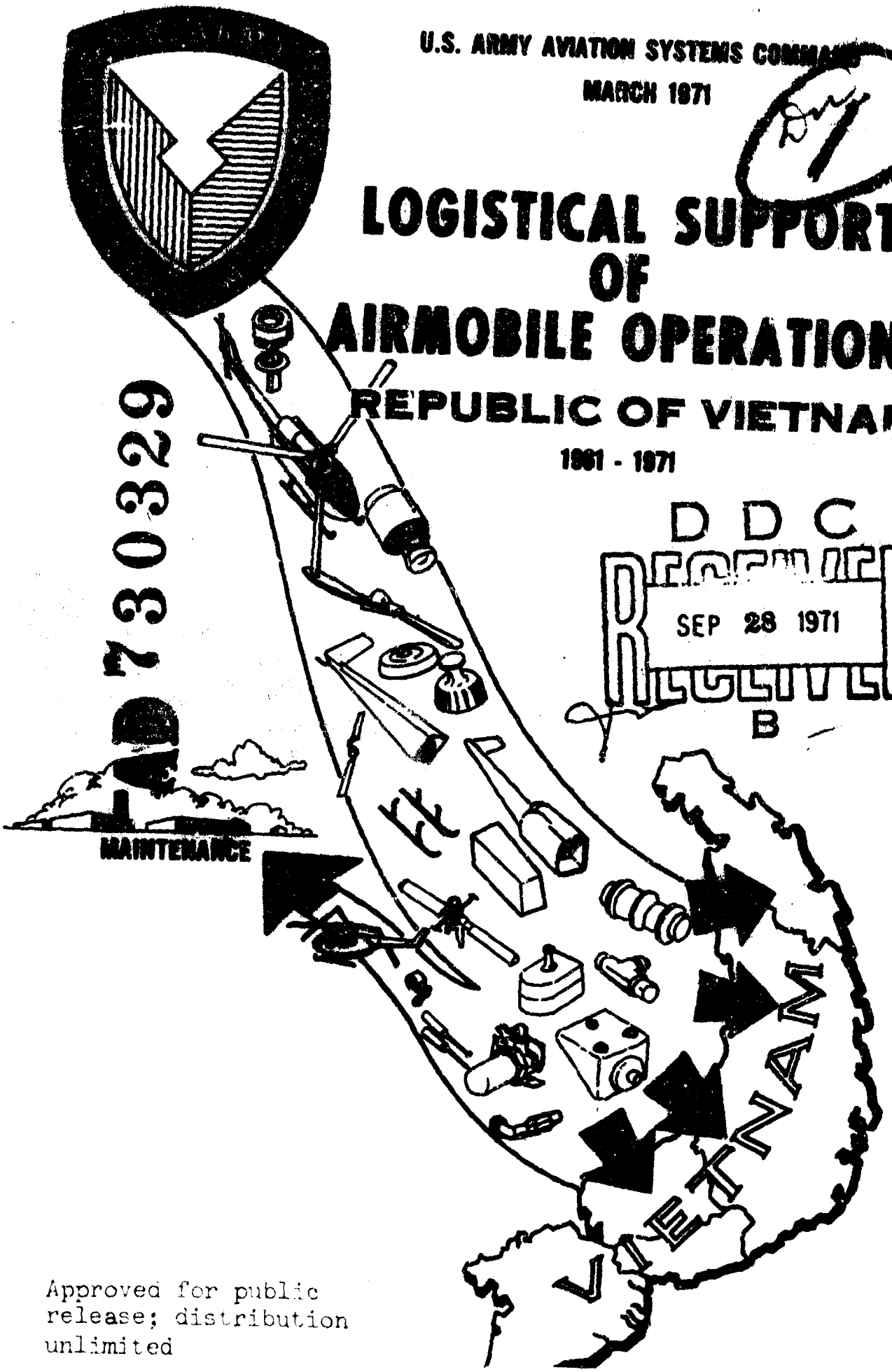
U.S. ARMY AVIATION SYSTEMS COMMAND

MARCH 1971

LOGISTICAL SUPPORT OF AIRMOBILE OPERATIONS REPUBLIC OF VIETNAM

1961 - 1971



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US ARMY AVIATION SYSTEMS COMMAND

March 1971

LOGISTICAL SUPPORT OF AIRMOBILE OPERATIONS REPUBLIC OF VIETNAM (1961-1971)

Major B. D. Harber

St. Louis, Missouri

FOREWORD

General William C. Westmoreland, in his comments on the war in Vietnam and the role of Army Aviation in that war, said, "Army aviation has meant much more than mobility to military forces – it has made our conduct of this war possible." General Frank S. Besson, former Commanding General, US Army Materiel Command, said, "Without our helicopters we would be bogged down by all of the disadvantages that the French suffered in Indo-China and Khe Sanh might well have become another Dien Bien Phu."

The highly commendable statements regarding the essential role of Army aviation in Vietnam are usually reflections of the highly successful results obtained against hostile guerilla forces; rarely do the statements or the historical accounts of events reflect the story "behind the scenes" – the story of the logisticians whose efforts so often dictate the success or failure of the tactical missions.

This historical study is a chronological account of the problems faced and the actions taken in the logistical support of air-mobile operations in Vietnam for the period 1961-1971.

Bobby D. Harber
Major, T.C.

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INTRODUCTION

Beginning in May 1961, the Communist Viet Cong forces substantially increased their attacks on South Vietnam with coordinated guerilla offensives.[1] The ensuing losses to Government of South Vietnam (GVN) forces during the remainder of 1961 made it abundantly clear that an expanded US role was essential if the communist takeover of South Vietnam was to be avoided.

At the request of GVN, this expanded role took the form initially of increased numbers of guerilla warfare instructors/specialists and military advisors and increased materiel support.[2]

Since the Viet Cong forces controlled large land areas and almost all the roads in South Vietnam, conventional means of transporting men and materiel were denied GVN forces. Attempts to overcome this situation by aggressive action on the part of the South Vietnamese were further aggravated by the effective guerilla tactics employed by Viet Cong forces.

On 11 December 1961, the US aircraft ferry-carrier USNS *Core* arrived in Saigon with 32 US Army helicopters and 400 men.[3] This first consignment of H-21 helicopters was the beginning of what would eventually give GVN forces the tools of mobility and surprise so essential in dealing with guerilla tactics of the Viet Cong; and it also opened the door for the greatest aviation logistics offensive in the history of the US Army.

DEPLOYMENT TO VIETNAM

The First Two

Two units were involved in this first deployment of aircraft to the Republic of Vietnam (RVN), the 57th Transportation Company (Light Helicopter), stationed at Fort Lewis, Washington, and the 8th Transportation Company(Light Helicopter), stationed at Fort Bragg, North Carolina. Each company had a TOE complement of twenty H-21 light cargo and two H-13 reconnaissance helicopters.[4]

When the units received their alert notification on 1 November 1961, neither knew if the alert were actual or practice. Both units were STRAC and had conducted frequent alerts and practice load-outs. The movement orders directed deployment to an unknown destination.

The units loaded out in accordance with unit loading plans; rapid provision of CONEX containers facilitated the loading. Although some shortages existed, both units were rated mission-ready.[4,5]

On 6 November 1961 -- five days after the alert – all 22 aircraft of the 57th were ferried from Fort Lewis (Figure 1) to Stockton, California, and arrived intact on 8 November 1961.[5] Fifteen of the H-21 aircraft organic to the 8th began their ferry flight to the west coast from Fort Bragg, North Carolina, four days after the alert. The other five aircraft were provided by the 33rd Transportation Company (Light Helicopter) stationed at Fort Ord, California, and the two H-13 aircraft were obtained at Sharpe Army Depot. The remainder of the 8th's equipment and supplies were transported to the west coast by C-133 aircraft.[6]

The H-21s were preserved by cocooning at the Alameda Naval Air Station to protect the fuselages from salt water spray; rotor blades were removed and placed in racks inside the aircraft; engines and other components were treated for protection against corrosion and inactivity; rotor heads were covered with protective barrier paper. All 32 of the aircraft were loaded onto the flight deck of the USNS *Core* in a manner that left little space unoccupied (Figures 2, 3). Equipment needed to make the aircraft flyable at destination was loaded below deck along with several Air Force T-28 trainer aircraft. The 400 men of the two units and the supporting field maintenance, signal and medical detachments were crowded into the small space remaining and the USNS *Core* "set sail" from the west coast on 21 November 1961 on a history-making voyage.[4,5]

Figure 1. CH-21s of the 57th Transportation Company Leaving Ft. Lewis Enroute to Stockton, California, 6 November 1961.

Figure 2. Cocooned CH-21s of the 57th and 8th Aboard the USNS Core Enroute to Vietnam.

Figure 3. Cocooned CH-21s of the 57th and 8th Aboard the USNS Core Enroute to Vietnam.

The remaining eight H-21s belonging to the 8th and all four H-13s were boxed and loaded aboard a conventional cargo ship which departed about a week after the USNS *Core.* The ship also carried the major portion of the units' vehicles, other authorized equipment, and escort personnel.[6]

Rough seas were encountered during the trip, and personnel aboard the USNS *Core* soon discovered that salt water spray was causing corrosion in the rotor head areas of the deck-loaded helicopters. Consideration was given to diverting to Subic Bay, Phillippines, to correct deficiencies in the protective coverings; however, this problem was satisfactorily resolved by use of canvas covers and frequent inspection/servicing of exposed parts (Figure 4), and the decision was made to continue on to destination. The other ship was not so fortunate; one of the H-21s broke loose inside the box, and the ship had to be diverted to Hawaii for replacement of the damaged aircraft with one from the 81st Transportation Company. This situation delayed considerably the arrival of the remaining aircraft, but they did arrive prior to movement of the 8th from Saigon to its permanent location at Qui Nhon.[4, 5, 6]

Destination — First of Many Firsts

The *Core* arrived at Saigon Port on 11 December 1961. Depreservation was begun while traveling up the Saigon River and completed at dock-side in Saigon. Rotor blades were installed and all other preparations made to fly the aircraft off the ship directly to Tan Son Nhut Airport (Figure 5). This "fly-off" was one of the many "firsts" in Army aviation that these two companies were to engage in.[5,6]

When the second ship arrived considerably later, there was not sufficient space aboard to prepare the aircraft for fly-off. Although considerable difficulty was encountered, a crane with sufficient capacity was eventually obtained for the off-loading.

As might be expected due to the sensitivity of the move, very little administrative planning had been done on the receiving end at Saigon Port and Tan Son Nhut Airport to accommodate the units. Considerable difficulty was encountered in setting up maintenance and operations facilities at Tan Son Nhut and finding billets for personnel. Additional problems were experienced when personnel were billeted in downtown Saigon in buildings which were under construction or in varying degrees of renovation — with no windows/screens, mosquito netting, or potable drinking water — requiring daily travel to and from Tan Son Nhut. (These

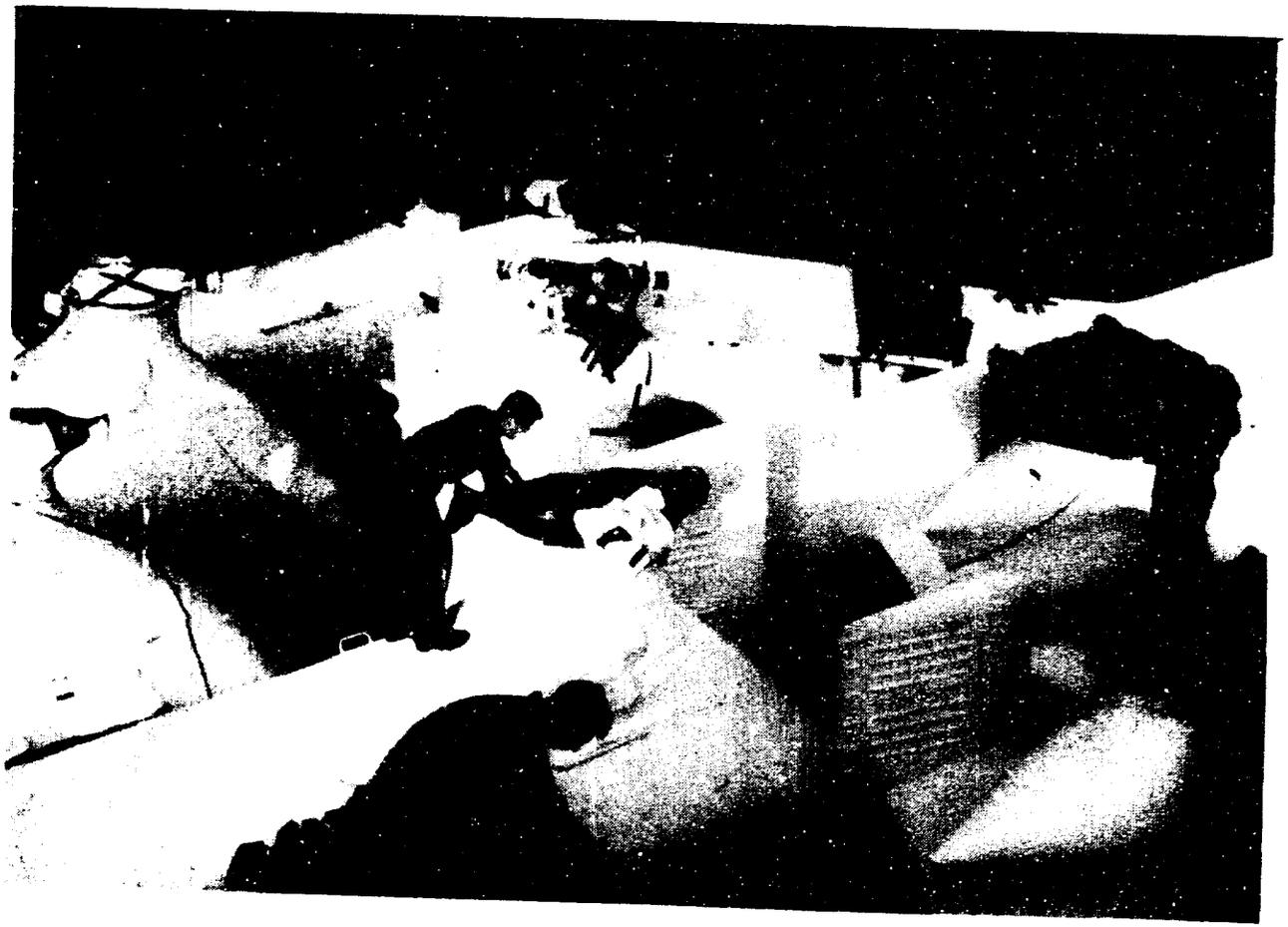


Figure 4. Replacement of Barrier Paper Around Rotor Heads with Canvas Covering.

Figure 5. CH-21 Prepared to Fly Off USNS Core To Tan Son Nhut, December 1961.

problems were eventually overcome by construction of billets and operational areas at Tan Son Nhut.)[4,5]

Logistics Support

The two units arrived in Vietnam with 30 days PLL (Prescribed Load List), and there were 30 days ASL (Authorized Stockage List) in the supporting field maintenance detachments. Resupply of aviation parts and supplies was extremely critical during the first few months while a supply system was being established. Initially, supply support was the responsibility of activities located in Okinawa, but the short notice and the distance removed combined to produce a far-from-adequate supply system. Eventually, an Aviation Supply Point was established at Tan Son Nhut and became minimally effective during the early months; it also provided support to other H-21 companies arriving early in 1962.[7]

An extremely critical maintenance problem arose when the wooden rotor blades began deteriorating because of extremely high humidity. Leading edge separations and other deficiencies were detected; some blades lasted less than ten hours. The field maintenance detachment supporting the 57th established a rotor blade repair shop and performed repairs on blades that would otherwise have been returned to CONUS for overhaul. Considering the ineffective supply system, such a situation would have seriously impaired mission availability rates and aviation support capability. Subsequently, Air America personnel were trained by the detachment, and the commercial company set up its own repair facility and provided back-up support to the H-21 companies.[5]

Most of the aviation logistical support problems experienced during the early days in Vietnam were attributable to the very short advance notice of the deployments and the very difficult task of establishing a large support complex concurrently with operational commitment of aviation units.[5,7]

Although seemingly insurmountable difficulties had to be overcome (critical shortage of engines, deterioration of rotor blades and avionics equipment due to high humidity, ineffective resupply, etc.), the aircraft consistently overflew DA programmed flying hours and exceeded aircraft availability norms. A transceiver capability for the Aviation Supply Point (in 1963) and the ultimate decision to air-ship all aviation parts and supplies contributed to rapid improvement of aviation logistics support.[8]

Mission Readiness

The 8th and 57th conducted their first joint training exercise on 22 December 1961, fielding 30 of the 32 aircraft then available in-country. During the exercise, over 1,000 Vietnamese paratroopers from the Army-Republic of Vietnam (ARVN) Airborne Brigade were transported from an assembly area to assault positions several miles away. Although this type of availability (near 100%) characterized several subsequent operations, aircraft availability was usually around 75%. Even this figure represented a continuous maximum utilization of personnel, equipment and facilities.[4,5]

Tactical Helicopter Airmobility

The first airmobile assault operation in Vietnam was conducted by the 8th and 57th in a joint operation on 2 January 1962 (Figure 6). Together, the two companies (less the aircraft aboard the second ship not yet arrived) transported over 1,000 ARVN soldiers into a small jungle landing zone approximately 300 x 150 yards in size. The operation did not result in significant contact with the enemy, but it demonstrated to the ARVN commanders the real potential of airmobile operations and rapidly generated more requests for aviation support than could be accommodated.[4] A one-time priority (during the first ninety days) was designated for the 57th to train ARVN units in airmobile operations. The unit trained over 25,000 ARVN troops during the period while also conducting 20 combat assault missions. During this training it was determined that the fabrication of an additional step at the helicopter entrance for the small-statured ARVN troops significantly reduced loading and unloading time.[4,9]

Another airmobile first in RVN was achieved when the 57th conducted joint operations with the 1st Marine Helicopter Squadron which arrived in-country in early 1962. The Marine unit was operating from the old French base at Soc Trang in the Mekong Delta.[4]

Another Arrival[7]

Following the 57th and 8th, the 93rd Transportation Company (Light Helicopter) arrived in RVN in January 1962.

The 93rd was stationed at Fort Devens, Massachusetts, when it received an alert order in November 1961 for deployment to an unknown destination. The alert included a requirement that all twenty TOE aircraft be up-graded to 75% service-life remaining on all components, and all personnel were to be qualified for

Figure 6. Strategy Session for First Airmobile Assault. (From Top Left Clockwise: MAJ Robert Dillard, CPT Emmett Knight, CPT Milton Cherne, LTC Stockton and four staff officers of ARVN Airborne Brigade.)

overseas deployment. Over 4,000 maintenance man-hours were required to upgrade the aircraft, and many problems relating to training and qualification of personnel had to be overcome. Major logistical problems developed in acquiring needed major components and other aircraft parts and supplies. Several units in CONUS were levied for H-21 qualified pilots and maintenance personnel, and several replacement aircraft were obtained from other units. Timely supply of CONEX containers again facilitated loading and shipment of unit supplies and equipment.

The 93rd and attached field maintenance, signal, and medical detachments departed the east coast aboard the USNS *Card,* sister ship of the USNS *Core,* in December 1961. The aircraft were preserved and selectively cocooned (around rotor heads and cockpit). Other openings and apertures were taped for protection against salt water spray. The aircraft were deck-loaded and unit equipment and vehicles were stored below-deck.

The route of travel was through the Mediterranean Sea, the Suez Canal, Aegean Sea, to Subic Bay in the Philippines. The unit and detachments were off-loaded at Subic Bay during the first part of January, where the aircraft were depreserved and prepared for flight. Then in mid-January, the 93rd aircraft with essential equipment were flown aboard an aircraft carrier, and other unit equipment was loaded aboard a landing ship operated by the Japanese for shipment to RVN. An engine failure experienced during the operation did not delay the deployment; fortunately, an Air Force H-21 was available in the Philippines from which an engine was cannibalized.

A Unique Delivery

When the USNS *Card* reached a point ten miles out in the South China Sea from Da Nang, South Vietnam, the aircraft were flown off the carrier deck to Da Nang Air Base. With the assistance of radio vectors to lead aircraft, the fly-off was accomplished without serious incident even though the weather conditions were very unfavorable with ceilings down to 100 feet over the ocean.[7]

Employment

The first thirty days were spent in unit readiness operations and training of ARVN troops in airmobile operations (similar to that described for the 57th). Primitive but adequate facilities were available at the Da Nang Air Base to support operations. Aviation parts and supply support were literally non-existent during the first 90 days, and the unit existed primarily on the 60-day unit

PLL and the 90-day ASL in the field maintenance detachment.

The first operational missions were undertaken to resupply and rotate personnel at several jungle outposts in the I Corps area. Some of these outposts had been virtually isolated from their parent forces for as long as a year. An appalling state of supply insufficiency existed. In some instances, a total break-down in troop morale and discipline was evident. These aerial missions did much to relieve the pressure on the outposts and played a crucial role in correction of these calamitous deficiencies.

By mid-1962, airmobile support had improved tactical conditions to the point that additional counter-insurgency measures could be implemented by ARVN forces. For example, a second outpost was established in the A Shau, providing a well-fortified position at each end of the strategically important valley near the Laotian border. Whereas patrols previously seldom ventured beyond the immediate vicinity of the one fortification, in a few short months they were aggressively patrolling the entire length of the valley between the two outposts. However, as we see in later developments, increased commitments by the insurgents and their northern benefactors again tipped the scales in the other direction.[7]

Things Stiffen Up

At this early date in 1962, there was still no effective logistics web of Army air capability netting the entire area of operations. Helicopter companies functioned within their own assigned areas and were only occasionally employed together in complex operations because of their range limitations. To some extent, the logistics gap was bridged upon arrival from Fort Riley, Kansas, in January 1962 of the 18th Aviation Company (U-1A Otter). To provide a utility air-net capability throughout the country, their aircraft were deployed at Tan Son Nhut to service the IV Corp area, at Nha Trang to serve the III Corp area, and at Qui Nhon to accommodate requirements in the I and II Corps areas in the northern part of the country.

The delivery of aircraft parts and supplies to aviation units widely separated from their support elements was a notable accomplishment of the "stiff-wings", and they unquestionably enhanced the ability of these aviation units to maintain their aircraft and perform their assigned missions.[7]

Aviation Logistics Support Posture (1961-1962) [10]

Although elements in Okinawa were originally responsible for

logistics support of the developing situation in RVN, the 9th Logistical Command in Okinawa was later bypassed in favor of developing a TD (Table of Distribution) unit tailored to meet the peculiar requirements of the Vietnam operation. This placed the TD activity in the position of needing to be fully operational at the same time it was trying to formulate, activate and organize. This initial logistics impact and the requirement to accommodate rapidly expanding requirements created a difficult situation, the effects of which were felt for some time.

Various pressures were also experienced because RVN requirements had not been programmed and funded for in the initial phases of the commitment. This initial supply posture of minimum response capability was a result of several previous years of austere programming and funding, necessitating severe limitations on inventories. The initial actions taken in satisfying RVN requirements created a critically depleted stockage situation for certain items. Although additional money was authorized in February 1962, it was not made available immediately and procurement could not be initiated until late May and June of 1962. The long lead-time required for procurement of some aircraft items further complicated the situation that existed during the first year in RVN. Table 1 reflects the supply posture pertaining to H-21 helicopters in the early years.

	FY 62				FY 63
CONUS Depots	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	1st Qtr
	(Millions of Dollars)				
Stock on Hand	27.8	23.7	17.5	14.8	14.6
Stock Due In	16.2	18.0	24.6	24.2	28.4
Stock Due Out	2.3	5.2	7.5	5.3	7.0
Issues	4.2	5.6	6.1	9.8	6.2

Table 1. CONUS Supply Posture, CH-21 Repair Parts (1961-1962)

Examination of Table 1 reveals the following:

a. A continuing drain of depot inventories and a downward

trend in depot stocks (a situation which had not reversed by the fall of 1962).

b. An improved procurement due-in position (causing a reversal in the depletion aspect in the 4th Qtr FY 63).

c. An increasing demand rate (issues and due-outs), reflecting unprogrammed deployment of aircraft to RVN during 1962.

In addition to increased logistics requirements to accommodate the increased flying hour program, extremely high support requirements attributable to the environmental and tactical situation were generated. For example, approximately 60 rotor blade sets per month were needed during the monsoon season to support the fleet of approximately 100 H-21s. (This is in addition to the many blade repairs accomplished by the supporting field maintenance detachments.) Also, the 57th Transportation Company required over 50 engine replacements in their first full year of operations. The engine overhaul contract in CONUS was terminated and the function assumed by the Army Aeronautical Depot Maintenance Center (ARADMAC), Corpus Christi, Texas, Army aviation's in-house depot facility, in a continuing effort to improve engine reliability. The primary problem in this regard, however, was the unsuitability of the engine for the H-21 helicopter.

Carrying the Ball

During these early days of US Army aviation in RVN before an adequate supply system and maintenance support system were available, the aviation units existed and accomplished their missions principally by the application of highly innovative and sometimes ingenious techniques by the extremely well-trained and highly experienced maintenance personnel and commanders. As described earlier, military technicians, in some instances, trained civilian contractors (such as Air America) who thereafter expanded to provide a wider scope of support. Crash- and battle-damaged aircraft in the "boneyards" were cannibalized for every usable part and component. The highly experienced and dedicated H-21 pilots performed feats with their aircraft which - with lesser experienced pilots - would have dictated mission aborts to prevent possible damage to aircraft or loss of life; the maintenance personnel and crew chiefs worked long hours, day and night, to keep their aircraft flyable. Dedicated crew chiefs, on many occasions, literally taped and wired and held their aircraft together, permitting them to be flown back to home base rather than have them face possible destruction in hostile areas.

As an example of aircraft utilization in these first helicopter companies, the 57th (later designated the 120th Aviation Company) logged over 17,000 flying hours, over 35,000 ton-miles, over one million passenger-miles, and over 20,000 combat support sorties during the period December 1961 to January 1964.[11]

VIETNAM ADVISORY CAMPAIGN
(15 March 1962 - 7 March 1965)

Tactical Situation[12]

North Vietnam planned in 1960 to infiltrate large numbers of reinforcements to the underground Viet Cong forces in South Vietnam; this was accomplished during the rainy season in 1961. Thereafter, Viet Cong attacks occurred throughout South Vietnam. At this time, and up until early 1965, the primary mission of US military forces was to advise and assist GVN forces in building its military structure to fulfill the needs of its national security. Because of the increasing scope and intensity of VC operations, this advisory task expanded very rapidly during this period. For example: VC regular forces grew steadily from two to five regimental headquarters; VC battalions doubled in the same period; quality and quantity of weapons and equipment improved considerably. This buildup of VC forces necessitated the deployment of additional US aviation units for counteraction; the deployment of additional aviation units required rapid growth, modernization and technical improvements in logistical support operations. From a single transportation battalion with three helicopter companies in early 1962, an enormous operational and logistical support complex was developed consisting of many battalions with many helicopter companies, fixed-wing units, maintenance units and other special purpose organizations.

Buildup

The 45th Transportation Battalion stationed at Fort Sill, Oklahoma, deployed to Vietnam early in 1962 and assumed command of the three helicopter companies and the 18th Aviation Company. Shortly thereafter, in the spring of 1962, the 33rd and 81st Transportation Companies (Light Helicopter) (H-21) were deployed to RVN in a manner similar to the previous units' moves. The 33rd, which deployed from Fort Ord, California, was positioned at Bien Hoa; the 81st, which came from Hawaii, was located at Pleiku. Both of these units also came under command of the 45th Battalion.[7]

The 57th Medical Detachment (Helicopter Ambulance), equipped with UH-1s, arrived in early 1962. The unit immediately and continually demonstrated the feasibility and desirability of battlefield evacuation of casualties by helicopter.[7,13]

In May 1962, the Military Assistance Command, Vietnam-Military Assistance Advisory Group (MACV-MAAG) Flight

Detachment was augmented with ten UH-1A helicopters which were positioned with the III Corps Advisory Group to support advisor operations.

