment and supplies that were sent to the Middle East. These regulations are intended to prevent the accidental importation of crop-infesting insects that may be living in the soil or sand residue found in or on the vehicles or other equipment. The regulation requires that items to be returned to the United States must first be steam cleaned and sanitized prior to reentering the U.S. To "clean" the equipment for transportation back to the U.S., a huge logistical undertaking had to be accomplished to prepare the items for shipment (8: All).



## **Washrack Units**

To meet the requirements imposed by the Department of Agriculture, all loose soil and sand had to be removed from the vehicles prior to returning to the U.S. As a result, four washrack units were set up to clean and sanitize the vehicles. Over 2,000 vehicles (air and ground) were washed each day, some of which had to be taken apart, such as engines removed, tracks taken off M1 tanks etc., all in order to make sure they would be acceptable for return to the U.S.. In order for these washracks to operate, water had to be brought to the sites by truck or pipeline. Asphalt was laid to support the vehicles being cleaned and sterile staging areas were built to stage the equipment until it could be shrink wrapped and held for transportation. In addition to all of the vehicles that needed to be cleaned, ammunition was also required to undergo the same treatment. Some 350,000 short tons were sent through the washracks prior to shipping. The washrack operation constituted the largest single operation during Desert Farewell (4:157).

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## **Theater Close-Out**

The close-out of the theater by the U.S. Army can essentially be divided into three distinct phases. Phase I, from June to mid-August 1992, consisted of the build-up of 61 provisional units using primarily replacement personnel. In concert with six active Army

units from Forces Command and four terminal transfer units, these units replaced 71 in-theater units that had ongoing missions. That is, the replacement units were put in place and trained to do the jobs of their predecessors. The organizational structure of theater logistics support forces was also reconfigured to more readily support the retrograde logistics mission (3:6).

As an additional part of the first phase, massive equipment and munitions stockpiles left in the desert were sorted and organized for retrograde disposition. In staging areas, required transportation assets were marshaled to begin moving stockpiled materiel to the port cities of Dammam and Al Jubayl. In all, nearly 50,000 truckloads were required to transport the massive quantity of retrograde materiel to the ports. Over 400 shiploads subsequently were required to move materiel from the theater back to the United States. Once returned to the U.S., the exposure of equipment to combat, the harsh desert environment, and shipment by sea necessitate that it will be several years before the majority of the salvageable equipment used in the war will be fully refurbished (3:7).

Phase II of the close out extended from mid-August until mid-December. During this phase, the three main activities consisted of withdrawal of materiel from the theater, the storage of prepositioned equipment and theater stocks in Doha, Kuwait, and the drawdown of provisional units and personnel in-theater. Units

including Patriot missile batteries redeployed from Kuwait to Saudi Arabia as a precursor to their subsequent withdrawal from the theater. Throughout the late fall and early winter, withdrawal of materiel and equipment continued. By 31 December, the majority of supplies, with the exception of ammunition, had been withdrawn and redeployed.

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## **New Agreements**

In keeping with a number of new and existing prepositioning agreements with host Persian Gulf nations, equipment and supplies were moved to a number of prepositioning sites. This prestocked equipment and materiel provides the United States with an exceptional capability to support exercises and contingency operations in the region. In addition, as a result of a new host-nation agreement forged as a result of the Gulf War, a permanent organization known as the Combat Equipment Group, Southwest Asia, at its inception, and subsequently as the U.S. Army, Kuwait, was established in Doha, Kuwait to manage and maintain prepositioned materiel and equipment stocks. By late October, U.S. Army provisional units began to stand down, with a caretaker command, Army Central Command (ARCENT) Forward established to oversee residual operations through at least June 1992 (3 8).

The final phase of the Army's theater close-out consisted of moving what remained of ammunition stockpiles to ports or collection points and either shipping it from the theater or destroying it at destruction facilities as appropriate. The numbers of provisional units and support personnel continued to decrease until ultimately only the permanent organizations at Doha and Dhahran remained with all other personnel withdrawn and any remaining facilities closed. Remaining in-theater are several Patriot missile batteries, the U.S. Military Training Mission based in Dhahran and Riyadh, the U.S. Army, Kuwait, and prepositioned stocks of equipment and materiel in Kuwait and Bahrain.

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## Reconstitution

Even with the eventual return of the majority of U.S. warfighting materiel from the theater, the logistics challenge was far from over. For the majority of the equipment, the exposure to the environmental effects of operating in the arid desert climate of Southwest Asia and of traveling to and from the theater of operations by sea promoted significant degradation of the equipment's readiness for future combat operations. Despite the Herculean sustainment efforts carried on throughout the Gulf War, a major reconstitution effort was required by the majority of participating units. The experiences of the U.S. Army's 1st Infantry Division (Mechanized), "the Big Red 1," in reconstituting unit

readiness and warfighting capability are typical of those experienced throughout the U.S. military following the conclusion of Operation Desert Storm.

For the ground forces, combat related operations began on 1 February and ended on 24 April 1992, when units began reforming back at their tactical assembly areas in Saudi Arabia. Efforts oriented at redeploying personnel and equipment out of the theater were begun almost immediately. These activities included preparing materiel for redeployment, shipping the materiel back to home unit locations, and eventually receiving repair and equipment items back at home stations. Once units and the majority of their equipment began arriving back at their U.S. bases, equipment had to be inspected, initial servicing and repairs performed, property accountability established, and supply support activities reestablished. A substantial effort was also required to revitalize unit maintenance management systems to accommodate the pressing requirements for beyond routine maintenance required by much of the equipment returning from the theater (9:18).

### **Reconstitution Defined**

Brigadier General James F. Brickman, Commander, 1st Infantry Division (Mechanized), defined post-redeployment reconstitution as:

"those extraordinary regeneration actions that are planned and implemented to restore units to a desired level of combat effectiveness in line with peacetime mission requirements and resources. These actions transcend normal day-to-day force sustainment and require Army-wide support in many areas" (9:18).

## **Goals**

For the "Big Red 1," the division's leaders designated three primary reconstitution goals -- managing excess, achieving a 90 percent materiel readiness rate, and maintaining a high training operational tempo.

## **Repair Parts**

Management of repair parts stocks was considered the first major challenge facing the division upon its return to Fort Riley, Kansas. A factor complicating the management situation, and fairly typical of the problems facing many of the units redeploying from Southwest Asia, the division's authorized stock of repair parts was not among the first of the division's shipments to be returned from the theater. Thus, at the very time that the division was trying to initiate a major reconstitution effort, it was hampered by the fact that the spare parts it required were somewhere between the port of Dammam, Saudi Arabia and Fort Riley, Kansas. Division commanders found themselves critically short of some essential items, but also buried in excess of others. Ordering additional

stocks of repair parts required in the short run to replace stocks still in transit from Saudi Arabia, quickly turned to excess as shipments from the theater began arriving over several months. In many cases, parts were ordered from the wholesale system when those parts were already stocked in a unit's authorized stocks -- unfortunately, spread out in redistribution channels between the theater and Fort Riley. In addition, the requisition and shipping times required to obtain items through the wholesale system resulted in equipment being "deadlined" for a lack of parts costing the division a loss of mission-capable days. (9:20).

### **Parts Influx**

Over a three month period following their redeployment from Saudi Arabia, receiving facilities at Fort Riley were inundated by two and a half times their normal daily volume as units requisitioned required repair parts and supplies. A key lesson learned by Army planners was that operating parts stocks should be among the first items redeployed so they will be available to support equipment as it arrives. Commensurate with this, planners also agreed that elements of the main support battalion should also have been redeployed ahead of the bulk of the division in order to be available to manage equipment and materiel as it arrived back at the home station (9:20).

## **Units Assume Supply Responsibility**

As units began to get their normal supply and maintenance activities back on line following redeployment, the potential for a bottleneck at the division level parts supply facility was quickly recognized. To avoid this, receiving activities and parts management were temporarily pushed down to the unit level while excess items were simultaneously processed up and out of the division through the centralized supply activity. Thus, units were instructed to identify, retain, account for, and use repair parts on hand at the unit level until notified to resume normal supply procedures (9:20).

Given the potential volume of unnecessary parts stocks, cancellation of due-in supply excess, that is, orders for supplies that were no longer needed, was a high priority for unit planners. The objective was to cancel excess early enough to prevent unnecessary items from being shipped from the depots and thus save funds. A major supply reconciliation revealed the existence of over 22,000 requisition documents for parts that had been shipped to Saudi Arabia, but not received. From July 1991 through February 1992, 1st Infantry Division (Mechanized) supply personnel canceled orders for over \$60 million dollars in excess due-in parts.

As equipment began to arrive back at Fort Riley, thorough technical inspections to identify spare parts and servicing



requirements were undertaken. Even this seemingly simple task, required almost 45 days of virtually round-the-clock operations. What was found was that the bulk of the division's equipment was in substantially worse shape than had been expected.

### **Additional Servicing Required**

Division equipment had been serviced prior to departure from Southwest Asia, including the required sanitization procedures against potential agricultural and soil contamination required of all equipment redeploying from the theater. However, these services were often performed at below standard levels using modified procedures due to the harsh desert environment, unavailability of required parts or supplies, the limited time available for service, or usually, some combination of all of the above. With this in mind, many service-related repair parts, supplies, and petroleum products were ordered while the unit was still in Saudi Arabia to ensure their availability when the unit arrived back at its home station following redeployment. This forward thinking, saved the division significant downtime and allowed a more rapid recovery pace than would have otherwise been possible (10:31).

### **Equipment Accountability**

One of the final logistics readiness challenges facing the 1st Infantry Division was accountability of the unit's real property and equipment. Waste and destruction of property are inevitable

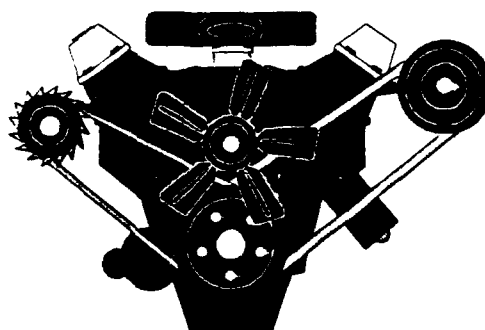
consequences of combat. However, modern equipment accountability requirements dictate that accurate inventories be established and maintained. Thus, a substantial effort was required to identify equipment that had been destroyed or lost during the unit's operations in the desert, and to adjust reported inventories and accountability documents as required. This seemingly mundane task was of extreme importance to at least some of the division's personnel as more than one supply officer found himself accountable for several million dollars of "missing" equipment. Seldom was such equipment really missing, but its current disposition had to be determined and both the physical assets themselves and the accompanying paperwork had to be appropriately shuffled to rebalance supply accounts. As might be expected, some units found themselves with far less than they were authorized while others found themselves far better equipped than when they initially deployed -- and, than their authorized equipment lists would allow.

The problems involved in actually achieving accurate inventories were not at all trivial. The very fact that much of the 1st Infantry Division's equipment arrived back in the U.S. over a period of many months meant that no wall-to-wall inventory was actually possible until well into the reconstitution effort. However, once such a 100 percent inventory was actually accomplished by all division units, an aggressive program of lateral transfers and turn-ins eliminated

inventory disparities while simultaneously avoiding an overtasking of already saturated central supply functions.

### **Reestablishing Supply Channels**

A final hurdle confronted by the "Big Red 1" centered on the need to reestablish normal, non-wartime, supply channels. When it deployed to Southwest Asia, the 1st Infantry Division effectively dropped from routine Army supply channels. As the unit's supply requirements were addressed through the contingency channels that developed as a part of the Desert Storm sustainment effort, the extensive, computerized database that the Army uses during peacetime to support all Army units no longer was provided with the information required to keep the database relevant to the division up to date. This seemingly minor glitch would, however, result in near chaos once the division was redeployed and attempted to reengage the normal supply system. The inaccuracies in the supply system database, coupled with changes to the system that were completed while the unit was deployed, resulted in a situation where the supply system refused to recognize the division's requirements. As a result, the wholesale supply system routinely rejected and canceled the division's requisitions. This problem would plague the division's reconstitution efforts for almost a year following redeployment and was accommodated only through the use of innovative work-arounds at both the "Big Red 1" and higher headquarters (10:33).



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## Delayed Desert Damage

Following redeployment from Saudi Arabia, one thing that readily became apparent to the U.S. Army Tank and Automotive Command (TACOM) in Warren, Michigan, was that the environmental impacts of Operations Desert Storm and Desert Shield on the Army's tracked and wheeled vehicle fleets had been substantially greater than anticipated. In response, TACOM initiated its 3D - Delayed Desert Damage program to determine the full extent and causes of desert related damage, determine appropriate corrective maintenance requirements and the corresponding man-hour and supply system effects entailed by the increased equipment maintenance requirements. At the onset of the program, 30 different tracked and wheeled vehicles actually operated during the war, and typical of the fleet being returned from the Southwest Asian desert, were run through extended depot level maintenance procedures.

## **Worse Than Expected**

Initially, vehicles were run through standard depot inspections as well as normal teardown and maintenance. Depot personnel were then instructed to conduct a more extensive analysis to determine if normal depot procedures were sufficient to fully detect all hidden damage and maintenance requirements. During the subsequent inspections, depot personnel found significantly more damage -- that would have gone undetected through normal depot procedures, than anticipated.

Most startling were three transmissions that had operated successfully during road tests and passed pre-shop analysis on dynamometers. Yet, further breakdowns of these transmissions revealed sand and corrosion and filtration or lubrication problems had compromised all three to the point of certain premature failure. Clutch plates were worn beyond tolerances due to visible sand. Two gears in one of the transmissions were welded together because of the extreme heat generated by contamination.

Depot shakedowns also revealed road-arm leakage and road-arms with large amounts of sand both inside and out. Deposits of sand or dirt were found in brake chambers. One chamber even had water in it. The teams even found sand in axle assemblies, starters, alternators, and virtually every engine and transmission. Depot and TACOM technicians found in-tank fuel pumps still operating but with sand and dust all over them. Heater boxes were

covered with sand inside and out. Various signs of burning, scoring, metal stress, viscosity breakdowns of lubricants, and dilution of fuel with water and sand were almost universal among the sample vehicles (11:25-26).

While TACOM's specific analysis was directed only at the U.S. Army assets under its control, the factors which caused the extensive damage encountered during the depot evaluation were certainly common throughout the Southwest Asia theater of operations. Hence, the other services should expect to encounter similar levels of unanticipated delayed desert damage throughout the Desert Shield/Desert Storm reconstitution process. In fact, given the extent of the potential damage, it is quite likely that the full extent of the delayed effects of U.S. involvement in Desert Storm on equipment and materiel will not be fully realized for years until these effects begin to show up as the premature aging and deterioration of assets involved in the Gulf conflict. The Defense Logistics Agency (DLA) and the U.S. Marine Corps are both initiating similar programs to combat the delayed effects of desert theater warfare. The Marine Corps program - "Saudi Arabia Non-combat Damage," or SAND, is underway at Corps logistics bases in Albany, Georgia and Barstow, California (11:27).

## **Climate and OPTEMPO**

In the final analysis it is clear that two factors clearly compound the detrimental effects on equipment associated with desert warfare. First, the ground portion of the war involved a sizable increase in the operating tempo (OPTEMPO) of the equipment involved. Usage rates accrued that were from 10 to 40 times the normal operating mileage for given vehicle classes within the fleet. Such a sustained, rapid pace of operations would be sufficiently grueling even under optimum conditions let alone in the fast moving combat environment that materialized during Operation Desert Storm. Second, the extraordinarily difficult terrain; blazing desert temperatures; and choking, airborne sand rapidly took its toll on both equipment and personnel alike. As U.S. planners learned through experience, the sand in Southwest Asia is much finer than that to which Westerners are accustomed. "It is more menacing. It penetrates. Any breach in seals or filters invites sand to enter" (11:27). In the desert environment of Southwest Asia, filters were often ineffective or clogged quickly. Engines rapidly overheated. Quick fix activities become a race to make the necessary repairs as rapidly as possible and bottom-up the work before further contamination completely undoes the maintenance effort altogether (11:27-28). An important facet of combat operations that was reemphasized during the 100 hours of ground combat during Desert Storm is well worth noting:

Clearly, the operational tempo of Desert Storm, compounded by the Southwest Asia environment, stretched the limits of American tank-automotive equipment. One last consideration impacting delayed desert damage is the fact that, as the operational tempo went up, maintenance decreased (11:27).

This is especially worth noting in light of the potential for future conflicts in the region, and, in fact, for any potential conflict in area characterized by harsh climatic conditions. By most standards, Desert Storm was an extremely short war, yet, the materiel degradation was substantial. The implications for sustained logistics and combat operations over a span of months versus the 100 hours of actual ground combat in Desert Storm should signal a clear message to logistics planners: maintaining equipment readiness in adverse climatic conditions will require a total logistics effort -- an effort that will tax both the sustainment and retrograde systems to the utmost.

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## **Desert Sweep**

When hostilities ended, a major challenge that still faced coalition allies and the nation of Kuwait was in disposing of the leftover remnants of the desert war. Literally millions of tons of unexploded mines, aerial bombs, and submunitions littered the Kuwaiti desert. In addition, immense stockpiles of salvageable munitions,



thousands of inoperable tanks and trucks, and abandoned bunkers and revetments were scattered throughout the theater. The danger from these wartime leftovers was very real indeed; the Kuwaiti government estimated that as of 13 October 1992, over 1,500 civilian casualties had occurred as a result of the deadly litter left after the Iraqi occupation and the subsequent allied offensive (12:4).

To facilitate returning the desert to its pre-invasion condition, Kuwait requested allied assistance and divided itself into seven sectors. Seven allied countries that took part in the war were then requested to clear a sector under contract to the government of Kuwait. These countries, the United States, Great Britain, France, Egypt, Bangladesh, Pakistan, and Turkey, then set about the dangerous task of clearing the desert within their respective sectors. Countries like Egypt chose to use military personnel to accomplish the dangerous task in much the same manner ordnance has been cleared since before World War II. Others, including the U.S., contracted the clearing effort to private companies.

### **Contracted Support**

Within the U.S. sector, Conventional Munitions Systems, Inc. (CMS), was selected to clear the 3,126 square kilometers (1,207 square miles) of desert, including 146 square kilometers (55.2

square miles) of minefields. By way of estimates, it is believed that a third of the approximately 100,000 tons of explosives dropped by the allies over Kuwait never exploded, either because they were duds or were swallowed by the sand (12:4). An official at Conventional Munitions Systems, Alfred L. Dibella, Jr., CMS's vice-president for planning and coordination conservatively estimates that more than one million dud submunitions from Rockeye aerial bombs litter the U.S. sector alone (13:54).

### **Deadly Litter**

Dibella believes that at least 100,000 tons of Rockeyes were dropped during the war, with each Rockeye containing at least 250 submunitions. That means that 25 million bomblets were dropped by allied aircraft -- "with a dud rate of 5 percent, which is a very low estimate, there are at least 1,250,000 unexploded Rockeyes in the desert" (13:54). The presence of such a vast quantity of unexploded ordnance in the desert forces U.S. personnel on seemingly less dangerous recovery and transportation missions to be routinely accompanied by expert explosive ordnance disposal (EOD) personnel. The presence of undetected munitions is a major threat to U.S. logistics personnel working to retrieve assets from the desert and certain areas, when the presence of munitions is combined with already hazardous desert terrain, are simply impassable altogether (14:14).