The 23rd Special Warfare Aviation Detachment, equipped with OV-1 Mohawks, arrived in mid-1962 and by May 1963 had flown in excess of 3,800 hours in a reconnaissance and photographic role in support of RVN forces.[14]

In June-July 1962, the 93rd Transportation Company at Da Nang accomplished a "swap" with the 1st Marine Helicopter Squadron at Soc Trang in the Mekong River Delta. This exchange was made because of the greater capability of the Marine H-34 helicopters to operate in the higher elevations of the northern regions.[7]

The first maintenance company to arrive in-country was the 339th Transportation Company (Direct Support). It deployed from Fort Riley, Kansas, in early 1962 and was positioned at Nha Trang. The mission of this unit was to support the 18th Aviation Company and provide back-up support to the field maintenance detachments operating with the helicopter companies. (The distance between the 339th and some of its supported units was such that effective support was almost impossible. This situation was alleviated considerably when the 611th Transportation Company (DS) was positioned at Vung Tau in the fall of 1962. The 611th assumed responsibility for back-up support of aviation units operating in the southern sector of RVN. Supply personnel of the 611th and 339th were displaced to Saigon in late 1962 and provisionally established operation of the Aviation Supply Point.) In the first two years of operation, the 611th recovered 139 downed aircraft, including 54 CH-21s and 43 UH-1s.[12,15,27]

When attempts to arm the CH-21 proved relatively ineffective, the Utility Tactical Transport (UTT) Company was deployed to RVN in mid-1962 and attached to the 45th Battalion. The UH-1 helicopters were armed with 30-caliber machine guns and 2.75-inch rocket launchers, and were employed in a protective role in support of the CH-21 transport helicopters. Many of the tactical doctrines for armed helicopter employment evolved during this period, including techniques for escort of transport helicopters and protective fire preparation of landing zones prior to and during landing of ground troops. The UTT Company was redesignated the 68th Aviation Company and later as the 197th Airmobile Company.[12,28]

Because of the ever-changing nature of the conflict in RVN, the Army Concept Team in Vietnam (ACTIV) was established on

6 November 1962. ACTIV was dedicated to applying, testing and evaluating innovative methods to win the conflict. It evaluated projects in three areas; namely, Army aviation, ground combat and logistics/electronics. Its projects were generated from many sources. A principal source of materiel evaluation was USARV's program for Expediting Non-Standard and Urgent Requirements for Equipment (ENSURE). A sampling of ACTIV's many projects include airborne "people sniffers", bullet detectors, footprintless shoes, airmobile artillery platforms, target acquisition and combat surveillence, and evaluations of AH-1G (Huey Cobra), LOH (Light Observation Helicopter), YO-3 (Quiet Airplane), and CH-54 (Flying Crane) aircraft.[16]

In the spring of 1963, the 45th Battalion relinquished control of all aviation units in the I and II Corps areas to a newly arrived unit, the 52nd Aviation Battalion.[17] On 23 June 1963, the following units were redesignated as indicated below:

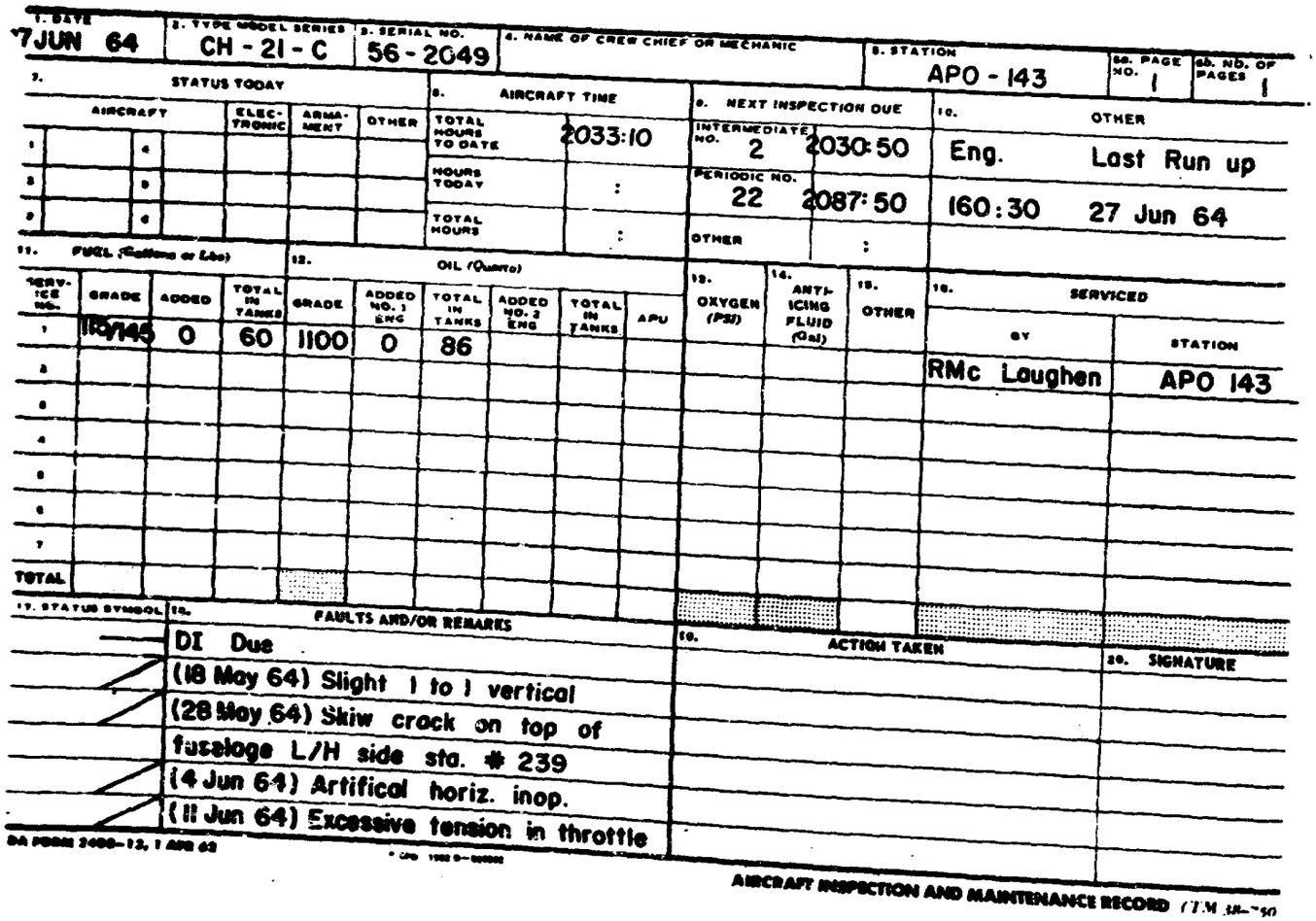
a. 45th Transportation Battalion to 145th Aviation Battalion.
b. 57th Transportation Company (Light Helicopter) (H-21) to 120th Aviation Company (Airmobile Light).
c. 8th Transportation Company (Light Helicopter) (H-21) to 117th Aviation Company (Airmobile Light).
d. 93rd Transportation Company (Light Helicopter) (H-21) to 121st Aviation Company (Airmobile Light).
e. 81st Transportation Company (Light Helicopter) (H-21) to 119th Aviation Company (Airmobile Light).
f. 33rd Transportation Company (Light Helicopter) (H-21) to 118th Aviation Company (Airmobile Light).

These redesignations coincided with initiation of the change-over from CH-21 Shawnee helicopters to UH-1B Iroquois helicopters. A CONUS training team was set up at Nha Trang in early 1963 to transition aviators, maintenance personnel, gunners and crew chiefs.[14] By early 1964, the transition from CH-21s to the UH-1Bs was completed, and with BG Delk M. Oden's signing of the flight log of the last aircraft (figures 7, 8), the last tired, old H-21 choppers retired from the scene of battle with an airborne salute from a flight of young, eager Hueys (Figures 9, 10).

More Diversified Support

The 1st Aviation Company (Caribou) arrived in RVN in December 1962. This unit established another "first" for Army aviation by ferrying its CV-2 aircraft from Fort Benning, Georgia, to RVN, a distance of 11,000 miles. Prior to leaving CONUS, all the aircraft were flown to ARADMAC for installation of self-

Figure 7. LTC Robert J. Dillard Signs Off the Last Flight as BG Delk M. Oden and LTC John C. Hughes Await Their Turns to Sign The Official Closing of The Log.



1. DATE: 7 JUN 64
2. TYPE MODEL SERIES: CH - 21 - C
3. SERIAL NO.: 56 - 2049
4. NAME OF CREW CHIEF OR MECHANIC:
5. STATION: APO - 143
5a. PAGE NO.: 1
5b. NO. OF PAGES: 1

7. STATUS TODAY

	AIRCRAFT		ELECTRONIC	ARMAMENT	OTHER
1		a			
2		b			
3		c			

8. AIRCRAFT TIME

TOTAL HOURS TO DATE	2033:10
HOURS TODAY	:
TOTAL HOURS	:

9. NEXT INSPECTION DUE

INTERMEDIATE NO. 2	2030:50
PERIODIC NO. 22	2087:50
OTHER	:

10. OTHER

Eng.	Last Run up
160:30	27 Jun 64

11. FUEL (Gallons or Lbs)

SERVICE NO.	GRADE	ADDED	TOTAL IN TANKS
1	115/145	0	60
2			
3			
4			
5			
6			
7			
TOTAL			

12. OIL (Quarts)

GRADE	ADDED NO. 1 ENG	TOTAL IN TANKS	ADDED NO. 2 ENG	TOTAL IN TANKS	APU
1100	0	86			

13. OXYGEN (PSI)
14. ANTI-ICING FLUID (Gal)
15. OTHER

16. SERVICED

BY	STATION
RMc Laughen	APO 143

17. STATUS SYMBOL

18. FAULTS AND/OR REMARKS

DI Due
(18 May 64) Slight 1 to 1 vertical
(28 May 64) Skiw crack on top of fuselage L/H side sta. # 239
(4 Jun 64) Artifical horiz. inop.
(11 Jun 64) Excessive tension in throttle

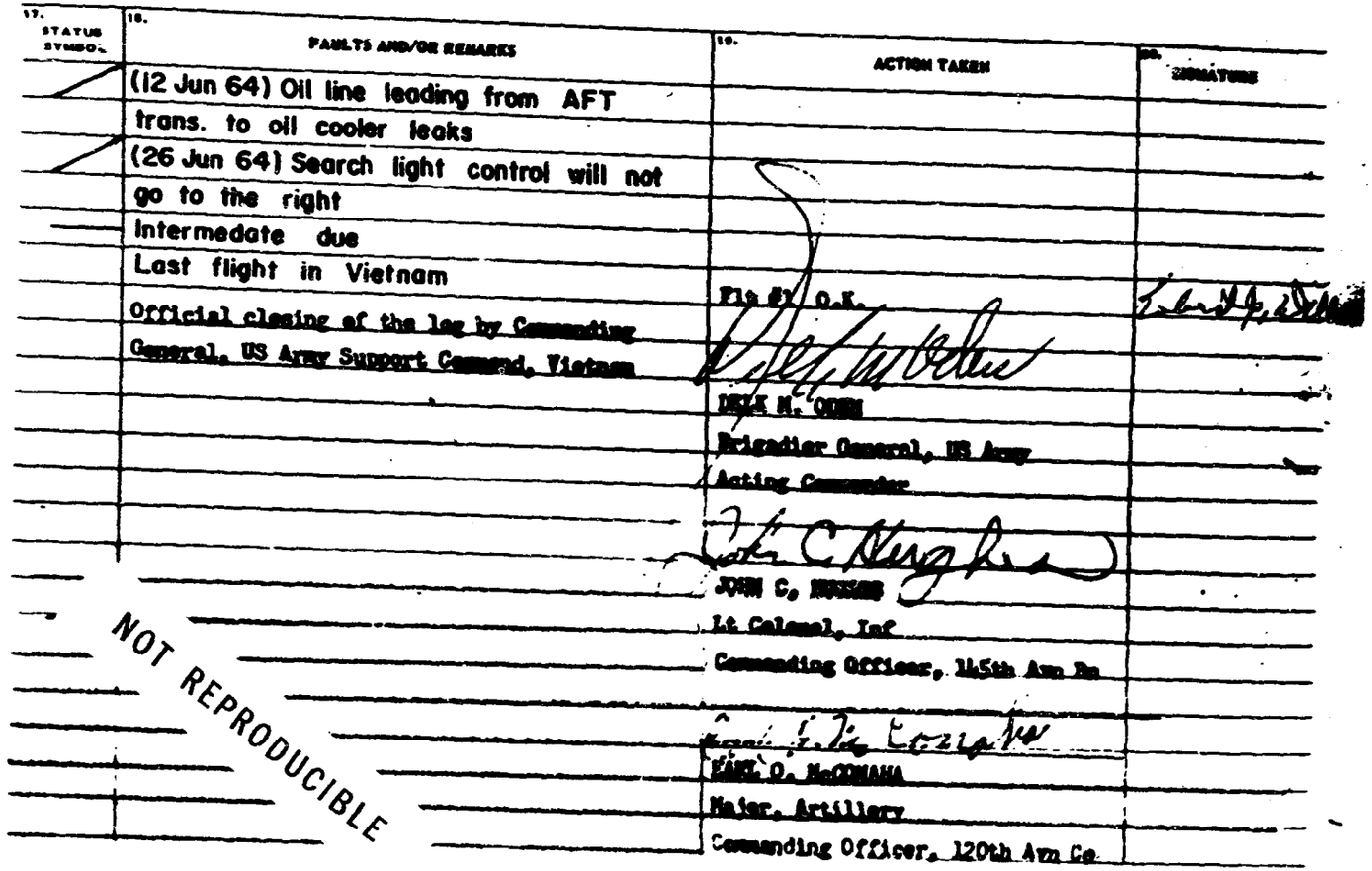
19. ACTION TAKEN

20. SIGNATURE

DA FORM 2408-12, 1 APR 62

AIRCRAFT INSPECTION AND MAINTENANCE RECORD (TM 38-750)

Figure 8. Official Closing of the Log for the Last CH-21 in RVN.



17. STATUS SYMBOL	18. FAULTS AND/OR REMARKS	19. ACTION TAKEN	20. SIGNATURE
	(12 Jun 64) Oil line leading from AFT trans. to oil cooler leaks		
	(26 Jun 64) Search light control will not go to the right		
	Intermedate due		
	Last flight in Vietnam	Fls #1 O.K.	
	Official closing of the log by Commanding General, US Army Support Command, Vietnam	[illegible]	
		[illegible] M. [illegible]	
		Brigadier General, US Army	
		Acting Commander	
		[illegible]	
		JOHN C. [illegible]	
		Lt Colonel, Inf	
		Commanding Officer, 145th Avn Bn	
		[illegible]	
		EARL O. McCOMAHA	
		Major, Artillery	
		Commanding Officer, 120th Avn Co	

Figure 8 (continued). Official Closing of the Log for the Last CH-21 in RVN.

Figure 9. The Final Salute to the CH-21 in RVN.

Figure 10. General Oden with the Officers of the 118th/120th Aviation Companies and UTT Company at Official Termination of CH-21 Service in RVN.

sealing fuel cells. The company initially located at Khorat, Thailand, where they operated from June to December 1962. The unit then displaced to Vung Tau, RVN, where it positioned twelve of its aircraft, and the remaining four were used as floats to support requirements throughout South Vietnam and, occasionally, in Thailand. These aircraft greatly enhanced the distribution of aviation parts and supplies to other aviation units in-country. (When the Caribou aircraft were relinquished to the Air Force in 1966, the effectiveness of in-country distribution of aviation parts and supplies to Army aviation units was noticeably impaired. This may have been attributable to the ever-increasing volume of logistic requirements and to the resultant decentralized control of resources.)[4,7]

Continuing Buildup

The 61st Aviation Company (Caribou) arrived in-country in July 1963 after ferrying its aircraft from the States via Europe, Middle East and Asia.[13,14]

The 1st Aviation Company established another "first" by ferrying its CV-2 aircraft back to CONUS in December 1963.

In mid-1963, four CH-37 medium transport helicopters arrived from the 19th Aviation Company in Korea, and two were assigned to both the 611th and 339th DS maintenance companies. These aircraft made substantial contributions to the aircraft recovery efforts of both units. The H-37s were capable of recovering many aircraft intact without major disassembly, thereby reducing exposure time in hostile areas and reducing man-hours required to return the aircraft to flyable status.

The 73rd Aviation Company (Aerial Surveillance), initially equipped with O-1 Bird Dogs and later with OV-1 Mohawks, and the 114th Airmobile Company (UH-1s) arrived in the spring of 1963.[14]

The 330th Transportation Company (General Support) arrived in the spring of 1963 and was positioned at Vung Tau. This was the first general support maintenance and supply company in-country. The supply platoon of this unit displaced to Saigon and assumed responsibility for operation of the Aviation Supply Point.[18] Other units arriving in-country during 1964 included the following:

a. 70th Transportation Company (DS).
b. 56th Transportation Company (DS). (Initially located at Vung Tau and later re-located to Saigon.)
c. 765th Transportation Battalion (Aircraft Maintenance and

Supply (AM&S)). (Located at Vung Tau; supply platoon later moved to Saigon to operate the Aviation Supply Point.)

d. 57th Aviation Company (U-1A Otter). (Located at Vung Tau.)
e. A/501 (UH-1). (Arrived from Fort Hood and positioned at Bien Hoa.)
f. A/502 (UH-1). (Arrived from Fort Benning and positioned at Vinh Long.)

By the end of 1964, US Army support in RVN consisted of the following:

a. 13th Aviation Battalion - Can Tho - Supporting IV Corps area - With three UH-1B companies and one fixed-wing platoon.
b. 145th Aviation Battalion - Saigon - Supporting III Corps area – With two UH-1B companies and one armed helicopter company.
c. 52nd Aviation Battalion - Pleiku - Supporting I & II Corps areas - With two UH-1B companies, one airlift platoon, and one fixed-wing platoon.
d. 14th Aviation Battalion - Nha Trang - Supporting all RVN and JUSMAG, Thailand - With one direct support maintenance company, one fixed-wing Otter company, and one fixed-wing platoon.
e. 765th Transportation Battalion - Vung Tau - Supporting all four aviation battalions - With two direct support maintenance companies, one general support maintenance company, one CV-2 Caribou company, and one special warfare aviation detachment (OV-1 Mohawks.)
f. Special Forces Group with miscellaneous aviation equipment.

VIETNAM DEFENSE CAMPAIGN
(8 March - 24 December 1965)

Changing Situation

Because of intensified communist activity in 1965 and, specifically, increased overt actions against US Forces, the US troop commitment grew rapidly from 23,000 on 31 December 1964 to 181,000 on 31 December 1965.

Among the many units arriving in 1965 were the following:

a. A/1 (UH-1) - From Fort Riley to Ban Me Thuot.
b. A/82 (UH-1) - From Fort Bragg to Vung Tau.
c. A/101 (UH-1) - From Fort Campbell to Soc Trang.
d. 14th Transportation Battalion (AM&S) - Positioned at Saigon and later relocated to Nha Trang.
e. 110th Transportation Company (Depot) – Positioned at Saigon.

The transition period in 1965 from an advisory participation to an active defense posture included many changes which affected logistics doctrine. Some of the more significant events which will be detailed later are as follows:

a. Announcement by Secretary of Defense McNamara of establishment of the Army's first air cavalry division.
b. Establishment of the Aviation Materiel Management Center (AMMC).
c. Establishment of the "Red Ball" direct requisitioning system for support of aviation units in RVN.

Howze Board and the Airmobility Concept

In the late 1950s, Army planners noted an increasing imbalance between firepower and tactical mobility. Mobility had not kept pace with the significant advances in firepower.[19,20] Almost immediately after taking office, Secretary of Defense McNamara ordered a study on the condition of Army mobility and asked for an estimate of the equipment needed to reach a satisfactory level. Not satisfied with the answers he received from this study, he convened the Army Tactical Mobility Requirements Board (commonly known as the Howze Board). This board consisted of 14 general officers, six high ranking civilian research officials, and more than 30 highly experienced but lower ranking Army officers. Secretary McNamara asked General Howze to study the entire role of Army aviation and its application to airmobility. He was not to be constrained by traditional doctrine, but was to study new organizational and operational

concepts, even to the point of having completely airmobile infantry, artillery, anti-tank and reconnaissance units.[20]

The study was conducted on a high priority basis and in an atmosphere completely divorced from traditional viewpoints and current doctrine. The board conducted a program of analysis, war games, exercises and field tests to evaluate fresh, bold and unorthodox concepts of tactical mobility.[21]

In addition to improving the airmobility of all Army units, the Howze Board recommended that specialized, completely airmobile divisions be formed immediately. General Howze called these units Air Assault Divisions; the combat troops were to be 100% air-transportable. He recommended light air-transportable weapons and aircraft-mounted rockets to substitute for heavy artillery. The Board recommended increasing the number of aircraft in the normal infantry division from 50 to 101 and established the number in the air assault division at 459.[20] (This was later changed to 434 aircraft when the 1st Air Cavalry Division (Airmobile) was formed.) Annex A contains a comprehensive discussion of the testing of the Howze Board logistical concepts in the 11th Air Assault Division (Test).

After three years of study, experimentation, field testing and evaluation, the Secretary of Defense on 16 June 1965 gave approval for the Army to proceed with the organization of an airmobile division. The unit selected was the famed 1st Cavalry Division, and the test unit (11th AAD) was renamed the 1st Cavalry Division (Airmobile). The general order establishing the division was published on 1 July 1965, and the unit was fully operational in RVN on 28 September 1965 - almost miraculous considering the many seemingly insurmountable problems which had to be overcome.[22]

*From Test to the Real Thing**

When the change-over from the 11th Air Assault Division to the 1st Air Cavalry (Airmobile) Division was made, assets were taken from the 11th and the 2nd Infantry Division and numerous other sources. Figure 11 reflects the 1st Cavalry organization after the following changes were made to the proposed Air Assault Division organization:

a. Deleted the LITTLE JOHN Battalion (recommended that the Air Force assume this mission).
b. Eliminated the OV-1 Mohawk Battalion (retained six OV-1s

*Description of deployment and movement of 1st Cavalry Division (Pages 28 to 38) taken from references 23, 24, 25, 26.

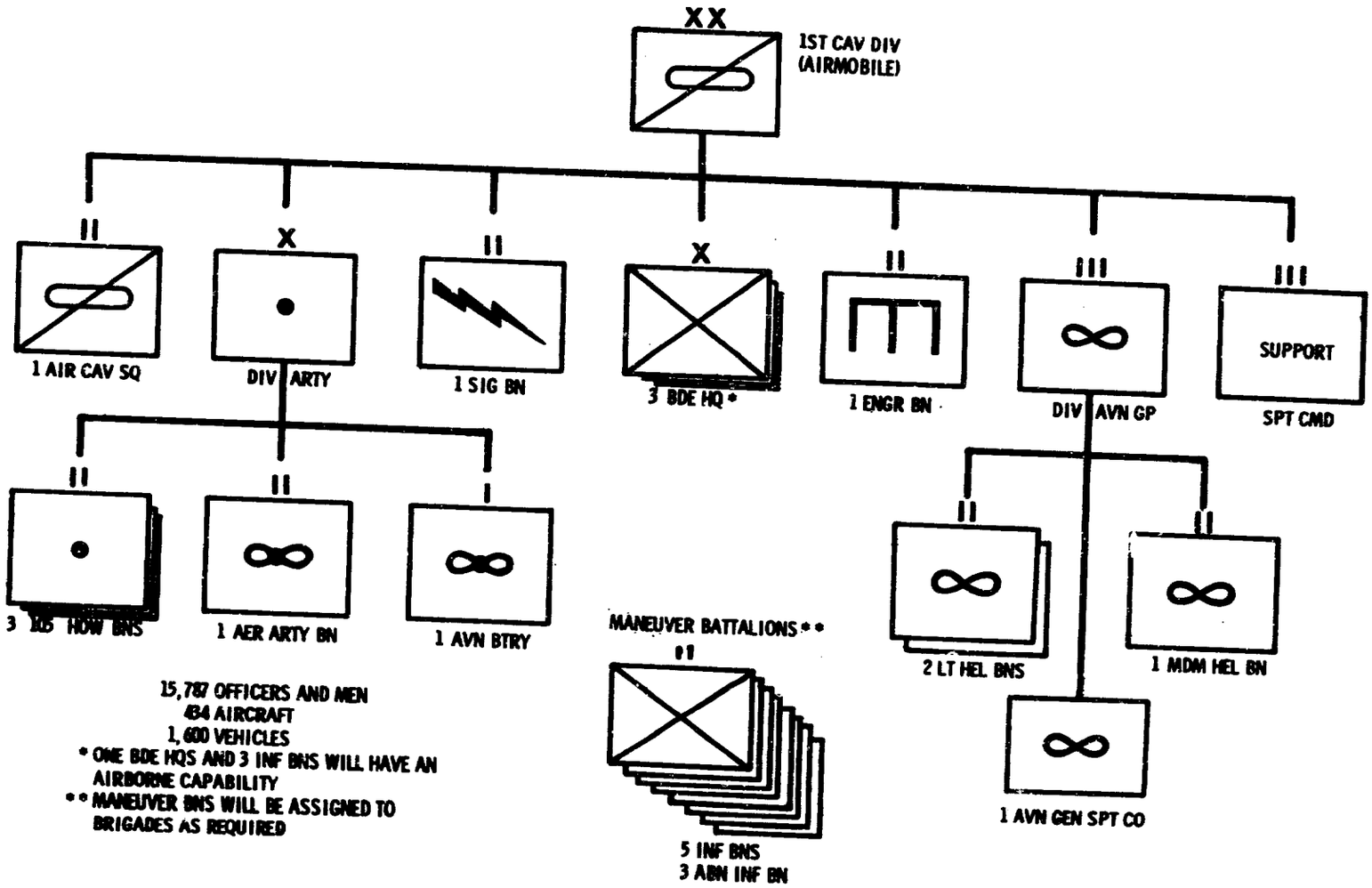


Figure 11. Organization, 1st Cavalry Division (Airmobile).

to accomplish the reconnaissance and surveillance mission).

c. Incorporated a full brigade of airborne instead of the original battalion.
d. Changed the air transport brigade to a group (added flexibility for tailoring assets to accommodate the many diverse missions).

There were many difficult problems to overcome in the change-over:

a. Almost 50% of the personnel were ineligible for overseas deployment.
b. Training of replacement pilots increased aircraft flying hours during a period when the aircraft should have been grounded for maintenance and modifications.
c. PLLs and ASLs needed replenishing (handicapped by requirement to provide parts and supplies for pilot training activities).
d. Conversion from A-B-C maintenance concept (and associated supply levels) to conventional methods was necessary (see Annex A).
e. Changes in TOEs required considerable equipment exchange and turnover.

Considering these and many other serious problems (which included the movement of over 400 aircraft, nearly 16,000 personnel, over 1,600 vehicles, and a great variety of other supplies and equipment), the job of becoming combat ready in just eight weeks was a momentous task.

Aircraft Status for Deployment

A survey of different aircraft revealed the requirement to accomplish a large number of modifications (MWOs) and other maintenance work in a very short period of time. The services of contract teams from various manufacturers were utilized to facilitate these maintenance requirements.

The 1963 and 1964 model CH-47 aircraft needed 23 mission-essential and safety-of-flight modifications, totaling 1,334 MWOs identifiable to 58 aircraft. After it was determined that all the MWOs could not be applied within the time frame available, 21 MWO kits were shipped with the aircraft. The UH-1 aircraft required application of 27 MWOs (total 1,878 modifications) and all were accomplished prior to deployment. Installation of new armored seats in the UH-1Ds was accomplished with the assistance of the manufacturer's representatives with no significant delays.

Planning for Deployment (July-August 1965)

Two staging areas were established to receive, process and load the aircraft onto four carriers in accordance with prepared plans.

a. Brookley Air Force Base, Mobile, Alabama, was designated to receive and process 163 UH-1Bs and UH-1Ds for loading aboard the USNS *Croatan* (9 Bs and 71 Ds) and the USNS *Card* (21 Bs and 62 Ds).
b. Mayport Naval Base near Jacksonville, Florida, was designated to receive and process 323 aircraft for loading aboard the USS *Boxer* (4 CH-54As, 6 OV-1s, 41 UH-1Ds, 57 CH-47s, and 107 OH-13s) and the USNS *Kula Gulf* (81 UH-1Bs and 27 UH-1Ds).

Because the USS *Boxer* was the only ship with full fire-fighting and area damage control capabilities, the safest aircraft (UH-1s) were loaded aboard the three MSTS ships and the other less-safe aircraft aboard the USS *Boxer.*

The processing activity at Brookley AFB was manned entirely by the 1st Transportation Battalion (Seaborne Depot). This unit was able to provide excellent technical assistance because of experience gained in past ocean shipments of AMC assets to overseas theaters. The O&R facility at Jacksonville Naval Air Station furnished personnel, supplies and equipment to "Spraylat" flight deck aircraft loaded at Mayport. The 1st TC Battalion provided personnel augmentation.

Aircraft not to be cocooned with "Spraylat" (CH-47, OH-13 and OV-1) were flown directly to Mayport, given minimum required processing, and marshalled for loading.

Except for certain modifications required for fly-off of helicopters from the carriers, the following techniques for ocean shipment were followed:

a. CH-47: Remove blades; stow in racks inside aircraft.
b. UH-1: Remove blades and stabilizer bar; package in plywood boxes.
c. OH-13: Remove forward blade; package in plywood boxes.
d. CH-54: Remove blades; package in metal containers.

The UH-1s and OH-13s were mounted on wooden skid bases, but this procedure complicated handling and is now considered unnecessary, expensive and time-consuming.

Approximately 80,000 man-hours were required to process all the aircraft aboard the four carriers.

Figures 12-17 show some of the activities associated with preparing for deployment of 1st Cavalry aircraft.

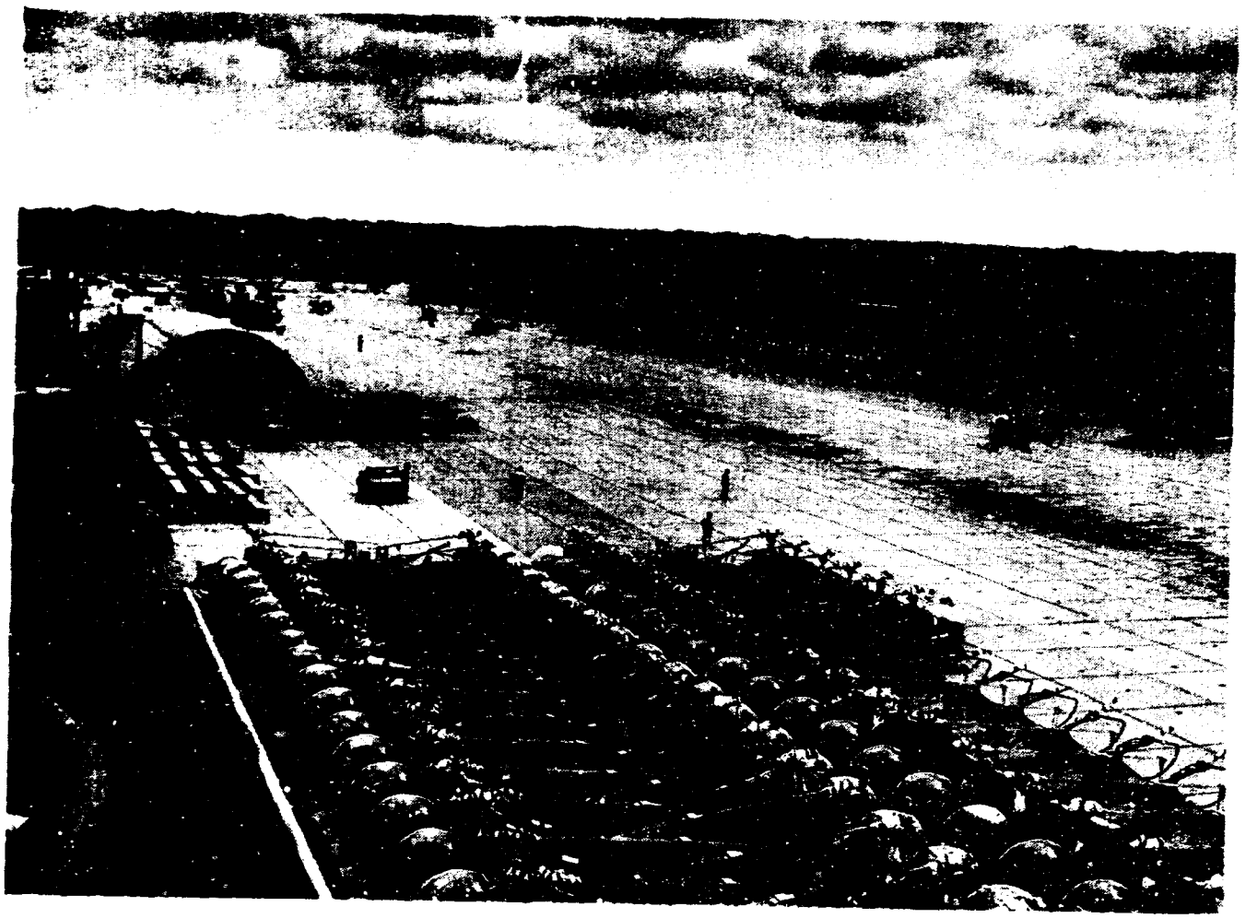


Figure 12. 1st Cavalry Division Aircraft Arriving and Being Processed at Marshalling Area.