## **Mines and Other Dangers**

Munitions dropped by coalition forces are far from the only hazardous obstacle facing CMS and its crews. Iraqi forces laid an estimated 500,000 mines in 16 different varieties within the borders of Kuwait during their seventeen month occupation of Kuwait. Not only did Iraq seed the desert with anti-tank and anti-personnel mines of its own design, but also with varieties manufactured by Italy, Belgium, Russia, China, Czechoslovakia, Great Britain, and Pakistan as well. Fortunately, CMS personnel found that their already dangerous work had not been complicated by Iraqi booby traps (13:54). However, exposure to the elements has caused many munitions to become unstable. One U.S. technician, a former EOD instructor with over 20 years experience was killed when a artillery shell exploded unexpectedly under routine handling (12:4). More than 50 sappers, as the expert technicians that handle the various forms of ordnance are known, have been killed in Kuwait since the cleanup effort began. Dozens more have been seriously injured, including Kuwait's entire five-man EOD team. "This stuff is very unforgiving," said Floyd D. Rockwell, a retired U.S. Army master sergeant now serving as a disposal technician with CMS (12:4).

As if simply removing the leftover ordnance were not enough, sappers and laborers working near the Iraq-Kuwait border often have to deal with hostile Iraqi border patrols that routinely fire over

their heads as the crews go about their ordnance sweeps. One U.S. technician, Clinton A. Hall, was taken prisoner by Iraqi forces for three days in early October when his duties carried him too close to a roving Iraqi patrol (12:4).

### **New Technologies**

CMS personnel are using a variety of state-of-the-art technology based systems to clear ordnance contaminated areas. Using the Navstar/Global Positioning System (GPS), mine fields, munitions caches, and other contaminated areas are precisely pinpointed and surveyed. Most of the Iraqi minefields were laid down in precise patterns so mapping is relatively easy once the areas are located. Rockeye bomblets however, are widely and irregularly dispersed so the task is that much more difficult. Using GPS, technicians plot ordnance locations using an 8-digit grid code that tells them which EOD team located the ordnance, the sector in which they are located, the type of ordnance involved, and the approximate number of each type found. The 26 GPS receivers and the plotting system utilized by technicians to precisely mark and plot dangerous areas are a part of a program known as the minefield and ordnance recovery system (MORES) (13:54).

Once mines or bombs are located, they are disposed of by a variety of means depending on their type and general location. Air delivered munitions such as Rockeye bomblets are generally

destroyed in place, but CMS is investigating the idea of using robot sappers to collect the unexploded ordnance for delivery and destruction at a centralized site. Mine fields were originally cleared by blowing up the mines in place. This practice proved unsatisfactory, however, as detonations tended to cover-up nearby unexploded mines with sand displaced by the explosion. Mines are now manually disarmed, collected, and moved to a central destruction site for disposal (13:55).

Locating mines has been made easier by CMS's adoption of a state of the art 13.4 pound, handheld metallic mine detector as a replacement for the U.S. Army's vintage standard detector which has seen type service for over 30 years. Ground penetrating radars capable of detecting munitions up to eight feet below the surface, and airborne and spaceborne synthetic aperture radar are also being utilized to scrutinize the region for hazards. The use of laser and energy beams to explode ordnance is also being evaluated (13:55).

Actually disposing of located ordnance also relies on the latest developments in explosives technology. Concentrations of Rockeye submunitions are destroyed using a foam substance that hardens on contact and becomes explosive as it hardens. Binary liquid explosives sprayed on contaminated areas which form an explosive slurry of sand and munitions are also used (13:55). The sheer volume of unexploded ordnance available makes the Kuwaiti

desert a virtual laboratory for development and evaluation of new and refined EOD techniques.

### **Captured Ordnance Stocks**

Not all the munitions found in the desert are duds, however. In addition to thousands of smaller caches and ammunition dumps scattered throughout the desert, at least five Iraqi underground munitions storage sites have been identified. Containing a total of one million tons of serviceable Iraqi munitions, these sites will be carefully salvaged and used to augment Kuwaiti military stockpiles (13:54).

The job of cleansing the desert of its deadly overburden is far from over. The \$134 million dollar contract is expected to keep CMS and its employees busy for five to seven years. New sites and hazards continue to be located, however. One of the problems still ahead is that it will take a considerable amount of time to get to areas located under the large oil spills created when retreating Iraqi forces set the Kuwaiti oil fields ablaze. These areas will have to be thoroughly scrutinized to ensure that no duds remain hidden under the viscous oil -- a job that will be difficult until the oil is cleaned up, a job that in itself will be extremely dangerous due to the possibility of the presence of the as of yet undetected ordnance (12:4).

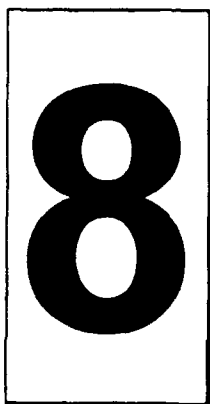
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# Logistics Doctrine

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## Introduction

The realities of the post cold war world geopolitical environment have wrought sweeping changes in the underlying structure and organization of the U.S. armed forces. As the military services wrestled with the implications of a shrinking defense budget, a generalized draw-down of military manpower levels, and the withdrawal of significant numbers of military personnel from both Europe and the Pacific Basin, the necessity of significantly redefining or at least reiterating the precepts of applicable military doctrine became readily apparent. For logisticians, the potential

ramifications on logistical doctrine are many. Evolution of logistics doctrine to encompass the changed realities of a significantly reduced overseas forward military presence, reduced funding for acquisition and maintenance of logistical capabilities, continued significant constraints on strategic lift capability, and the need to support a focus on regional contingency planning, are all aspects of the emerging operational climate to which existing logistics doctrine must adapt. As the U.S. reduces the size of its military forces and significantly reduces the number of those forces based overseas, pressures on logistics systems to rapidly deploy and support contingency responses will increase accordingly.

The logistics requirements of supporting an operation such as Desert Shield or Desert Storm will be undiminished by the fact that there will be fewer available intermediate staging points from which to meet theater logistical requirements. A scenario such as another conflict in the Persian Gulf takes on an entirely new perspective when the necessity of meeting logistics requirements without the benefits of the substantial stockpiles of personnel and equipment prepositioned in Europe is recognized.

Such is the potential environment challenging the military logistician of today. For the logistician, an underlying understanding of the fundamental concepts reshaping the U.S. military provides a strong sense of the magnitude of the impact of such changes on existing logistics systems and the formidable

potential demands evolved logistics systems will have to meet in order to allow the United States to maintain a credible power projection capability.



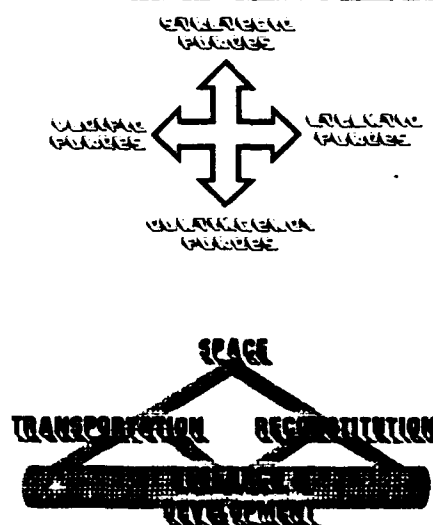
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## **The Base Force**

Recognizing the need for a coherent vision to unify and shape the services' efforts at reducing their existing structure, Chairman of the Joint Chiefs of Staff, General Colin Powell, USA, articulated the concept of a base force as a means for meeting new and enduring strategic realities. The base force concept recognizes the inevitability of reductions in military structure following the end of the cold war. It provides a core military capability that is intended to allow the United States to continue to meet essential national objectives and international commitments.

The concept of the base force serves to identify the crossover point between enduring tasks and the realities of shrinking defense budgets. As such, the base force represents a force level below which the United States may no longer possess sufficient military

capability to continue to meet critical strategic national objectives. From this perspective, the base force concept is not without considerable risk. It provides a level of military strength which should be sufficient to meet existing and future threats to U.S. national interests (1:1). However, there is no guarantee that continuing congressional pressures for significant reductions in defense spending or the emergence of new and unanticipated threats will not leave the United States with a diminished capability to defend her interests.



**Figure 5. The Base Force Framework (2: 19)**

The proposed structure of the base force is of significance to the military logistician in that it envisions three force components: an Atlantic force equipped, trained, and postured for threats characteristic of Europe and Southwest Asia; a Pacific force structured to support the theater's primarily maritime nature; and a

contingency force capable of projecting U.S. interests in low-intensity conflict, insurgencies, anti-drug wars, anti-terrorism, and non-combatant evacuations (1:1). Strategic nuclear forces will balance out the U.S. military force structure of the future by serving their traditional deterrent role, albeit from the evolved perspective of a constrained fiscal reality. Lieutenant General George L. Butler, director, J-5 (strategic plans and policy), Office of the Joint Chiefs of Staff, summed up the base force this way:

The concept is a force tailored to the perceived realities of a world undergoing a sea of change in political power and power politics. It anticipates the prospects for a smaller force, with an appropriate mix of active and reserve elements, highly mobile, well equipped and trained, competent to underwrite America's unique, enduring global obligations. The Base Force is not sized for today's world, it is the 'don't go below force' for a world which will have been largely relieved of the vestiges of superpower competition. (1:1)

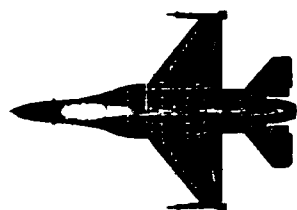


**Table 2. Base Force Composition (2:19)**

		Fiscal Year 1991	Base Force
Strategic	Bombers Missiles SSBNs	B-52 + B-1 1000 34	B-52H + B-1 + B-2 550 18
Army	Active Reserve Cadre	16 Divisions 10 Divisions	12 Divisions 6 Divisions 2 Divisions
Navy	Ships Active Reserve	530 (15 CVBGs) 13 Air Wings 2 Air Wings	450 (12 CVBG) 11 Air Wings 2 Air Wings
USMC	Active Reserve	3 MEFs 1 Division/Wing	3 MEFs 1 Division/Wing
Air Force	Active Reserve	22 FWE 12 FWE	15 FWE 11 FWE
CVBG: Carrier Battle Group		MEF: Marine Expeditionary Force	FWE: Fighter Wing Equivalent

In the intervening period following the conclusion of the combat phase of Operation Desert Storm, the Air Force, reacting to the rapid changes in the world political climate and its experiences in Operations Desert Shield and Desert Storm, initiated a rapid progression of operational, logistical, and doctrinal changes designed to establish the basis for a "leaner and meaner," but still highly capable fighting force as envisioned by the Air Force Chief of Staff, General Merrill A. McPeak. The changes in the U.S. strategic threat perspective due to the end of the cold war mandated that the doctrinal elements of aerospace power projection as codified in Air Force contingency plans, mission capabilities, and operational and logistical practices and policies, be overhauled to reflect the new realities of the world of 1990s. Flowing from the conceptualization of the Air Force mission as

"global reach, global power," the Air Force initiated a comprehensive renovation of all aspects of its organization and operations. In the face of the staggering reorganization of the Air Force along its war fighting organizational lines, and the subsequent and corresponding changes in traditional operational roles, the Air Force sought to reiterate the basis of these changes by bringing its written doctrine up to date with world events and recent military experience.



**Table 3. Levels of War - Key Characteristics (3: 1-4)**

<b>Levels of War/ Key Characteristics</b>	<b>Strategic</b>	<b>Operational</b>	<b>Tactical</b>
<b>Combat Scope</b>	War	Campaign	Battle
<b>Decision Level</b>	NCA	CINC/Air Component	Wing Cmdr
<b>Geographic Focus</b>	World	Theater	Region
<b>Planning Horizon</b>	Years/Months	Weeks/Days	Days/Hours
<b>Ultimate Objective</b>	Political	Military	Sociological
<b>Enemy Target</b>	National Will	Commander's Mind	Infrastructure
<b>Critical Logistics</b>	Production	Distribution	Maintenance
<b>Primary Constraints</b>	Policy	Resources	Headquarters
<b>Decisive Resources</b>	People	Information	Facilities
<b>Management Activity</b>	Planning	Coordinating	Directing
<b>Dominant Force</b>	Aerospace	Aerospace	Ground/Naval
<b>Type Courage</b>	Civic	Intellectual	Moral
<b>Support Dependency</b>	Global	National	Theater

The strategic vision embodied in "global reach, global power" has become highly institutionalized within the Air Force and to this extent, subsequent logistics planning and doctrinal development activities have sought to include the principles of the global reach, global power vision in their operational implementation. To this end, the Air Force white paper which first codified the concept provides an important basis of understanding for subsequent doctrinal developments.

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## **Global Reach, Global Power**

Reflecting the demise of the Soviet Union and the accompanying monumental changes in the world geopolitical environment, the U.S. Air Force prudently recognized the need to develop a sound strategy for evolving itself in the face of the post cold war world. The 1990 white paper that spawned "global reach - global power" provided the Air Force with not only a general sense of direction for shaping its future, but also served as a significant marketing tool within important Capital Hill and Department of Defense circles (1:13). "Global reach - global power" became a buzz phrase indicating the Air Force's sense of place in the yet to be defined defense strategy of the fiscally constrained 1990s.

The sterling performance of airpower in the Gulf War served to lend considerable credence to the Air Force's vision of its future



role in a drastically reduced and streamlined Department of Defense. As the first of the services to put forth such a document, reflecting a strong sense of organizational direction within the new world order, allowed the Air Force to position itself favorably for the fiscal and structural challenges that lay ahead (1:13).

While explaining the "evolving view of Air Force thinking," the paper reads much like well-written Madison Avenue copy. The preeminent role of airpower in projecting future U.S. interests and, in particular, Air Force airpower, are quite naturally a recurrent theme throughout the document. Perhaps the greatest strength for the Air Force of the vision established with "global reach - global power" is that the direction therein established required few changes as the defense funding realities of the 1990s began to emerge. Over the last several years, the Air Force mission message within the defense political scene has been straight forward: "global reach - global power." The strength of the overall concept, as well the tangible public relations dividends accrued by the Air Force, has securely anchored the notion of "global reach - global power" throughout the DoD collective conscience.

For the Air Force logistician, the challenge ahead is to develop a capable logistics doctrine in light of the realities of the post cold-war era and the new Air Force vision articulated through "global reach, global power." An understanding of the depth and scope of the changes commensurate with adoption of this vision and

recognition that this vision was adopted within the framework of unprecedented changes to the world order, provides the basis for comprehending the monumental challenges facing today's military logistician.

In the absence of the Soviet Union, the United States has fundamentally won the Cold War. However, the world is no less a dangerous place, and many will argue, is made all the more dangerous by the power vacuum the former Soviet Union's departure from global politics has wrought. Within the United States, emphasis on domestic affairs coupled with a recognition of the necessity to gain control of a spiraling national debt, has placed heavy pressure on the military to cut programs and people. Yet, such cuts must be made in recognition that the world may be a more dangerous place than ever before. As the result, the logistician is challenged to maintain and sustain a credible national power projection capability through streamlines and more efficient logistics structures.



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# Global Reach - Global Power

## The USAF White Paper (Excerpt) (4: ALL)

Reflecting the demise of the Soviet Union and the accompanying monumental changes in the world geopolitical environment, the U.S. Air Force prudently recognized the need to develop a sound strategy for evolving itself in the face of the post cold war world. The 1990 white paper that spawned "global reach - global power" provided the Air Force with not only a general sense of direction for shaping its future, but also served as a significant marketing tool within important Capital Hill and Department of Defense circles.<sup>1</sup> "Global reach - global power" became a buzz phrase indicating the Air Force's sense of place in the yet to be defined defense strategy of the fiscally constrained 1990s.

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1 Department of the Air Force. *The Air Force and U.S. National Security: Global Reach - Global Power. A White Paper*. Government Printing Office, June 1990.

2 James W. Canan. From the Sea. *Air Force Magazine*, January 1993. pp. 10-13.

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### The Air Force and U.S. National Security Strategy:

#### Global Reach - Global Power

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#### A White Paper

June 1990

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### The Threat for the 1990s

- Remnant of capable nuclear and conventional force within the former republics of the Soviet Union.
- Developing nations with increasingly large and sophisticated military capabilities.

- Continual proliferation of sophisticated weapons and technologies across the globe.
- Infringement on U.S. economic, security, or political interests by newly developed threats around the world.
- Flow of illegal drugs into the U.S.

"The combination of continued and emerging threats to national security interests, proliferation of sophisticated weapons, and reduced numbers of U.S. forces in an unstable world presents new challenges for U.S. military forces. The likelihood that U.S. military forces will be called upon to defend U.S. interests in a lethal environment is high, but the time and place are difficult to predict."

#### **The U.S. Air Force and the Evolving Security Environment**

As spelled out in the white paper, the Air Force renews its commitment to joint operations and cooperation with its sister services. The role the Air Force carves out for itself is both unique and complementary to that of the other services. The ability of the Air Force to project "aerospace power" and to effectively provide "versatile lethal force" in a myriad of conflict scenarios, "anywhere, anytime, and anyplace," in close concert with joint forces provides a sense of the force capabilities posture the Air Force is seeking to establish as the standard within the "global reach - global power" framework. The objectives of "global reach - global power" are:

- Sustain deterrence through nuclear capable forces.
- Provide versatile combat force through theater operations and power projection.

- Supply rapid global mobility through tankers and airlift.
- Control the high ground; specifically, space and C<sup>3</sup>I systems.
- Build U.S. influence through strengthening of security partners and relationships.

#### **Sustain Deterrence**

Due to the continued existence of former forces of the Soviet Union with considerable nuclear capability, it is still necessary to field and maintain a highly competent deterrent nuclear force. New strategic nuclear capabilities will continue to be explored and developed by the U.S. in order to ensure an effective deterrent capability in response to improvements in existing threats or emergence of new threats in the future.

As a consequence of the regional deterrent need to retain a flexible response option (tactical), modern theater nuclear forces and capabilities are required. Air launched capabilities within this force arena are a credible employment option.

#### **Provide Versatile Combat Force**

In contrast to the relatively stable nature of nuclear deterrent objectives despite downsizing of forces through arms-reduction agreements, significant and fundamental changes are likely within the conventional forces arena. "U.S. forces must be able to provide a rapid, tailored response with a capability to intervene against a well-equipped foe, hit-hard, and terminate quickly. The implication for U.S. forces is a requirement for fast, agile, modernized conventional capabilities."

While there have been many changes in the world political environment, the need to retain a credible conventional force capable of responding to a diverse spectrum of regional conflicts is undiminished. In addition, the possibility of future conflict with an element(s) of the former Soviet Union/Warsaw Pact cannot be entirely discounted.

### **Theater Operations and Power Projection**

The key attribute of the Air Force in the area of theater operations and power projection is its ability to bring force to bear on short notice over long distances. Speed, range, and flexibility allow the Air Force to rapidly project U.S. interests.

Key tenets of Air Force theater operations include:

- Joint/Combined Operations with Ground Forces.

The need to rapidly overcome enemy theater forces in order to secure friendly air and ground objectives dictates that joint operations with ground forces will continue to be a significant mission requirement. "Airpower's speed, range, and lethality allows rapid shifting of effects, concentrating firepower wherever the joint force commander needs it -- from close battle, across the length and breadth of the theater, to its deepest reaches."

- Presence and Direct Application of Force.

"Conventional airpower offers exceptional flexibility across the spectrum of conflict as an instrument of national resolve. The Air Force can deter, deliver a tailored response, or punch hard when required -- over great distances -- with quick response." Simply put, the Air Force can get there first, no matter how far away;

essentially putting "bombs on target" faster than any other available military response alternative.

- Complementary Air Force and Naval Operations.