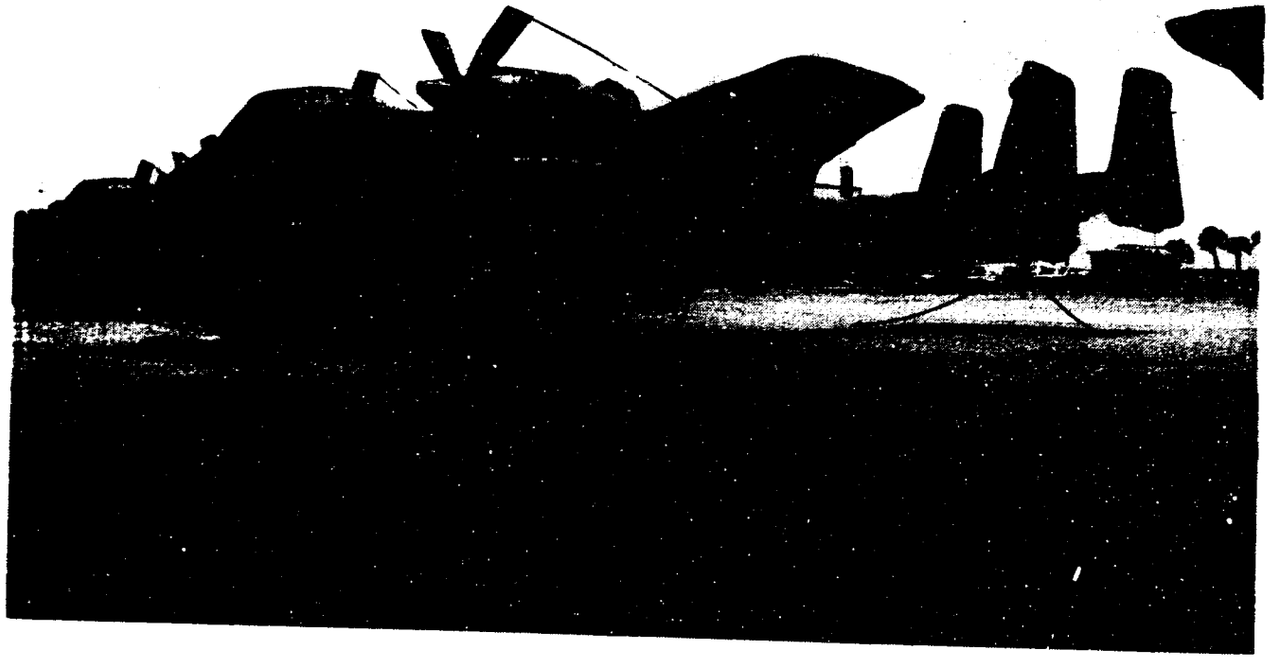


Figure 13. OV-1 Mohawk Wrapped for Delivery.

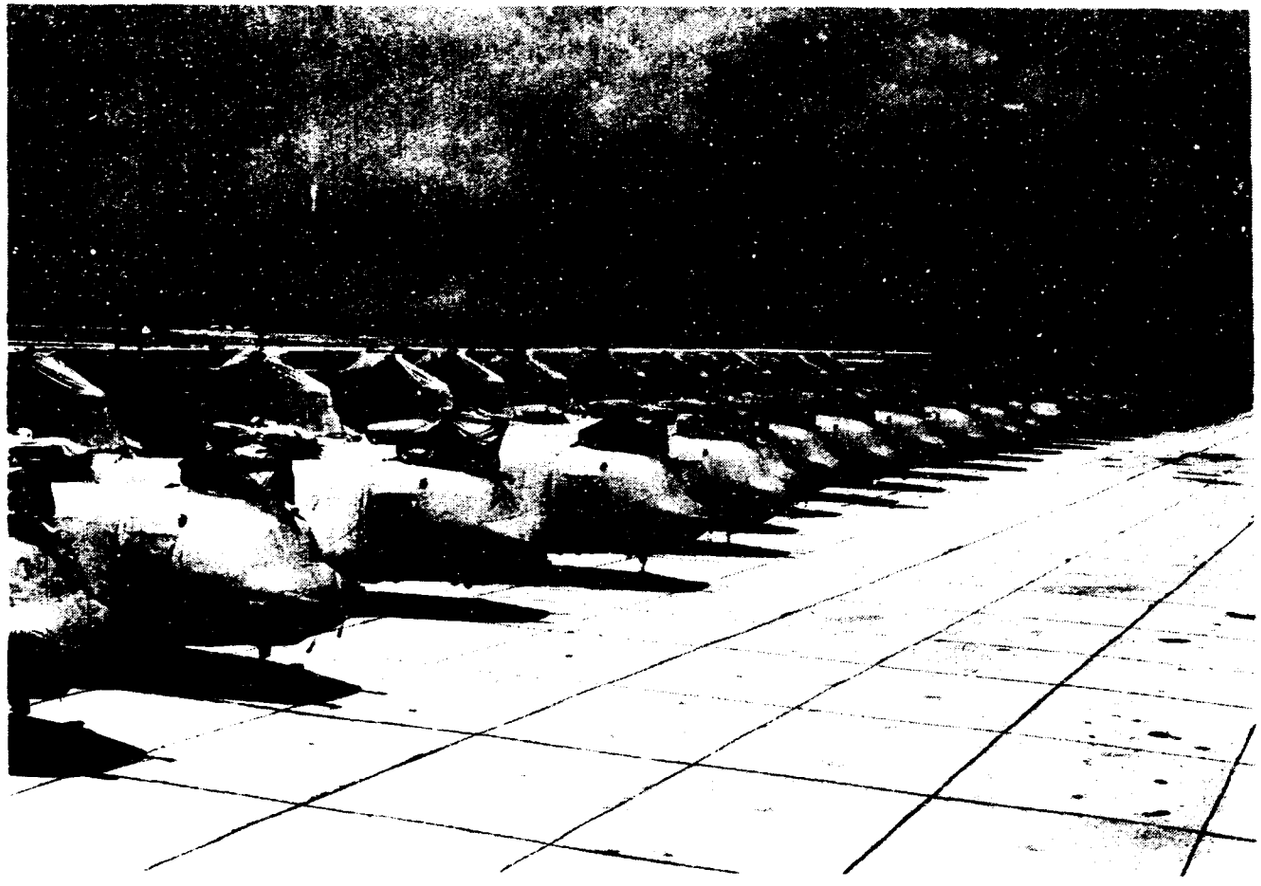


Figure 14. CH-47 Chinooks "Dressed" Left to Right Prior to Loading.

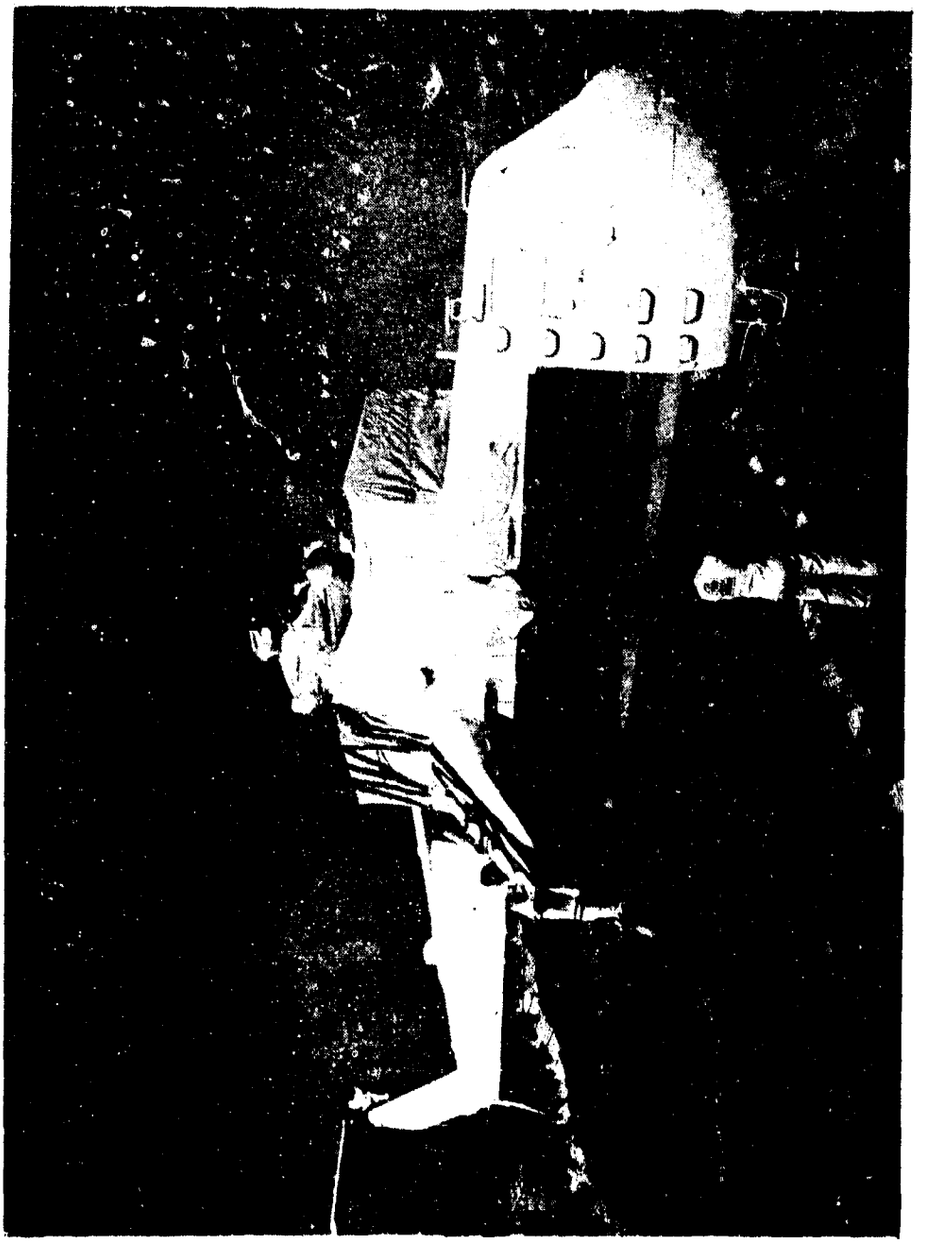


Figure 15. This CH-54 Flying Crane is About to Get a Taste of its Own Medicine.

Figure 16. UH-1s Cocooned with Spraylat Loaded for Deployment.

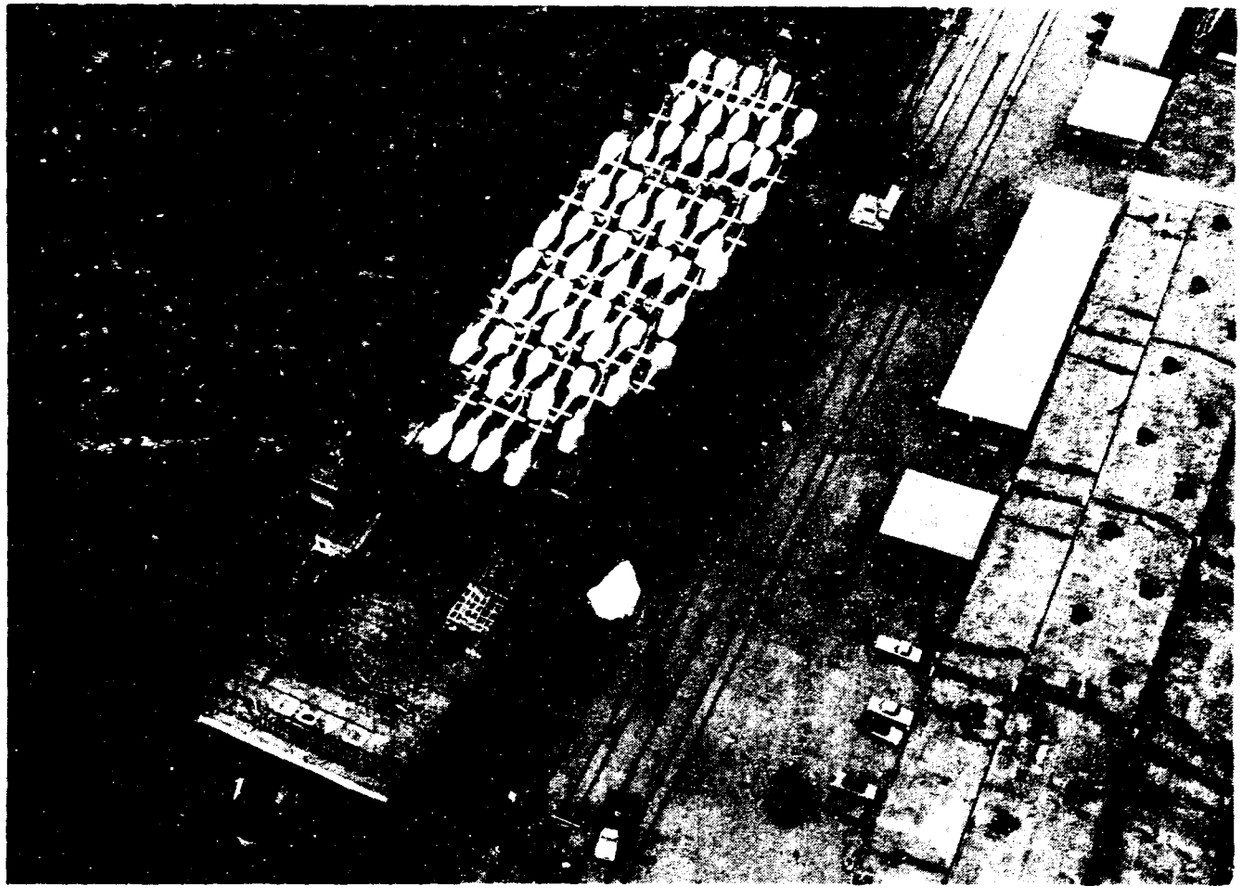


Figure 17. 1st Cavalry UH-1s Positioned Aboard USNS Card Prior to Deployment.

Problem Areas

Many of the aircraft arriving in the marshalling areas had incomplete or missing records, damaged blades and components, and numerous fluid leaks. There were insufficient division liaison officers at the marshalling sites, preventing or delaying essential coordination. The manufacturer's sling assembly for loading CH-47s aboard the ships was unsatisfactory; the Jacksonville NAS designed and fabricated a new one. Blade boxes fabricated at depot required extensive rework to correct design discrepancies and poor workmanship. Cradles for UH-1s built at depot were reworked to correct components not made in accordance with drawings. Since only the USS *Boxer* had adequate fire-fighting and servicing equipment aboard, Army equipment had to be acquired for shipment aboard other vessels to insure adequate fire protection and servicing prior to off-loading at destination.

Movement

The 1st TC Battalion provided four- and five-man teams to accompany each vessel for monitoring of aircraft condition and security. The USS *Boxer* proceeded via the Suez Canal, while the three smaller vessels traveled via the Panama Canal. The USNS *Card* encountered severe weather with typhoon winds up to 115 knots; no serious damage resulted. The other vessels encountered very little weather.

Frequent, almost daily, repairs to Spraylat coatings were needed; water entered reusable covers and seam failures occurred. Subsequently, Equipment Improvement Recommendations (EIRs) from the 1st Cavalry Division indicated that 33 windshield panels on CH-47s were delaminated or blistered. The suspected cause was heat retention by the aircraft shipping covers under prolonged exposure to sunlight.

Destination

Upon arrival at Qui Nhon, South Vietnam, the aircraft were depreserved and prepared for flight while on board the carriers. Only the OV-1s and two non-flyable UH-1s were off-loaded by floating crane. The feasibility of mass fly-off delivery of Army aircraft to an overseas destination was demonstrated.

Ia Drang[29]

Initially, the 1st Cavalry Division was assigned the mission of protecting the key communications center at Pleiku, but almost

before the division had settled into its base camp at An Khe, it was heavily involved in the Battle of Ia Drang Valley.

A division of the North Vietnamese Army, consisting of three regiments, attacked the Special Forces camp at Plei Me on 19 October 1965. Within two days, when it became apparent that ARVN and the Special Forces team could not repel the invaders, the 1st Air Cavalry Division initiated its support. The division was given the mission to move in reinforcements, take over the operations and seek out and destroy the enemy.

The battle lasted 35 days, and on 26 November 1965, the 1st Air Cavalry Division had completed its mission of pursuit and destruction. The statistics of the aviation units involved, to a large extent, tell the story of how the mission was accomplished.

The assigned and attached aviation units were directed by subordinate headquarters, the 11th Aviation Group and the Support Command. The units of the 11th were the 227th and 229th Assault Helicopter Battalions (UH-1s), the 228th Assault Support Helicopter Battalion (CH-47s), and the 11th Aviation Company which provided general support helicopters and 6 OV-1s for aerial surveillance and target acquisition. The Support Command controlled the attached 17th Aviation Company (CV-2s) and the attached 478th Flying Crane Company (CH-54s).

During the 35 days of the campaign, the aircraft delivered 5,048 tons of cargo from the wholesale terminals to the hands of the troops in the field. In addition, they transported 8,216 tons into Pleiku from various depots (primarily Qui Nhon and Nha Trang). Whole infantry battalions and artillery batteries were moved by air, and approximately 2,700 refugees were moved to safety. In all this flying, 59 aircraft were hit by enemy fire - three while on the ground - and only four were shot down; of these four, three were recovered.

A most significant logistics test was accomplished during this battle - the question of whether or not we could maintain our aircraft for prolonged periods of combat. The records show that at the end of this long campaign the division's aviation maintenance personnel were putting more mission-ready aircraft into the air than were being deadlined for combat, operational or maintenance reasons. The challenge was met even during the period of peak operations.

This impressive logistical performance resulted from a round-the-clock team effort on the part of the men who flew, maintained, controlled, refueled, and repaired the aircraft in a hostile area in all kinds of weather.

AMMC

By early 1965, there were approximately 660 aircraft in RVN, mostly helicopters. They were supported by direct support field maintenance detachments located with most of the aviation units. Back-up direct support and general support were provided by three DS maintenance companies, one GS maintenance company, and an Aviation Supply Point stocking approximately 8,000 line items.

In July 1965, the US Army Support Command-Vietnam became the United States Army-Vietnam (USARV). USARV provided plans and guidance for establishment of a depot facility complete with inventory control point. This depot, located in Saigon, absorbed the old Aviation Supply Point and became the Aviation Materiel Management Center (AMMC). The Supply Platoon of the 14th Transportation Battalion (AM&S) and the 110th Depot Company were attached to AMMC in September and November 1965, respectively. Construction of depot facilities and warehouses accelerated greatly during this period. In November 1965, an ADP (Automatic Data Processing) system was installed and Red Ball Express System was inaugurated to keep abreast of items which were deadlining aircraft.[18] A more detailed account of AMMC history and functions will be given later.

Much of the credit for the superior logistical support during the Battle of Ia Drang Valley must be given to the AMMC for assuring availability of aviation items of supply.

Red Ball Express[30]

Red Ball Express was the first of several direct requisitioning systems - termed "Stovepipe" - implemented for the purpose of decreasing the Not Operational Ready-Supply (NORS) rate on aircraft in Vietnam (Figure 18). With the rapid increase in aircraft arrivals during 1965, the supply system quickly fell behind in its ability to provide sufficient repair parts to keep the aircraft flying. The deadline rate became unacceptable and, since this condition was true of all other types of equipment, the Secretary of Defense on 1 December 1965 directed the establishment of Red Ball Express. Although aviation items were not affected as critically as other items of equipment, two factors were primarily responsible for the inadequate logistical build-up during 1965; first, environmental circumstances (including severe climate and terrain conditions, separation and isolation of forces and supporting elements, limited supply and communication routes and high

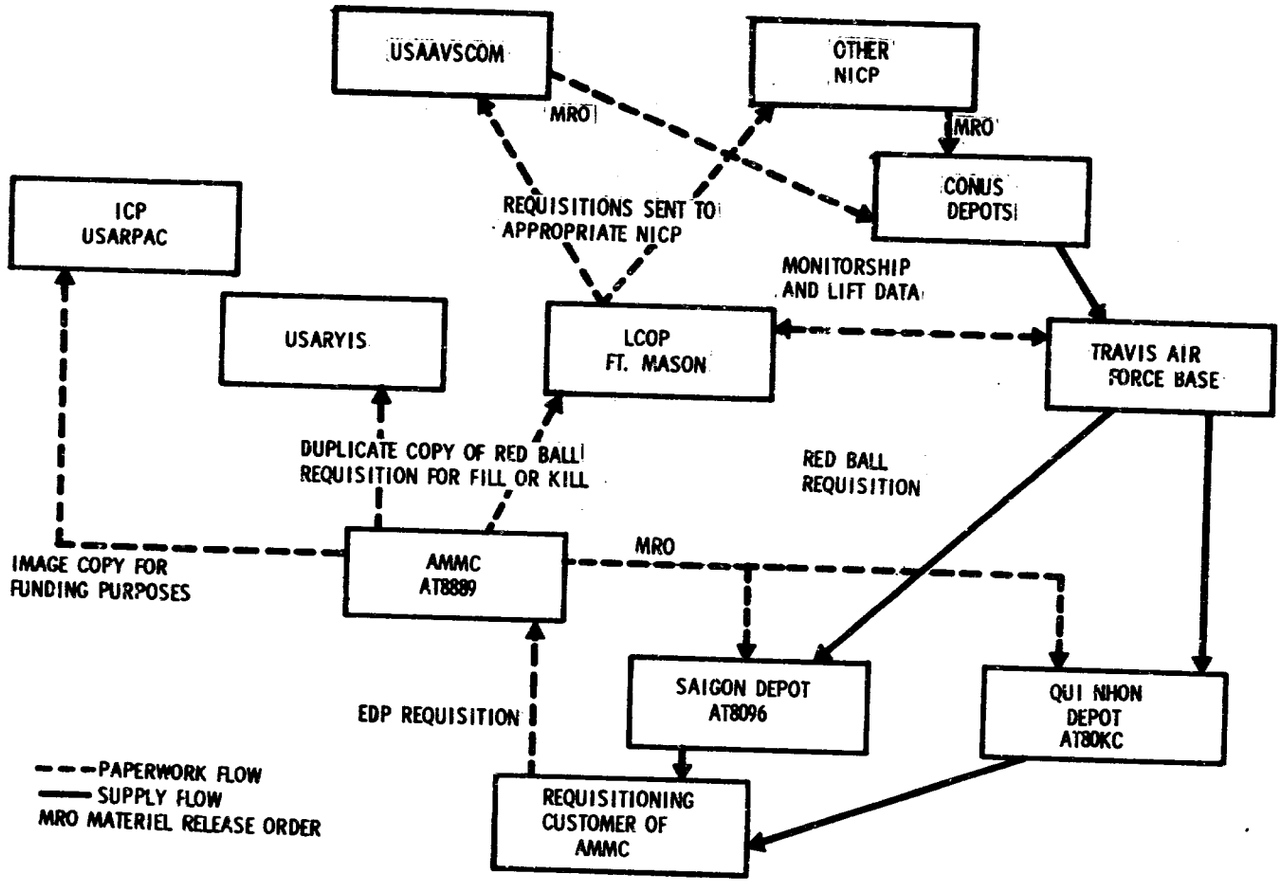


Figure 18. Red Ball Express Requisition and Supply Flow.

security requirements) and second, saturation of supply and transportation systems resulting from the ten-fold increase of combat and combat support forces in slightly over one year. Red Ball Express provided reserved and predictable airlift delivery responsive to COMUSMACV for the purpose of expediting delivery of repair parts required to remove equipment from deadline.

A major factor in establishment and operation of Red Ball was the designation on 3 December 1965 of the Logistics Control Office – Pacific (LCO-P) as the focal point in CONUS for system control. Red Ball became operational on 6 December 1965 with the arrival at the LCO-P of the first batch of requisitions from Vietnam.

Initially, Red Ball used designated airlift with daily flights from Travis AFB to Vietnam, carrying Red Ball cargo exclusively. Subsequently, this reserved priority lift system was superseded by assigning Red Ball aircraft priority co-equal with all Services super-priority transportation procedures 999.

An extension of Red Ball Express was implemented in January 1967 - referred to as Red Ball Expanded (RBX). This system allowed the DSUs to requisition repair parts to replenish stocks (to 25% of the reorder quantity) when a zero balance for an EDP item was anticipated within the next 15 days. RBX was short-lived, however; on 23 July 1970, it was suspended because duplication occurred when other supply management systems (such as Stovepipe, selective items management and closed loop) were implemented.

In addition to the primary purpose of expediting delivery of repair parts to remove deadlines, a number of other Red Ball objectives have evolved:

a. Insure that equipment operationally ready rates are maintained at acceptable levels.
b. Provide responsive transportation of repair parts.
c. Provide an expanded acquisition capability.
d. Provide limited stockage capability for anticipated needs.
e. Provide visibility and overview of the supply system.
f. Insure performance within MILSTRIP time-frame.
g. Provide timely and one-stop status to requiring customer.
h. Provide single source of management control for repair parts requisitions required to remove equipment from deadline.

The vastly improved operationally ready (OR) rates in RVN since inception of the program attest to the success of Red Ball. A total of 145,397 Red Ball requisitions for aircraft parts were received between December 1965 and December 1970; only 217 were outstanding on 31 December 1970.

COUNTEROFFENSIVE
(25 December 1965 - 15 September 1969)

Introduction

During the Vietnam Counteroffensive, the number of Army aircraft in USARV increased from about 1,650 to approximately 4,200. Significant milestones for logistics support in this period included formation of the 34th General Support Group (Aircraft Maintenance and Supply), the realignment of responsibilities for aircraft by the Army and the Air Force, and conversion of the 101st Airborne Division to an airmobile division. This period was also characterized by many innovative techniques in aircraft maintenance and supply.

Establishment of 34th General Support Group (AM&S) [31,32]

In July 1965, Army aircraft maintenance in RVN was provided by three direct support companies and one general support company. Aviation supply was managed by the Aviation Supply Point (ASP) in Saigon. All of these units were part of the 12th Aviation Group, which in turn, reported to the US Army Support Command (USASC) (Figure 19). The ASP managed only aircraft peculiar repair parts. The requisition channel was from the aviation unit to DSU to ASP to Okinawa to CONUS. Other items of supply required for operation and maintenance of Army aircraft such as POL, tools, and ground support equipment were requisitioned from Okinawa through USASC.

As the role of Army aviation continued to grow, BG John Norton, CG, USASC, formed in 1965 an ad hoc committee to study means to provide the best possible support for the ever-increasing number of aircraft. His objectives were to:

a. Provide one-stop maintenance and supply support to Army aircraft (including airframe, engine, avionics and armament).
b. Provide an organization that had the ability to grow.

The ad hoc group considered the following organization structures:

a. Aircraft maintenance and supply units integrated into the Aviation Brigade structure.
b. Aircraft maintenance and supply units integrated into the 1st Logistical Command structure and working from their support area bases.
c. A separate command organization (group) controlling all non-divisional aircraft maintenance and supply units. This group could be assigned to the following three organizations:

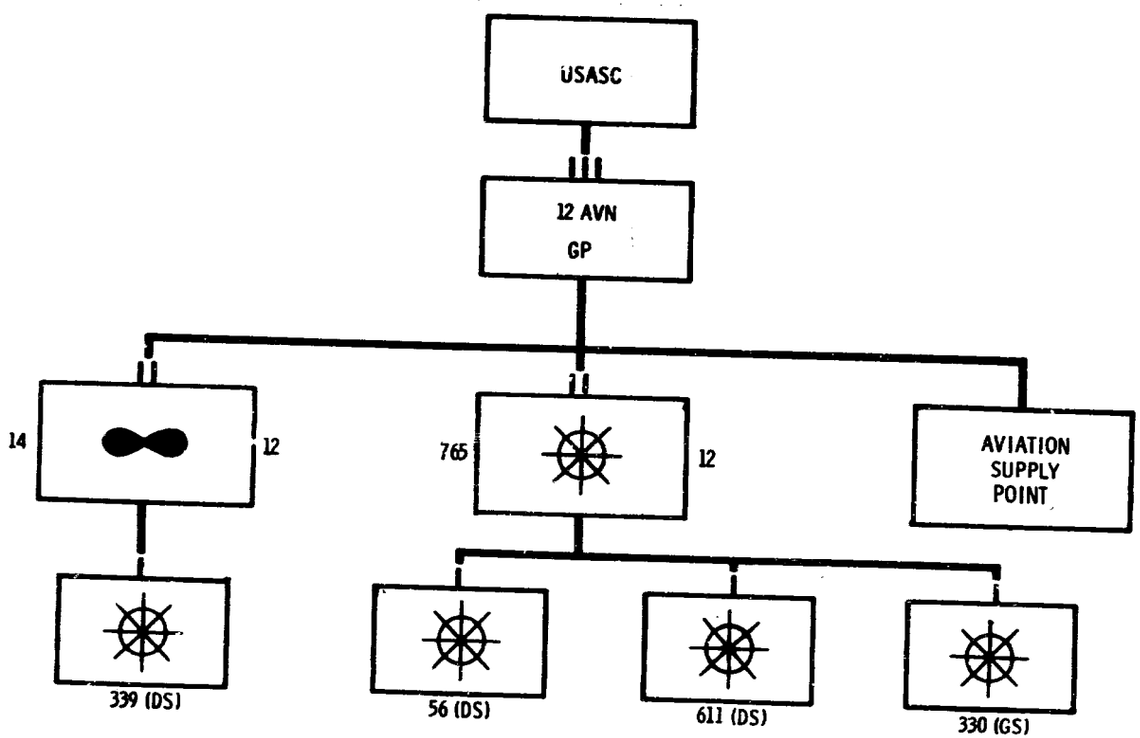


Figure 19. Organization for Aviation Logistics Support, July 1965.