The future offers significant opportunities for complementary Air Force and Naval operations. The Air Force can respond quickly in order to allow time for Navy carriers to arrive on station. Land based aircraft (Air Force) can be used in conjunction with Naval forces to significantly increase the striking power of a naval task force. Carrier based aircraft can be used in close proximity to coast (littoral area), thus freeing Air Force deep interdiction aircraft for other missions. The unique capabilities of each force allow significant advantages and opportunities for force multiplication when employed in a complementary manner.

- Special Operations and Low-Intensity Conflict.

The Air Force is committed to support for and involvement in special operations activities. This includes fielding of specialized aircraft and adaptation of existing platforms (A/AO-10 for example) to the special operations mission. In addition to the capabilities offered by its specialized aircraft, conventional Air Force activities such as air refueling, airlift, and precision attack all play an integral role in special operations. Within the area of low-intensity conflict, the Air Force will play an increasing role in counter-narcotics operations both in border surveillance and support of eradication efforts by friendly foreign nations.

### **Supply Rapid Global Mobility**

As the numbers of U.S. forces stationed overseas continues to decline, airlift will provide essential capability for rapid

deployment of contingency forces. Rapid global mobility provides the means to deploy mission essential assets in the face of reduced or absent forward presence. Airlifters will provide the means to position critical forces on short notice while sealift provides movement of stabilizing and augmenting personnel and equipment. Aerial refueling not only provides the means to deploy over great distances, but also serves as an effective force multiplier through the increased range, payload, and loiter times of supported aircraft.

### **Control the High Ground**

Space based systems offer significant opportunities and challenges. The rapid growth in technology has not only made operations within this region more feasible, but also critically important to long-term U.S. national interests.

Advantages offered by space borne systems include:

- Global Coverage.
- Relatively Low Vulnerability.
- Autonomous Operations.

With the existence of smaller force structures in the foreseeable future, space systems offer the ability to serve as effective force multipliers by extending the capabilities and coverage of more conventional U.S. forces. Command and control, surveillance, and navigation capabilities are all vastly enhanced through utilization of space positioned assets.

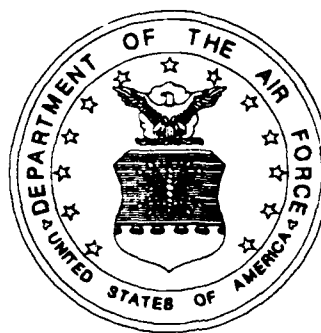
Present limitations include limited launch capacity, lack of a viable anti-satellite capability, and the need for a wide area global surveillance system. As the traditional provider of DoD space systems, the Air Force is uniquely

postured to support in future role in this area.

### **Building U.S. Influence**

Through utilization of its aerospace assets and capabilities, the Air Force is in a unique position to extend or enhance U.S. influence abroad. Security assistance is one means of strengthening U.S. security partners and enhancing U.S. influences. However, the use of Air Force aircraft, personnel, and equipment in support of humanitarian relief, counter narcotics operations, and search and rescue provide additional, and often more universally accepted, means of projecting a stabilizing U.S. influence in distant parts of the globe.

"We see a window of opportunity to become even more useful to the nation. With the Air Force's range and rapid reaction, we are prepared to meet the challenges of the future . . . to provide **Global Reach - Global Power.**"



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## Logistics Doctrine

The need to grasp a fundamental understanding of the nature of logistics in the face of the new international geopolitical and military environment gives rise to a basic revisitation of logistics doctrine. Much confusion over what constitutes the core of such doctrine and even dissension over the meaning of the word "doctrine" diminishes the ability to garner the key lessons and insights from past military campaigns and develop coherent and executable plans for the successful prosecution of future logistics efforts.

### Definitions

A straight dictionary definition of logistics and doctrine reads simply:

**lo•gis•tics** \lo-ˈjis-tiks\ *n sing or pl:* the procurement, maintenance, and, transportation of matériel, facilities, and personnel -- **lo•gis•tic** *adj* (5: 413)

**doc•trine** ˈdäk-trên\ *n* 1: something that is taught  
2: DOGMA, TENET -- **doc•trin•al** \trên-l\ *adj* (5: 217)

Lacking any eloquence or elaboration, these definitions leave us severely wanting for a cogent grasp of just what it is that logistics doctrine offers the modern logistician in the form of a framework for

determining and planning for future logistics challenges vis a vis past military experience.

Looking a few years into the Air Force's past, the 1956 edition of the *United States Air Force Dictionary* offers a tangible and lengthy definition which begins to convey the greater meaning embodied in the concept of logistics doctrine:

**logistics**, *n.* (log) [French *logis* quarters] **1.a.** In an operational sense, that part of the military activity that provides for the buildup and support of a military force by providing for supplies, equipment, transportation, maintenance, construction and operation of facilities, movement and evacuation of personnel, and other like services, so as to render the military force efficient and effective in both combat and noncombat operations. **b. Restrictive.** The furnishing of supplies and equipment. **2.** In terms of military theory, the art or science of building up a military force and of providing support by the means suggested in sense 1, including aspects of recruitment, training, and assignment of personnel; the practice of this art or science. (6: 305)

The definition is further noted and goes on:

Originally, 'logistics' was restricted to the art and practice of quartering, supplying, and transporting troops. By extension, with the increasing complexity of warfare, the term in a broad sense came to cover (a) the design and development, procurement, storage, movement, distribution, maintenance, transportation, evacuation, and disposition of *materiel*; (b) the induction, classification, welfare, training, assignment, movement, transportation, evacuation, and separation of *personnel*; (c) the acquisition or construction, maintenance, operation, and disposition of *facilities*; (d) the acquisition or furnishing of *services* (sometimes referred to as administrative support); (e) the planning and implementation involved in any of these activities.



This broad sense derives from the nature of a military force. This force consists of trained men with materiel (weapons and equipment), likewise of intangibles -- a will to endure or fight, and leadership. The process by which the physical parts of this force (materiel and personnel) are procured, made ready, transported, supplied, served, and maintained are part of the process of logistics. Since these processes are inextricably engaged with those of tactics and strategy, their manipulation and control is that of an art or science. However, since they are apart and distinguishable from the things that the force is created to do, they are not in themselves the operation. Instead they are helpmates to the operation. Cf. **infrastructure**, *n.*, note. (6: 305)

Perhaps a bit verbose by modern standards, the above definition is perhaps as complete and thoroughly couched in the military conceptualization of the meaning of logistics as any that can be found. A corollary to the definition of logistics is also found in the worn pages of the 1956 dictionary:

**logistics concept.** 1. A plan or idea on how to build up or support a military force, i.e., to provide supplies, equipment, transportation, maintenance, etc. 2. As used in military theory, a concept of war in which success in arms is considered to depend largely upon the degree of effectiveness of the logistics effort, as in 'the logistics concept made creation of huge stockpiles inevitable.' Cf. **strategic concept**, **tactical concept.** (6: 304)

Flipping a few hundred pages forward, we find that doctrine also receives an extensive treatment shared by few other concepts included in the book:

**doctrine**, *n.* A rule, proposition, or teaching that has such official sanction or authority as to be used to guide and direct those who are bound by such sanction and authority, esp. a rule, proposition, or teaching that arises from a concept (which see in

both senses). *collectively*, a body of such rules and teachings. *Specif.* 1. A teaching on the nature of a thing and on what can be done with it, which teaching is cast in the form of a proposition or propositions that are either true or false. See **basic air doctrine**. 2. A teaching on how to do something, or on what to do in a given situation, cast in the form of practical rule, command, or exhortation that normally takes policy into consideration or the propositions derived from a concept of what a thing is or of how a thing works. See **operational doctrine**. (6: 173)

Again, the definition is further noted and elaborated upon:

In sense 1, doctrine on the nature of air power or doctrine on the nature of war is true or false as the concept is true or false. In sense 2, doctrine is evolved to give guidance in particular situations, ranging from how to fight a war, or from what limitations to place upon a command, etc., to what relations should exist among the services. In evolvement of such doctrine, consideration is given both to currently accepted concepts of air power and war and to the particular plans entertained by the commander to adapt to these concepts. Doctrine in sense 1 changes only in response to a change in understanding of phenomena; doctrine in sense 2 may change with each new concept of how to do something.

It is not uncommon to regard concepts as doctrines, and in a manner of speaking they are, for the differentiation between the two is often one of aspect rather than substance, and the two, esp. in military contexts, are so much a part of each other that one cannot be considered without the other. (6: 173)

In a more modern definition, often quipped somewhat flippantly when an individual is asked to provide his or her own definition of logistics: logistics becomes getting the right people, with the right equipment, to the right place, at the right time, in the right condition, and at the right price. Regardless of which definition you prefer, success in the logistics effort is inseparable from victory in the military campaign.

## **The Role of Doctrine**

To complete the understanding of the role of doctrine in developing an effective logistics-strategy-tactics integration, Joint Publication 1, *Joint Warfare of the U.S. Armed Forces* offers the following perspectives (7: 5):

*At the very heart of war lies doctrine. It represents the central beliefs for waging war in order to achieve victory . . . . It is the building material for strategy. It is fundamental to sound judgment.*

General Curtis E. Lemay, USAF

*Doctrine provides a military organization with common philosophy, a common language, a common purpose, and a unity of effort.*

General George H. Decker, USA

*Doctrine [is] every action that contributes to unity of purpose . . . it is what warriors believe in and act on.*

Captain Wayne P. Hughes, Jr., USN  
*Fleet Tactics*

*Doctrine establishes a particular way of thinking about war and a way of fighting . . . doctrine provides the basis for harmonious actions and mutual understanding.*

Fleet Marine Force Manual 1  
*Warfighting*

## **Logistics Doctrine is Essential**

Coherent logistics doctrine can serve as the unifying basis for maintaining a capable Air Force logistics force. Logistics doctrine provides the sense of "wholeness" that offers the opportunity to counter the trend towards over specialization in the logistics disciplines and fragmentation of logistics capability. As defined previously, logistics and logistics doctrine encompasses the broadest range of Air Force activities. Under the umbrella of logistics doctrine almost everything accomplished in the Air Force other than operational tactical forces is an element of logistics.

For logistics doctrine to function as it should, as a rallying point and force for integration of the myriad of complex activities which fall under the logistics umbrella, it must be alive and functional. It must be sufficiently tangible to be grasped and understood at all levels of the force. Doctrine has to be useful, clear, and unambiguous. To be useful, logistics doctrine must provide precepts, that while not carved in stone, are not so dynamic as to become quickly obsolete. In this case, doctrine is the rosetta by which a cogent logistics capability is manifested (8).



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## **Logistics Principles**

Successful implementation of aerospace logistics doctrine in part rests on the principles providing the foundation for creation of that doctrine. The degree to which any of the following principles are observed will depend on the perspectives and beliefs of senior Air Force leadership. An Individual's point of view may cause one to dispute the exact principles which should be used to develop logistics doctrine, but the necessity of maintaining a consistent focus in developing successful doctrine dictates that such efforts cannot go far from the path defined here.

### **Objectiveness**

This establishes the practical nature of Air Force logistics. The Air Force and its logistics force function to attain stated objectives. Activities which are carried out which vary from these objectives are ultimately irrelevant to the functioning of the organization and should ultimately be eliminated. Thus, the Air Force logistics system, like the Air Force itself, should be oriented towards helping the United States attain its national objectives. Each logistics function should be directed towards the goal of assisting in obtaining these national objectives. For the Air Force logistician, all activities and decisions should be focused on creating and obtaining the requisite military capability to fulfill stated national objectives (8).

## **Equivalence**

Logistics must be established as equivalent to Air Force strategic and tactical efforts. The three are coequal. To allow any one to dominate another diminishes the effectiveness of all. The same relationship holds true for activities comprising the Air Force logistics system. All logistics activities must share a common level of relevance. While specific activities may at times have to dominate the moment, in whole, equivalence assures that no part of the total system is neglected to the eventual detriment of United States warfighting capability (8).

## **Flexibility**

Especially relevant in today's rapidly changing defense environment, flexibility ensures adaptability to change in missions, objectives, strategy, tactics, or resources. Both systems and personnel must be flexible. Over specialization should be avoided where it limits adaptability (8).

## **Responsiveness**

The logistics system must be responsive to customers' needs and able to rapidly accommodate evolutionary requirements. The logistics system must operate through the eyes of the user. Needed resources have to be provided in the right quantity, at the right time, in the right configuration to meet user requirements (8).

## **Economy**

It is a fact of life that resources are limited. National resources are applied to a diverse range of programs, uses, and needs in the service of an equally diverse range of national objectives and interests. A prime goal of the Air Force logistics system must be to deliver and apply needed resources as efficiently as possible. Cost versus benefit tradeoffs must be carefully analyzed to ensure that resources are wisely spent, but that the asset delivered by the logistician meets the warfighting needs of the user (8).

## **Manageability**

Careful management of logistics activities is extremely important to the interests of the United States. The resources included within the Air Force logistics system represent a considerable national investment that must be wisely managed. The implications of so called "logistics logistics" must be carefully weighed and in no case allowed to interfere with the United States ability to project a capable combat force. The many elements of the logistics system must be carefully managed in consideration of the overall objectives and needs of the system and its very reason for being, that is, providing for the creation and sustainment of U.S. combat power (8).



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## Logistics and Combat Power

Although it is operational activities which ultimately express a nation's military might, logistics contributes to deterrence and warfighting capability by providing the means to successfully wage war. To this extent, the role of logistics in peacetime is meshed with the wartime role in that the ultimate goal in either case, is to provide a viable base from which preparedness for war, or ultimately, waging of a military campaign can be accomplished.

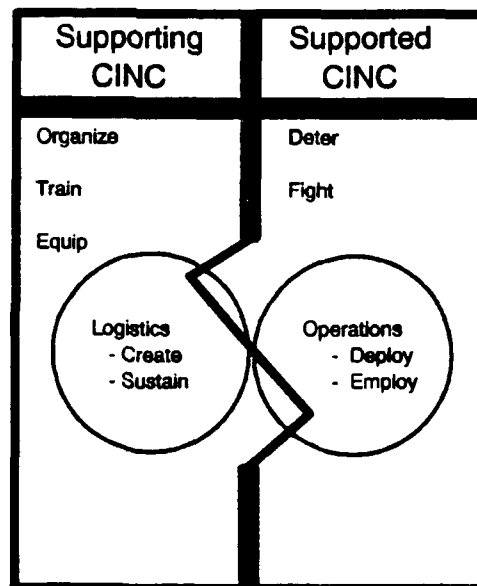
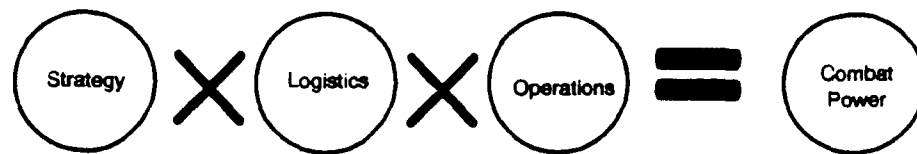


Figure 6. Logistics and CINC Responsibilities (3: 1-1)



The full potential of a fighting force's combat power cannot be achieved when operational (tactical) considerations are meshed with logistics considerations under the umbrella of a coherent campaign strategy. Neither the best strategy, nor a shallow operational capability will long sustain a campaign if the underlying logistics structure is not sound.

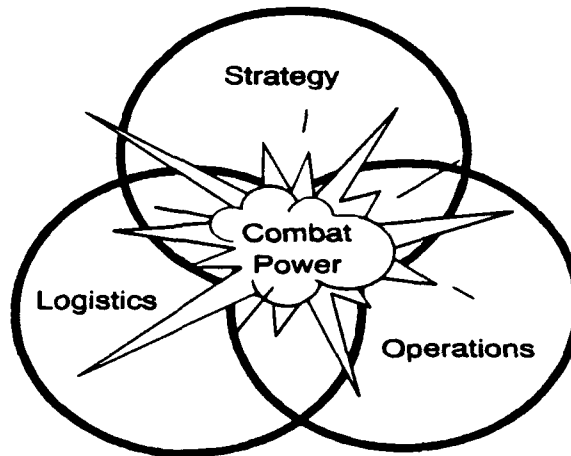


**Figure 7. Combat Power Equation (3: 1-2)**

Logistics, strategy, and tactics (or operations) form a functional triad which serves as the basis for establishing credible force projection capability. This triad serves not only as the basis for initially projecting power to a distant theater in the first instance, but means power projection on its broadest sense. Thus, power projection includes the ability to sustain a force during combat operations. History is replete with examples of unsuccessful campaigns where attrition and a defective logistics infrastructure worked together to defeat a once potent adversary (9: 142 - 175).

The combat power triad is a fundamental tenet of logistics doctrine. Logistics, strategy, and tactics are so linked as to be inseparable.

No single element is effective without the other. The principle of equivalence is manifested through the conceptualization of the power triad.



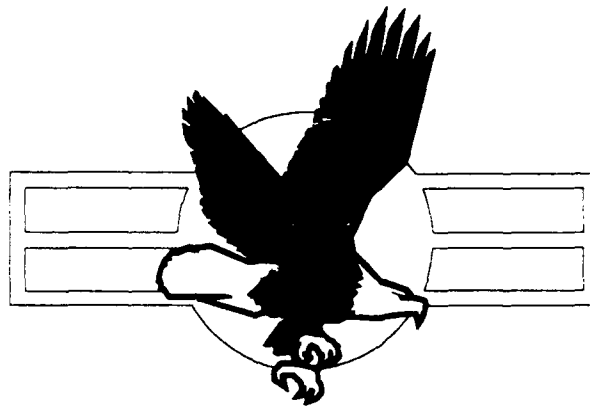
**Figure 8. The Combat Power Triad (3: 1-2)**

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## **Logistics Doctrine and the Future**

As of this writing, the Air Force is moving forward in attempting to codify logistics doctrine into a new, viable document that will achieve the majority of the objectives and goals related here. It is an endeavor of extraordinary significance undertaken by a cadre of dedicated individuals with genuine motivations. However, the ultimate product of their hard work is being forged in an environment of dynamic change and structural upheaval. The success of their effort will be proved out over the course of years as the Air Force successfully adapts to its new environment and builds on its experiences in conflicts such as the Gulf War. It is an

extraordinary challenge that will fundamentally affect the Air Force and her role in supporting United States national objectives. It is a challenge that logisticians must meet with enthusiasm and dedication for the stakes are very high indeed. Given the caliber and dedication of the men and women of the Air Force today, it is also a challenge which we believe that the Air Force will ultimately conquer without fail.