The Aviation Brigade, 1st Logistical Command, or under USARV Headquarters as a separate major command.

Matrices were developed listing alternatives which considered span of control, flexibility, responsiveness, and the ability to expand and provide one-stop maintenance. Each alternative had certain advantages which were given extensive consideration prior to the selection of the optimal solution. In addition to the ad hoc committee officers, others such as BG Wright, ADC, 1st Cavalry Division; COL Duke, CO, 1st Logistical Command; LTC Boatwright, AMC Customer Assistance Office; and LTC Ellis and various other officers from ACTIV were contacted for their thoughts and opinions.

Integration of the maintenance and supply support into the Aviation Brigade structure was not feasible primarily because of the requirement to provide direct maintenance and supply support to the smaller non-brigade and non-divisional units and back-up support to divisional units. If the transportation aircraft maintenance units had been placed in operational groups and battalions of the Aviation Brigade, the responsiveness to other customers might have been impaired. Company size units of the Aviation Brigade already had DS maintenance and supply capability either organic to the units or as KD detachments, and since organic back-up capability was not needed at brigade, it was determined that the support should be placed elsewhere.

The integration of the aircraft maintenance and supply function into the 1st Logistical Command structure was promising. The disposition of the logistical support areas of both were roughly parallel. Once a central inventory control center (ICC) was established, duplication of lines could be eliminated and personnel requirements could probably be reduced. Complete logistical support could be provided through a logistical command without taxing the tactical operators with this responsibility.

Problems arose, however, when the minute details of operation were analyzed. The highly specialized skills available in the transportation battalions and companies were absolutely essential in providing adequate maintenance and supply for aircraft systems. Under the 1st Logistical Command, what would be the command structure and policy? The low density of aircraft maintenance and supply companies in any one logistical area did not warrant the assignment of an aircraft maintenance and supply (AM&S) battalion headquarters as a command and control element. The composite battalion command in the Log Command support areas

could not provide adequate supervision in this technical area. This meant that the Transportation AM&S Battalion Headquarters would have to be broken into components and that these composite Battalion Headquarters, Area Support Command Headquarters, 14th ICC, and 1st Logistical Command would have to be augmented with the necessary skills. Extensive MTOEs requiring much time would have to be prepared and, at this point in the buildup, time was of the essence. Also, 1st Logistical Command was in a tremendous expansion and buildup phase and did not appear able to take on additional support requirements.

Flexibility was also an important consideration. Due to the lack of secure ground transportation routes, flyable aircraft received intensive command emphasis. Extra efforts were made to keep availability rates high and immediate response was demanded of the maintenance and supply support units when aircraft were down. Support was shifted from one place to another as tactical requirements dictated, and any degrading of this capability would have adversely affected the war effort. Assignment of the aircraft maintenance and supply support units to fixed logistical support areas tended to reduce this flexibility.

Putting the ASP in with the 14th ICC did not offer any additional responsiveness, as the ICC was having its own problems of recording accurate in-country on-hand balances and locations. By August of 1965, the 1st Logistical Command depots and the ports were becoming crowded, ships were awaiting berth space, and relief from this situation could not be predicted. The proposal to add responsibilities to the 1st Logistical Command staff for aviation maintenance and supply was not favorable for maintaining high aircraft availability and responsive support.

The alternative of a separate command organization to provide the aircraft maintenance and supply support seemed to offer the best solution. With this organizational structure, the requirements to provide one-stop maintenance and supply support could be more easily satisfied. It was realized that a duplicate out-of-country requisitioning system (14th ICC and ASP), especially in the avionics and armament area, could mean overlap and duplication of stocks. However, many of the items were peculiar to the aircraft systems, and for those that were common, the demand history would be recorded only for units that each requisitioner supported. This would mean a smaller individual requisition objective (RO) at both the 14th ICC and ASP when compared to total demands being recorded at one point. The sum of the two ROs would be slightly higher than a single RO, but the resultant responsive support warranted this approach.

If this solution was accepted, a group structure for aircraft maintenance and supply offered single manager control with greater responsiveness and flexibility in providing aircraft logistic support.

The next problem was to determine where the group should be placed in the overall command structure. Assignment to the aviation brigade would place it under the control of the operator having the highest aircraft density. Again, however, it reduced the probability of equable support to divisional units and non-divisional/non-aviation brigade units such as Signal and Engineers. It diminished responsiveness by placing an operational headquarters between the USARV G-4 staff and the key logistical AM&S support element.

The assignment of the group to the 1st Log Command had the major advantage of concentrating logistical support under a single commander who would answer to USARV G-4. However, the 1st Log Command Headquarters would require augmentation with AM&S personnel and, again, the principal aviation logistic support element would be one headquarters removed from responsive reaction to USARV Headquarters. Considering these factors, the most responsive command structure was to place the AM&S Group directly under USARV with staff supervision by the G-4.

The above alternatives were presented to General Norton and his staff by the ad hoc committee in September 1965 with a recommendation to adopt the separate group structure and have it report directly to USARV. General Norton accepted the recommendation and directed implementation of the plan.

The US Army Combat Developments Command Transportation Agency at Fort Eustis developed a proposed TOE structure for the group headquarters, and in-country modifications were accomplished. AVSCOM provided recommendations for a management structure to provide aircraft support from a single-point, in-theater, aircraft repair parts ICC.

AVSCOM's recommendations, with in-country modifications, evolved into the Aviation Material Management Center (AMMC) concept. The AMMC TDA and the proposed TOE for the General Support Group (AM&S) were forwarded for approval. USARV directed formation of a provisional Group Headquarters in November 1965. LTC Clarence Ellis, ACTIV, became the Group's commander and, using the assets of the old USASC Aviation Detachment and the Aviation Supply Point, formed a skeleton staff. Personnel and equipment resource requirements were levied

on the 14th and 765th Transportation Battalions (AM&S) to provide a minimal functional base. Since the AMMC concept had not been approved, this function was performed as an extension of the Provisional Group's staff. Approval of the 34th General Support Group (AM&S) TOE came in USARPAC GO 6, dated 17 January 1966. This approval authorized the proper staffing of the headquarters but gave no relief in the critical day-to-day management requirements to expand the old ASP and establish a separate ICC to support the fast-growing aircraft fleet. The Supply Division of Group Headquarters performed this function until more help arrived. The 241st Transportation Company (Depot) arrived in February 1966, giving the AMMC the capability of operating two depots. In April 1966, the 58th Transportation Battalion arrived and assumed operational control of AMMC.

Computerized Requisitions for 34th GS Group Units

In order to streamline and modernize the 34th GS Group requisitioning procedures, transceivers were installed at Pleiku, Qui Nhon, Cam Ranh Bay, Nha Trang, Vung Tau and Saigon for direct requisitioning to AMMC. (The 1st Cavalry Division at An Khe had this service as of late 1965). AVSCOM supplied six Freiden flexiwriters to assist the DS units and AMMC in their operation. Teletypewriter service was provided between AMMC, Vung Tau, and Phu Loi by late 1965 to speed transmission of Equipment Deadlined for Parts (EDP) requisitions. As all divisional and non-divisional aircraft DS companies (listed in AR-725-60-1) became recognized as authorized requisitioners worldwide, the AMMC stopped dealing with the vastly increasing number of separate aviation activities in a retail distribution manner and became a centralized aviation ICC and an in-country wholesale distributor to the companies. Figures 20 and 21 show the request, requisition, and supply flow prior to and subsequent to this action.

Plans were formulated to construct a second aviation depot site in the Long My Valley west of Qui Nhon. Construction started in July 1967 and supplies began arriving in November 1967. The 241st Depot Supply Company which had split operations at Cam Ranh Bay and Saigon moved to the new site to operate the depot. Limited electronic accounting machine (EAM) equipment was placed on site to handle location data, sort materiel release orders (MRO) received from the AMMC, and produce necessary shipping documents. Centralized accountability of stocks in the northern depot was maintained on the Saigon computer. Stock

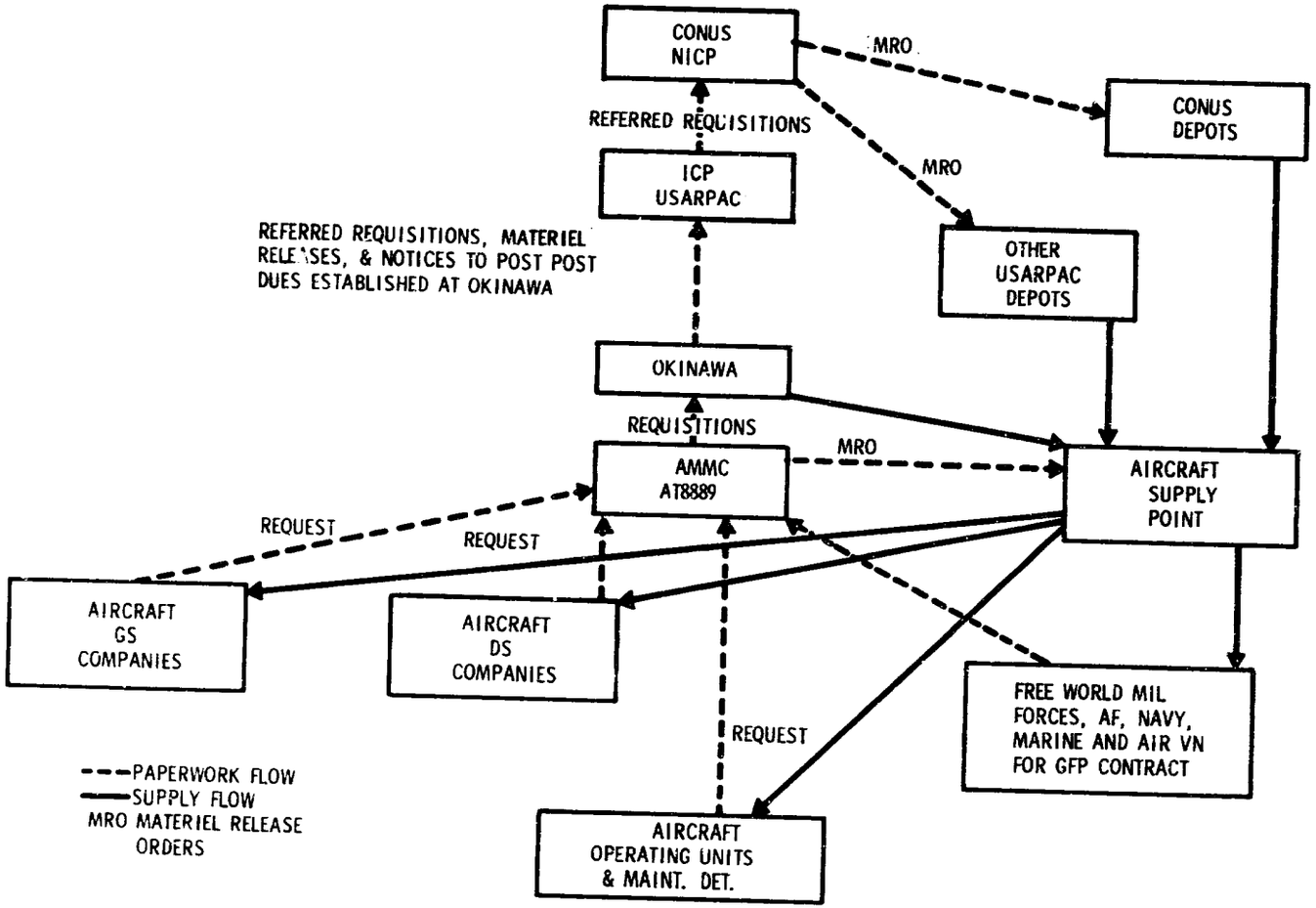


Figure 20. Request, Requisition and Supply Flow Prior to 1966 (Priorities 02 through 17).

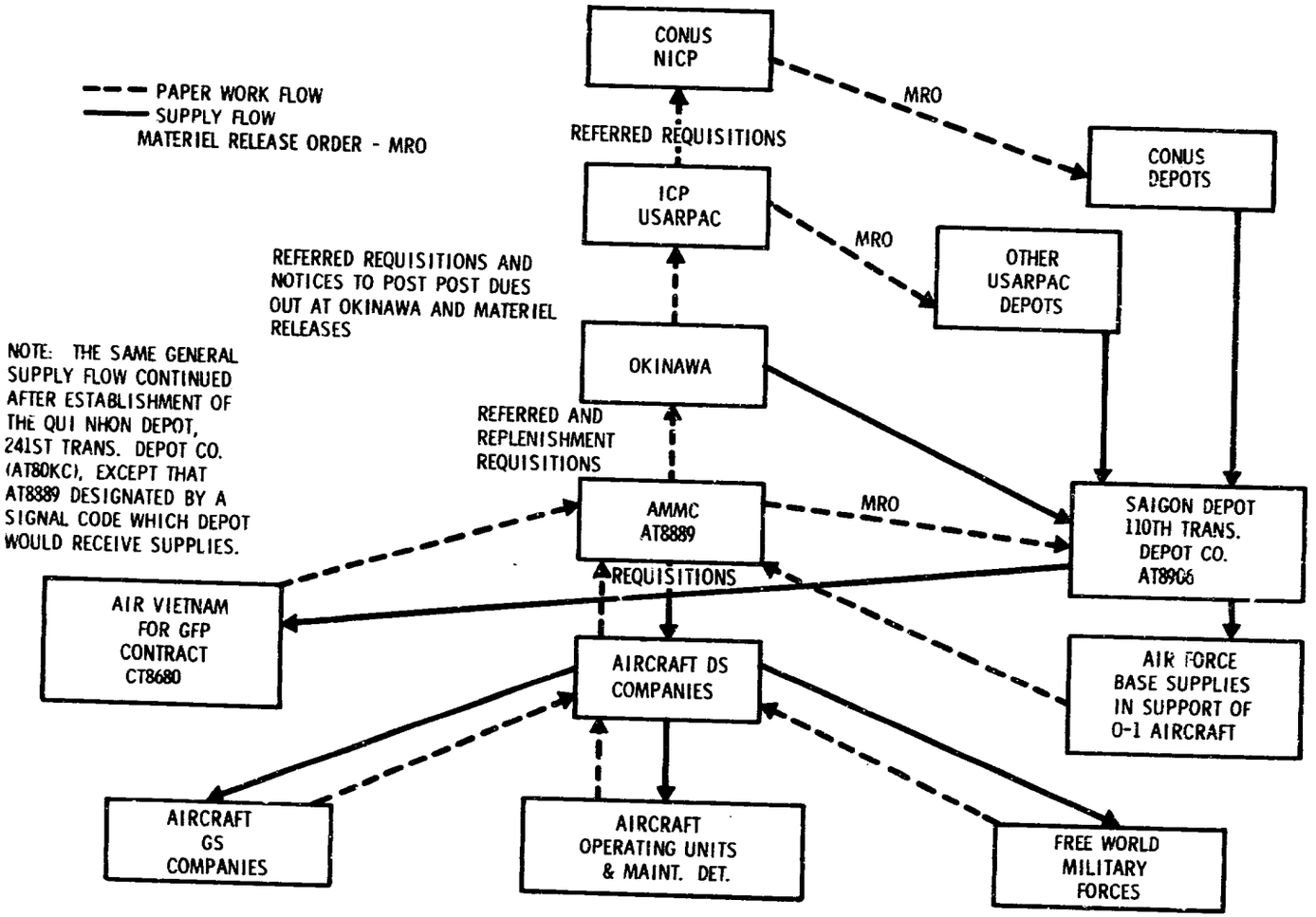


Figure 21. Request, Requisition and Supply Flow, April 1966 to April 1968 (Priorities 02 through 17).

levels at each depot were controlled by computer programs based on density of aircraft supported by the depot. Items with an RO of eight or less were stocked only in the Saigon depot.

Passing requisitions to Okinawa and on through USARPAC caused many delays and adversely affected the operational availability of aircraft in-country. Because of this continuing problem, several direct requisitioning (Stovepipe) systems were implemented. Prior to Stovepipe, all aviation unit requirements for aviation repair parts were submitted to DSUs, and all other supply support (ground support equipment, housekeeping, ammunition, POL, etc.) requisitions were submitted through logistics channels of the 1st Logistical Command. (In addition to satisfying demands from aviation units, the DSU stocks items to support the DS maintenance function and supports the general support company when it is collocated with the DSU.)

When demands received by the DSU were not in stock, the demands were placed on AMMC. Prior to May 1966, requisitions generated by DSU for items managed by AVSCOM were routed to AMMC and all other requisitions were routed to the 1st Logistical Command. Items not stocked by AMMC were passed to 2nd Logistical Command in Okinawa and, if not in stock, were passed on through USARPAC to the applicable CONUS supply source for direct shipment to AMMC.

Effective in May 1966, all repair parts applicable to Army aircraft and installed avionics and armament were managed by AMMC, and the DSU had a single requisitioning source. (Currently, the "P" Manual provides a single publication and a simplified requisitioning system for placing demands on AMMC.)

Red Ball Express, the first direct requisitioning system (page 41, Figure 18) in December 1965, was followed by Projects HJW (CH-47) in July 1966, MIY (UH-1) in November 1966, MIX (OH-6A) in April 1967, MWC (CH-54) in July 1967, and finally with OFP covering all aircraft systems in April 1968. Project OFP, which superseded all the other systems except Red Ball, provided for all priority 02 through 17 replenishment requisitions and passing orders from the AMMC to go directly to AVSCOM with USARPAC receiving information copies for funding purposes only. Project OFP provided that all NICP (WECOM, ECOM, etc.) requisitions flow from AMMC to AVSCOM and then be redistributed to the appropriate NICP. The requisition and supply flow after Project OFP was initiated is shown in Figure 22. AVSCOM monitored all actions on these requisitions and provided 100% status to AMMC. In this way, AVSCOM, with

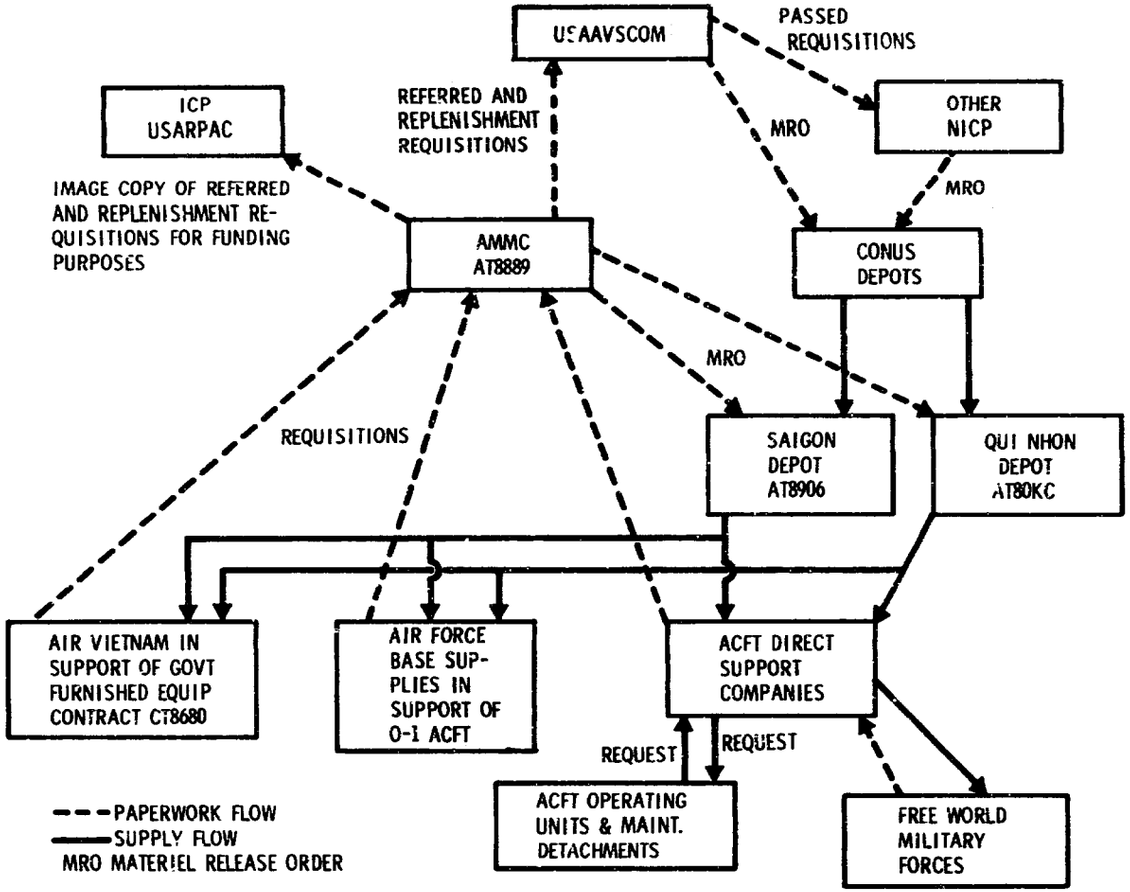


Figure 22. Request, Requisition and Supply Flow for Priorities 02 through 17 After Project OFP Was Initiated.

complete knowledge of aircraft system requirements, could assist on any item that was affecting its operational availability.

Representatives from AVSCOM worked in-country with AMMC and also assisted with maintenance and retrofit problems and requirements. This close working relationship between 34th GS Group, AMMC and AVSCOM significantly expedited supplies and greatly improved the overall aircraft OR rate.

EDP requisitions under the Red Ball Express System also bypassed the USARPAC supply system. These requisitions flowed to the Logistic Control Office-Pacific (LCO-P) at Fort Mason and were routed to the appropriate NICP for action (Figure 18) with complete information to AVSCOM for monitorship purposes. In order to exploit the potential for faster turn-around times, a second copy was furnished the 2nd Log Command in Okinawa on a "fill-or-kill" basis. If USARYIS could fill, they would notify the LCO-P to cancel that requisition and would ship the part to AMMC. Although this procedure still existed in late 1969, the fill from USARYIS decreased to less than one percent as the draw-down in aviation stock in Okinawa continued. As with routine requisitions, USARPAC was furnished information copies on Red Ball requisitions for funding purposes.

With the approval of the AMMC TDA in February 1968, the 58th Transportation Battalion was reassigned from the Saigon area to Red Beach at Da Nang. The 610th Transportation Company (GS), the 142nd Transportation Company (previously the 339th) and the 335th Transportation Company (later attached to the Americal Division) were placed under command of the 58th to provide aircraft maintenance and supply support to the I Corps Tactical Zone (CTZ) where aircraft density had increased significantly. Aircraft density had also greatly increased in III and IV CTZs, and the 520th Transportation Battalion arrived in-country in March 1967 to support the northwestern portion of II CTZ. The 765th Transportation Battalion at Vung Tau supported the remainder of III CTZ and IV CTZ. Area support coverage and unit locations of 34th GS Group units are shown in Figure 23.

Supply responsiveness was enhanced considerably through improved ADP capability when the AMMC Data Processing Center TDA was approved in May 1968. Figure 24 reflects the present organization of AMMC.

The 34th Group's mission of providing dedicated, one-stop maintenance support for aircraft to US and Free World Military Assistance Forces in RVN included:

a. Providing direct and general support maintenance to

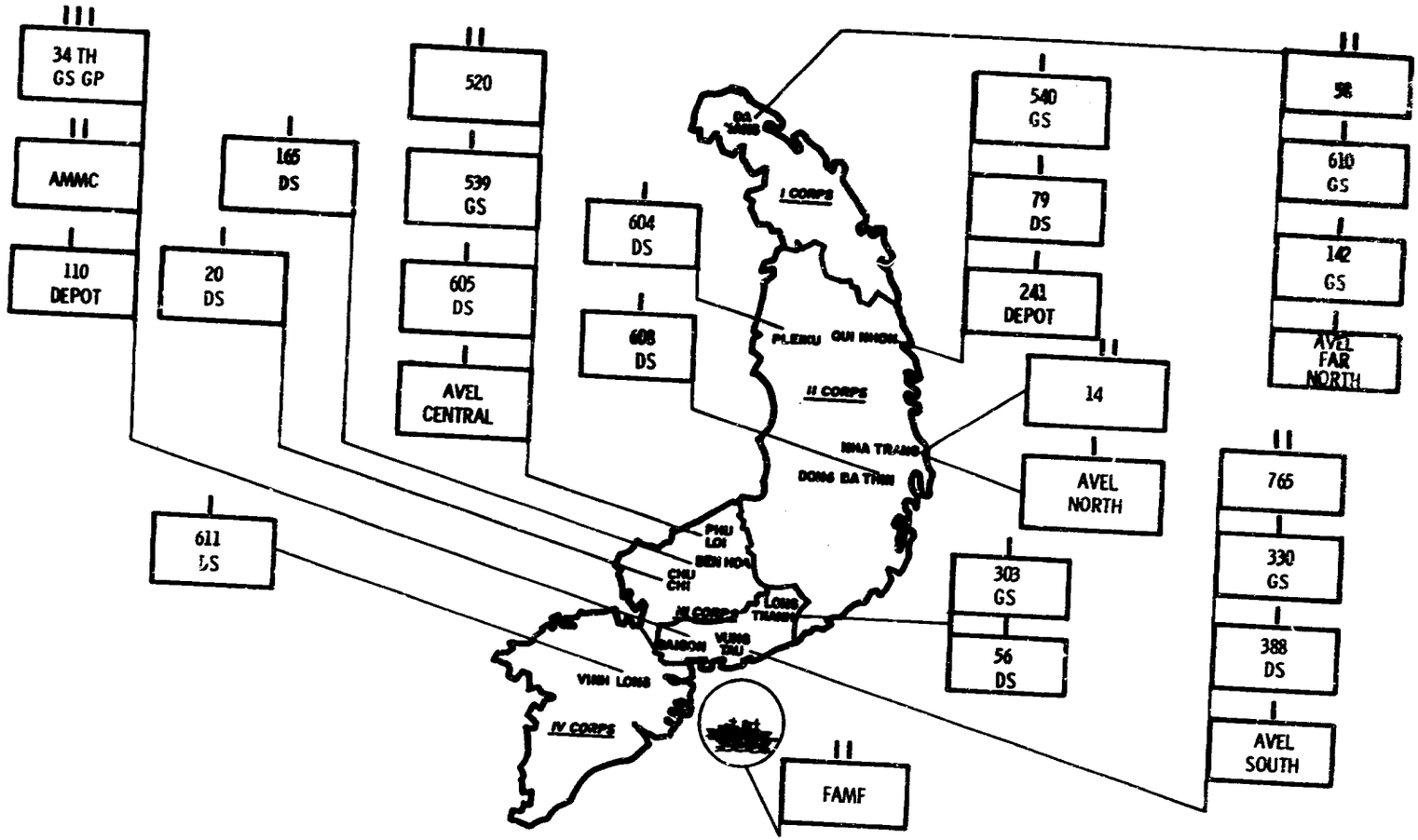


Figure 23. Deployment of the 34th General Support Group in Vietnam.

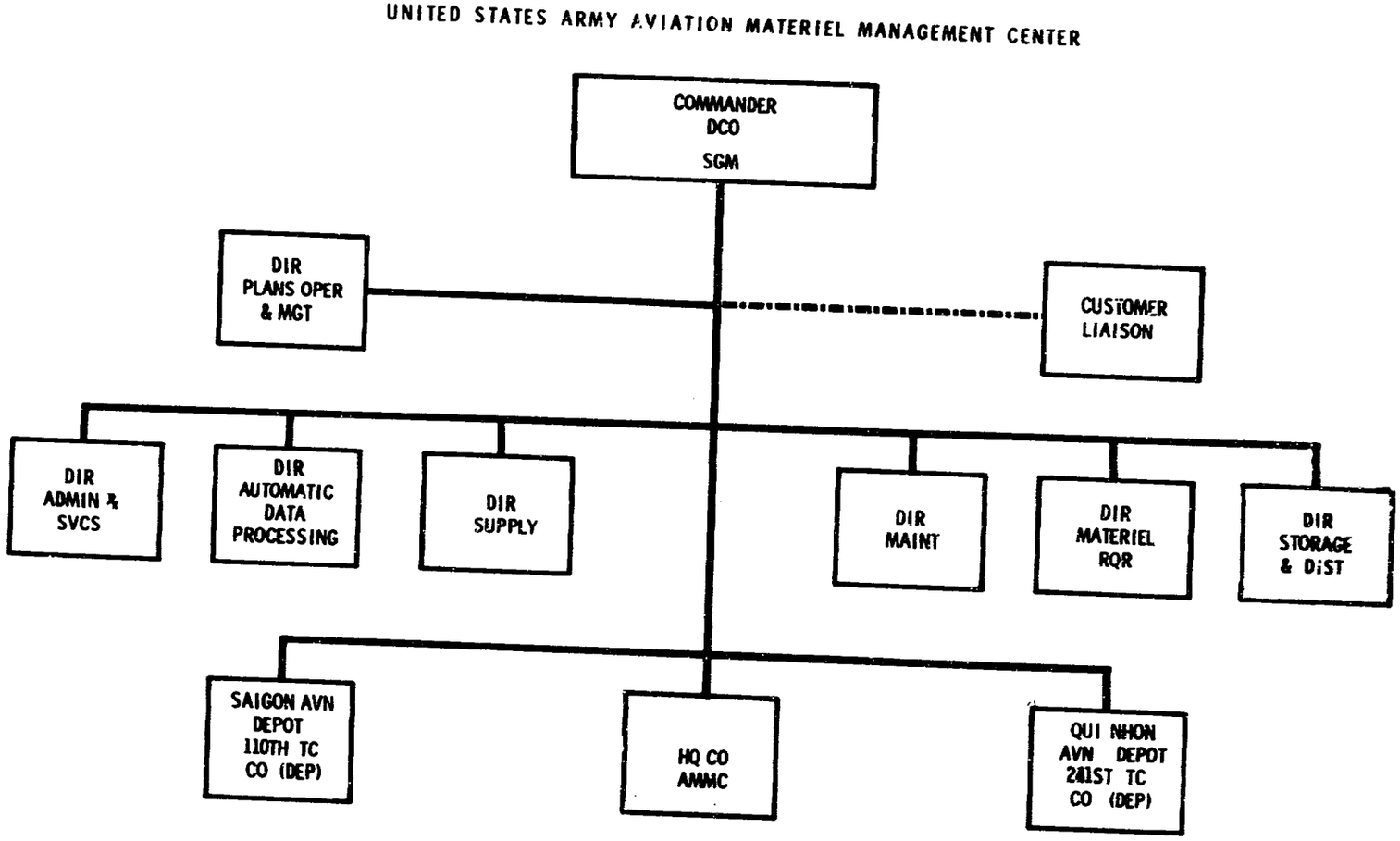


Figure 24. AMMC Organization.

non-divisional aviation units and back-up support to divisional units

b. Maintaining theater float stock of major aircraft end-items.

c. Processing aircraft and related systems in and out of RVN.

d. Rigging and recovering downed aircraft for supported units.

By mid-1967, the 34th Group had four transportation battalions and the Aviation Materiel Management Center. It had also assumed operational control of the Floating Aircraft Maintenance Facility (page 58), a seaborne aircraft maintenance facility with limited depot maintenance capability, anchored off the coast at Vung Tau. The current organization of the Group is shown in Figure 25. The Avionics/Electronics (AVEL) Companies were provisional companies formed out of spaces in the DS and GS companies and cellular teams of the Group to provide general support in the avionics area. They were formed to provide optimum utilization of the Group's assets in the avionics field.

In addition to this military structure, the Group was augmented by civilian personnel under three principal contracts with Lear-Siegler, Lockheed and Dynalectron. These personnel brought to the Group the skills not normally found in the two-year soldier. Of particular importance were skills in sheet metal working, aircraft engine, avionics, and armament repair, and the operation of computerized supply systems.

Army and Air Force Roles and Missions Pact

During this period of growing Vietnam requirements, the roles and missions being performed by the Army and Air Force in support of ground troops came into conflict.

In April 1966, an agreement was reached which realigned responsibilities for the various types of aircraft employed by the Army and the Air Force. The Army agreed to transfer its CV-2 and CV-7 fixed-wing transport aircraft to the Air Force, to disarm its reconnaissance aircraft, and to relinquish all future claims on fixed-wing aircraft designed for tactical airlift. The Air Force agreed that in cases of operational need, light transport aircraft (CV-2, CV-7, and C-123) performing supply or trooplift functions may be placed under the control of Army elements such as corps, divisions, or brigades. Also, the Air Force agreed to drop its opposition to Army helicopter development.

Under previous arrangements, USAF aircraft had flown supply missions for other services on a "mission basis". This meant that Army commanders had to make a formal request to the Air Force for each mission. Under this new agreement, Army

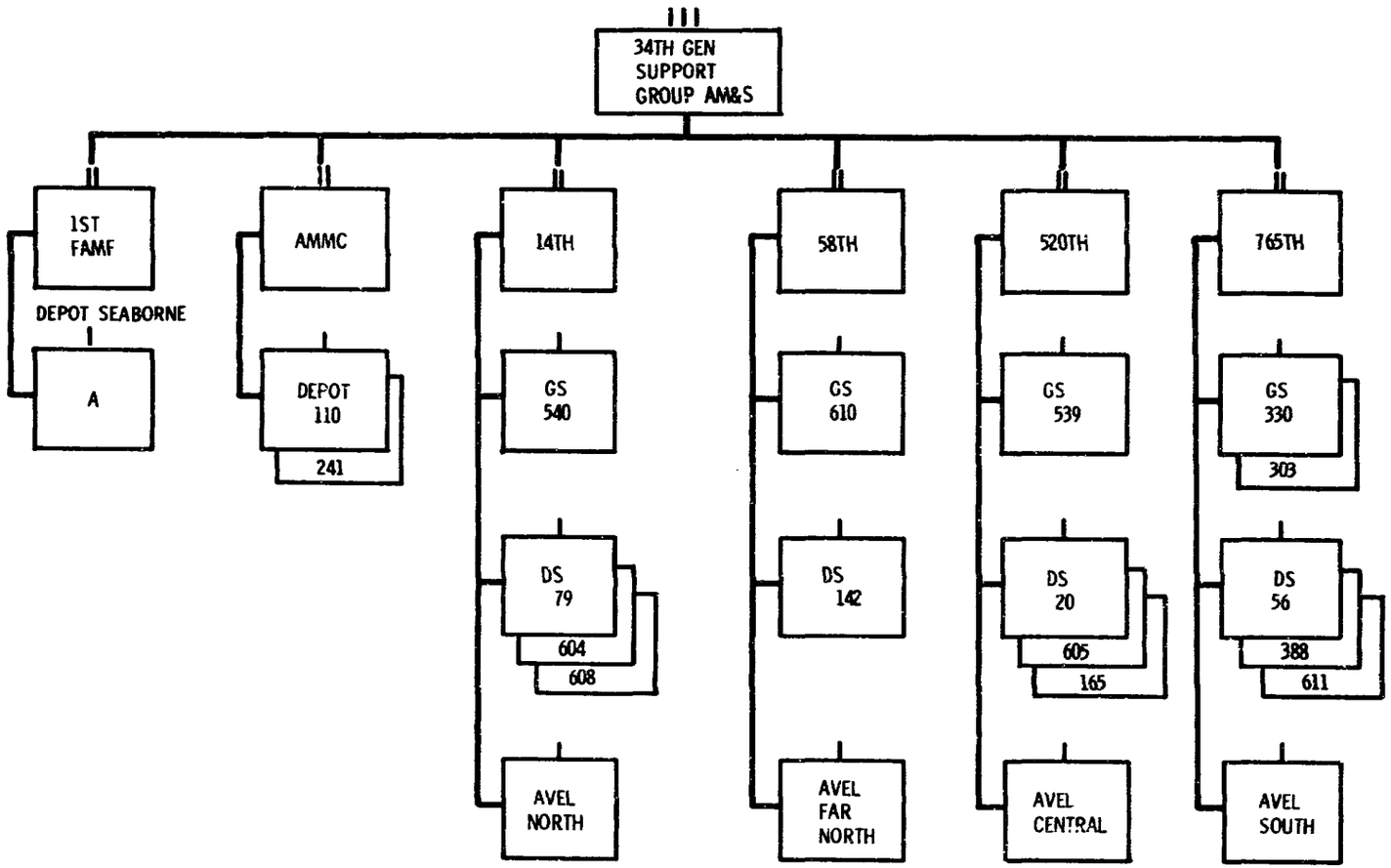


Figure 25. 34th General Support Group Organizational Structure.

commanders may assume operational control of a number of transports. This arrangement gives the Army field commander the same operational flexibility that he had when the aircraft belonged to the Army.

Many Army commanders feared that Air Force crews would not expend the special effort required to satisfy the ground commanders' needs. The extent to which the Air Force has failed to meet the demands of Army commanders is understandably not well publicized; however, their very successful resupply of Khe Sanh and the Special Forces camp at Ben Het while they were under siege is well known.

The Air Force took over 144 Army CV-2 Caribou in Vietnam on 1 January 1967 and redesignated the aircraft the C-7. In the first year of operations of the Caribou in Vietnam, the Air Force claimed its crews flew more than 100,000 combat hours - increasing flying hours, sorties flown, and payload tonnage by almost 25% over all previous Vietnam records.[34] In evaluating these claims, it must be realized that the Air Force has used the C-7 in a slightly different role than the Army did. The Army often used the Caribou to move supplies from division or brigade supply areas to forward bases. This required a greater number of - and more difficult - take-offs and landings and more ground time to load and unload than flights between major supply bases. As a result of the Army's current airmobility concept, the Air Force has used its transports to move large amounts of cargo and passengers over comparatively longer distances. Army helicopters are then used to move these supplies and personnel to forward areas.[35] This separation of roles may account for some of the higher payload and flying hour statistics generated by the Air Force.

FAMF[36]

One of the most innovative measures conceived by the Army in RVN was the Floating Aircraft Maintenance Facility (FAMF). As increasing numbers and types of aircraft were deployed, it appeared desirable to have a fixed-base depot maintenance capability available to back up the field maintenance units.

In 1965, it was decided to convert the *Albemarle*, an ex-seaplane tender, into a floating maintenance facility. Renamed the *Corpus Christi Bay*, the ship was outfitted and deployed to RVN waters in early 1966.

The FAMF has approximately 370 Army maintenance personnel and supporting technicians on board to perform maintenance

activities and approximately 130 civilian maritime crewmen to operate the ship.

The 1st Transportation Battalion (Aircraft Maintenance - Depot) (Seaborne) operates 26 production shops and 16 support shops. Capability includes overhaul of engines, transmissions, rotor hubs and other major aircraft components. The unit can also conduct metal and other materiel fabrication, instrument repair and calibration, components testing, failure analysis, and spectrographic analysis of fuels and oils. Closed circuit TV is available in each shop for easy accessibility of needed blueprints. Additionally, repairs can be performed on aircraft armament systems and avionics equipment. A parachute shop is available in which service and repair of such things as the Martin-Baker ejection seat used in the OV-1 Mohawk are performed.

Two UH-1s are assigned for administrative use. Both Army and Navy have two boats (LARC 15s - 15 ton capacity) to carry heavy supplies and non-flyable aircraft between shore and ship. Each Service also has one 26-foot personnel boat for administrative use.

The ship has 67,000 square feet of shop space and over 12,000 square feet of storage space. Two 22-ton cranes are installed for lifting equipment, aircraft, and other heavy supplies aboard. The FAMF stocks over 17,000 line items for internal operations and for support of on-shore activities. FAMF is backed up by the facilities of ARADMAC in CONUS. A daily review of EDP parts is made and those that can be filled from stock or fabricated are extracted. Approximately 100 EDP requisitions are filled each week in this manner. In one year, FAMF processed over 20,000 aircraft components and returned over 16,000 of them to service.

FAMF does not replace the present field unit complex. The concept keynotes the increase in range and depth of support available in overseas areas, particularly in event of emergency demands. It extends the capability of the CONUS base plant, ARADMAC, located at Corpus Christi, Texas, directly to the overseas commander.

Operation Eagle Thrust[37]

The 1st Brigade of the 101st Airborne Division had been operating in the III Corps Tactical Zone for nearly two years, when, in 1967, the decision was made to deploy the remainder of the division to Vietnam. This deployment was unique in that the division was airlifted from Fort Campbell, Kentucky, directly to Bien Hoa Air Base, Vietnam. This constituted the longest and

largest airlift undertaken up to that time - 10,024 troops and 5,357 tons of cargo over a distance of nearly 10,000 miles.

The movement was named "Operation Eagle Thrust" and was accomplished in eight phases (Table 2) from 17 November 1967 to 30 December 1967. It required 369 C-141 and 22 C-133 transport missions.

Operation Eagle Thrust began with the arrival of the first C-141 at Fort Campbell in the pre-dawn hours of 17 November to begin the deployment of the Advance Command and Control Element (Phase A). This aircraft departed at 1445 Z, 17 November, and arrived at Bien Hoa at 0845 Z, 19 November. Aboard was BG Frank B. Clay, Assistant Division Commander and Commander of the Advance Command and Control Group.

The operation officially ended at 1910 Z, 18 December 1967, when the 2nd Brigade closed at Bien Hoa. Following the official completion of the operation, five additional missions transported the rear detachment and closed on 30 December 1967.

The highlight of the operation was the departure of MG Olinto M. Barsanti, Commanding General of the 101st, from Fort Campbell on 11 December as part of Phase E, the airlift of division troops. The C-141 was piloted by General Howell M. Estes, Commanding General of the Military Airlift Command. Upon arrival at Bien Hoa, General Barsanti led his troops forward to report to General Westmoreland.

The helicopters belonging to the 101st Airborne Division were airlifted during Phase H, the only phase employing C-133 aircraft. Because of the routing, off-loading at Tan Son Nhut rather than Bien Hoa, and peculiar crew requirements, this phase required eighteen days for completion. It began during Phase C and closed during Phase F.

The movement of the 101st Aviation Battalion to SEA presented special challenges and problems to all personnel involved. The battalion consisted of a headquarters and headquarters company, an airmobile light company, and a general support company. However, at the time the unit was first notified of the movement, it was operating with a 30% fill of officers and warrant officers, and only 51% of its helicopters. From this critical shortage of personnel was deducted the non-deployable personnel (those who already had RVN tours). Moreover, many of the aircraft required modifications and maintenance to meet the standards for overseas deployment. With all these problems, it is indeed commendable that the officers and men and support personnel were able to deploy the battalion on schedule with the rest of the division.

SCHEDULE OF MISSIONS

Phase	Unit	Troops		Cargo		Missions		(Zulu Times)	
		Actual	Planned	Actual	Planned	Actual	Planned	Start	Close
A	Advance Command & Control	222	212	94.4	107.2	9	9	17/1445 Nov	19/0710 Nov
B	Advance Party	996	1011	1301.0	1176.8	77	68	20/1535 Nov	25/2315 Nov
C	3rd Brigade Task Force	3860	4168	1295.9	2252.0	109	150	01/1540 Dec	07/0820 Dec
D	Command and Control Gp	215	220	152.9	125.1	10	10	06/1555 Dec	08/0650 Dec
E	Division Troops	1147	1219	1164.5	1729.5	75	93	07/1020 Dec	12/0440 Dec
F	2nd Brigade Task Force	3240	3379	955.5	1086.4	84	86	13/0015 Dec	18/1910 Dec
G	Rear Detachment	285	205	25.3	11.4	5	3	22/1615 Dec	30/1110 Dec
H	Helicopter and Outsize	59	—	368.0	—	22	18	01/1515 Dec	18/1725 Dec

Table 2. Description of Deployment Phases — 101st Airborne Division.

Following deployment to Vietnam, the division operated in III CTZ for several months. In mid-March 1968, the division was sent to I Corps. In July 1968, the Army announced that the 101st Airborne Division was to become an airmobile division (the timetable and plans for this conversion remain classified). The division's aviation battalion and transportation aircraft maintenance company became the foundation of the airmobile division. Other aviation units were formed in CONUS, and after a period of training, were deployed to Vietnam to join the division.

The US Army Aviation Systems Command (AVSCOM) provided support for these units through maintenance liaison visits, by expediting the issue of tool sets and spare parts packages, and by providing civilian contract maintenance teams to assist in preparing the aircraft for overseas deployment.

The organizational structure of the 101st Airborne Division (Airmobile) was patterned after the 1st Cavalry Division (Airmobile), with one important distinction; aviation direct support maintenance detachments were provided each company-sized aviation unit. In addition, the 5th Transportation Battalion had two direct support companies which provided back-up maintenance support for the detachments. This method of organizing is more costly in terms of personnel and equipment, but its success is indicated by the fact that the 1st Cavalry Division is switching to the same concept.

Supply Procedures[38]

The Vietnam Counteroffensive period was characterized by many innovative techniques which improved aviation supply procedures and enhanced aircraft operational readiness. Maintaining or decreasing the "not operational ready-supply" (NORS) rate during a time of rapid build-up has been achieved by intensive management of aviation materiel resources. This additional emphasis on management has enabled the Army to reduce the quantity of inventory in the supply pipeline without adversely affecting the OR or NORS rates.

As aviation units deployed to RVN, they were issued initial supply support packages to sustain them until the supply system adjusted to their demands. Although procedures and assignment of responsibilities for preparation of initial support ("push") packages for deploying aviation units have changed considerably since the beginning of the Vietnam conflict, AVSCOM was charged with the responsibility in 1966 and specific procedures were established. The packages were prepared in accordance with

AR 700-70 and based on mission support plans (MSP) received from RVN. The MSPs contained information on type of aircraft, days of supply, "ship to" addresses, date of release and fund citation. Detailed listing and card decks were provided the USARPAC ICP and AMMC.

Table 3 shows the number of support packages prepared by AVSCOM for RVN in accordance with AR 700-70 and CONARC Regulation 220-10. The quantities listed for 1969 and 1970 reflect the de-escalation policy now in progress.

The direct requisitioning procedures (Red Ball/Stovepipe) addressed on pages 40 and 51-53 are perhaps the most effective tools developed during the Vietnam era to insure that customers receive critical aviation supply requirements when and where they need them. Various other programs have been implemented to enhance supply effectiveness and reduce costs. The Selected Management Items (SMI) system provided that specific items be subjected to controlled requisitioning procedures to maintain coordinated (USARPAC, USARV, AVSCOM) levels of support.

Through the Item Status Order Review (ISOR) program, initiated in December 1967, coordination is made with AMMC for validation of accumulated dues-out. The SMI and ISOR systems serve to effect reductions in excessive quantities or develop a basis for expanded procurement and overhaul actions. The cumulative savings of the ISOR program resulting from cancelled requisitions was $12,479,910 as of February 1971. The ISOR procedures are accomplished in addition to quarterly backorder reconciliations in accordance with AR 725-50.

The AIMI (Aircraft Intensive Management Items) program was implemented as an improvement of the SMI program. A listing of items selected as AIMI is prepared for supported commands for a mutually agreed upon level of supply on a quarterly basis. The overseas supported command's requisitions for one month's supply of the negotiated level must be submitted to AVSCOM 60 days prior to Required Delivery Date (RDD). This procedure aids AVSCOM in identifying and isolating problem areas affecting logistics readiness and reduces the number of open requisitions to a manageable level. It also defines for both AVSCOM and the customer a specific time frame in which responsive action must be taken. The first AIMI conference was held in December 1966 with 96 selected items; the present list has 157 items.

In order to insure availability of critically short-supply items to the overseas commander, a procedure known as "Blue Dot" was established in October 1965 to provide a list of short-supply (or

"PUSH" PACKAGES

Level of Support	Calendar Year 1965	1966	1967	1968	1969	1970
Organizational	37	55	128	161	9	42
Maintenance Teams	32	33	70	89	16	0
Direct	22	63	65	53	8	3
General	11	30	34	19	5	0
Depot	10	14	12	7	1	0
TOTAL	112	195	309	329	39	45

Table 3. Initial Supply Support Packages for RVN.

potentially short-supply) items to the manufacturing plant for expediting. As the items are produced and accepted, the quantities are reported telephonically to AVSCOM. Shipment is then directed by AVSCOM from the production floor direct to the user, under control of depot operating personnel located at the plants. If the items are not critically needed (but are expected to be), or if direct shipment from the plant to user is not feasible, a procedure known as "Fast Truck" places a truck at the production floor and effects immediate delivery to the nearest depot. In one to three days, all potentially critical items of supply delivered from contract are available at depots for issue. As an example, eight to ten truckloads a day are currently moving from Bell Helicopter Company to Red River Army Depot under "Fast Truck" procedures.

Controls are built into AVSCOM's ADP program to prevent issue of excessive quantities. All AIMIs, critical items, and other selected items are rejected for management review; all requisitions for modification kits, aircraft shop sets and aerial delivery equipment are rejected on the first pass for approval of the materiel manager prior to issue; all other items are controlled under a quantity edit program depending on the supply control study method coding. This method of control is essential to maintain the integrity of the logistics pipeline even though experience indicates only about 2% of aviation requisitions are returned to the customer on the basis of excessive quantity.

Special Assignment Airlift Missions (SAAM)

In FY 68 the preferred method of transporting Army aircraft changed from surface mode to SAAM flights. Several factors entered into this decision: adequate surface carriers were not available; it provided for exchange of aircraft essentially on a one-for-one basis (the closed loop concept - one operational for one retrograde) in the shortest possible time; airlift decreased vulnerability to enemy attack; and it lessened the possibility of damage enroute for both operational and retrograde aircraft. Early shipments of aircraft on SAAM flights involved very little disassembly, but subsequent development of shipping devices requiring limited disassembly of aircraft (the "Piggy-Back" and "Side-Saddle" concepts) resulted in much more efficient utilization of SAAM aircraft capacity. For example, C-124s and C-141s increased their UH-1 loads from two to three and C-133s increased theirs from four to five (Figures 26-29). Tables 4 and 5

Figure 26. Five "Piggy-B[illegible] UH-1s Await Loading Aboard Air Force C-133.

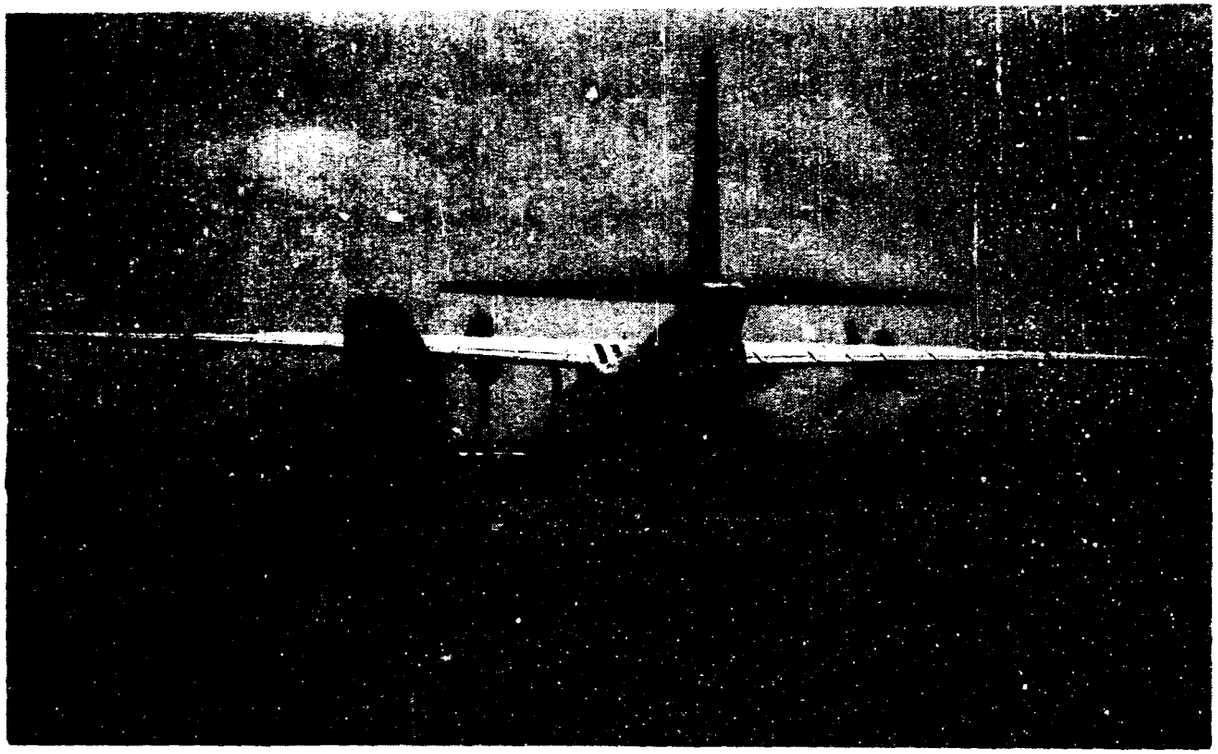


Figure 27. UH-1s Prepared for Shipment – "Piggy-Back" Style.

Figure 28. Three "Side-Saddle" UH-1s Await Loading Aboard Air Force C-141.

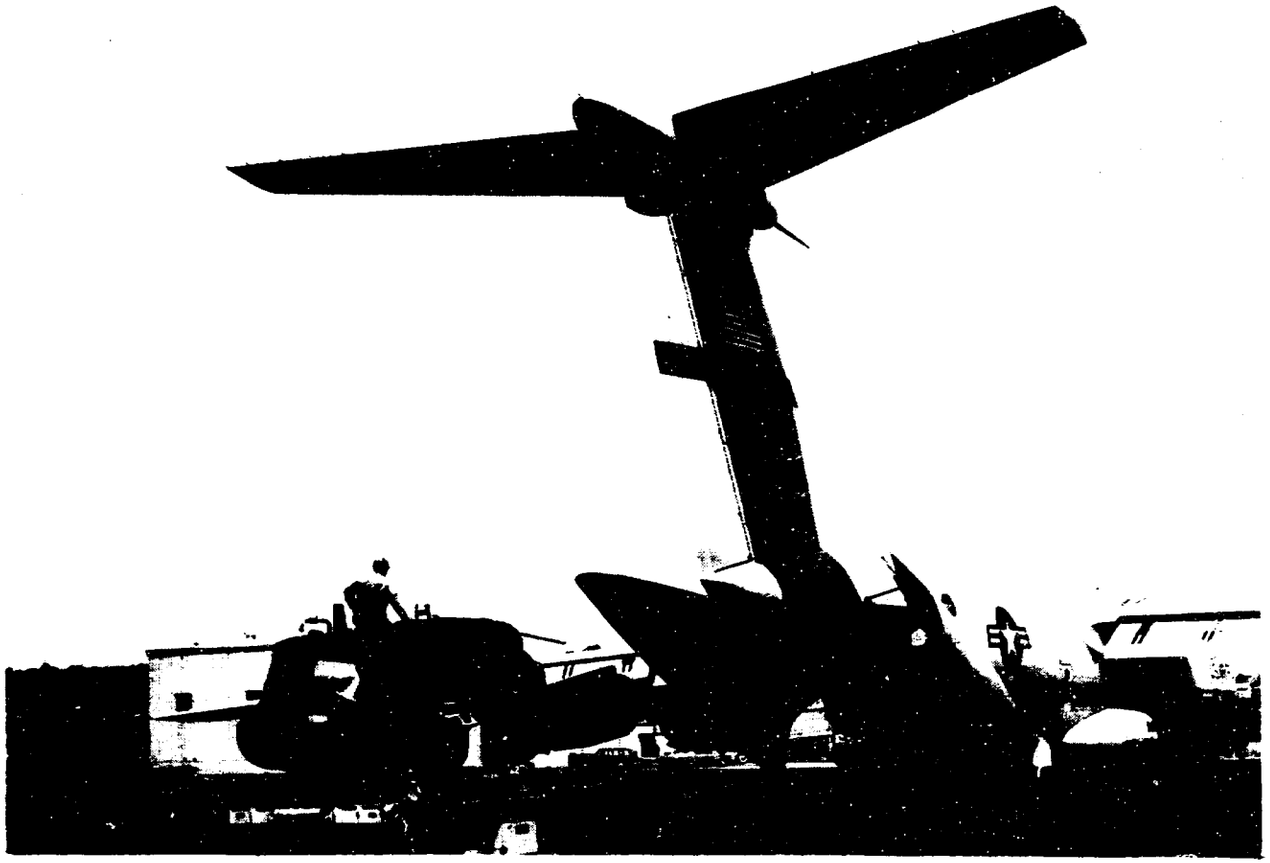


Figure 29. UH-1 Prepared "Side-Saddle" Style for Loading Aboard C-141.

SPECIAL ASSIGNMENT AIRLIFT MISSIONS (SAAM) TO/FROM RVN

FORWARD MOVEMENTS

	Number of Missions	Quantity of Aircraft
FY 68	343	982
FY 69	468	1,467
FY 70	571	2,334
TOTALS	1,382	4,783

RETROGRADE MOVEMENTS

	Number of Missions	Quantity of Aircraft
FY 68	148	391
FY 69	480	1,612
FY 70	426	1,249
TOTALS	1,054	3,252

Table 4. Aircraft SAAM Flights, FY 68 – FY 70.

SURFACE SHIPMENT

	Surface Missions	Quantity of Aircraft
FY 68	25	781
FY 69	24	794
FY 70	11	185
TOTALS	60	1,760

Table 5. Surface Shipment of Army Aircraft to RVN.

provide information on SAAM and surface shipments for FY 68-FY 70.

Serviceable turbine engines have been intensively managed by Red Ball personnel since October 1967. Prior to May 1968, engines required for RVN were trucked to the nearest Air Force base and loaded on channel aircraft on a space available basis. After 24 May 1968, these engines moved by SAAM aircraft. The Turbine Engine Control Office was established at AVSCOM on 11 August 1969 to monitor, control and distribute (by serial number) all serviceable and unserviceable engines. Close coordination with AMMC is maintained to ascertain types and quantities of turbine engines required. SAAM engine shipments have reduced shipping time from more than ten days to 33 hours, reducing substantially the number of engines in the pipeline. Because of this dedicated, intensive management of turbine engines, Red Ball requisitions for engines have not been necessary since May 1968. The other outstanding feature of this system is that when a shipment of turbine engines is off-loaded in RVN, a like number of retrograde engines is immediately loaded for return to the overhaul facility in CONUS, keeping the overhaul line operating at maximum capacity. Table 6 provides quantitative information on engine SAAM flights since inception of the program.

CONUS TO USARV TO CONUS
MAY 1968 TO 12 MAR 71

Average Time Each Way	32 Hr
Cost Per Flight – Round Trip	$35,222
Total Flights to USARV	442
Total Flights to CONUS	464
Total Serviceable Engines Shipped	16,073
Total Unserviceable Engines Returned	13,763

Table 6. Turbine Engine SAAM Flights To/From RVN.

NORS[39]

The real test of the effectiveness of the supply system is the NORS rate. Unless highly effective techniques are introduced, NORS rates can be expected to increase significantly when there is a notable increase in number of aircraft or flying hours. Annex B provides aircraft inventory and utilization information for all aircraft in RVN. Figures 30 and 31 provide a "running account" of NORS, NORM and OR rates since FY 65.