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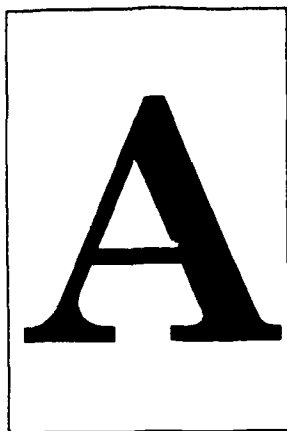
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## **Appendix**

# **Photograph Captions**

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## **Operation Urgent Fury (Grenada)**

### **Page**

197. Members of the 82nd Airborne Division boarding a C-141 for transportation to Grenada. Photo by Tech. Sgt. M. J. Creen (Official U.S. Air Force Photo)
198. Servicemen gathering their gear after landing at Port Salines in Grenada. (Official U.S. Air Force Photo)
199. Airlift Control Element personnel working in the control center in Grenada. (Official U.S. Air Force Photo)
200. American students boarding a C-141 for evacuation from Grenada. Photo by JOC Gary Miller. (Official U.S. Navy photo)
201. Soldier being attended to in Puerto Rico after having been wounded during Operation Urgent Fury. Photo by Tech. Sgt. M. J. Creen. (Official U.S. Air Force Photo)
202. Hot meals set up for troops during operations in Grenada. (Official U.S. Air Force Photo)
203. Heat lamps were used to keep the meals warm. (Official U.S. Air Force Photo)

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## **Operation Just Cause (Panama)**

### **Page**

204. Jeep being loaded on a MAC plane for transport to Panama. (Official U.S. Air Force Photo)

205. Air Traffic Control center set up to control traffic around Panama. (Official U.S. Air Force Photo)
206. F-117's were first used in combat during the Panama Operation Just Cause. (Official U.S. Air Force Photo)

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## **Operations Desert Shield/Storm (Persian Gulf)**

### **Page**

207. United States troops boarding a Military Transport plane for deployment to the Middle East. (Official U.S. Air Force Photo)
208. The use of Civil Reserve Air Fleet (CRAF) played an important role in deploying troops to the Gulf War. (Official U.S. Air Force Photo)
209. Several units had to deploy prior to receiving the desert camouflage uniforms. (Official U.S. Air Force Photo)
210. United States troops arriving at Saudi Arabia. (Official U.S. Air Force Photo)
211. Servicemen and their equipment are loaded onto transportation trucks and buses to be driven to their units locations. (Official U.S. Air Force Photo)
212. Heavily loaded transport ship preparing to dock at a Saudi Arabia port. (Official U.S. Air Force Photo)
213. Local nationals of the host country Saudi Arabia were helpful in working at the docks to dock and unload ships. (Official U.S. Air Force Photo)

- 214. A naval ship used to ferry trucks to the Gulf. This type of ship normally is a carrier for helicopters. (Official U.S. Air Force Photo)
- 215. Heavy equipment in queues waiting to be loaded on the ship for transport to Saudi Arabia. (Official U.S. Air Force Photo)
- 216. Trucks and trailers are loaded onto the transport planes through the tail section turned ramp. (Official U.S. Air Force Photo)
- 217. Tanks and trucks waiting at a United States port prior to being loaded onto the transport ships. (Official U.S. Air Force Photo)
- 218. Tanker trucks loaded and positioned on the ship used to take them to the Gulf. (Official U.S. Air Force Photo)
- 219. Loaded ship ready to head off to the gulf. (Official U.S. Air Force Photo)
- 220. Crane from the ship showing how tanks are loaded for transportation. (Official U.S. Air Force Photo)
- 221. A floating crane is used to unload a tank at a Saudi Arabian port. (Official U.S. Air Force Photo)
- 222. Trucks are driven directly into the hull of the transport ship. (Official U.S. Air Force Photo)
- 223. Ammunition is spread out all over the desert sand prior to dispersal to the units. (Official U.S. Air Force Photo)
- 224. Chemical gear worn during threats of chemical warheads coming from the Iraqi Scud launches. (Official U.S. Air Force Photo)

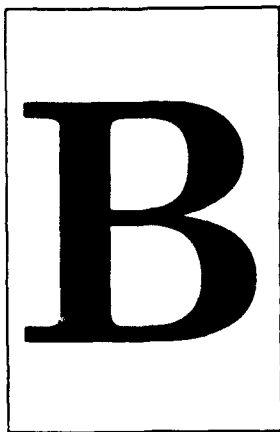


- 225. Chemical gear worn by the troops when the threat of a chemical weapon being used against them. (Official U.S. Air Force Photo)
- 226. Patriot Missile launcher. (Official U.S. Air Force Photo)
- 227. Patriot Missile being fired. This type of missile was successful in intercepting Scud missiles launched from Iraq. (Official U.S. Air Force Photo)
- 228. Members of the coalition force looking for buried land mines using wooden sticks to locate the mines. (Official U.S. Air Force Photo)
- 229. Helicopters at a forward location are refueled from another helicopter. (Official U.S. Air Force Photo)
- 230. Lack of sand to fill sand bags was not a problem in the desert. (Official U.S. Air Force Photo)
- 231. Desalinization units being set up to provide fresh drinking water for the troops. (Official U.S. Air Force Photo)
- 232. Bladders were used to hold millions of gallons of water to help provide drinking water for the personnel located in the theater. (Official U.S. Air Force Photo)
- 233. Servicemen preparing to raise a tent used to house the troops while in the desert. (Official U.S. Air Force Photo)
- 234. Mini city of tents set up to house the troops during their time in Saudi Arabia. (Official U.S. Air Force Photo)
- 235. Huge mounds of sand was positioned to make a natural fence around a units location. (Official U.S. Air Force Photo)

236. Tremendous dust storms are kicked up whenever a military transport plane lands or takes off in the desert (Official U.S. Air Force Photo)
237. Helicopters had to be cleaned and wrapped prior to being loaded on a transport ship for return to the United States. (Official U.S. Air Force Photo)
238. Happy troops returning to the United States after serving in the Gulf war. (Official U.S. Air Force Photo)
239. Large Naval Hospital ships moored off the coast of Saudi Arabia. (Official U.S. Air Force Photo)
240. Training exercises conducted in the desert to prepare medical units for the handling of casualties. (Official U.S. Air Force Photo)
241. A reminder that all servicemen deployed to the gulf war did not make it back to the states alive. (Official U.S. Air Force Photo)
242. Much needed bottled drinking water being moved to take to the troops in the desert. (Official U.S. Air Force Photo)
243. Servicemen going through the chow line and receiving one of the daily hot meals provided for them. (Official U.S. Air Force Photo)
244. Box of cookies provides an extra treat as part of the meal. (Official U.S. Air Force Photo)
245. McDonalds, one of many private corporations that donated goods or services, sent boxes of chocolate chip cookies to the gulf. (Official U.S. Air Force Photo)

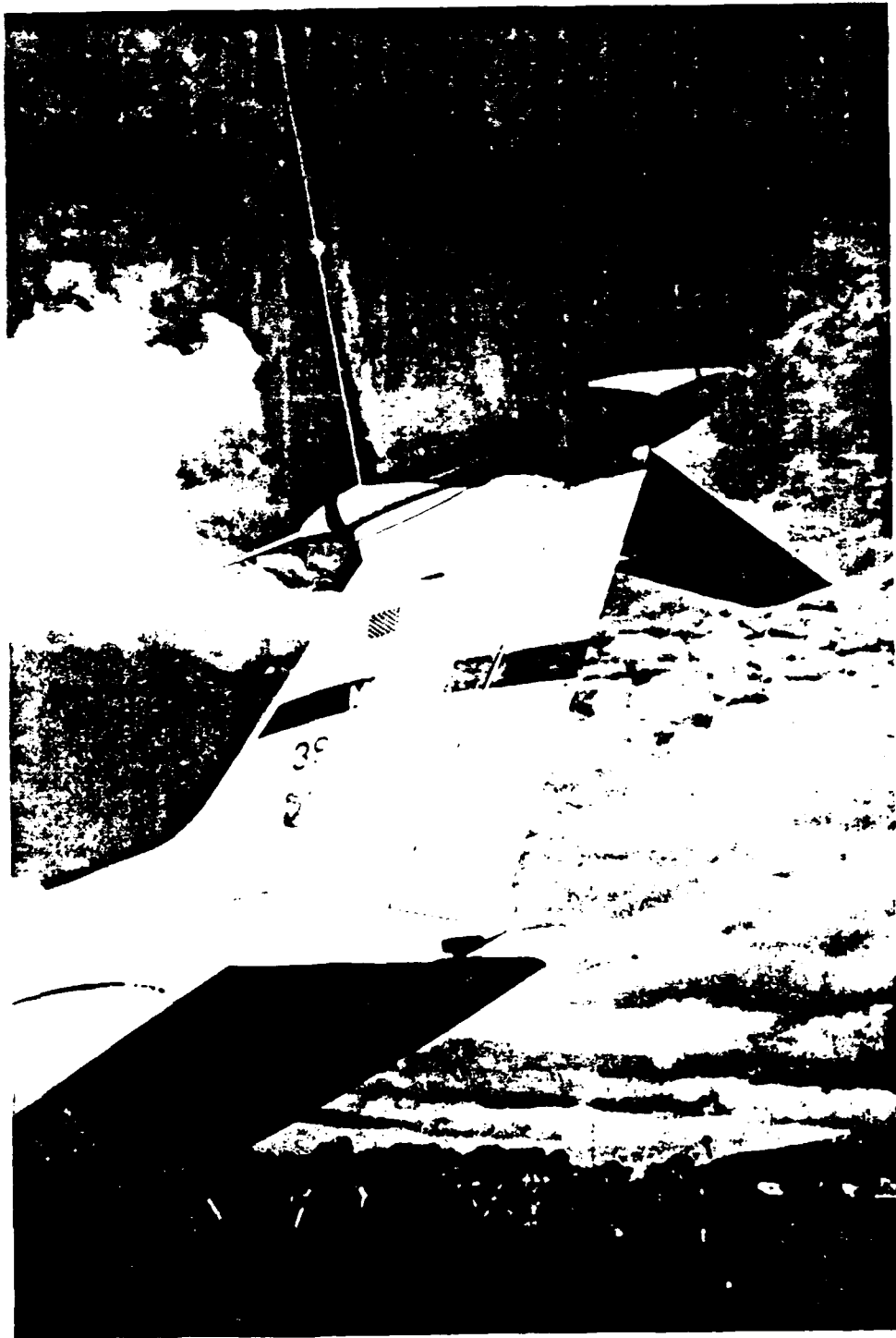
- 246. Bags of mail sent to the Gulf war to help comfort the service men and women. (Official U.S. Air Force Photo)
- 247. Large sacks of mail being loaded onto a transport plane to be taken to the troops serving in the Gulf war. (Official U.S. Air Force Photo)
- 248. Christmas gifts sent to those serving in Desert Shield / Desert Storm during the Christmas season. (Official U.S. Air Force Photo)
- 249. Tent theaters set up to entertain the troops with movies. (Official U.S. Air Force Photo)
- 250. Makeshift horseshoe pits were easy to set up in the desert. (Official U.S. Air Force Photo)
- 251. Serviceman making the best of his free time while deployed in Saudi Arabia. (Official U.S. Air Force Photo)
- 252. Barber shops like this were set up to help maintain proper grooming. (Official U.S. Air Force Photo)
- 253. Chapels were available to allow the service men and women to attend religious services. (Official U.S. Air Force Photo)
- 254. C-5's from the Military Airlift Command (MAC) were used to transport heavy equipment to the theaters. (Official U.S. Air Force Photo)
- 255. Four wheel drive all terrain vehicles used to get around on the sand with ease. (Official U.S. Air Force Photo)
- 256. Troops transported by Navy ships disembark on the beach and ready to move out to their specific locations. (Official U.S. Air Force Photo)

257. Trucks, as well as other type of equipment, needed to be cleaned before they could be returned to the United States. (Official U.S. Air Force Photo)



## **Appendix**

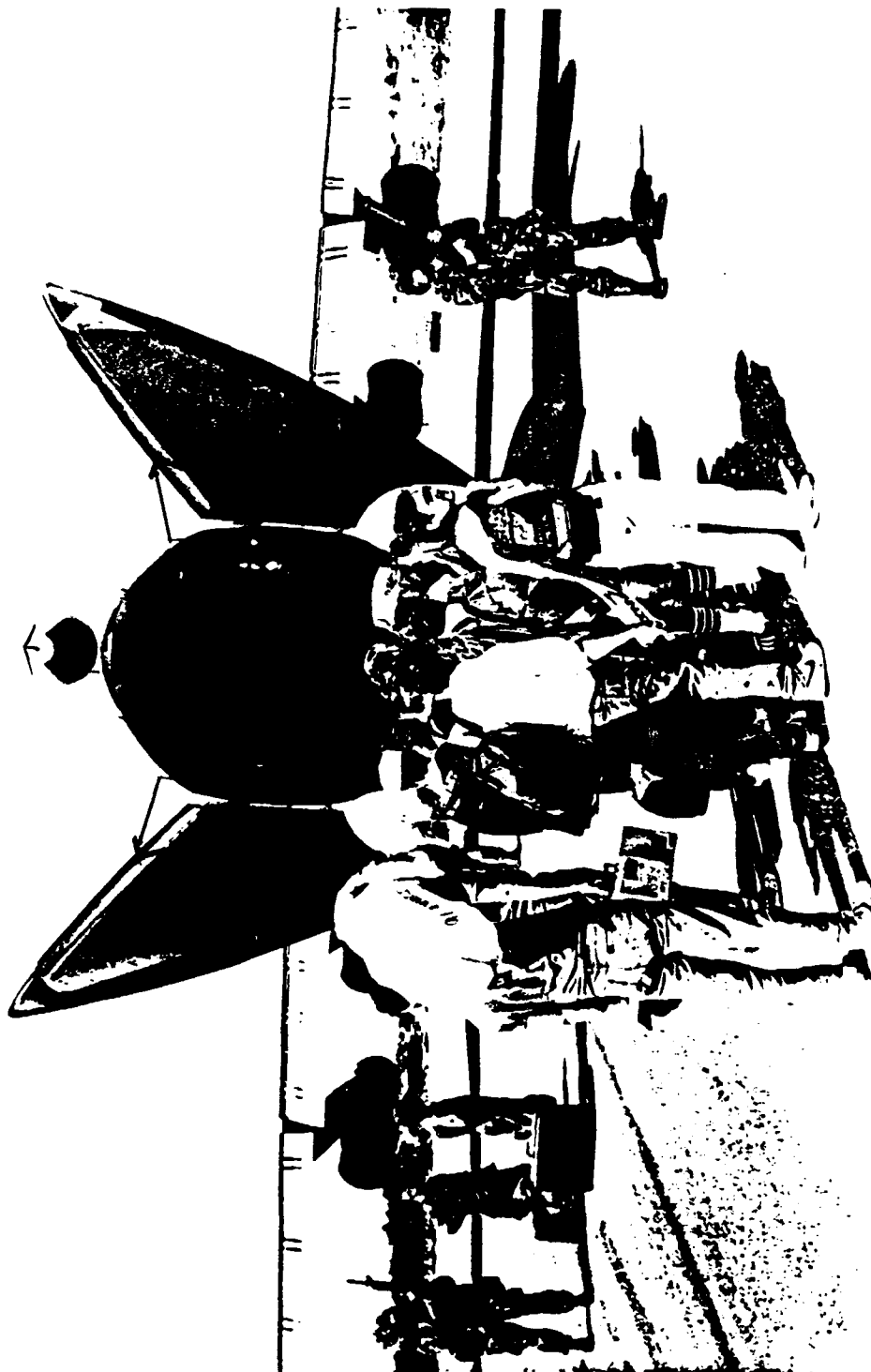
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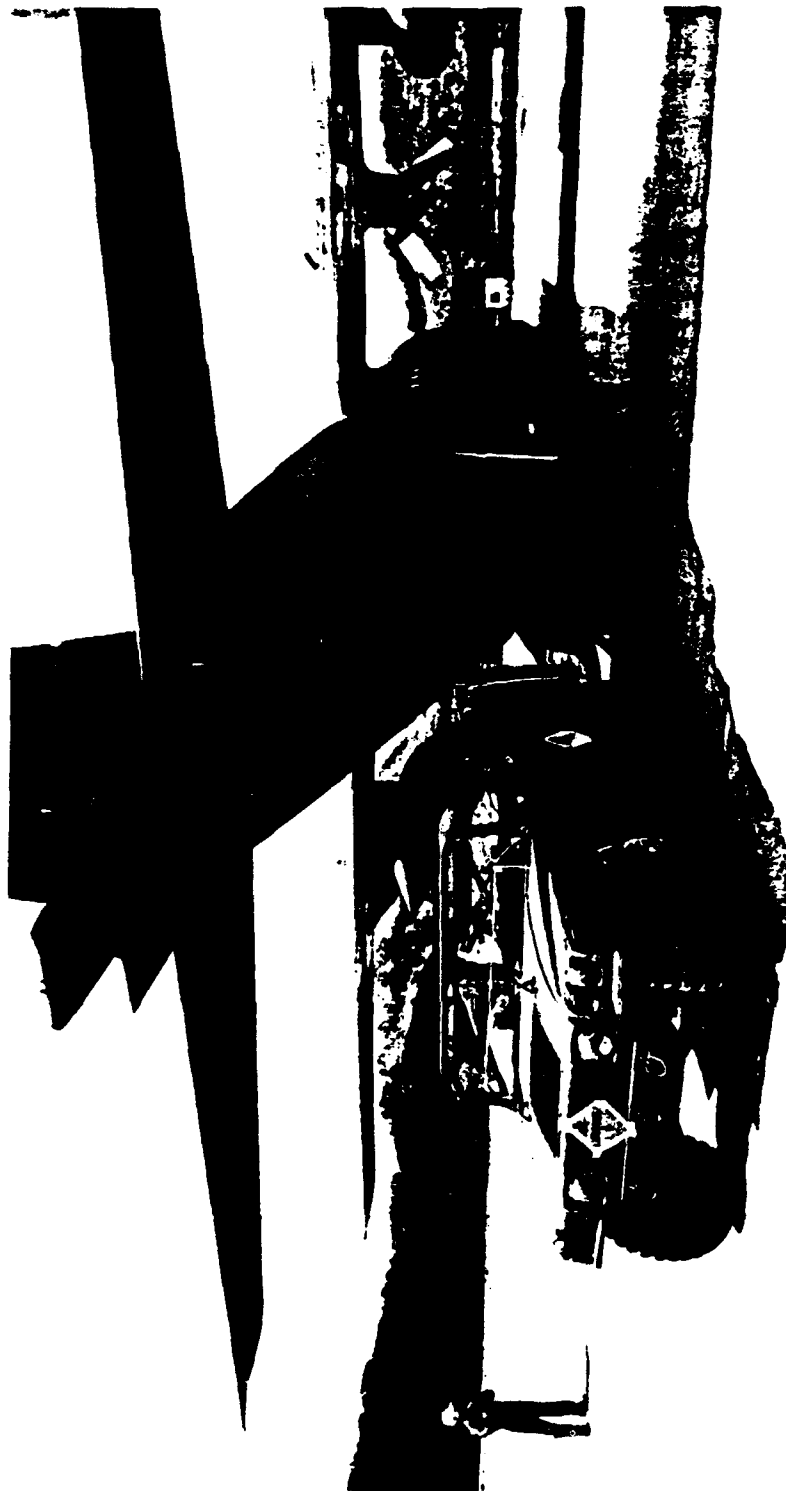






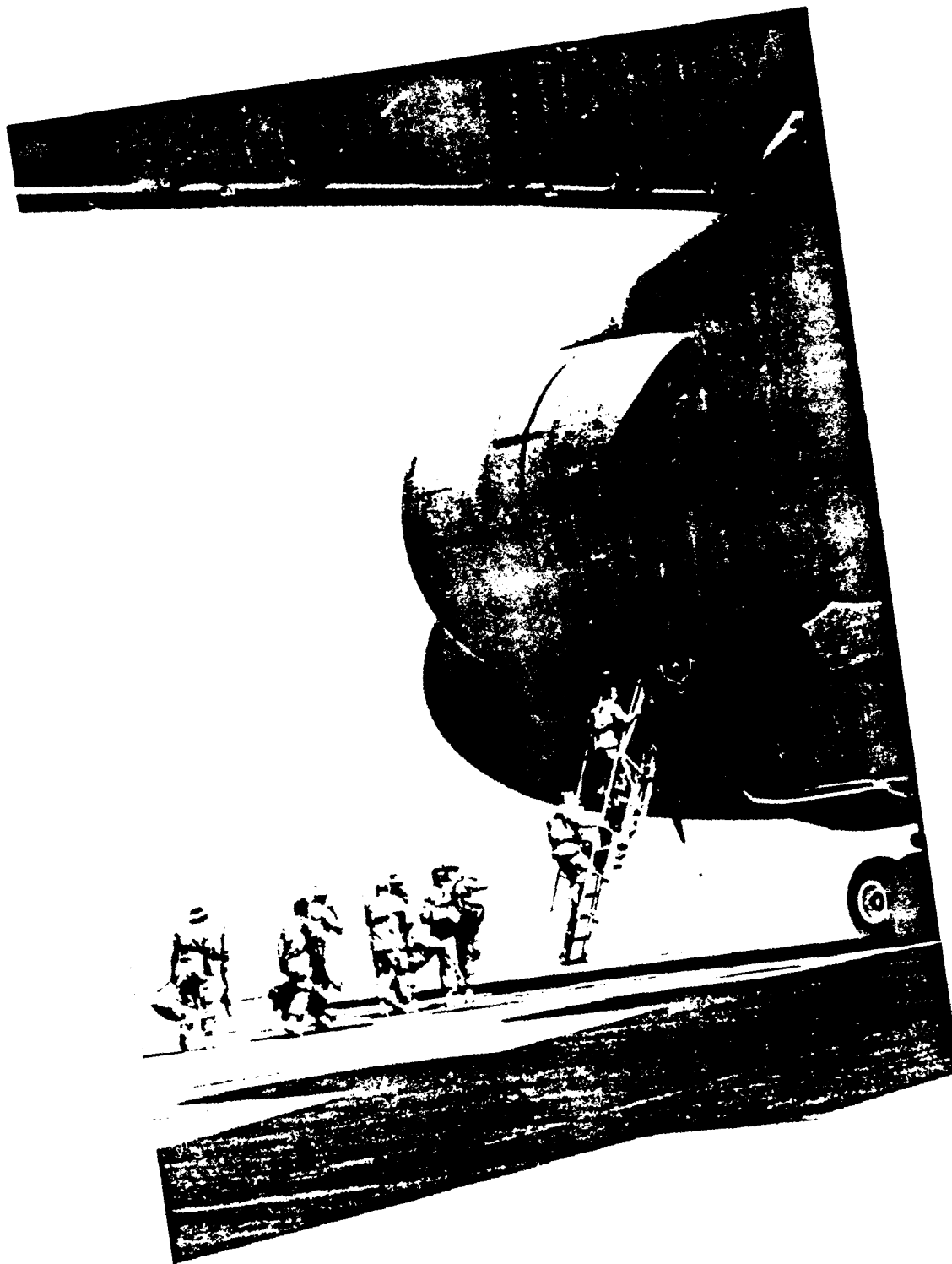
















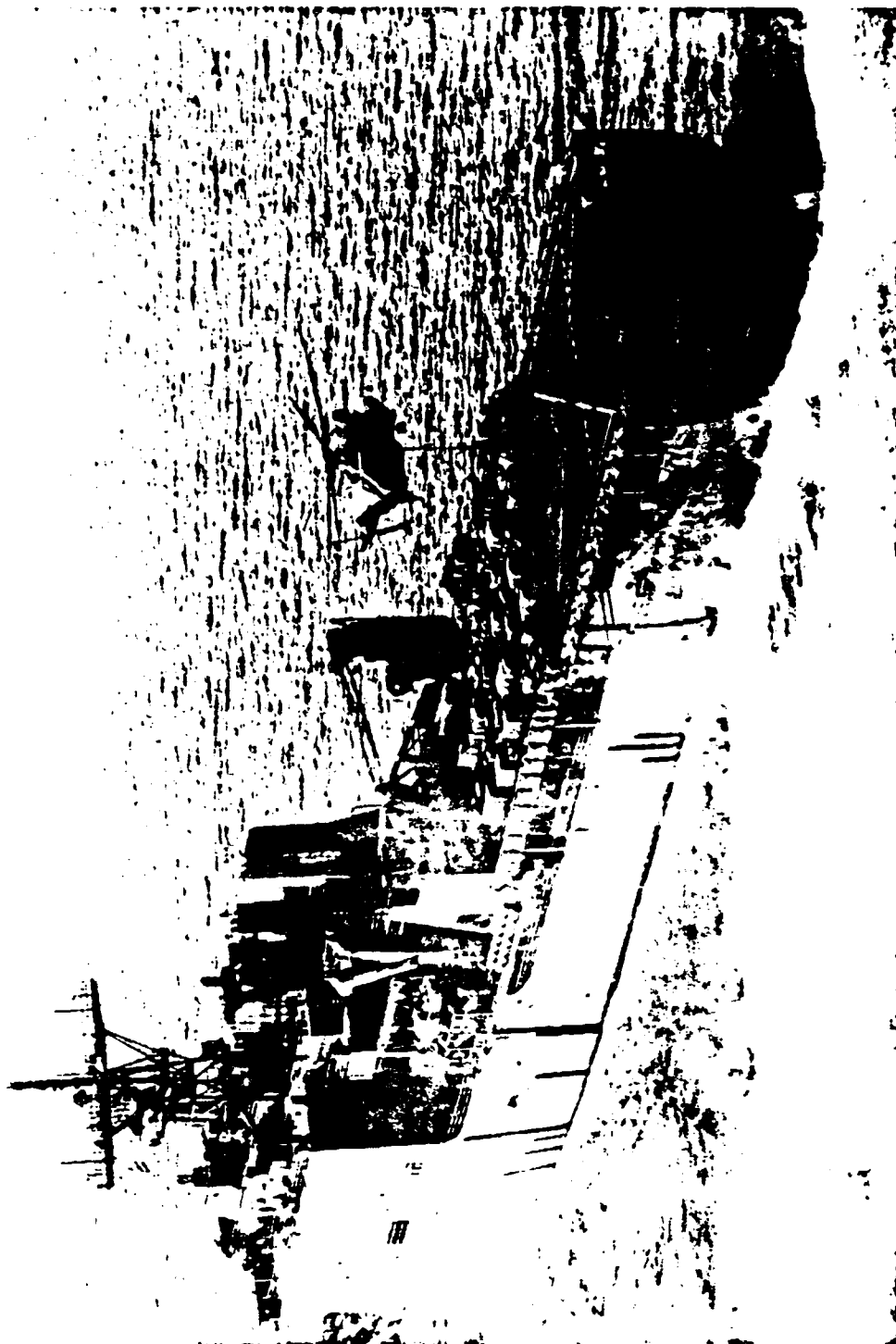








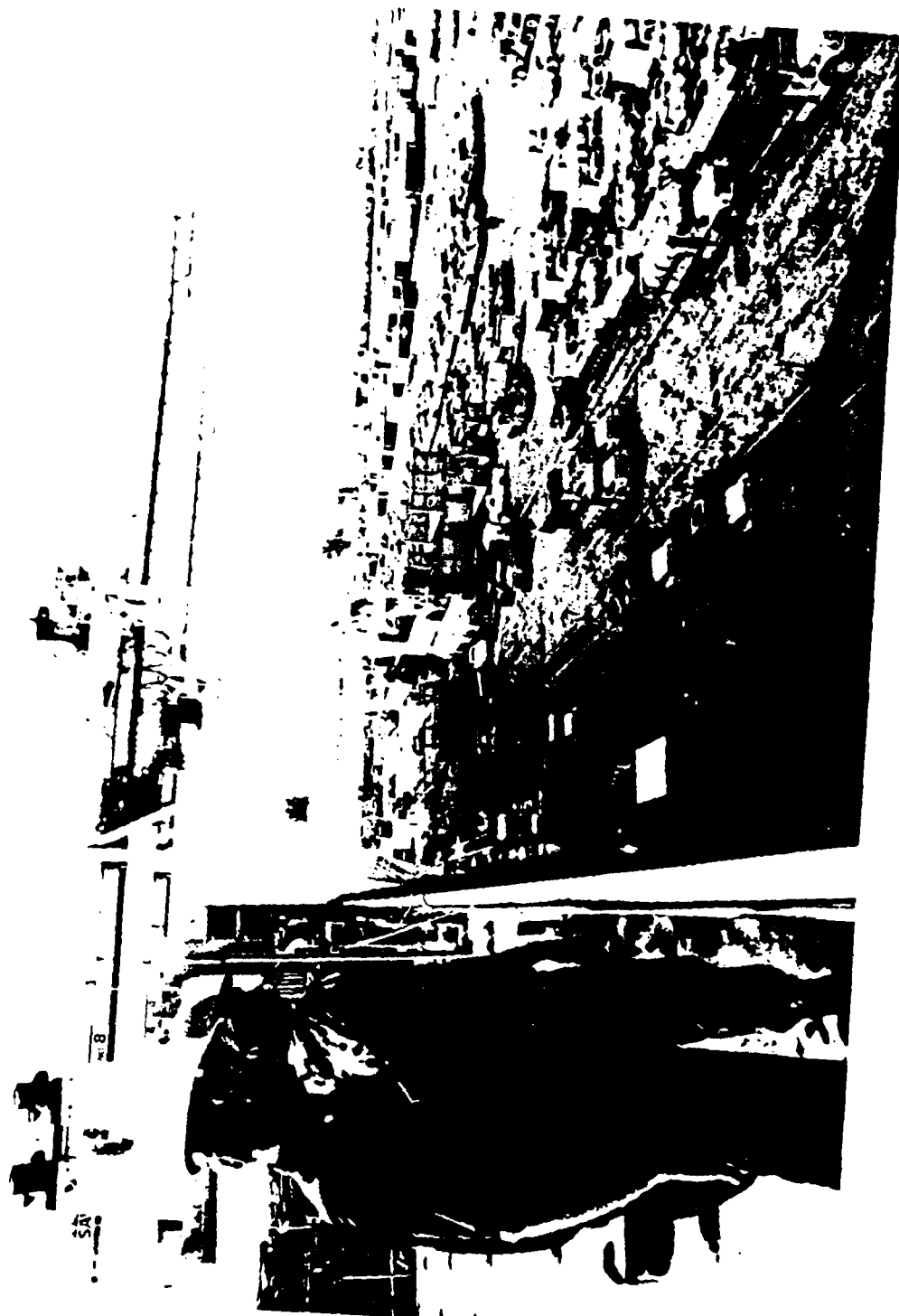




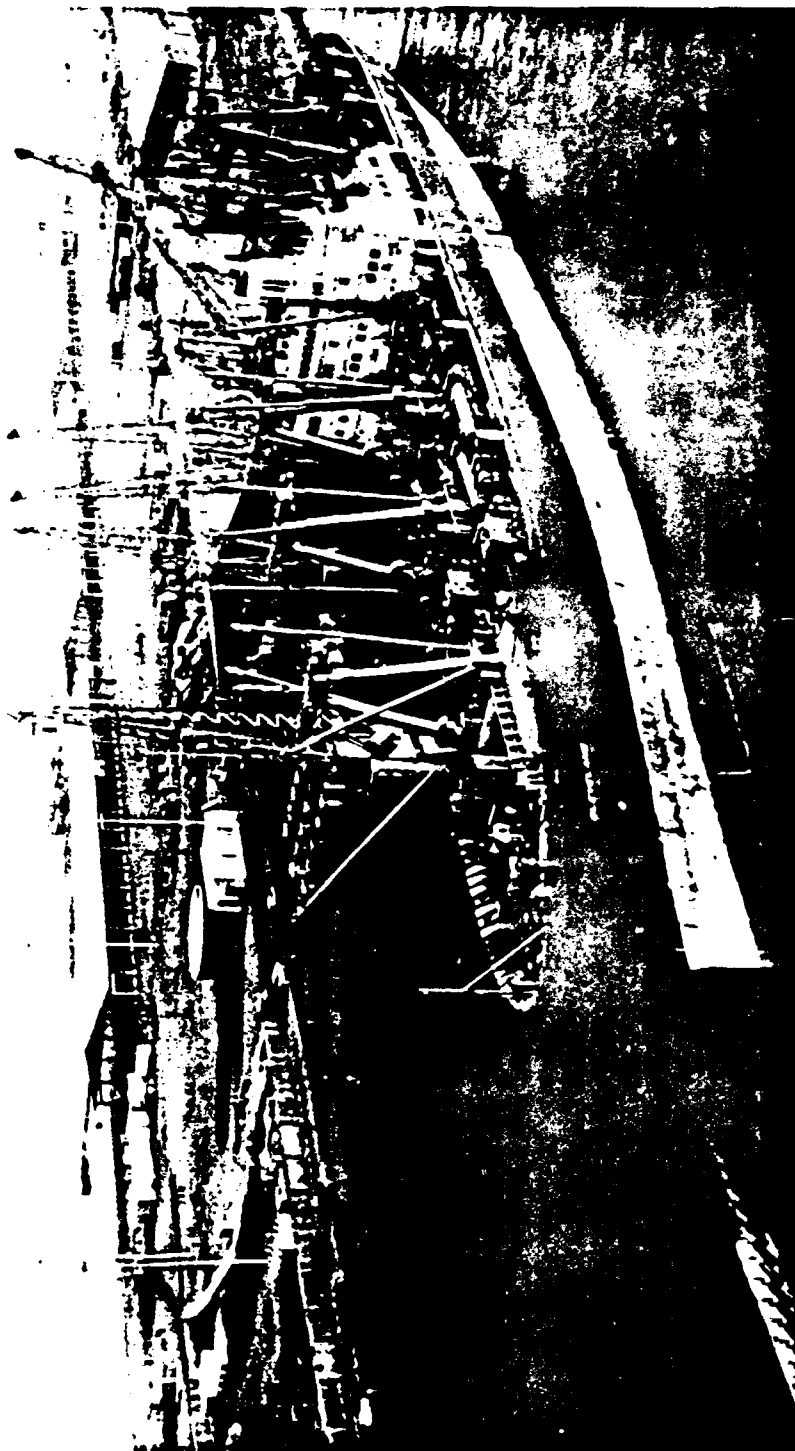


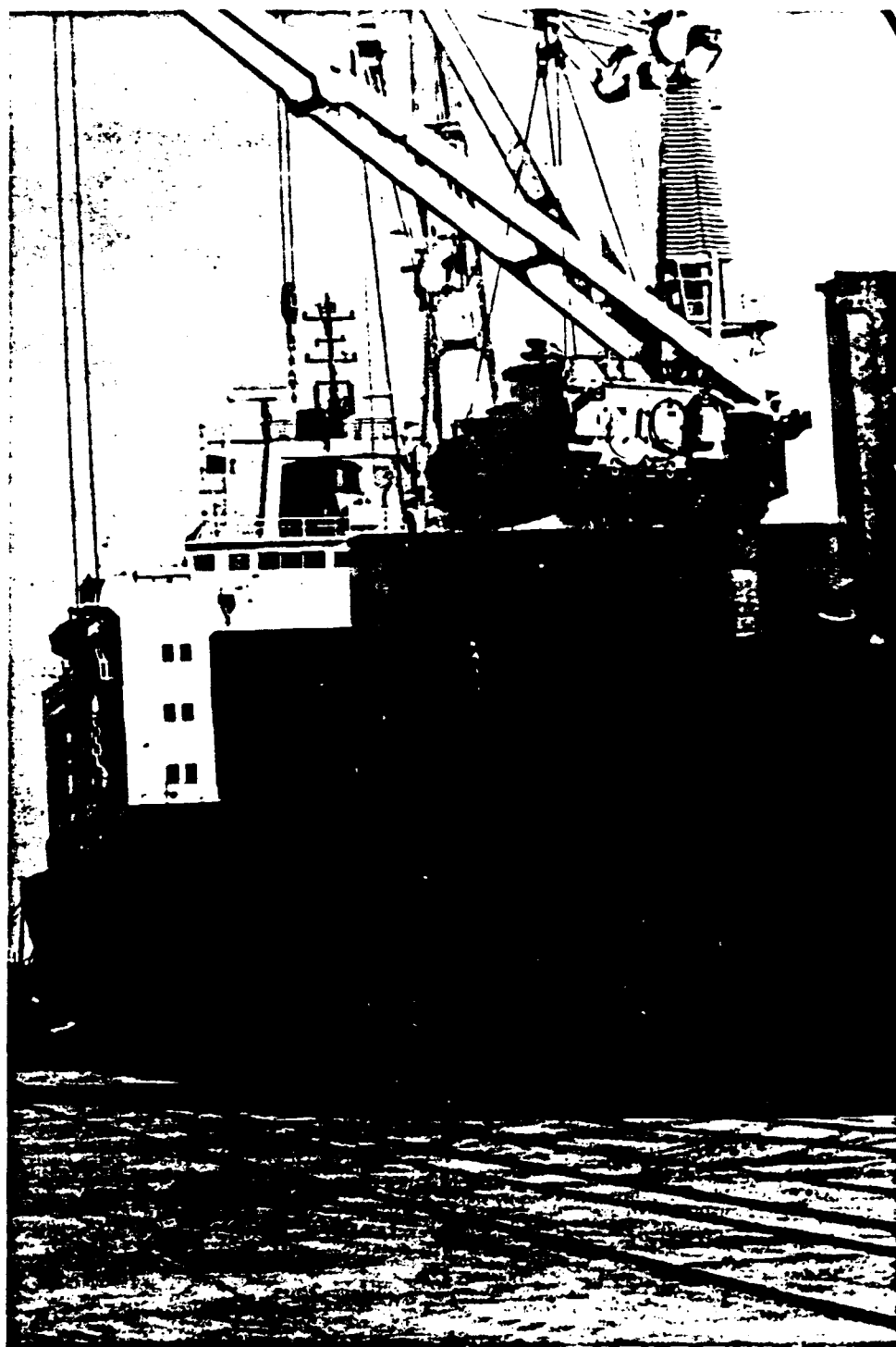


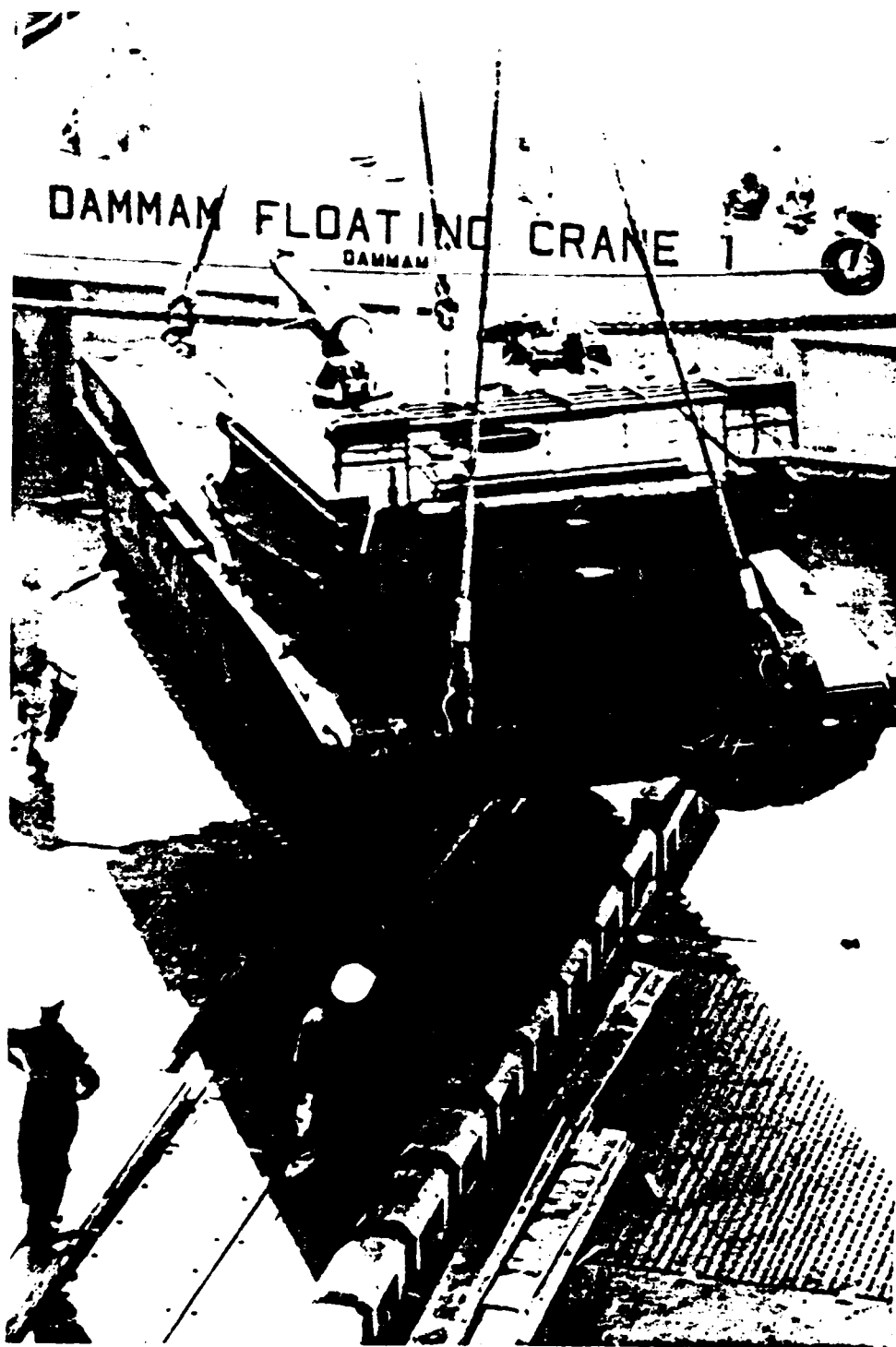


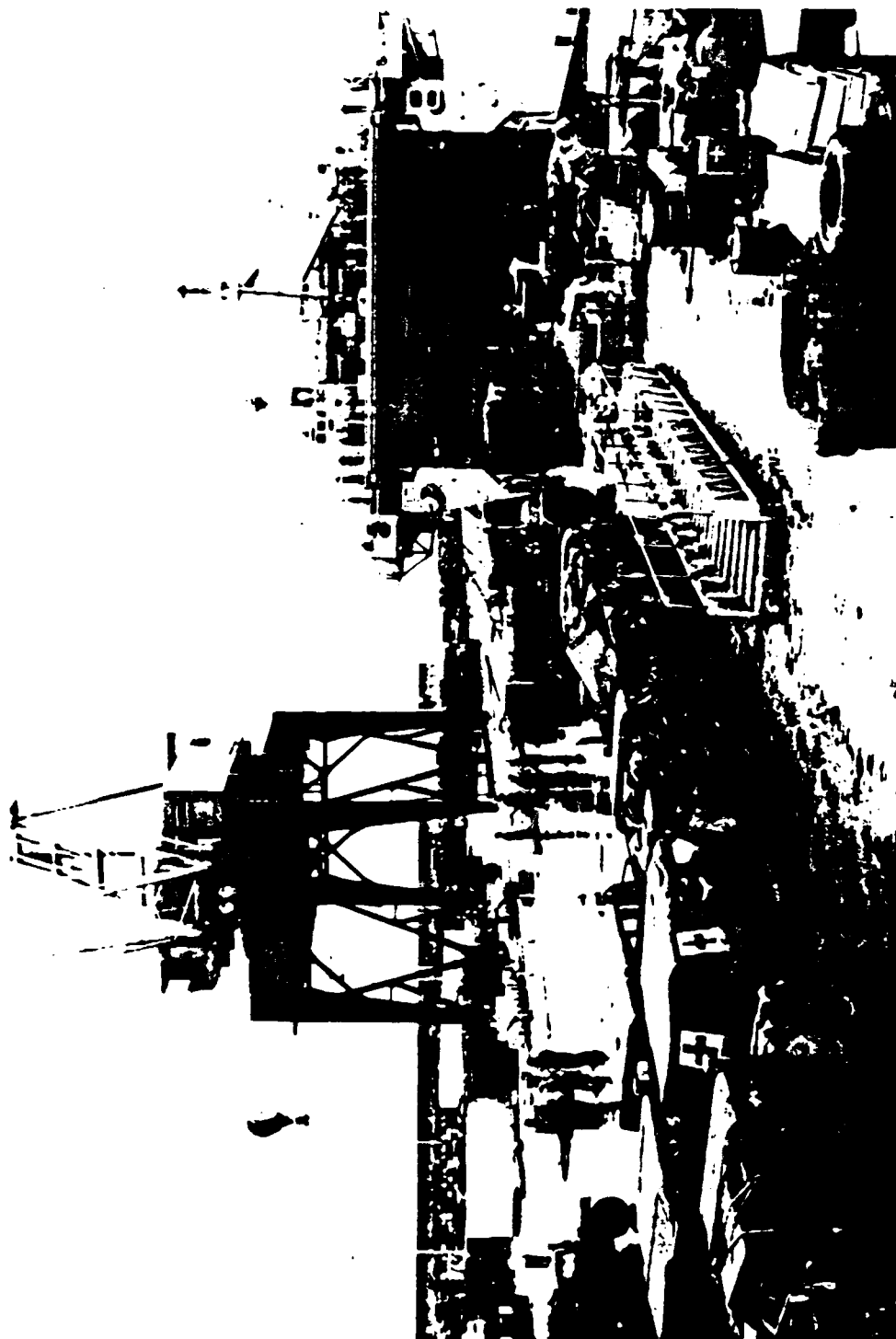








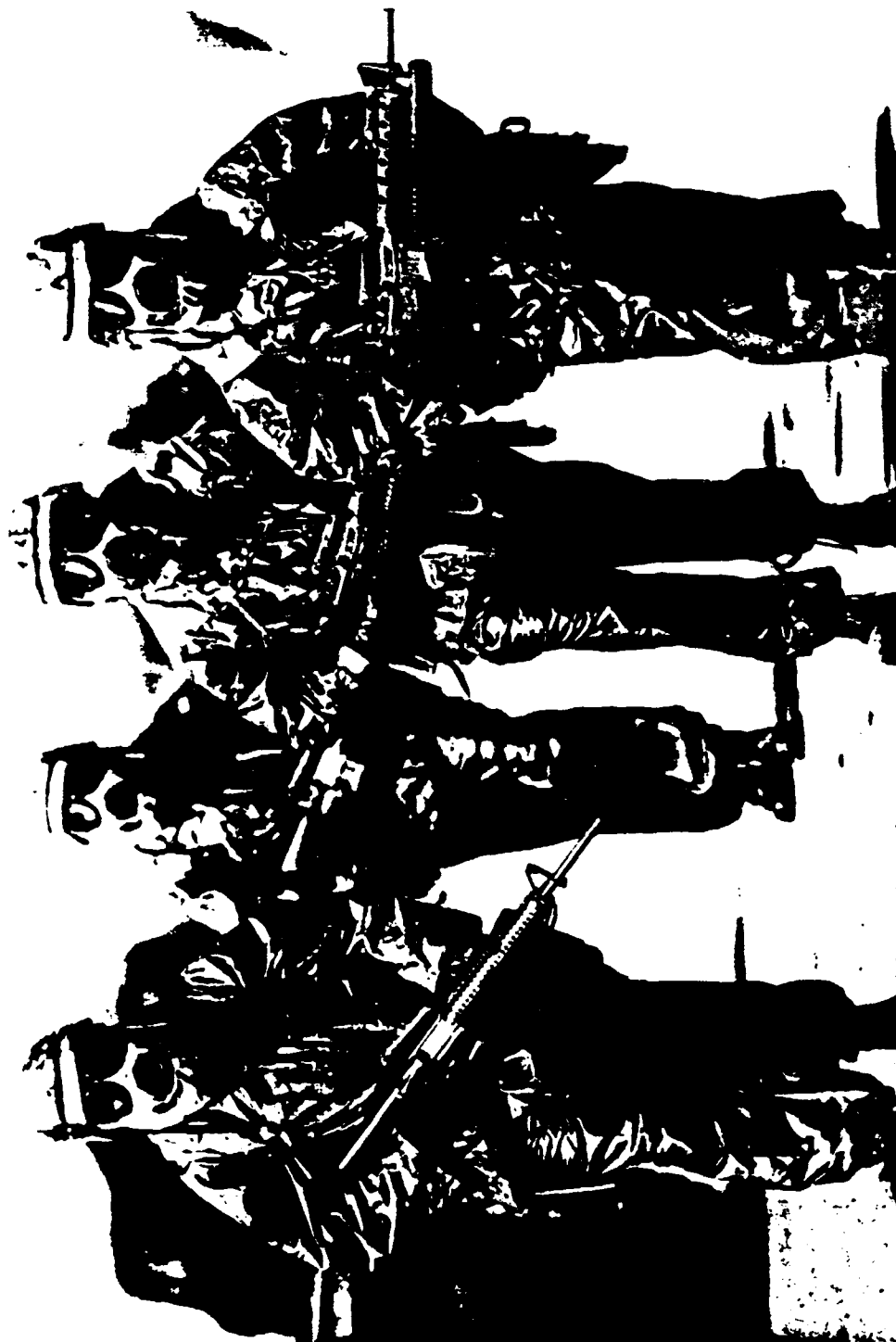


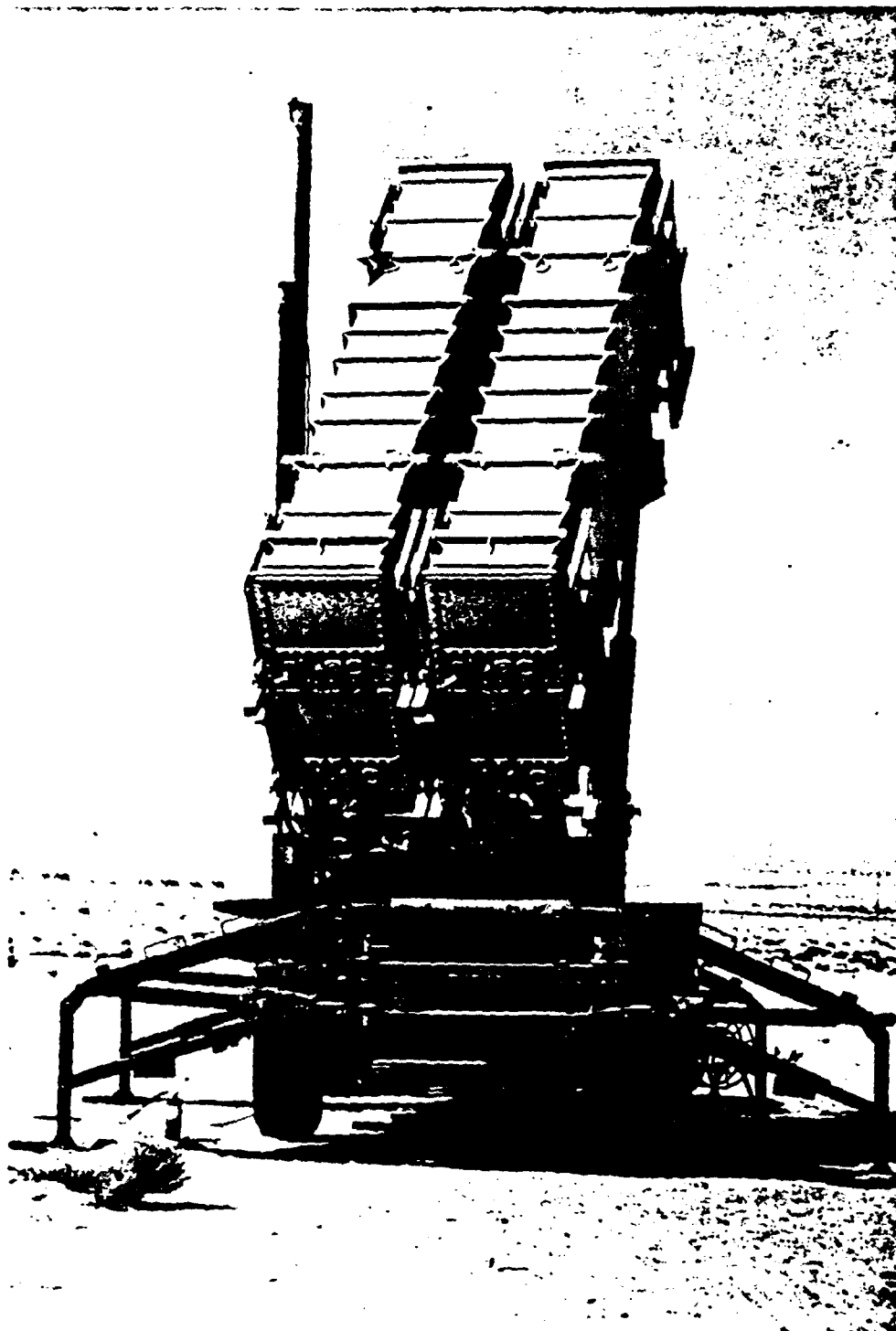






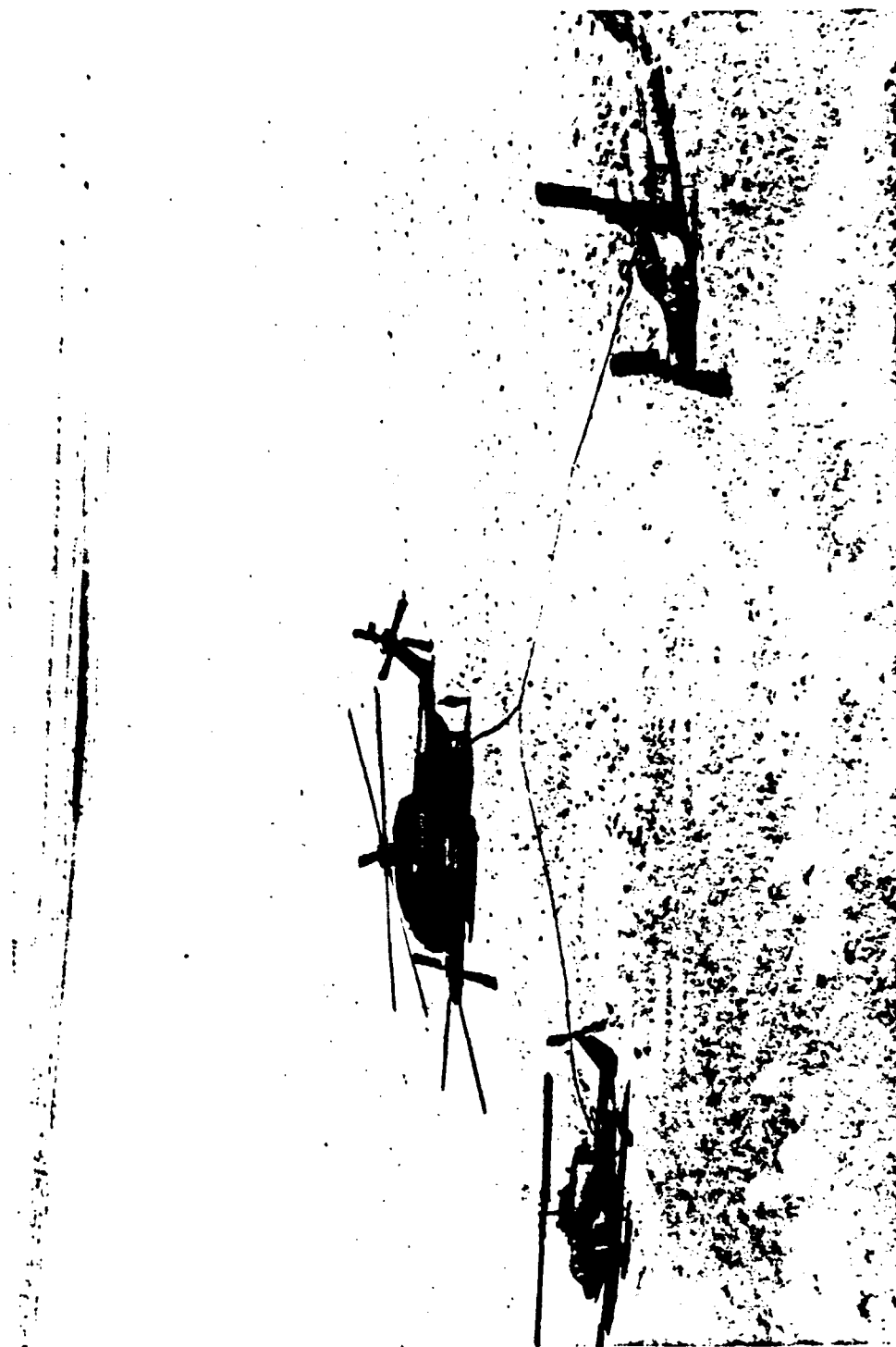
















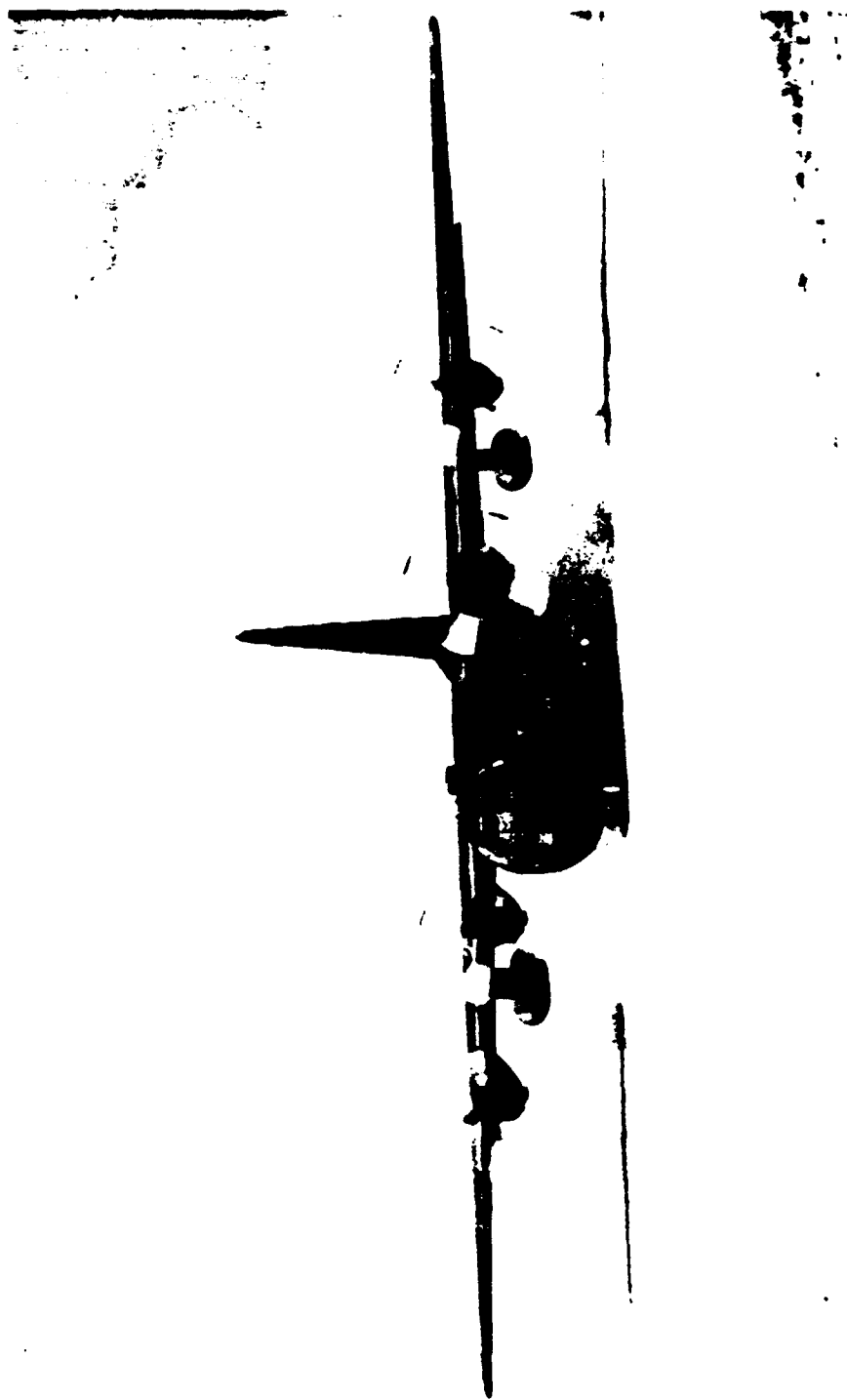




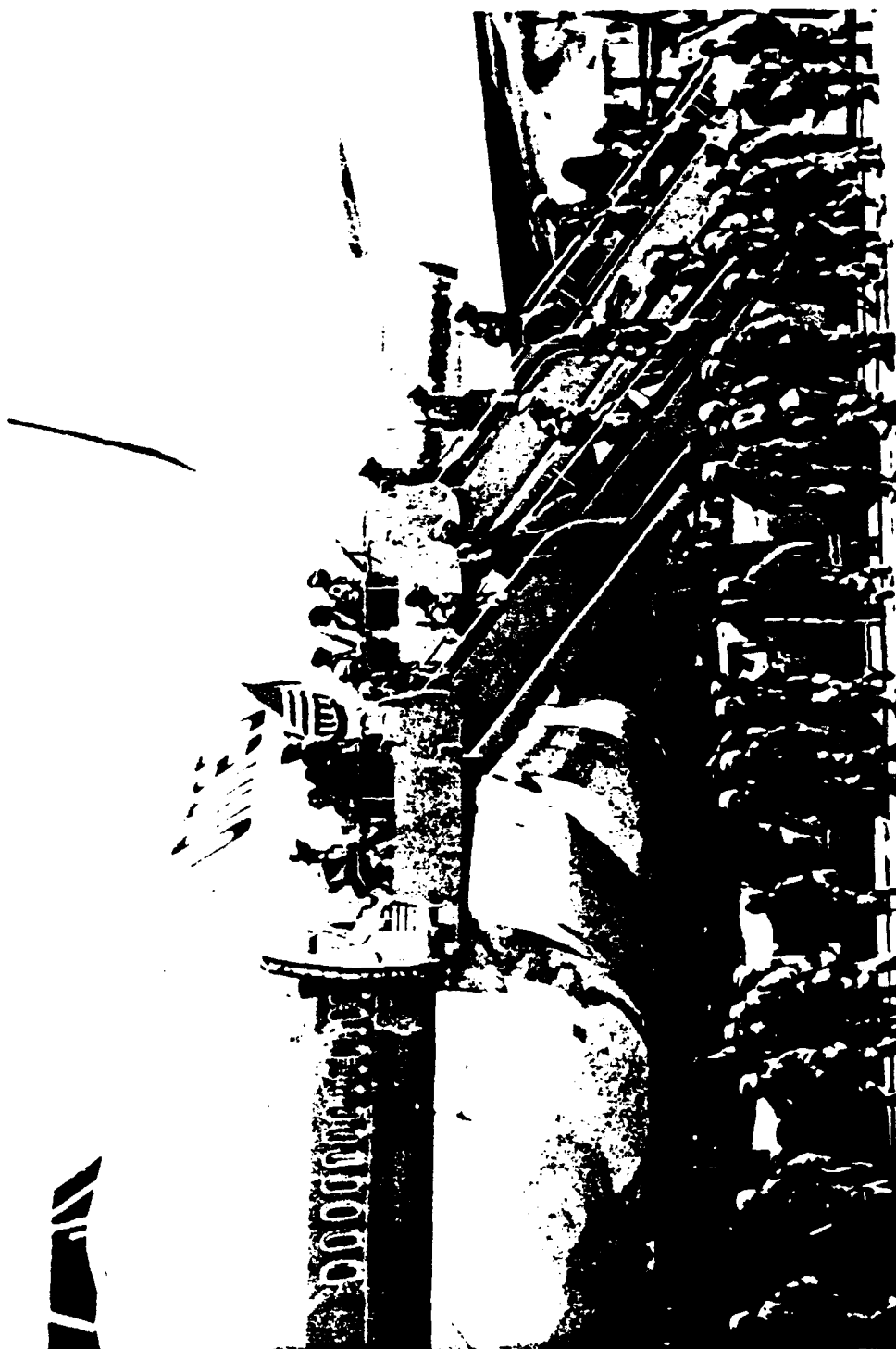


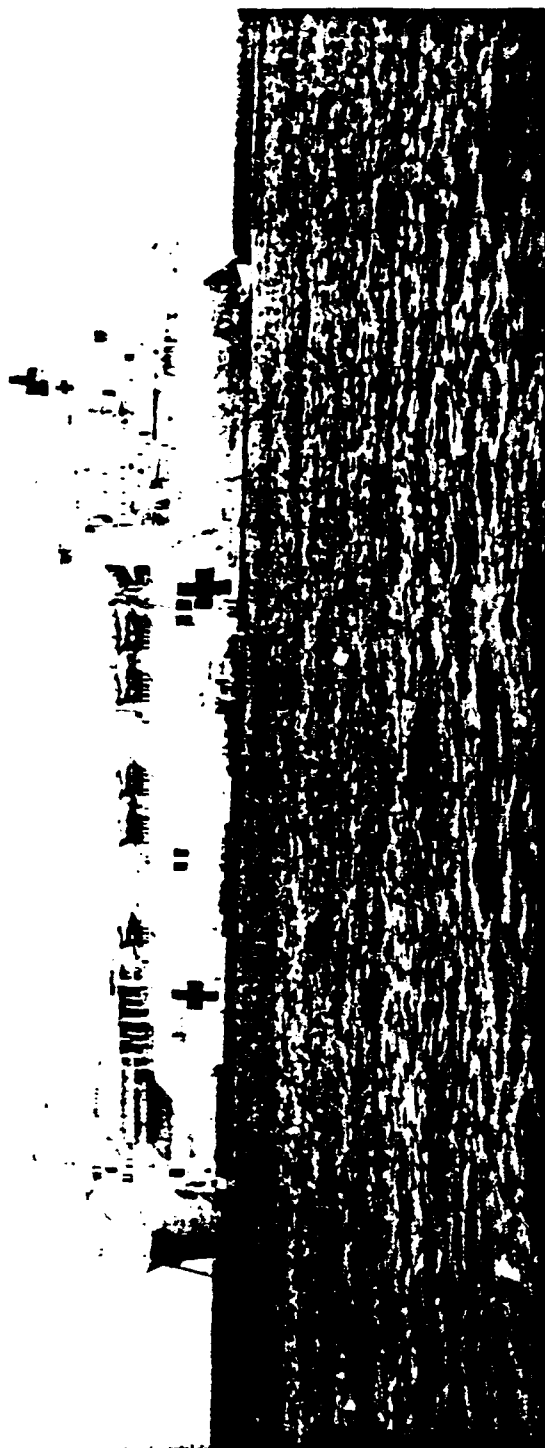




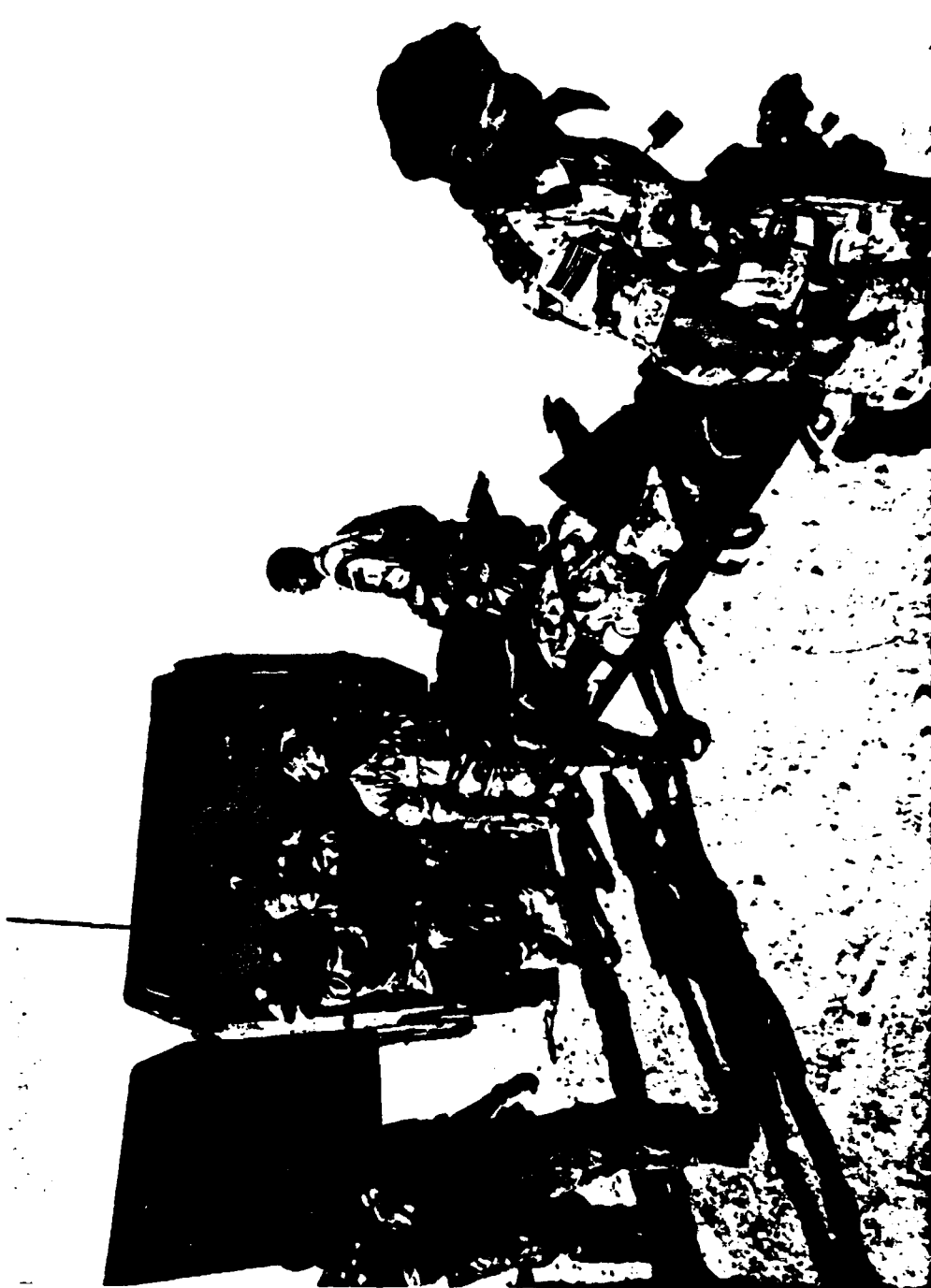


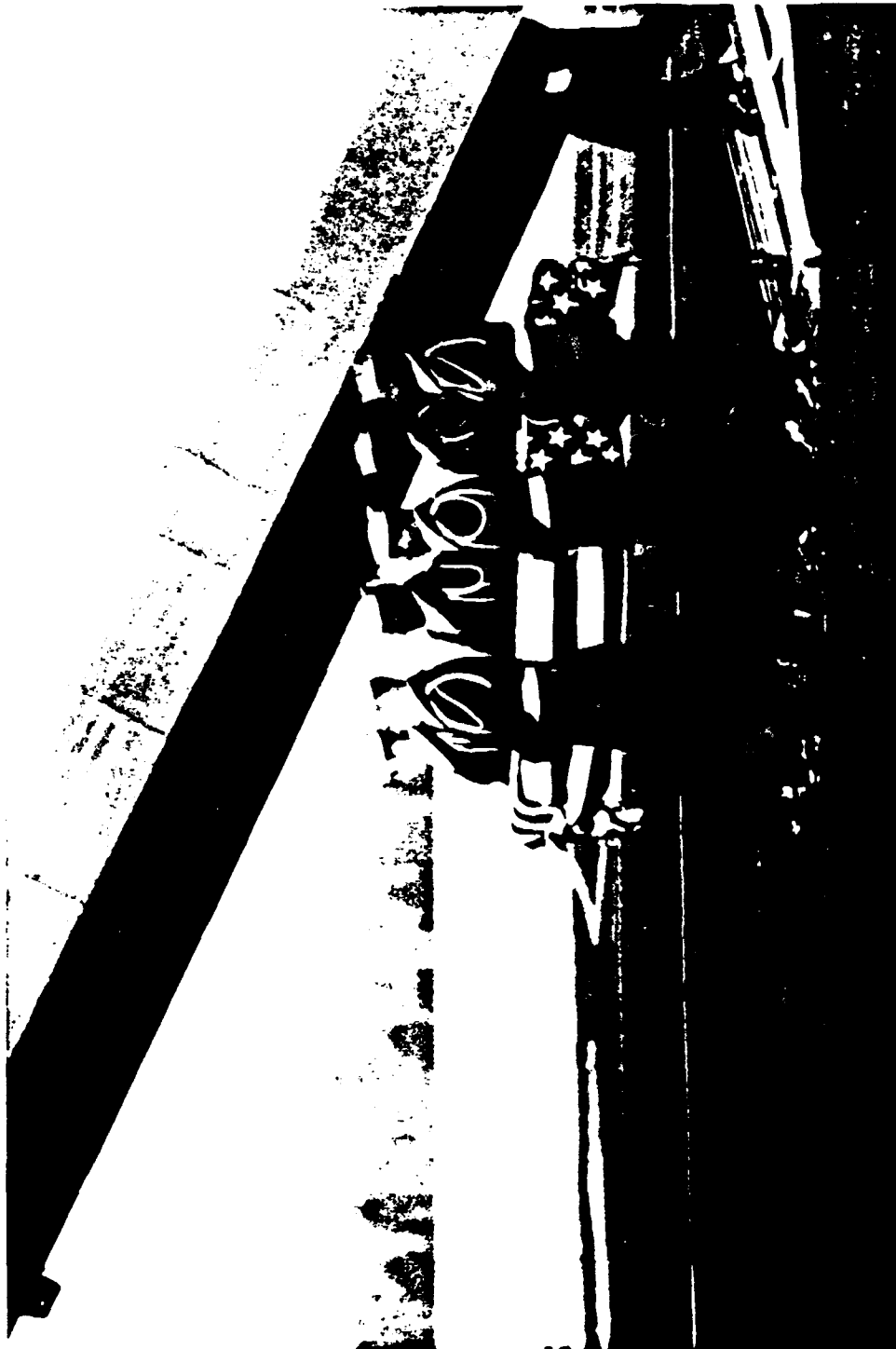


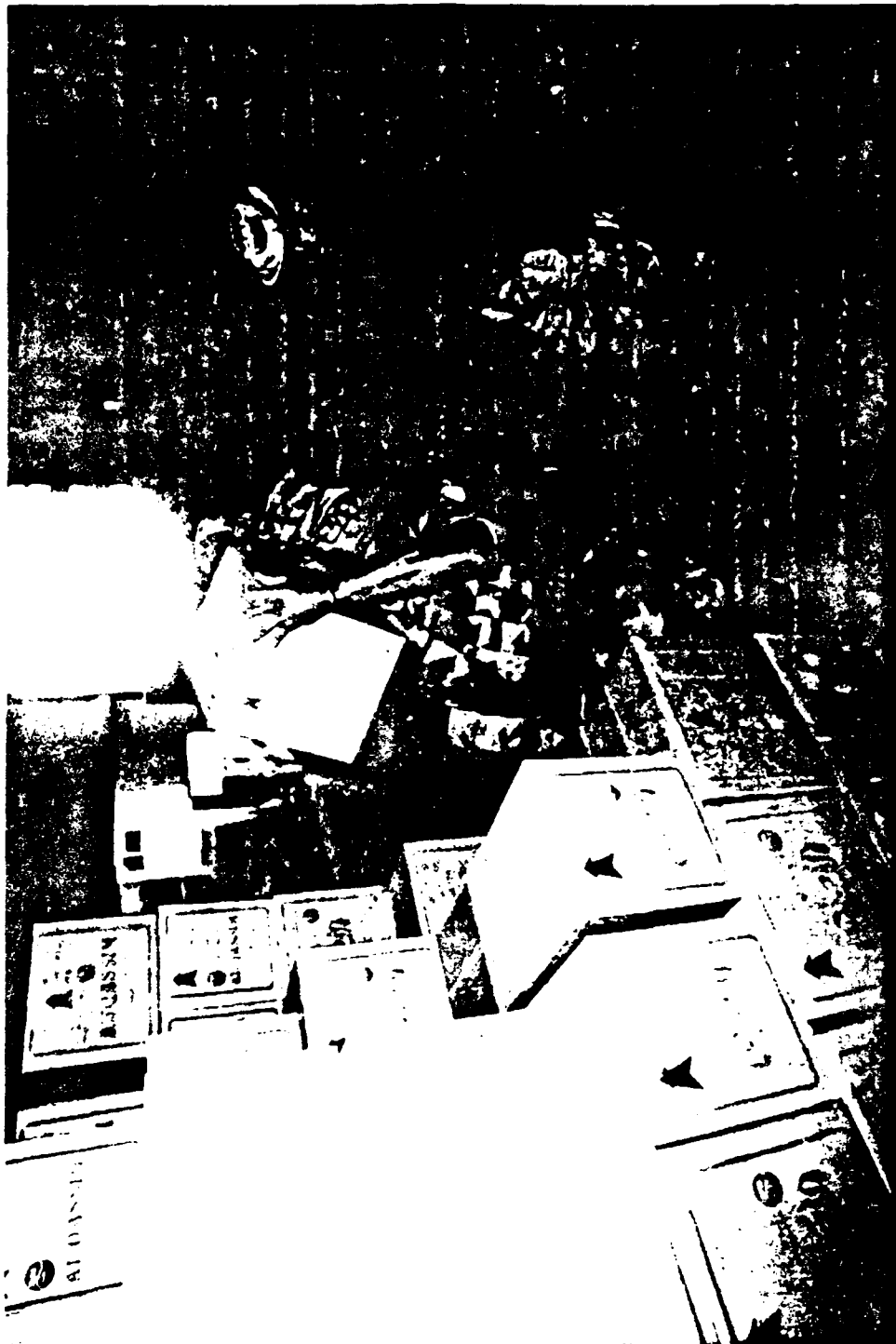














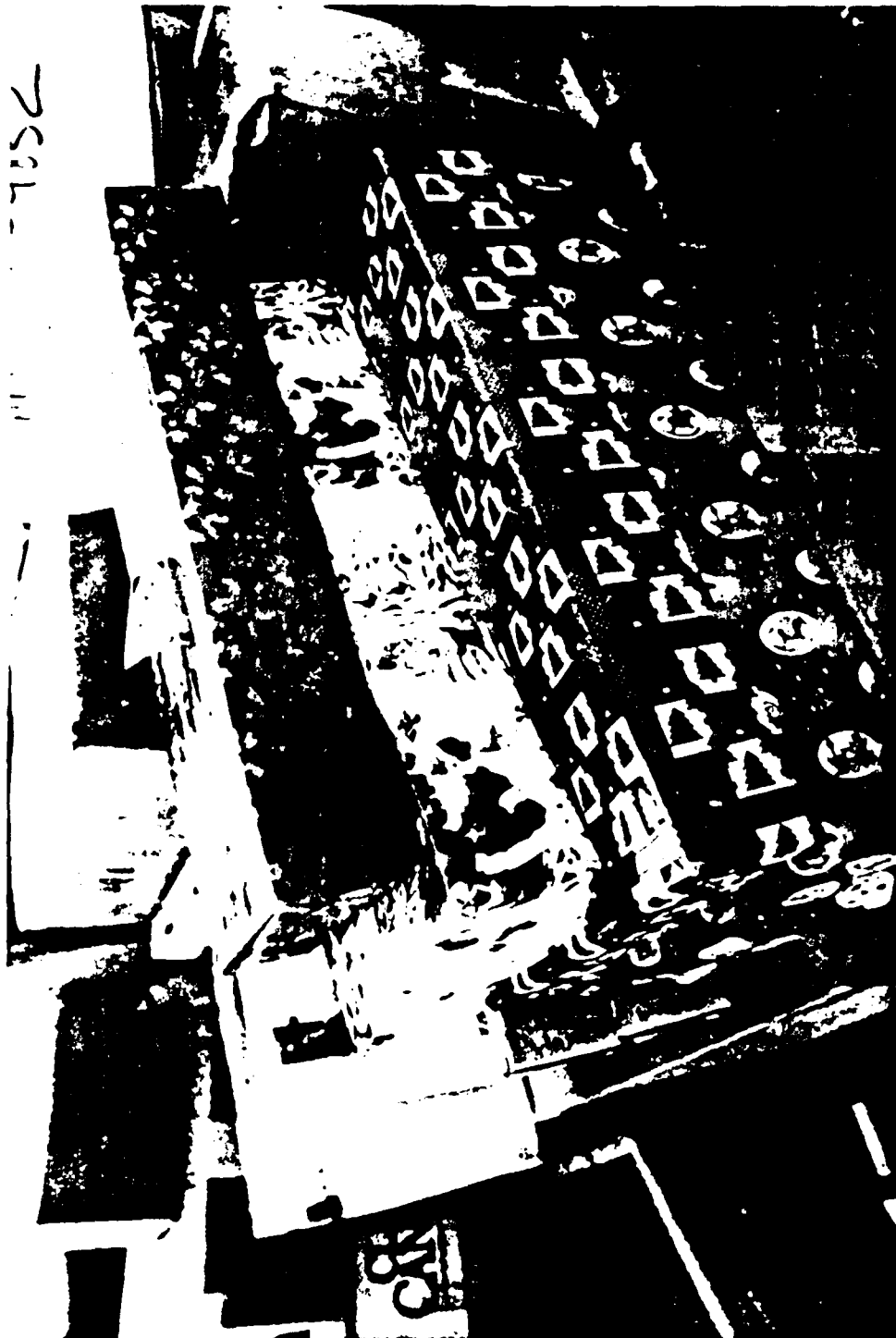






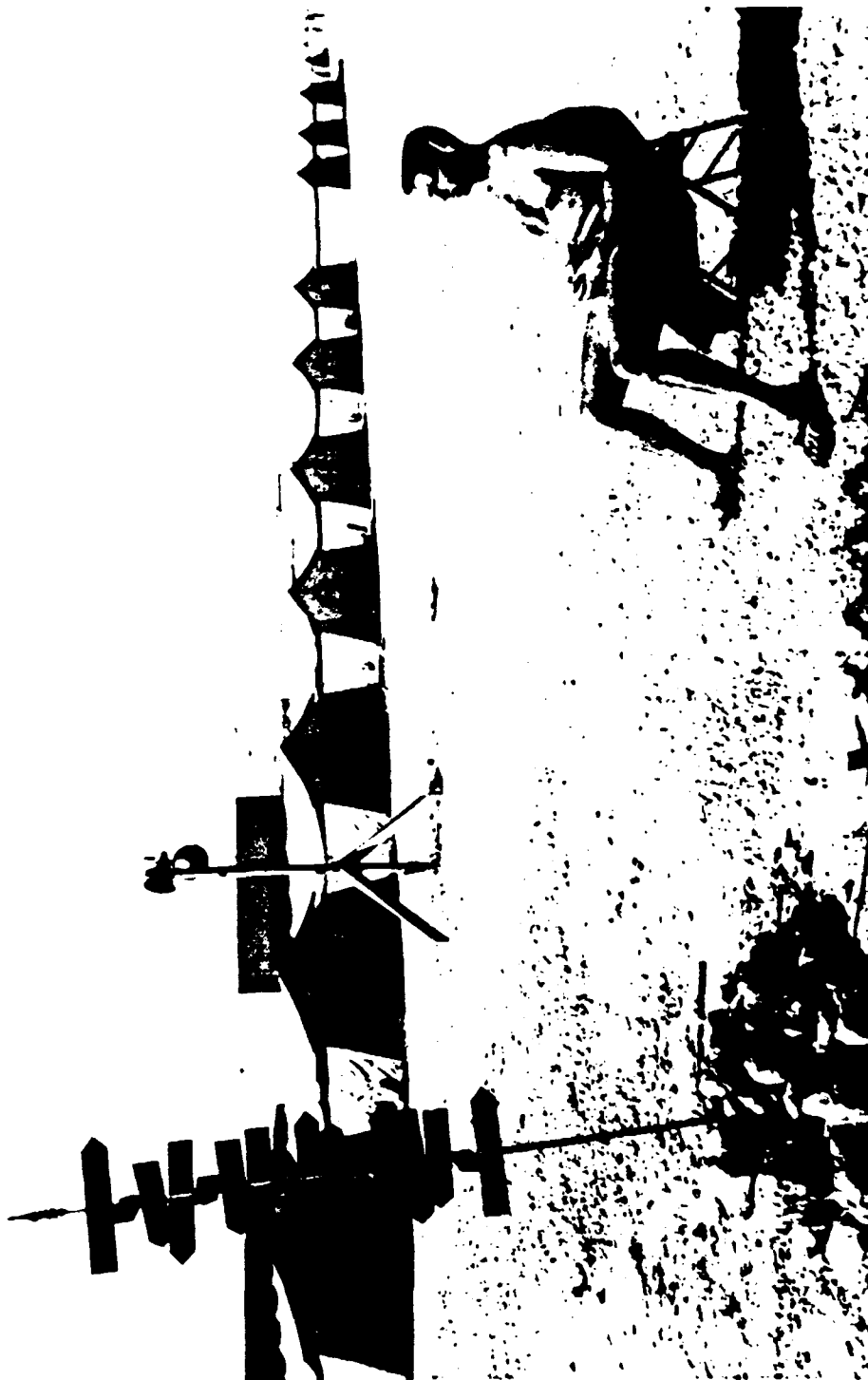


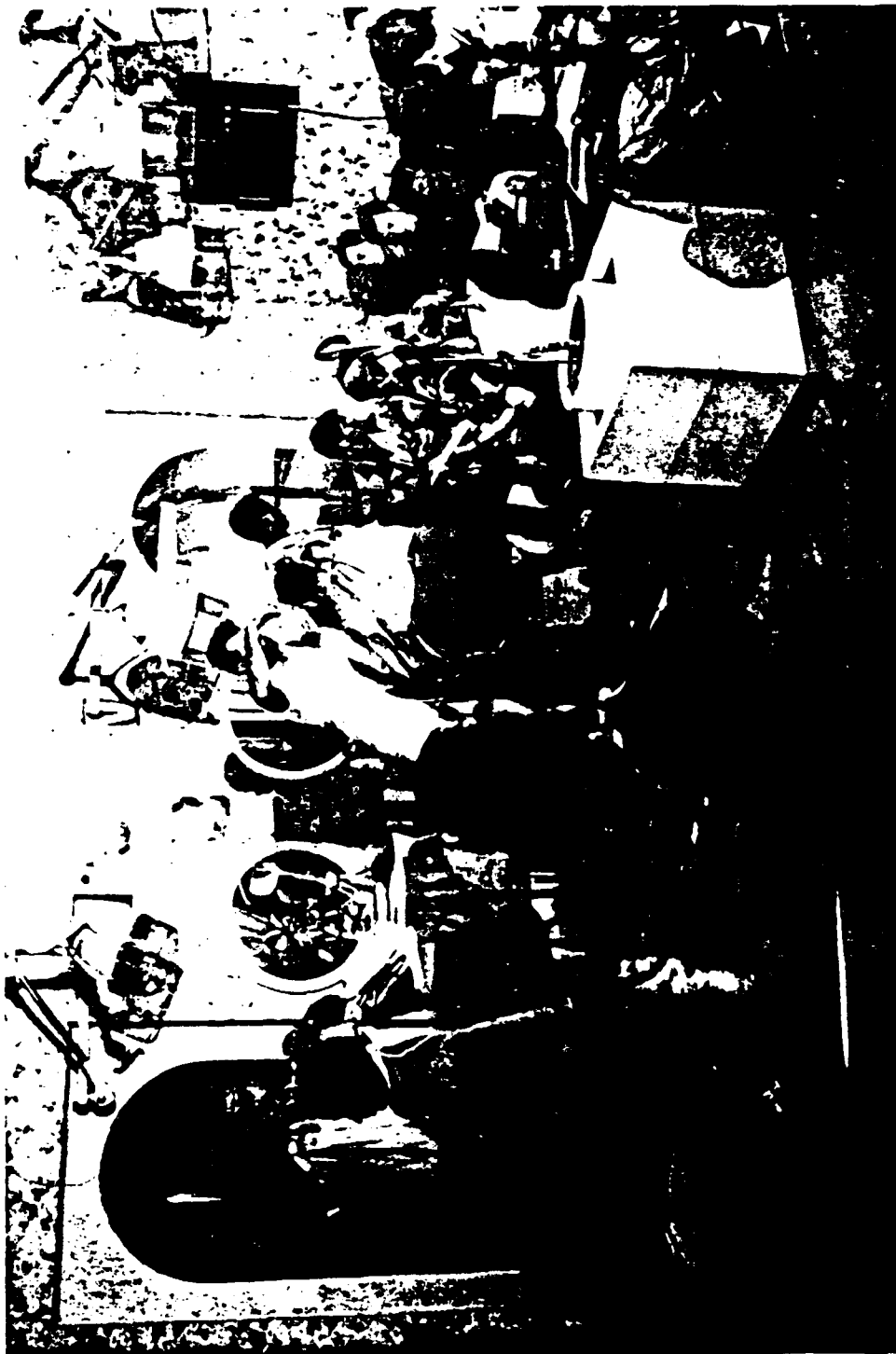




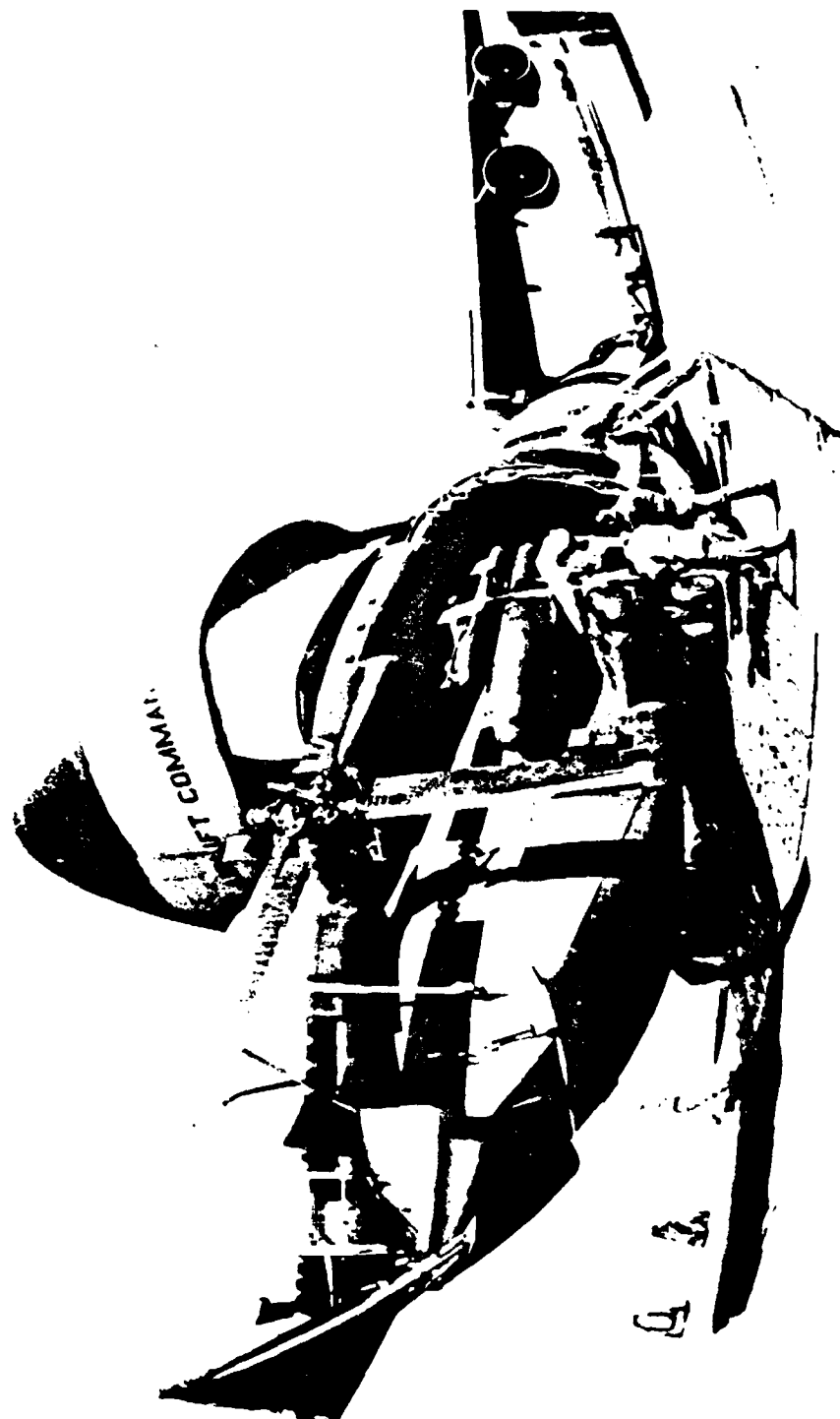