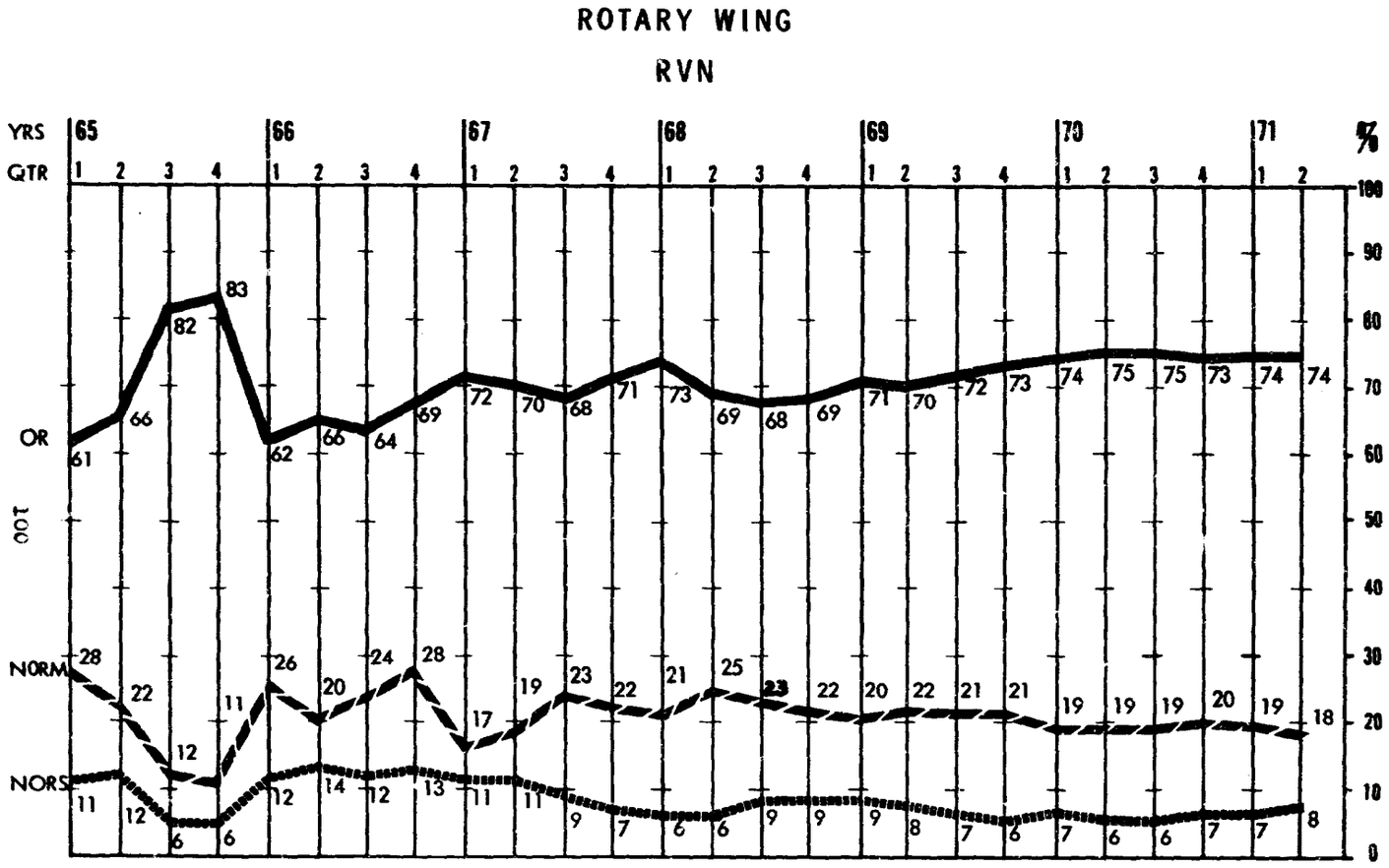


Figure 30. Not Operational Ready-Supply (NORS), Not Operational Ready-Maintenance (NORM) and Operational Ready (OR) Rates for Rotary Wing Aircraft – RVN (1965-1971).

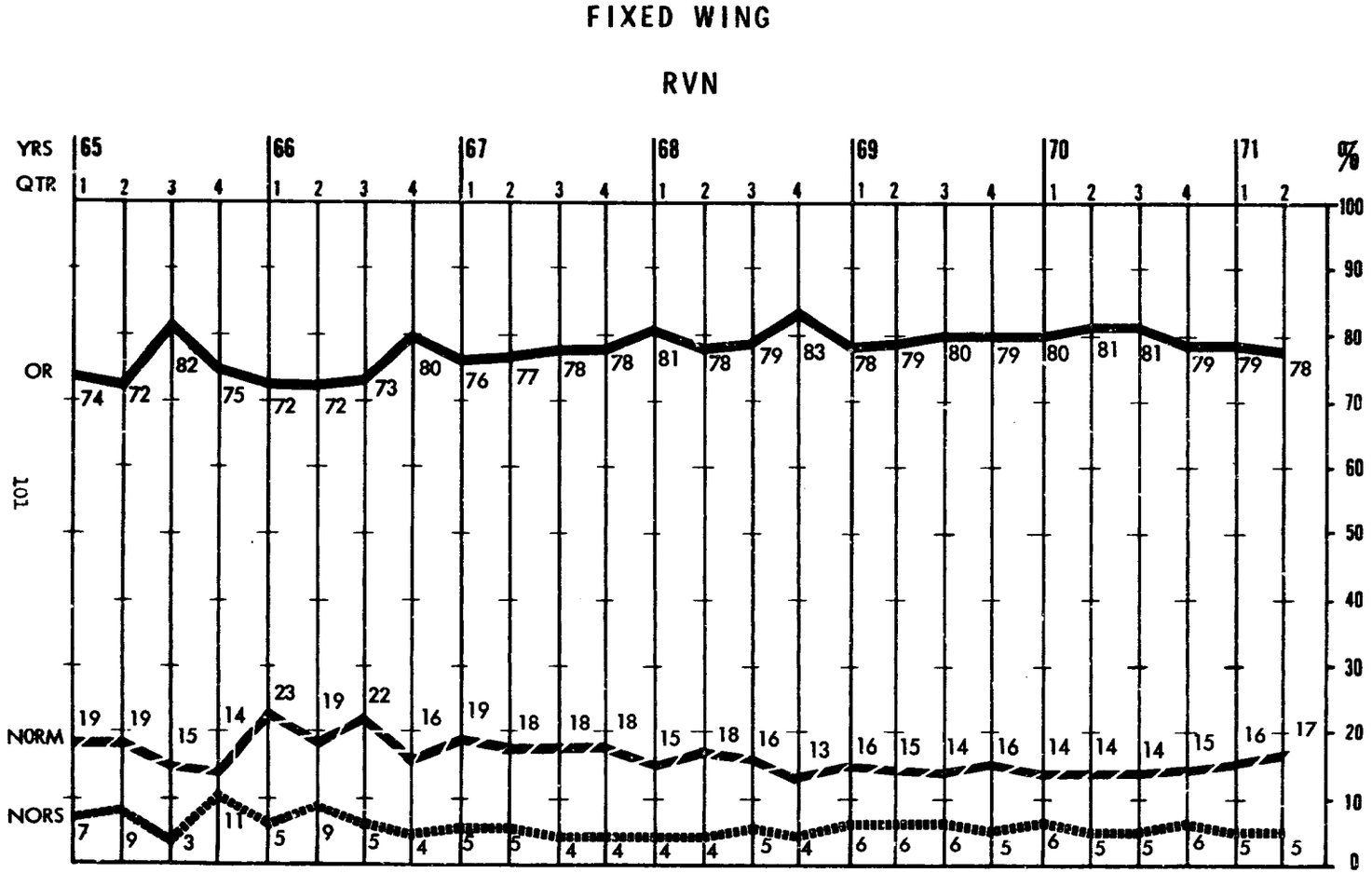


Figure 31. Not Operational Ready-Supply (NORS), Not Operational Ready-Maintenance (NORM) and Operational Ready (OR) Rates for Fixed Wing Aircraft – RVN (1965-1971).

AVSCOM Participation in Customer Assistance[40]

AVSCOM bears the responsibility of providing field forces with the best equipment available and insuring that it is properly maintained. Technically, its logistics efforts stop at the shoreline, but its responsibilities actually continue as long as the equipment is in the field. The equipment can support the troops in the field in a satisfactory manner only when it receives proper supply and maintenance support - when and where it is needed.

The scope of customer assistance has taken on a different meaning in the last few years. There was a time when customer assistance meant liaison with a command element. This liaison was conducted on periodic visits. In CONUS, stock records were checked, maintenance was checked, procedures were commented on, items of supply or maintenance problems were identified, a report of accomplishments was produced, and actions were generated to advise the customer of findings and corrective actions taken. Today, particularly in Southeast Asia, customer assistance means more than periodic liaison visits. The Army Materiel Command Customer Assistance Office, Vietnam (AMC CAO-V) is one of the customer assistance programs. AVSCOM supports the program and has provided various staff technical representatives to provide on-site support of Army aircraft. Three staff technical representatives, one maintenance technician field assistance coordinator and one aeronautical engineer are attached to CAO-V continually. In addition, technically qualified ARADMAC representatives assist in evaluating damaged aircraft for evacuation to CONUS for repair and rebuild. Until early 1966, the sole operating warehouse in the depot support of Army aviation in Vietnam was in crowded quarters at Tan Son Nhut Air Base. Plans were under way to construct warehouses and to allocate a centrally located area for complete storage operations. AVSCOM, with representatives from four depots, dispatched a six-man team to survey the plans for warehouses and storage areas. In 60 days, this team completed a plan for both inside and outside warehousing, a location system, receiving and shipping flow patterns, and offered procedures to cover inventory, re-warehousing and space utilization.

Through 1965, the stock record and stock control section of the Aviation Supply Point maintained manual records and manually processed inventory transactions for approximately 16,000 line items. In February 1966, AVSCOM sent two people to assist in designing and installing a punch card stock accounting system. The equipment was acquired within USARPAC and was

operational in March 1966. The stock accounting and materiel management system for aircraft, avionics and armament repair parts was later extended to a UNIVAC 1005 card processor with a 30,000 item stocking list. Following that, AVSCOM worked with USARPAC in the development of more sophisticated ADP systems, which now provide for expanded materiel management techniques and maintenance data collection.

The Army forces in the field are provided equipment and personnel to support the maintenance of the end item. However, the equipment and/or the manpower are not always at the right place in sufficient quantities – or in the event of adequate numbers of personnel, the desired level of competence is sometimes lacking – and, therefore, the field units must be supplemented with technical assistance personnel. This assistance is offered in several ways:

a. Civilian contract maintenance personnel are employed to perform modification maintenance and repairs to aircraft.
b. The Supply and Maintenance Technical Assistance Program uses manufacturers' representatives or Department of the Army field representatives to help resolve maintenance problems, especially at the unit level.
c. New Equipment Training Teams (NETTs) are deployed to assist in introducing new aircraft or armament subsystems.
d. Army Aircraft Mobile Technical Assistance Program (AAMTAP) teams provide additional training for maintenance personnel.

It is important to note that these programs are intended to supplement the field commander's maintenance capability, and none of them are intended to be a permanent means of assistance. Once the manpower problems which hinder aircraft maintenance have been solved, these assistance programs may be discontinued.

Civilian contract maintenance service played an important and necessary role in keeping aircraft weapons systems operational in RVN. Three major contractors (Lockheed, Lear-Siegler, and Dynalectron) were used on a large scale to supplement the aircraft maintenance capability. Table 7 depicts the growth of this requirement in RVN from FY 65 through FY 70. These contracts, negotiated and administered by AVSCOM with in-country contracting officers' representatives (COR), provided skills, especially in heavy structural repair and highly complex avionic item repair, which were not available from two year soldiers. Additionally, the use of these contracts added flexibility in meeting changing situations. Shifts to augment capabilities in other workload areas could be made more easily with the contract personnel

than with semi-fixed military units. Heavy equipment was not generally shifted to the new site since it was normally available along with living and working facilities. Tool boxes and light equipment, being the responsibility of the contractor, presented no accountability problems for the military in transfer of property. Job orders for specific task accomplishment were given to the contractors for completion and return to the military.

COMPANY	FY65	FY66	FY67	FY68	FY69	FY70
Lockheed Acft Svc Co.	–	–	–	100	232	287
Lear-Siegler Inc.	–	–	457	624	832	733
Dynalectron Corp.	34	239	550	847	1056	872
TOTALS	34	239	1007	1571	2120	1892

Table 7. Civilian Contract Maintenance Authorizations FY 65–FY 70.

The 34th Group employed most of these contract personnel (in both the supply and maintenance field); however, some of them were used in the divisional aircraft direct support units and in separate aviation and medical companies.

Other contracts provided support in the avionics maintenance area (e.g., GCA equipment, Doppler navigational system, ZYR/ZYS avionics retrofit), spectrographic oil analysis, and various aircraft modifications and retrofits.

Performance standards and quality of work were, with few exceptions, outstanding. Security, messing, transportation, and housing of these personnel presented localized problems comparable to that of a like number of military. Not having to provide security, these civilians had high productive availability and enhanced continuity of effort and expedited job completion. This is not to be construed as a proposed policy or doctrine for future plans or situations that develop; however, when military strength ceilings were imposed and when sufficient support troops were not authorized to maintain the equipment in theater, civilian augmentation became essential.

The Supply and Maintenance Technical Assistance Program is organized under the provisions of AR 700-4. This program employs manufacturers' or Department of Army civilian (DAC) field representatives who are trained in maintenance of one or more aircraft, engines, or aircraft subsystems. They have been instrumental in finding answers to technical questions, resolving maintenance problems, and providing extra training for maintenance

personnel. During FY 70, over 200 "tech reps" were employed in the Republic of Vietnam.

New Equipment Training Teams have been deployed to the Republic of Vietnam to assist in the introduction of the OH-6A, AH-1G, U-21, CH-47C, and OH-58 aircraft, and the T53-L-13 gas turbine engine. These teams provide in-country training for maintenance and operating personnel, and the teams come complete with instructors, equipment, training materials, and personnel to maintain their equipment. In cases where the field commander does not require a complete NETT, AVSCOM may prepare New Materiel Introductory Letters or provide on-site briefing teams to provide needed introduction of new materiel.

Since the skill level of the maintenance personnel assigned to the organizational and support units was not always at the desired level, an Army Aircraft Mobile Technical Assistance Program (AAMTAP) School was established in Vietnam under the auspices of the 34th Group to improve the needed skills. The instructors were either contract representatives or DACs. The students were attached to the school from the various units and were provided classroom instruction on various aircraft and turbine engines and in aircraft repair parts supply procedures. This school has recently been replaced by the Army Aviation Refresher Training School (AARTS) sponsored by USARV. Table 8 reflects the type of courses and the number of students enrolled. All of these many customer assistance efforts have been most helpful in providing the field commanders in RVN the right kind of support at the right place and at the right time.

Course	Course Length (Weeks)	Students Per Class	Total Grads FY 69	Total Grads FY 70
AH-1G, UH-1C	2	20	408+	560
UH-1D, H	2	20	436	472
OH-6A	2	20	492	560
CH-47	3	18	266	280
T53-L-11	2	17	324	204
T53-L-13	2	23	396	552
T55-L-11	3	10	+++	120
T55-L-7	2	17	252	200
T63	1	17	324	476
M-5, XM156, M-21	1	15 EM	339++	120
XM-28, XM-18E1	1	15 EM	—	240
XM-28, XM-18E1	1	10 OFF	—	160
M5, XM-156, M-21	1	10 OFF	—	120
Tech Supply	2	20	341	560
Tech Inspector 2	2	20	+++	560
CH-47, Maint Sup	2		+++	
TOTAL			3578	5184

+ Includes UH-1B
++ Total for all Armament Courses
+++ New Course

Table 8. Army Aircraft Refresher Training School Graduates, FY 69; FY 70 Graduate Projections.

DE-ESCALATION

Effect on Aviation Logistics Support

Implementation of the President's de-escalation policy announced on 16 September 1969 has had almost no impact on the amount of logistics support provided to RVN. While the number of combat troops and units has decreased significantly, aviation logistics requirements have continued as a result of the Vietnamization program.

Reference to the flying hours graph (Annex B) reveals that total flying hours reached its peak in May 1970 and began to "fall off" afterward to the level experienced just prior to the Tet 68 offensive. The aircraft inventory, however, has remained relatively constant since the de-escalation announcement, with the number still remaining at approximately the 4,000 level.

As increased combat responsibility is turned over to the Vietnamese, the logistics responsibilities will soon follow. Until this responsibility is assumed by the Vietnamese, the number of US logistics support units, together with the degree of logistics support required, can be expected to remain fairly constant.

Red Ball 34[41]

Although de-escalation had been announced, innovative techniques to improve aviation logistics support continued in RVN. An example is Red Ball 34. In March 1970, the 34th Group began delivery service to the nine direct support units in I and II CTZ. Working in close cooperation with the Traffic Management Agency, Military Assistance Command-Vietnam, and the 834th Air Division, the 34th Group set up a daily schedule for two C-130 aircraft flights from Saigon.

One flight delivers parts to Cam Ranh Bay, Qui Nhon, and Pleiku. The second stops off with parts at Chu Lai, Phu Bai, and Da Nang. Both flights stop at Phu Cat to pick up NORS parts from the Qui Nhon aviation depot. The flights leave Saigon each night, fly their circuits, and return to Saigon ten hours later. The sequence of stops on both flights is designed to meet NORS cargo generation patterns from two depots and reparable shipments from the direct support units. Space not needed by the Red Ball 34 system is available to aerial ports enroute for opportune terminal cargo. An AMMC courier accompanies each flight to monitor the system and provide feedback for improving the system.

NORS requisitions are transceived by the direct support units

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early in the morning to AMMC. The parts are picked and packed, taken to the aerial port that afternoon, and delivered by the Red Ball 34 flights during the night. The parts are ready for pickup at the aerial port serving the direct support unit the following morning.

The NORS and other high priority aircraft parts are unitized. The cargo on any one pallet is limited to that for a single direct support location. The rapid offloading and backloading of aircraft minimizes ground time. The C-130 schedules are arranged to provide delivery of two pallets a day to each direct support location, one from each depot. The use of unitized loads permits simplified documentation, better control, ease of identification, and intermodal movement of palletized loads between depot, carrier and direct support unit.

The traditional Red Ball with the 34th Group's numerical designation superimposed in the center was chosen to represent the system. Each pallet is labeled with this symbol, and it is stamped in red ink on all air cargo documentation. The symbol alerts aircraft loadmasters and aerial port and direct support personnel that these are expedited aircraft parts.

The C-130 flights proved to be a catalyst for the other functional areas. What started out to be an improvement in the transportation system soon had an impact on other interrelated aspects of aviation supply and distribution. The feedback information provided by the system helped extend management visibility of supply responsiveness to communications, automatic data processing, and transportation and has become another effective tool for improving aircraft NORS status.

EVALUATION OF THE VIETNAM EXPERIENCE[31, 32, 42]

Maintenance — General

The one-stop aircraft maintenance and supply concept envisioned by General Norton at the beginning of the buildup of Army aircraft in RVN proved to be invaluable to the tactical commander. Being able to take an aircraft to a supporting unit site and receive avionics, armament, and aircraft maintenance, along with complete supply support, substantially reduced turnaround and intransit time in keeping a variety of sophisticated weapons systems in a high state of operational readiness.

USARV had the task of total, in-country, wholesale aviation supply distribution, a large portion of the retail aviation supply responsibility, and a large share of the aircraft maintenance capability. The creation of the 34th General Support Group (AM&S) as a major subordinate command added much to the flexibility and responsiveness of support furnished. With this portion of the support function outside of the operators control and not diluted in the massive logistical support area structure of the 1st Logistical Command, a great deal of latitude was immediately available to the USARV staff. Now they could quickly shift resources to cope with combat damage and the changing tactical situation. With the theater float stock of aircraft being maintained by the 34th Group, overloads of maintenance backlogs in operational units could be adjusted in a timely manner by trade-out of aircraft, insuring the operator of needed assets to perform his mission. Excessive combat damage in one operational unit could be treated in this same manner with the 34th Group spreading the inherited workload throughout its structure so as not to overload any one unit. In addition, since the 34th Group had the mission of retrograding and receiving all aircraft for the theater, appropriate adjustments could be made in arriving destination for Air Force aircraft delivering incoming Army aircraft, assuring backhaul loads on returning Air Force flights.

The 34th General Support Group (AM&S) provided continuous daily management and monitorship of workload distribution and priority of maintenance effort, as matched against skills, tools, and shop facilities available. With 34th Group units operating from Da Nang (Red Beach) in the North to Vinh Long in the South, seldom were any aircraft more than thirty minutes away from one-stop maintenance sites. The intersectional maintenance and supply support provided to aircraft weapons systems had consistently paid dividends because of a low Not Operational

Ready-Supply (NORS) rate which supported a high monthly flying hour program. As a result, management by specialists and concentrated maintenance and supply by skilled professionals under a vertical command structure should be a consideration in designing any future logistical support for weapons systems. Maintenance management by a unified intersectional commodity oriented command proved to be a key factor for success of Army aviation in RVN.

Maintenance Personnel

A lack of qualified maintenance specialists consistently hindered the aviation maintenance support operation. At the peak of Army aviation involvement (31 July 1969) only 72.8% of the critical hard skill maintenance MOSs were filled. This in itself would have precluded the 34th Group from performing its mission were it not for civilian contract maintenance personnel. However, it should be noted that the unified vertical command structure enabled the 34th Group to obtain maximum utilization from the available personnel resources. The loss of critical aviation skills to other unrelated fields was minimized.

The flexibility enjoyed by the 34th Group in shifting personnel resources was not often available to commanders of operating units. It is unfortunate that the management and supervision that was applied to aircraft repair parts and maintenance equipment was not matched by equally effective management and supervision of personnel resources. Most of the problems affecting the productivity of maintenance personnel were attributable to disparity in skill levels, rotational policy, lack of experience, inadequate training and personnel shortages. (A detailed discussion of these problems is contained in *Logistics Review, USARV (1965-1969), (Annex K - Aviation Maintenance System),* obtainable from Defense Documentation Center, AD No. 876516L.)

Materiel and Equipment

The quality of equipment used in maintaining aircraft was generally good, but there were problems in obtaining sufficient quantities and adequate maintenance support. Shortages existed in certain special tools, generators, cleaning equipment and test sets. The major problem was lack of repair parts and maintenance for this supporting equipment. The problems resulted because the items were new in the system, were of low density and had only commercial catalog and parts data. These items, plus items procured under the ENSURE (Expediting Non-Standard Urgent

Requirements for Equipment) program, required long lead times on repair parts, and seldom were qualified personnel in-country to maintain them.

Shortages of mobile lifting devices to remove and install heavy aircraft components caused many maintenance delays. Other examples of maintenance support equipment which were difficult to obtain were hydraulic test stands, aircraft weighing scales and battery testers. Repair parts for these items were also difficult to obtain, possibly because of the low density and lack of adequate publications.

Location of Supporting AM&S Units

Although logistical support was difficult for operating units early in the RVN conflict because of the distance removed from the supporting units, this problem was alleviated considerably following the establishment of the 34th General Support Group. Since 1967, operating units have been no more than a few minutes removed from the supporting AM&S units. The aviation direct support companies were also consistently shifted in-country to position them close to supported units.

Environmental Effects on Aircraft Maintenance

The tropical environment of RVN contributed significantly to high maintenance requirements. The high temperature and humidity and sandy operational areas caused the paint on the aircraft to be worn away, forming corrosion and rust; rubber seals and boots deteriorated rapidly, causing leaks; bonding separation on honeycombed paneling was extensive; there was frequent damage to rotor blades and engine turbine sections from sand erosion and foreign objects; heavy monsoon rains and high temperatures often made outside work almost unbearable or impossible. The extreme environmental conditions often caused damage so severe that aircraft had to be evacuated to CONUS for depot repair; time-between-overhaul (TBO) was shortened for many major components and sub-assemblies; widely varying density altitudes often caused pilots to operate their aircraft in over-gross conditions, increasing the accident rate.

Miscellaneous Factors Affecting Maintenance Support

Perimeter defense and frequent mortar and rocket attacks drained available resources and decreased maintenance capability. This decrease of maintenance personnel, together with damage sustained by aircraft in assault operations and mortar and rocket

attacks, made published planning schedules unreliable. Manning level planning was consequently based on experience and was difficult to justify.

Lack of proper facilities hampered maintenance operations. Self-help construction programs diverted manpower needed in other areas. Long delays between construction requests and final completion further complicated maintenance support.

Lack of installation of central electrical power sources caused problems; unit generators were in continuous operation and breakdowns occurred frequently.

Organizational-Direct Support Maintenance

In order to maintain the highly complex aircraft systems, most divisional and many non-divisional aviation units had limited DS capability. In some units, this capability was organic to the operating unit; others used attached DS detachments to provide this capability; still others had no DS capability collocated with the operating unit but relied on DS companies to provide this support on an area-coverage basis.

Aviation units were able to sustain high flying hour programs and high availability rates through various combinations of organizational and DS maintenance capability and considerable backup support. However, this often resulted in expensive duplication of tools, test equipment, and trained personnel. For example, the 101st Division had engine mechanics; the 5th Transportation Battalion provided backup support with two maintenance companies containing these skills; the 142nd Transportation Company of the 34th General Support Group provided more backup with like skills. Supporting the 142nd was the 610th Transportation Company (GS) and the Floating Aircraft Maintenance Facility with its limited depot maintenance facilities. Finally, there was the CONUS-based US Army Aeronautical Depot Maintenance Center or factory facilities for engine overhaul. At each of the in-country levels, many of the same tools and supplies were required. As the number of maintenance levels increased, the duplication of tools and supplies became greater.

The cost of providing duplicate tools and test equipment was largely offset by the specialization the combination afforded. An engine repairman in an assault helicopter company worked only on the Huey engines; an engine repairman in an assault support helicopter company worked only on the Chinook engines. Their counterparts in the 5th Transportation Battalion or the 34th Group worked on all types of Army aircraft engines.

The benefits from specializing in this way were especially significant in Vietnam where high turnover and low experience levels among maintenance personnel were universal problems. Increased specialization in aircraft types reduced the amount of time needed to "break-in" a new mechanic and reduced the amount of effort required for on-the-job training.

*Recommendations (Aviation Maintenance Support)**

One-Stop Support. The concept of one-stop service which required collocating maintenance and supply support, to include the functional areas of aircraft, avionics and armament, should be continued to provide adequate support.

Maintenance in Forward Areas. Modular-type components should be furnished by the supply system in order to facilitate ease of maintenance in forward areas. Maintenance time would then be reduced, as well as the number of tools, stock levels, facilities, and maintenance personnel.

Two Echelon Maintenance. There should be two levels of maintenance as follows:

a. The operator level where preventative maintenance, inspections and trouble shooting and component changes are performed.
b. The support level where all other maintenance is performed by one unit at a fixed site. Beyond this, the aircraft should be evacuated.

Vertical Management. Technical maintenance and supply problems should be managed vertically, that is, from the NICP that has the primary responsibility for the end-item to the ultimate user of the end-item.

Computer Support. Improved management techniques to include a computerized requisitioning system should be implemented. The computers used should be capable of operating on line or in "real time" in order to be able to process requisitions in the time period desired.

Centralized Supply Accountability. Centralized accountability of supply assets, both serviceable and unserviceable, should be implemented throughout the theater. This goal will be complemented by the use of improved computers. The computer should be able to identify quantities of supplies at any point in the pipeline and have the capacity to cross level in-theater assets.

*These recommendations are quoted verbatim from Reference No. 31.

Area Support. An area support maintenance concept should be continued so as to minimize movement of units as tactical considerations change. This allows a support unit to relocate assets within its area of responsibility to meet changing tactical requirements.

Supply System Response. The supply system should become completely responsive to the customer to prevent the customer from circumventing the system by hoarding parts and abusing requisitioning priorities.

Direct Delivery Transportation System. A direct delivery transportation system eliminating transshipment points and congested cargo terminals should be a central feature of any supply system that supports the quantity of aircraft and the activity rates characteristic of operations in RVN today.

Future Study and Analysis. A comprehensive study and analysis should be made by experienced aviation and supply personnel who have returned from RVN to determine the support structure and composition for the future.

Supply – General

The decision to establish the AMMC and keep aviation supply separate from the huge, impartial, routine supply system paid off handily with improved efficiency, minimum number of float aircraft and higher operational readiness. The advantages of dedicated aircraft supply through AMMC far outweighed the disadvantage of small duplication of low-dollar value items.

The establishment of Red Ball and other Stovepipe procedures (direct requisitioning) resulted in timely, effective responses to requirements for aviation supply. Prior to these supply procedures, the high NORS rates for aircraft was totally incompatible with the ever-increasing requirements for aviation support of tactical units in RVN.

Supply Personnel

The personnel problems impairing efficient maintenance also affected the supply system. A full discussion of the effects of the rotational policy, inadequately trained personnel, inadequate CONUS training base and other areas may be found in *Logistics Review, USARV (1965-1969) (Annex G - Aviation Supply System)* obtainable from the Defense Documentation Center (AD Number 512114L). Because of the many personnel problems, augmentation by civilian contract personnel was necessary for accomplishment of the supply mission. Of the 1,892 personnel

used in FY 70 shown in Table 7 (page 77) 447 (or 23%) were used to support the aviation supply effort. Other contractual augmentation in the areas of specialized modifications and retrofits was essential; assistance provided by both DACs and contracted manufacturers' representatives under the Field Services Representatives Program proved invaluable; in-country supply training provided initially by AVSCOM personnel in the AAMTAP School at Vung Tau and later by contract was a valuable contribution to the aviation supply effort.

Supply Materiel

Shortages of packing and preservation material for crating and shipping of supplies consistently plagued the system. Shortage of storage bins and substitute material for their construction, along with inadequate warehouses, also hindered the supply system. The total lack of electronic computers, initially, and then the installation of computers with insufficient capacity, reduced the potential effectiveness of the RVN supply system. The use of electronic accounting machines (EAM) for AMMC was also a case of requirements estimates being too conservative. Small step increases in computer capability resulted in less efficient operations as lines of supply exceeded capacity, and many man-hours were lost during changeovers.

Supply Facilities

Although plans were made for "tying in" of all aircraft DS units to AMMC by transceivers and teletypewriters, this was never accomplished. Many requisitions were either hand-carried or phoned in to AMMC. This situation resulted in unacceptable response time and increased errors because of poor telephone connections. The lack of humidity controlled air-conditioned facilities for electronic equipment resulted in jammed equipment and subsequent delay in processing requisitions.

Communications with AVSCOM improved to the point that almost all problems associated with the long distance removed were resolved. AVSCOM assumed responsibility for monitoring and expediting all CONUS supply agency items which affected aircraft availability. Daily communication by telephone between AMMC and AVSCOM expedited aviation supply requirements; a twice-weekly telecommunications service was established between AVSCOM and the 34th Group whereby hard copy printed data and problems were transmitted and quick responses obtained;

electrically transmitted messages were also used extensively. Liaison conferences between RVN and AVSCOM representatives were also held as required to negotiate stockage levels of critically short items. Direct requisitioning procedures and excellent communications channels were the most important factors contributing to success of the aviation supply system in keeping aircraft flying in RVN.

The construction of facilities to store and protect aviation supplies was a constant problem. The lead time between request for construction and completion was excessive. Self-help programs were stymied because of inadequate building supplies and inability to divert critical skills from operational requirements. Aviation supplies were consequently stored in unprotected outside areas where deterioration occurred rapidly in the hot, humid climate. This type of damage was probably the most formidable and expensive problem encountered in aviation supply in RVN.

Environmental Effects on Supply

High humidity, sand, mud quagmires, salt air and operation of aircraft in buffalo grass and jungle tree canopies all combined to put an extremely high demand on the aviation supply system for repair parts. Light packing and crating of aircraft parts for air shipment without water proofing resulted in rust and corrosion of contents shortly after arrival. Improper packing, crating and preservation of expensive reparable components returned to overhaul facilities resulted in the parts being condemned upon arrival because of deterioration enroute.

The lack of adequate roadnets, railroads and airfields forced utilization of helicopters for supply missions which would normally be accomplished by ground transportation vehicles and fixed-wing aircraft.

Miscellaneous Factors Affecting Supply Support

Perimeter defense provided by supply personnel in the isolated logistical islands reduced the number of personnel available for supply operations. Although very few aviation supplies in stock have been lost as a result of enemy action, the damage inflicted on aircraft from this cause has increased the load on the supply system to provide more spare parts.

For the most part, logistics installations were shifted to the areas of highest aircraft densities to provide more responsive supply support. The construction of the second depot near Qui Nhon (Long My Valley), operational in November 1967, was a

result of that philosophy. When the depot was built, however, it was not intended that the Army would be active in the northern I CTZ. When the Americal and 101st Divisions began operations there with the accompanying high density of aircraft for airmobile support, the depot at Qui Nhon was too far removed. Another error was made in locating the depot too far away (20 miles) from the closest Air Force airfield through which almost all the supplies were processed.

*Recommendations (Aviation Supply Support)**

One-Stop Support. The one-stop maintenance and supply concept for aircraft in overseas areas should be retained and improved.

Vertical Management. Intensive vertical management of aircraft weapons systems must be considered for adoption in a theater of operation instead of the massive centralized supply concept which reduces responsive support.

Requisitioning System. The vertical requisitioning system between the overseas theater weapon systems oriented ICC and the CONUS NICP (AVSCOM for aviation) responsible for the weapon system should be adopted. The technique of using commodity managers in the Army Materiel Management Center in the same commodity orientation as like managers at the CONUS NICP has led to working relationships between two individuals who could expedite prompt action when problems arose.

Personnel. Consideration must be given to lengthening tours and providing more overlap for replacement personnel to reduce the lack of continuity in operations. Use of civilian contract maintenance personnel should continue as long as needed to provide skilled technicians and job continuity.

Automatic Data Processing. Computers and transceivers of sufficient capacity should be authorized at each level of supply to provide for daily transaction cycles and necessary management information.

Transportation System. A direct delivery transportation system that eliminates transshipment points and congested cargo terminals should also be a central feature of any supply system which supports the quantity of aircraft and the activity rates which were characteristic of operations in RVN.

These recommendations are quoted verbatim from Reference No. 32.

Logistics Offensive

Although many of the logistical techniques being advanced in the Logistics Offensive Program proposed by LTG Joseph M. Heiser, Jr.[42] had already been incorporated in a dedicated effort to improve aircraft operational readiness in RVN, a continuing pursuit of those goals offers great rewards for Army aviation.

Application of the *Inventory in Motion* principle has resulted in reducing the pipeline time of turbine engines from thirteen months to seven months, at a savings of approximately $243.6 million per year. The answer to keeping aircraft engines, components, and repair parts inventory in motion lies in the following:[18]

a. *Visibility* - Knowing where assets are and their condition.
b. *Forecasts* - Being able to anticipate accurate removal/consumption rates.
c. *Transportation* - Being able to rapidly transport parts and components.
d. *Overhaul Capability* - Being able to reduce time in overhaul.
e. *Management* - Being able to direct, manage and control individual, high-value items.

The *Closed Loop/Direct Exchange* principle was employed with the use of SAAM flights for T53/T55 turbine engines. These flights delivered new or rebuilt turbine engines to RVN and returned with a like number of reparable retrograde engines. This procedure was so successful with engines that it was expanded to include total aircraft systems. The latest application of this principle was the air delivery to RVN of three CH-47s aboard an Air Force C-5A and the retrograde to New Cumberland Army Depot of three unserviceable CH-47s - all within a 72-hour period (Figure 32). *Assets Control* was employed by AVSCOM assuming responsibility for monitoring and expediting all CONUS repair parts requirements affecting aircraft.

Planning for implementation of the *Maintenance Support Positive* concept is in progress. Every effort will be made to relieve the combat commanders and frontline units of involved maintenance workloads; modular replacement of engines, components and accessories at organizational level is being investigated.

Continued emphasis on these areas and other objectives of the Logistics Offensive will enhance our capability to support present requirements in Vietnam and will insure that contingency aviation logistics requirements in the future will be met in a timely and effective manner.

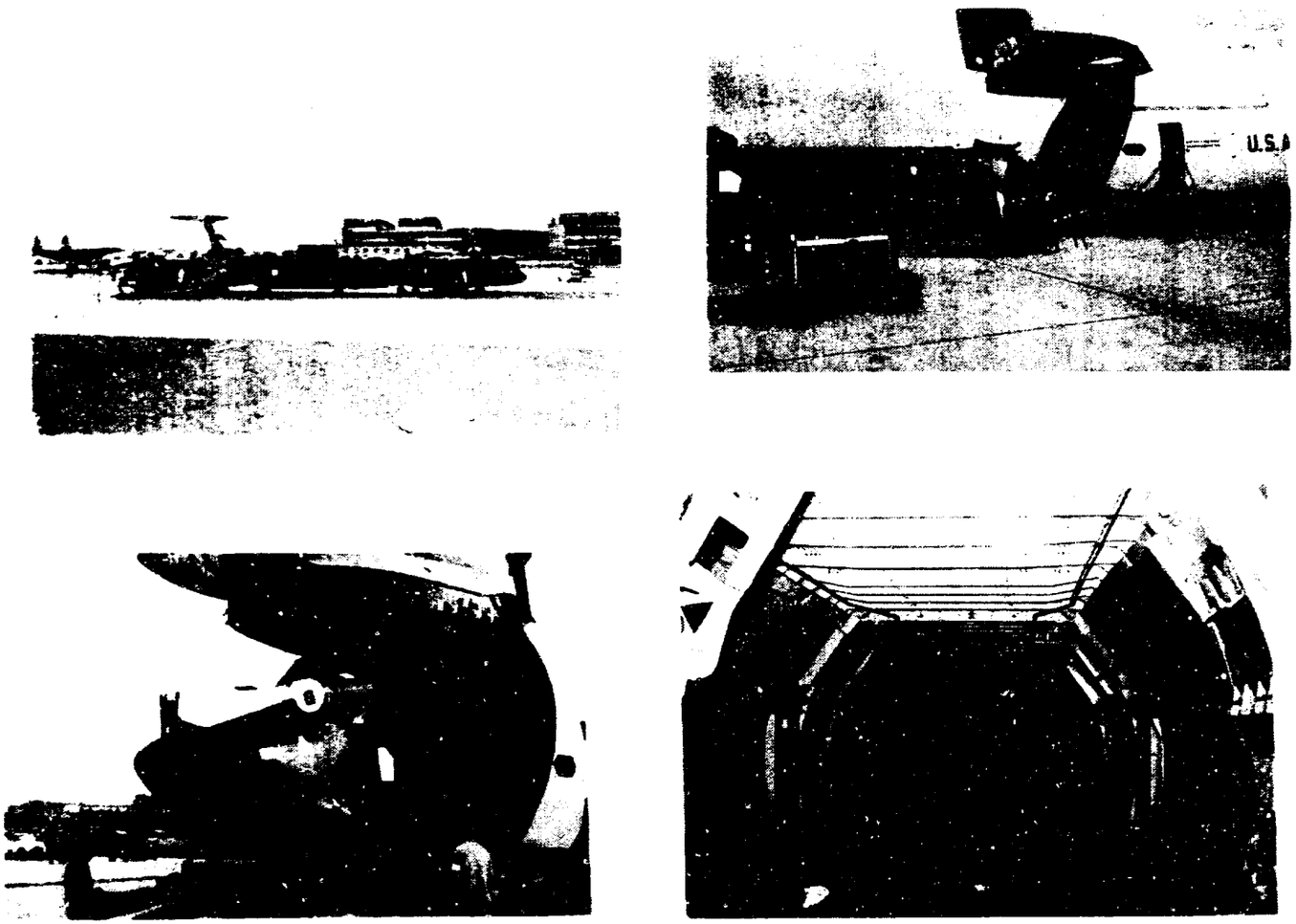

Figure 32. Loading of Three CH-47s Aboard Air Force C-5A.

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ANNEX A

11th AIR ASSAULT DIVISION (TEST)

LIST OF TABLES

ANNEX A

11th AIR ASSAULT DIVISION (TEST)

Logistical Concepts

The basic maintenance concepts used for support of the 11th were similar to those used throughout the Army; however, there were certain concepts which represented distinct departures from standard maintenance practices. These changes were meant to enhance the mobility characteristics of division maintenance units in consonance with the air assault mission of the division. The major deviation from the normal were as follows:

a. Maintenance echelons were designated as A-B-C levels with "A" level generally corresponding to organizational, "B" level to direct support, and "C" level to general support.

b. Work in forward and division base areas was to be limited, with extensive repairs accomplished in rear areas. Specifically, aircraft downtime was limited to four hours in the forward areas and to 72 hours in the division base area. Work that could not be accomplished within these time-frames was programmed for accomplishment at the logistics base (C-level) or by other support units. The objectives of this concept were to preclude the tie-up of facilities, tools and personnel in major maintenance projects, and to insure that aircraft incapable of moving under their own power would not impede the mobility of division maintenance units.

c. Repairs in the forward area were oriented to modular and component replacement with maximum use of maintenance float equipment.

d. Scheduled inspection requirements were revised with the objectives of reducing maintenance man-hours required and decreasing aircraft downtime. Inspections were also redesignated by the use of a number system: #1 inspection replaced the "daily," #2 replaced the "intermediate," and #3 and #4 inspections replaced the "periodic."

e. Airmobile specialist teams from B-level units were scheduled to assist in repairs at the operating site in lieu of returning aircraft to the rear. These teams were established to expedite maintenance and provide organizational units with access to skills, tools and equipment not carried in their own TOE.

All of these concepts were not carried out in actual practice. The limitations of the four and 72 hour downtime for aircraft in forward and division base areas, respectively, was not often

feasible. Maintenance float aircraft and quick-change assemblies and kits of major components were often not available. In most cases, B-level units were located so close to the units they supported that airmobile teams were not required. In cases where they were separated by sufficient distance, teams were provided by the B-level units on a full-time basis. Generally, airmobile teams were used only to evacuate to the rear those aircraft incapable of movement under their own power.

Comparison – 11th AAD vs ROAD[33]

A study published in September 1965 by the American Power Jet Company showed the effect that these concepts had on maintenance accomplishments. Comparison of data from the 11th and similar data from other Army units are hereafter presented.

Utilization:

Table A-1 analyzes utilization of personnel in three principle phases: pre-maneuver, maneuver, and post-maneuver. This approach was made to permit separate compilation for comparisons of periods during which varying operational requirements were emphasized. The principal objective was to study the effect of high aircraft utilization on personnel utilization and to determine if the air assault concept produced major changes in personnel utilization at the various levels of maintenance.

Technical Assistance:

Technical assistance furnished the 11th consisted of contract

	Percent Distribution of Total Regular Man-Hours*				% of Overtime to Total Regular Man-Hours	
	Productive		Total		Productive	
	Indirect	Direct	Productive	Non-Prod	Direct	Indirect
11th Air Assault Div:						
Pre-Maneuver	26.72	45.01	71.7	28.27	18.6	14.2
Maneuver	30.68	61.36	92.0	7.96	46.6	22.2
Post-Maneuver	19.55	39.00	58.6	41.45	4.5	4.2
ROAD DIVISION	18.10	40.70	58.8	41.20	20.6	12.0

*Total Regular Man-Hours Were Based on a 44-Hour Week.

Table A-1. Man-Hour Distribution, 11th AAD, A-Level Versus ROAD Division.

technical representatives, some military personnel, and civilian Army employees.

A large number of new, highly complex aircraft were assigned to the 11th, and contract technical support was provided during early field utilization. Some of these aircraft contained components which were new in the Army inventory; e.g., the T55 engines and auxiliary power units in the CH-47. Electronic gear and R&D equipment installed in the OV-1 aircraft required considerable support from various manufacturers. (Items such as the Decca Navigational System, Doppler System, and a strobe light system were all supported by contractor personnel.) Approximately 80 maintenance personnel were provided by Vertol to support the CH-47 at C-level. Several personnel from Sikorsky assisted in maintaining CH-54 helicopters.

Modifications:

Modifications applied to some aircraft required a considerable portion of maintenance man-hours. Tables A-2, A-3, and A-4 describe in percentage ratios the man-hours used for modifications at each maintenance level (A, B, C) during each of three major periods.

The major increase in modifications to the CV-2 (Caribou) during the post-maneuver period resulted from the requirement to install a reversible-pitch propeller (650 man-hours per aircraft). Because of the extensive nature of some CV-2 modifications, the rate of application lagged behind the rate required. This was not true for any of the other aircraft. The 11th not only kept pace but, in most instances, improved the fleet configuration through modifications applied.

Aircraft Type	Pre-Maneuver Period	Maneuver Period	Post-Maneuver Period
OV-1	.31	.04	.33
CV-2B	.25	.10	.92
OH-13S	7.72	negl.	3.33
UH-1B	1.79	.10	.53
UH-1D	.18	negl.	.32
CH-47	7.38	.72	2.11

Table A-2. Modification Man-hours as a Percentage of Total Maintenance Man-hours (A-Level).

Aircraft Type	Pre-Maneuver Period	Maneuver Period	Post-Maneuver Period
OV-1	9.36	.00	1.74
CV-2B	5.11	.13	22.63
OH-13S	1.61	.88	9.04
UH-1B	.18	1.20	15.88
UH-1D	.00	.04	12.79
CH-47	40.93	1.69	62.51

Table A-3. Modification Man-hours as a Percentage of Total Maintenance Man-hours (B-Level).

Aircraft Type	Maneuver Period	Post-Maneuver Period
OV-1	Negl.	5.02
CV-2B	Negl.	26.22
OH-13S	18.75	19.68
UH-1B	5.88	9.28
UH-1D	32.58	3.01
CH-47	11.01	6.40

Table A-4. Modification Man-hours as a Percentage of Total Maintenance Man-hours (C-Level).

Man-Hour Requirements:

Maintenance man-hours per flying hour during the three principal periods are compared to worldwide averages for each type aircraft (Table A-5). The major increase in man-hours during the post-maneuver period were necessary to accomplish maintenance deferred during the maneuver period. The high flying hours during the maneuver period resulted in major inspections and replacement of time-change components. In a further break-out of man-hour data, it was determined that A-level units generally accomplished less maintenance than the worldwide averages at organizational level. This situation reversed at B-level, and at C-level the rate reversed again. Thus, it is apparent that the A-B-C level concept resulted in moving maintenance from A-level to B-level and, to some degree, in the accomplishment of maintenance at B-level that would normally be done at C-level in other units. The failure of C-level to accomplish substantial maintenance was

Aircraft Type	Maintenance Man-Hours per Flying Hour 11th AAD				M/H per F/H Worldwide Average
	Pre-Maneuver	Maneuver	Post-Maneuver	12 Month Average	
OV-1	5.3	6.6	9.9	6.4	8.8
CV-2	5.0	4.8	11.1	6.3	11.4
OH-13S	1.9	3.1	6.1	3.4	3.6
UH-1B	2.5	3.6	5.7	3.1	4.2
UH-1D	2.0	2.5	5.3	3.8	–
CH-47A	14.7	12.0	24.4	16.0	–
CH-37B	19.3	10.2	–	16.6	18.0
CH-54A	–	12.5	17.8	15.1	–

Table A-5. Maintenance Man-Hours Per Flying Hour (All Levels of Maintenance).

a reversal of the concept of moving maintenance to the rear from both the forward and division areas. The failure of C-level to accomplish its prescribed work was the result of several factors including:

a. Lack of enforcement – or feasibility – of the four hour and 72 hours downtime rules.

b. Equipping of B-level units as well or better than the C-level units to accomplish maintenance.

c. Late activation of the C-level unit.

Parts Consumption:

In comparing total parts consumption at all levels of maintenance, there appears to be no major difference between the 11th and other units worldwide. In the area of expendable parts usage, the worldwide average is somewhat higher than the 11th. (The CH-47 had major problems with several subsystems, resulting in very high removal rates.)

Supply:

The requisitioning and supply procedures used by the 11th were generally consistent with Army standards except for some adjustments to meet the high mobility requirements of the concept. Levels of supply maintained by various organizational units were kept at a minimum consistent with mission objectives:

a. A-level PLL provided three days of supply based on demand data plus combat essential stockage.

b. B-level ASL was comprised of demand-supported and mission-essential items. Requisition objective was five days on hand plus ten days order and shipping time.

c. C-level ASL consisted of demand-supported items, with the requisition objective set at 15 days supply on hand and eight days order and shipping time.

The major differences between the 11th supply procedures and those used by other Army units were the identity of the maintenance and supply channels and the reduced stockage objectives at A and B levels.

Supply Support Effectiveness:

Table A-6 compares the demand accommodation rates of A-level with ROAD units. At no time did demand accommodation rates reach 50% of requisitions submitted. At the highest rate, less than half of the requisitions matching the ASL could be met from stock. This indicates an inadequacy in the basis on which the PLLs were prepared and the inability of the system to support the limited levels authorized.

Demand accommodation rates would be improved and the incidence of zero balances reduced by using a single, packaged PLL for all aircraft of a given type. Construction of such a PLL should

	Typical 11th AAD Units[1]		ROAD Division Units[2]	
Category	Sep–Nov 1964	Apr–Jun 1965	Jun–Sep 1964	Feb–Jun 1965
Total Number of Requisitions Received	1465	1388	1157	764
No. of Requisitions on PLL	675	603	635	320
No. of Requisitions not on PLL	790	785	522	444
% Demand Accommodation	46	44	55	42
% Requisitions Filled	22	9	7	5

[1]11th AAD Units Represented Operate: OV-1, UH-1B, OH-13S, UH-1D, CH-37B Aircraft.

[2]ROAD Division Units Represented Operate: OV-1, UH-1B, OH-13, CH-34 Aircraft.

Table A-6. Demand Accommodation (A-level) Versus ROAD Division Units.

be based on a broad range of demand history rather than on individual histories accumulated by small units.

As was found in the assessment of PLLs, consideration should be given to establishing packaged and stabilized ASLs. Table A-7 compares the effectiveness of B-level operations with typical DS operations in the ROAD Division.

Category	11th AAD	ROAD Division
Number of Requisitions Received	68,557	906
Number of Requisitions for ASL Items	35,490	360
% Demand Accommodations	52	40
Number of Requisitions Filled	15,574	259
Total Requisitions Filled	23	28

Table A-7. Comparative Demand Accommodation/Satisfaction Rates (B-level) Versus ROAD Division.

EDPs:

Table A-8 compares the age of outstanding EDP requisitions. As can be seen, the rate increased for the 11th during the post-maneuver period, approaching the rate indicated for the ROAD Division.

Summary:

Aircraft flying hours generally exceeded the worldwide averages for comparable aircraft (Table A-9). The scheduled inspection system required more man-hours to accomplish than the system used by other units. Total maintenance man-hours per flying hour were lower in almost every instance than the worldwide averages (Table A-10).

Maintenance was centered at the B-level with corresponding reductions at A- and C-levels as compared to other Army units. The principal reduction was at the C-level, and the magnitude of reduction indicates the need for further study to determine the proper role of C-level maintenance units and the appropriate personnel and equipment requirements.

Revisions to ASLs at B-level occurred frequently, and order and shipping time for added items resulted in high level of zero balances; deletions resulted in high level of excesses. Consequently, although ASL changes were based on demand patterns, the ability to meet demands did not increase as a result of these

Category	11th AAD – (611th Bn)		ROAD Division	
	Maneuver	Post-Maneuver	Maneuver	Post-Maneuver
Total EDPs	1539	1561		1606
% Over 15 Days	21	30		36
% Over 30 Days	8	14		17

Table A-8. Age of Outstanding EDP Requisitions, 611th Maintenance Battalion Versus ROAD Division.

Type Aircraft	11th AAD			Worldwide
	Pre-Maneuver	Maneuver	Post Maneuver	
OV-1	31	70	26	16
CV-2	62	177	52	38
OH-13S	23	71	13	12
UH-1B	32	68	26	31
UH-1D	50	84	29	–
CH-37	21	57	–	15
CH-47	14	53	8	–

Table A-9. Flying Hours PerAircraft Per Month, 11th AAD Versus Worldwide Average.

Type Aircraft	11th AAD			Worldwide
	Pre-Maneuver	Maneuver	Post Maneuver	
OV-1	5.3	6.6	9.9	8.8
CV-2	5.0	4.8	11.1	11.4
OH-13S	1.9	3.1	6.1	3.6
UH-1B	2.5	3.6	5.7	4.2
UH-1D	2.0	2.5	5.3	–
CH-47A	14.7	12.0	24.4	–
CH-37B	19.3	10.2	–	18.0

Table A-10. Total Maintenance Man-hours Per Flying Hour, 11th AAD Versus Worldwide.

changes. A stabilized ASL with changes made at less frequent intervals would have been more effective.

Although PLLs were based on unit demand history, the base was too small to be statistically sound. Packaging PLLs based upon demands experienced by several units for a larger number of aircraft would have produced a PLL capable of meeting a higher percentage of demands.