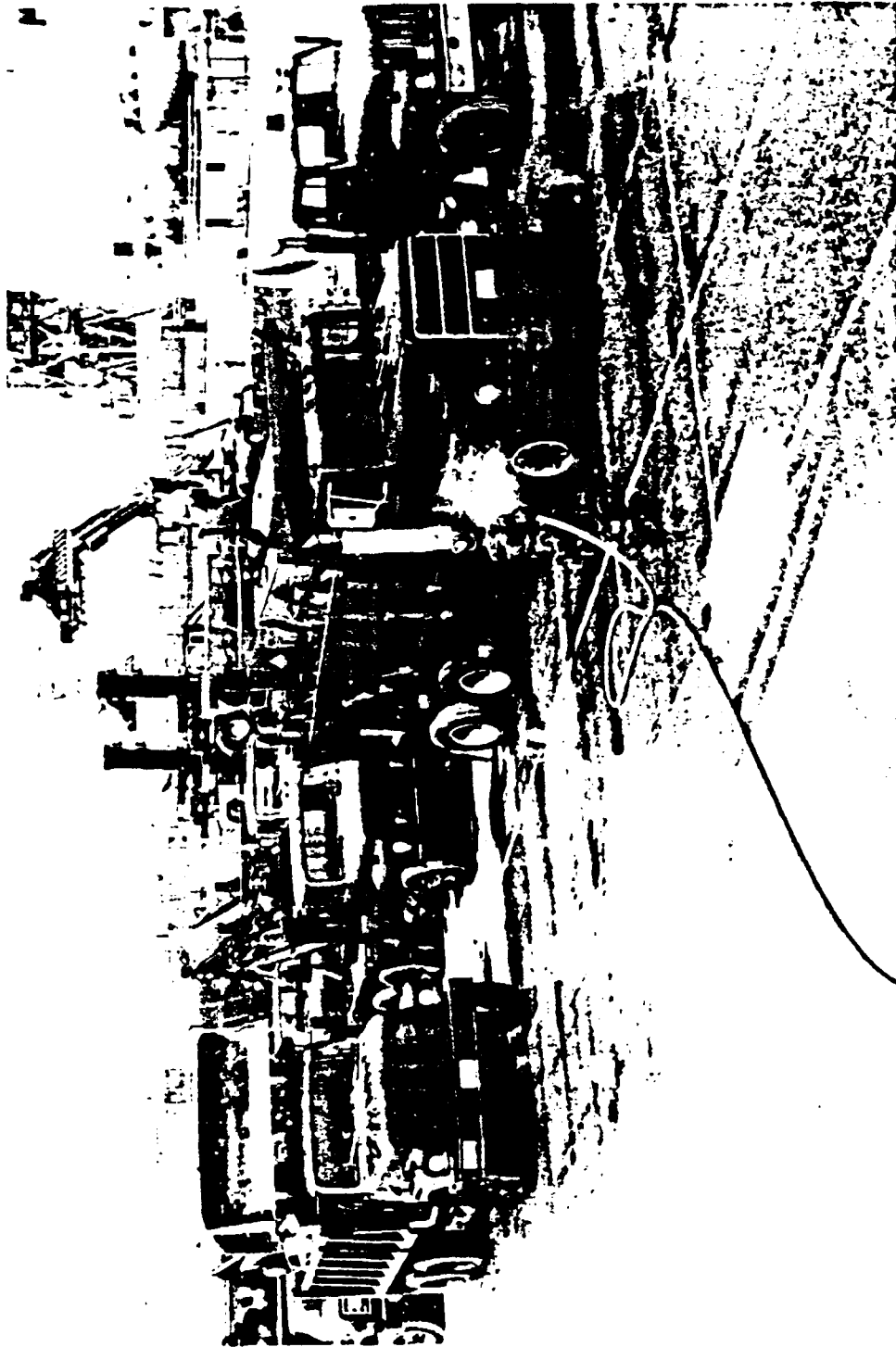












# Vita

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## Captain Bill Wheeler

Captain Bill Wheeler was born on 7 September 1963 in Alexandria, Virginia. He attended Marietta College, Marietta, Ohio, and graduated with a B.A. in marketing and management in 1985. Captain Wheeler's assignments have included Williams AFB, Arizona; Kelly AFB, Texas; and Air Forces Iceland, Naval Air Station Keflavik, Iceland. Following graduation from the Air Force Institute of Technology, Captain Wheeler will be assigned to Headquarters, Air Mobility Command, Scott AFB, Illinois as the Chief, Logistics Decision Support Systems.

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## Alan Will

Alan J. Will was born on 27 April 1960 in St. Marys, Ohio. He graduated from New Bremen Local school in New Bremen, Ohio. He attended Ohio State University and graduated with a Bachelor of Science degree in Electrical Engineering (BSEE) in 1983. He accepted a position with the government at the Defense Electronics Supply Center in Kettering, Ohio. Just prior to entering the School of Logistics and Acquisition Management at the Air Force Institute of Technology, he was a project engineer responsible for the MIL-S-19500 and MIL-D-87157 Qualified Products programs. He will return to the Defense Electronics Supply Center upon graduation from AFIT.

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## 13. ABSTRACT (Maximum 200 words)

This research effort provides material for use in updating the book The Logistics of Waging War. This particular book gives a logistics overview of past American Military conflicts but had not been updated since 1982. Our objective was to research the logistics aspects of the major military operations since 1982. These operations include: Operation Urgent Fury in Grenada (1983), Operation Just Cause in Panama (1989), Operation Desert Shield in Saudi Arabia (1990), Operation Desert Storm in Iraq and Kuwait (1991), and Operation Desert Farewell in Saudi Arabia (1992). Also included in this study is a review of Air Force logistics doctrine in light of United States military experience since 1982. This document had undergone several major changes and we attempted to bring those changes to light and show what if any impact could be expected as a result of the new revision. The bulk of our research effort concentrated on the Air Force logistics scenarios but we also included many examples from the other services as well. A large collection of photographs have been included to help the reader gain a perspective of the many different areas that logistics cover.

## 14. SUBJECT TERMS

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