ANNEX B

AIRCRAFT INVENTORY AND FLYING HOURS

REPUBLIC OF VIETNAM

1963-1970

AIRCRAFT INVENTORY – RVN

1963-1970

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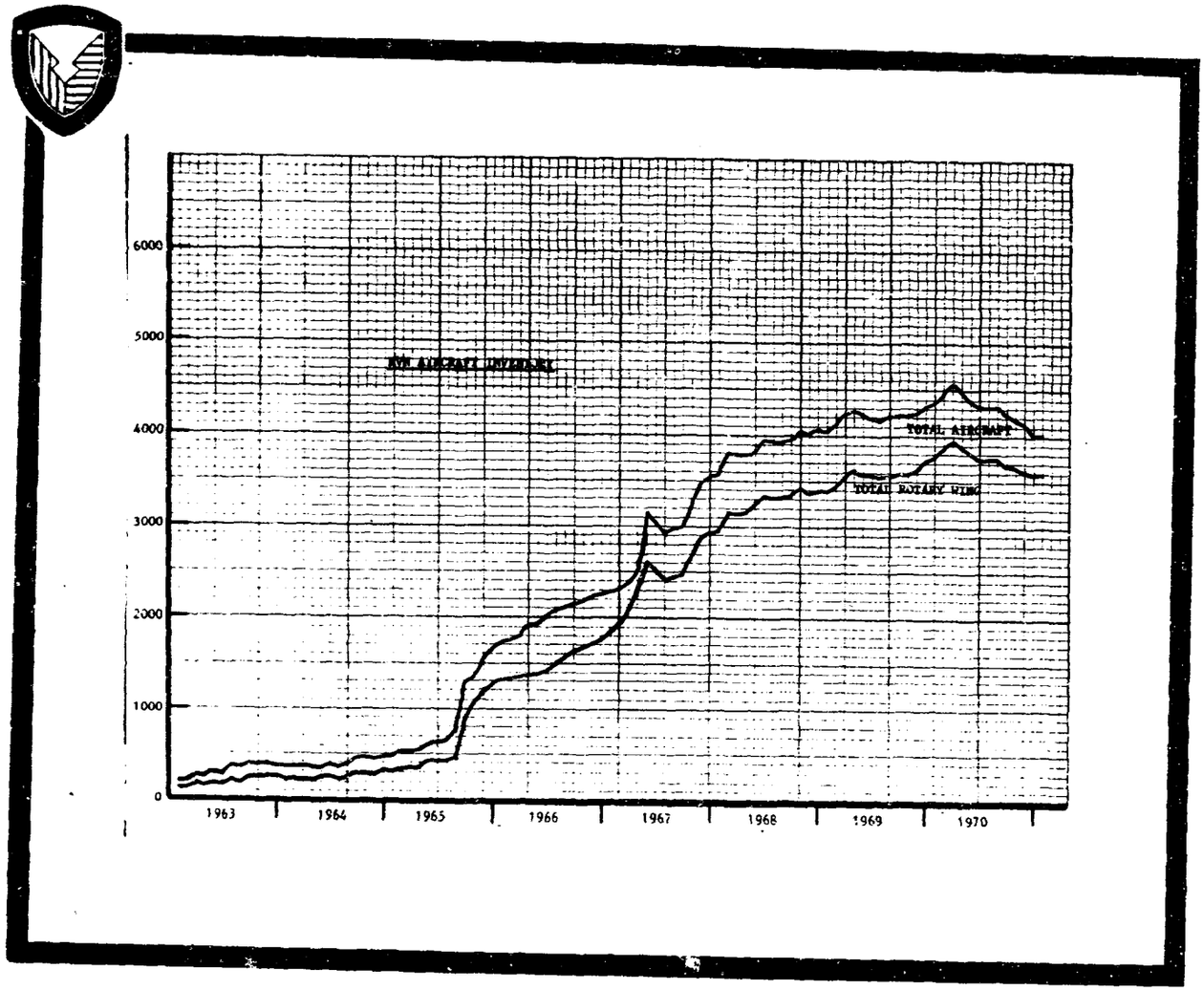
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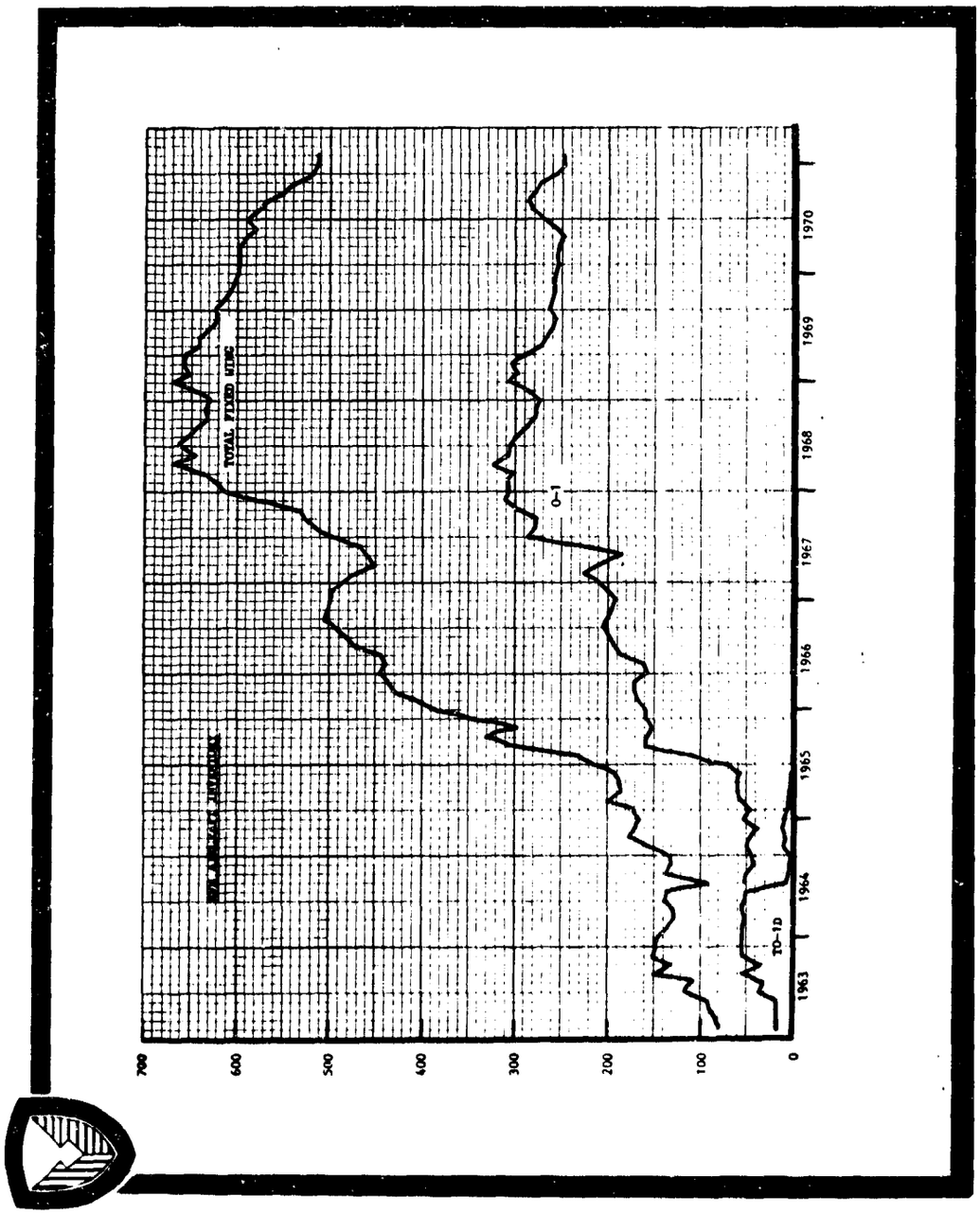
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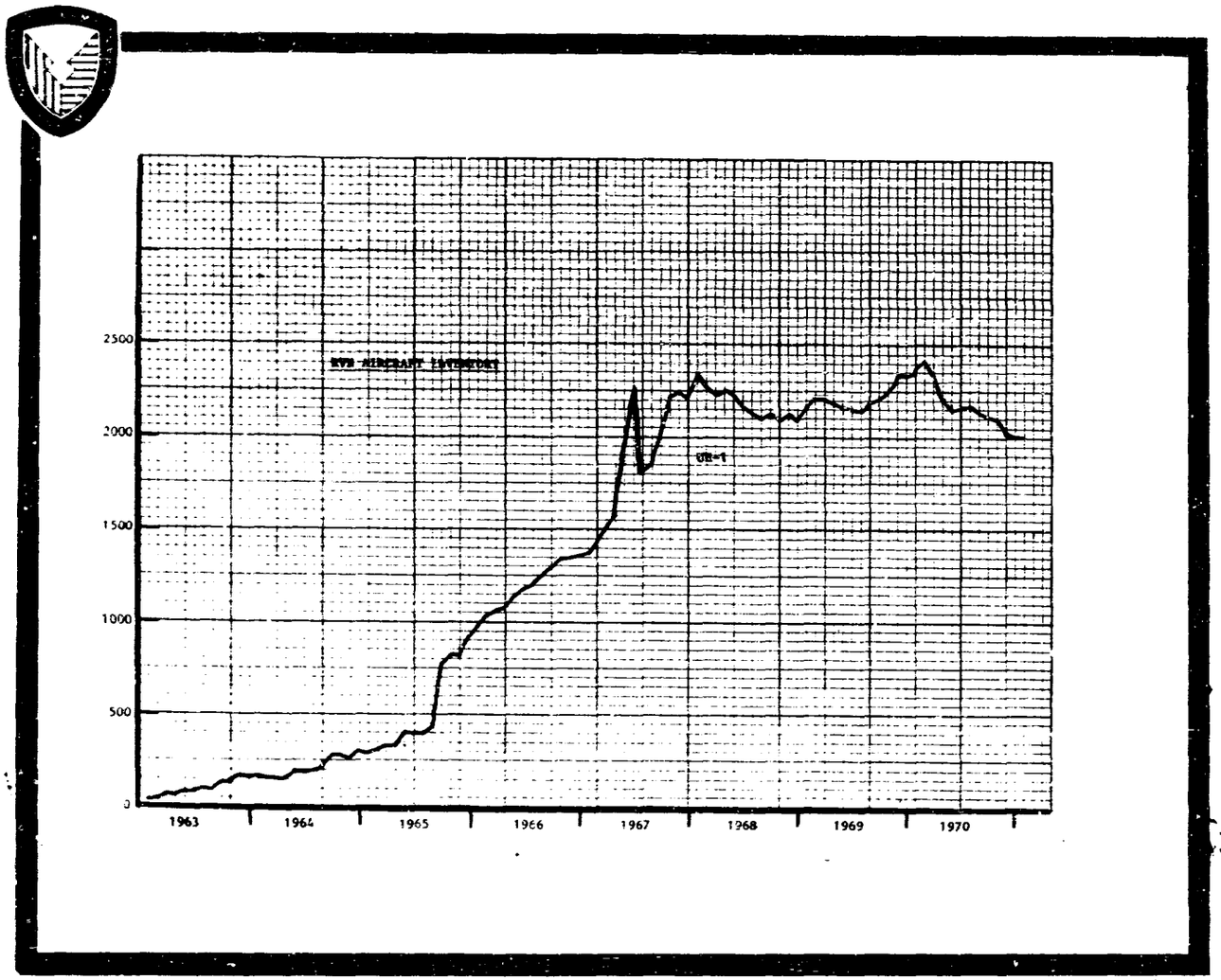
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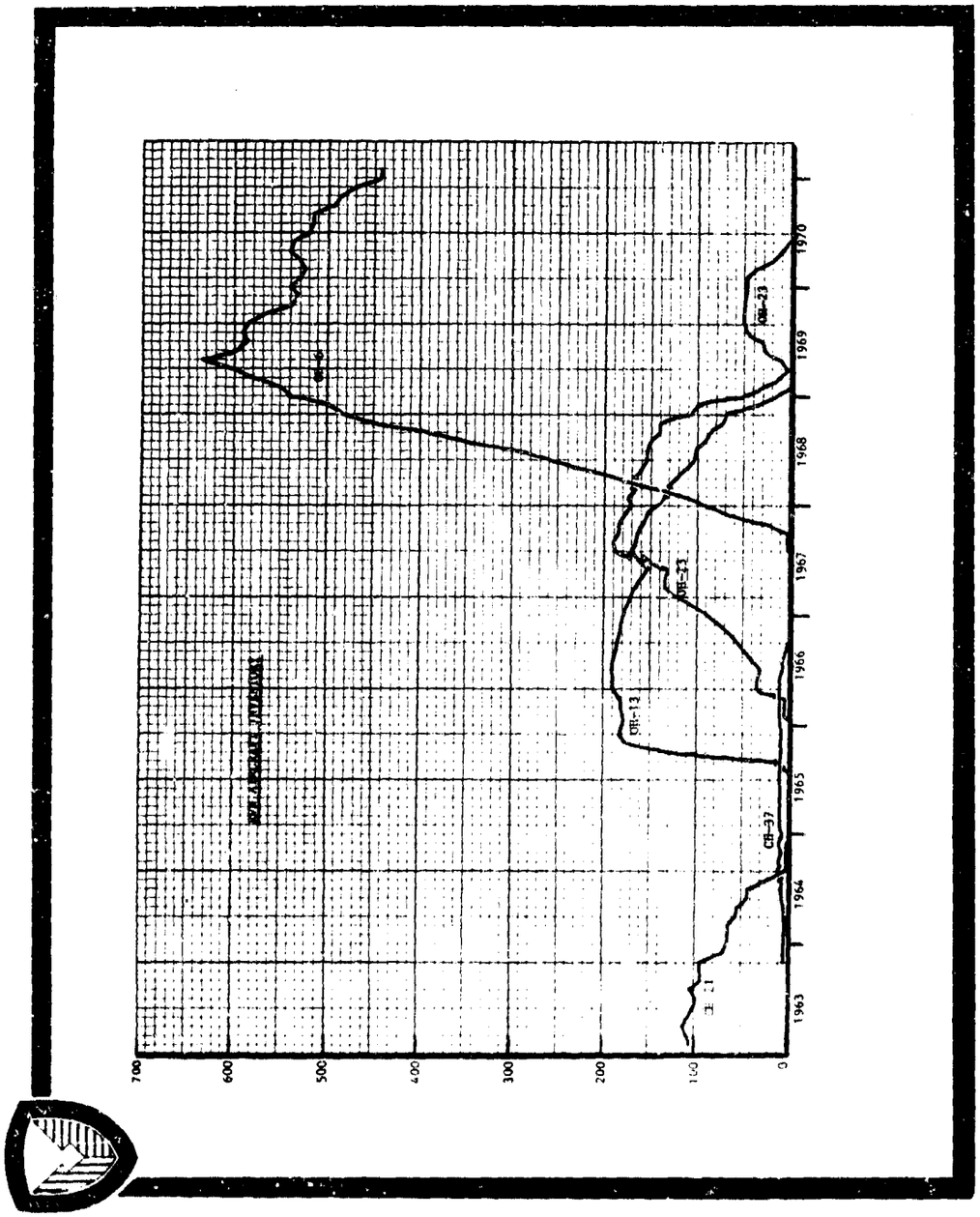
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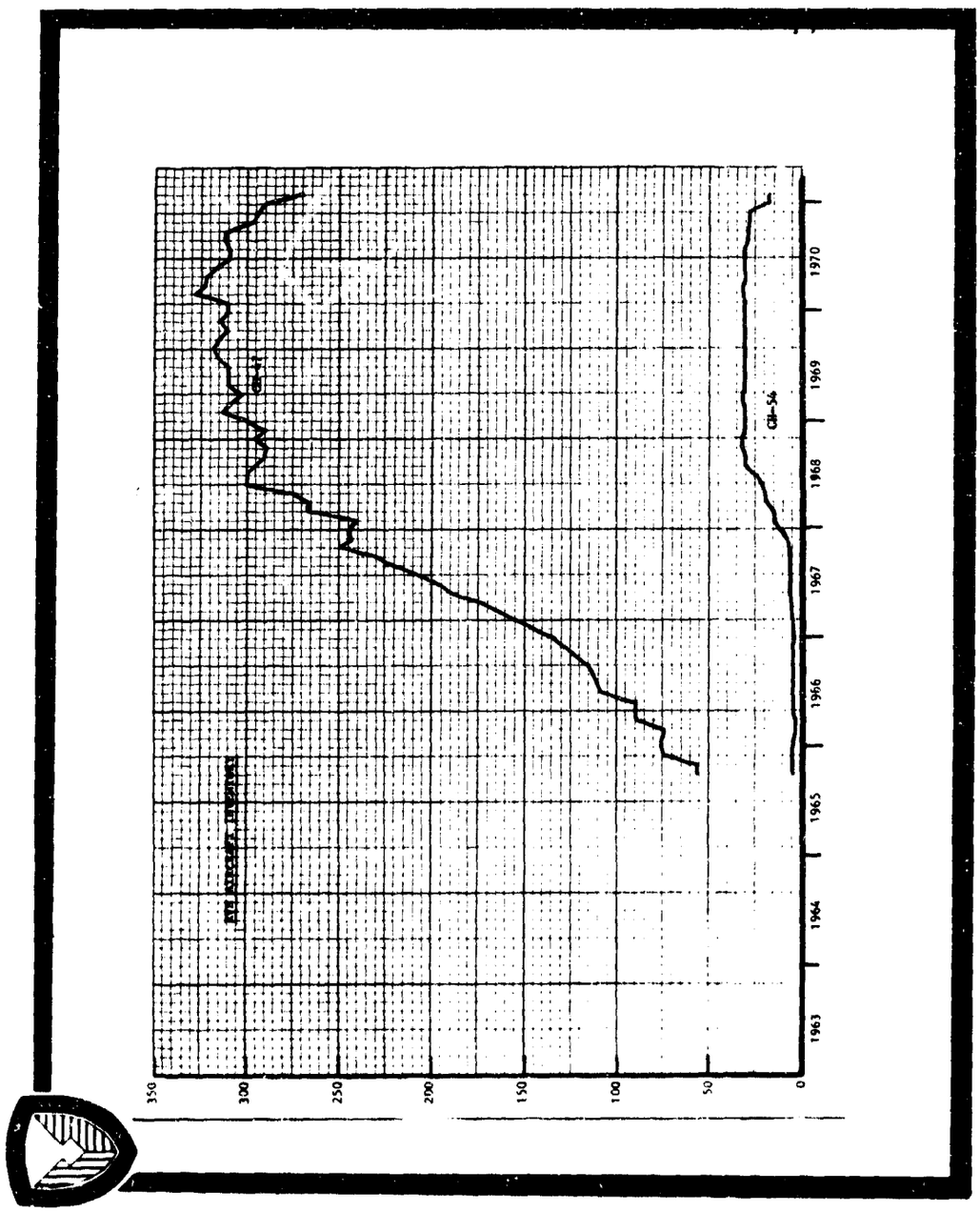
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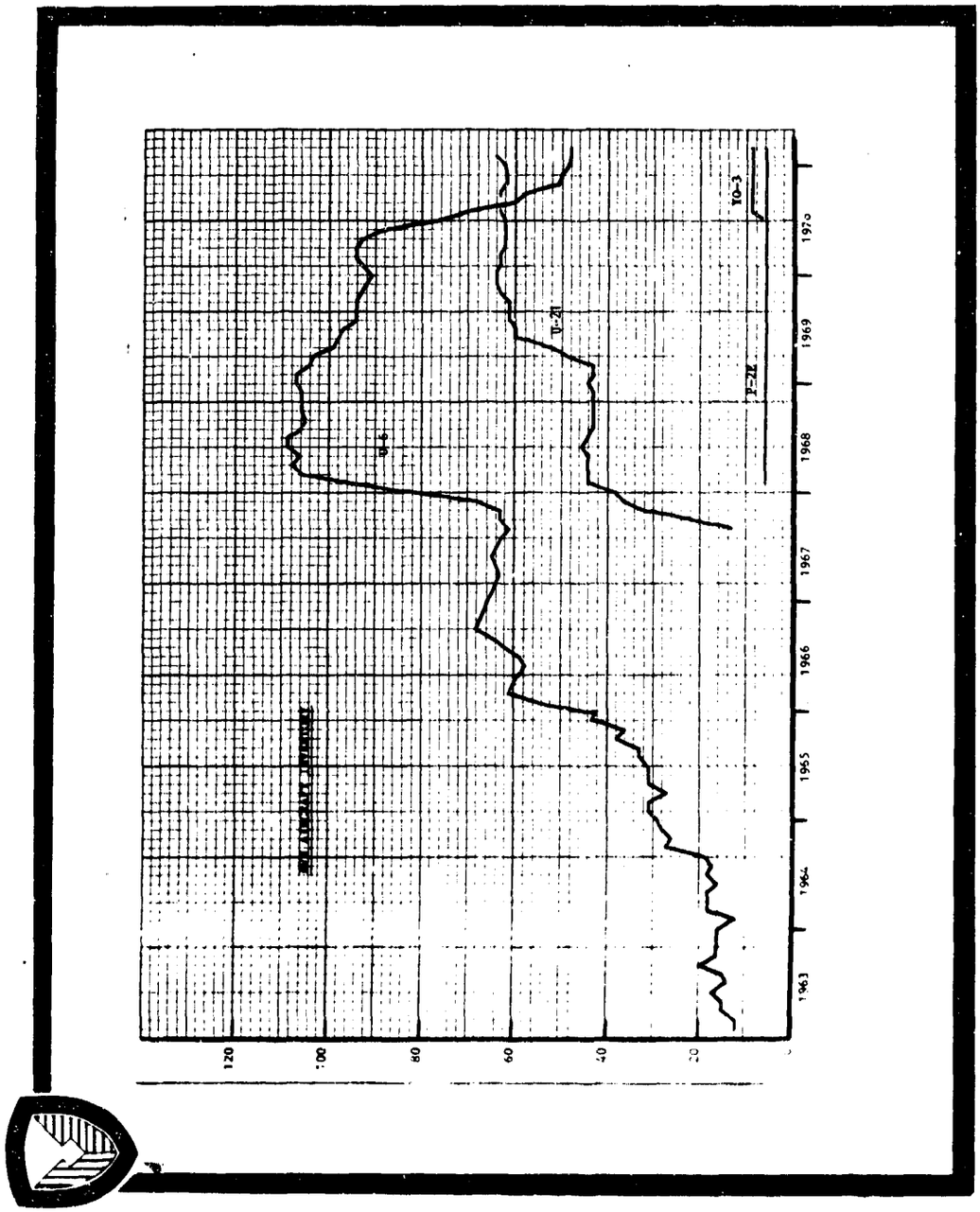
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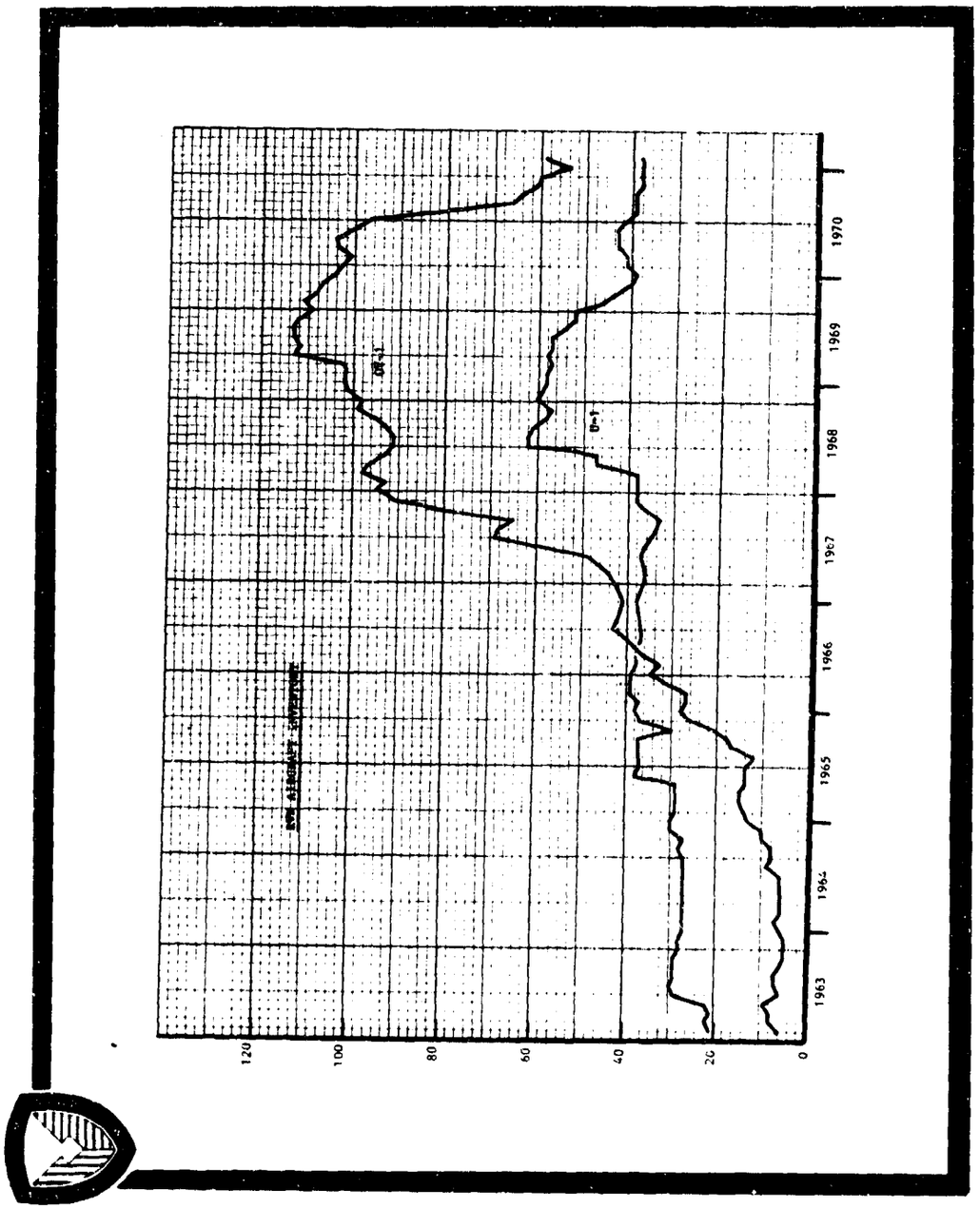
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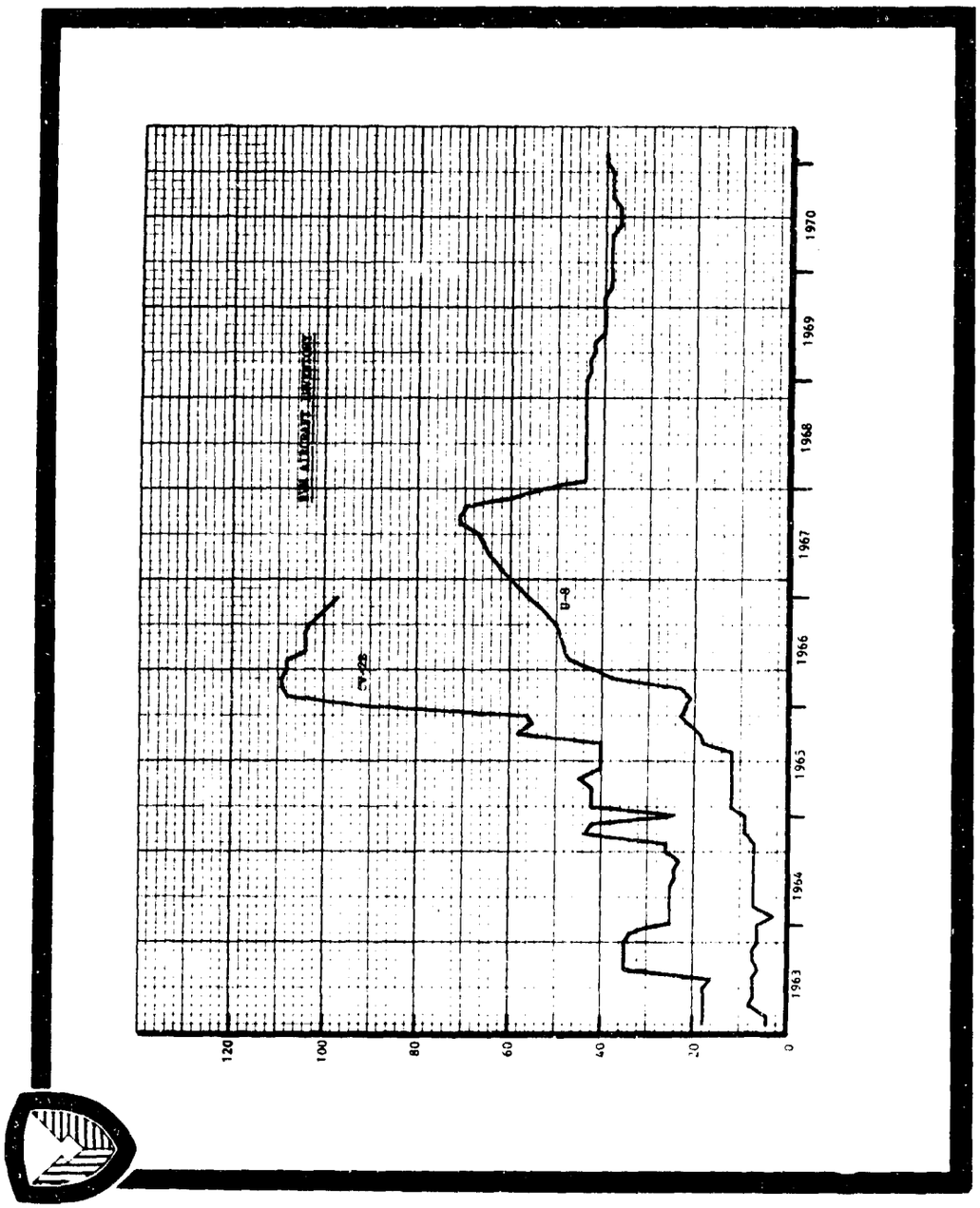
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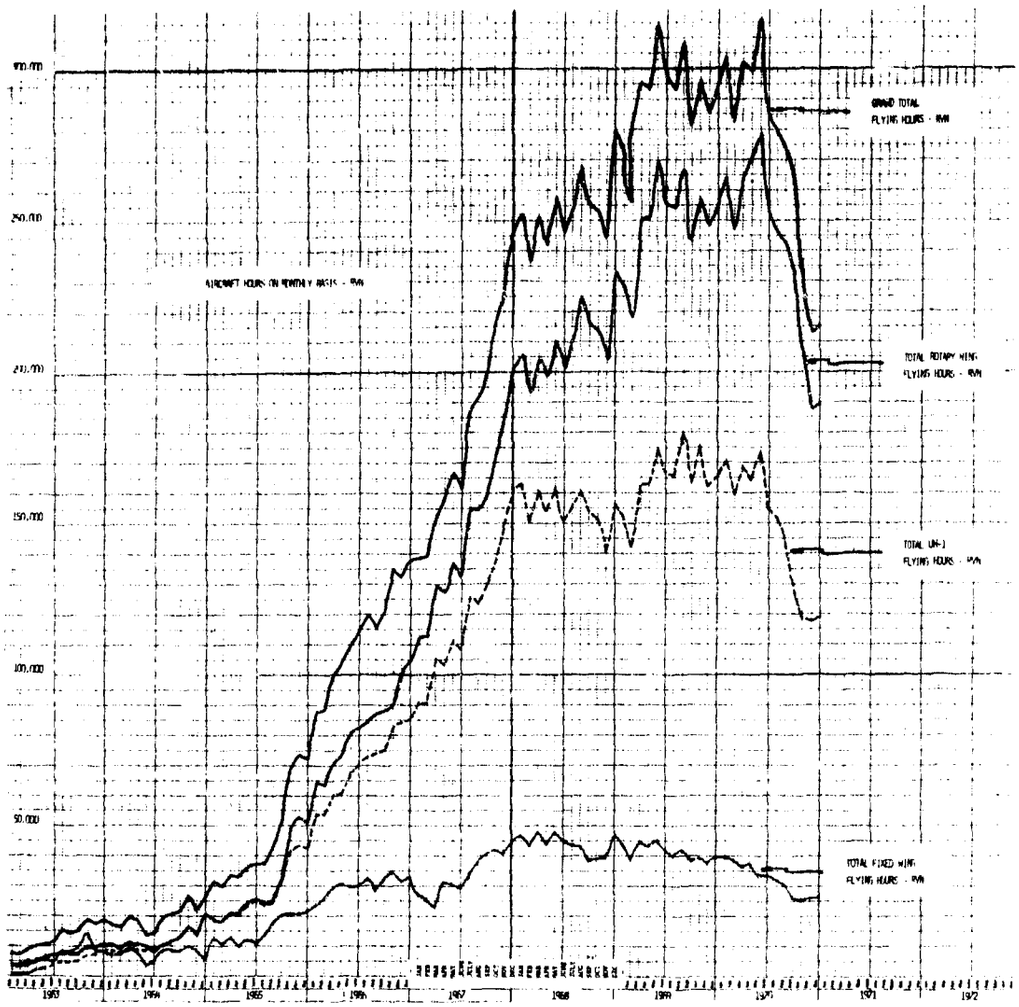
AIRCRAFT FLYING HOURS – RVN

1963-1970

LIST OF GRAPHS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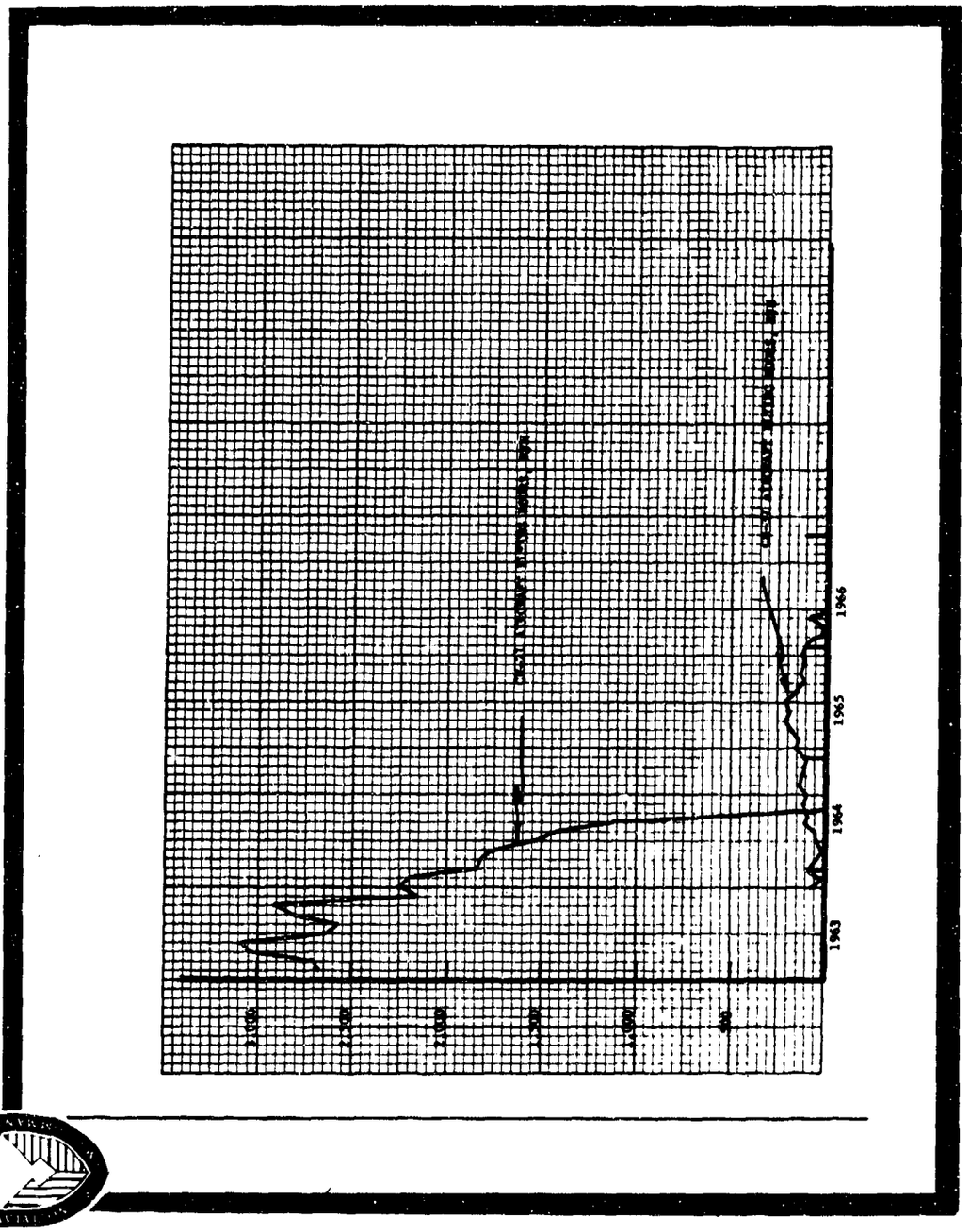
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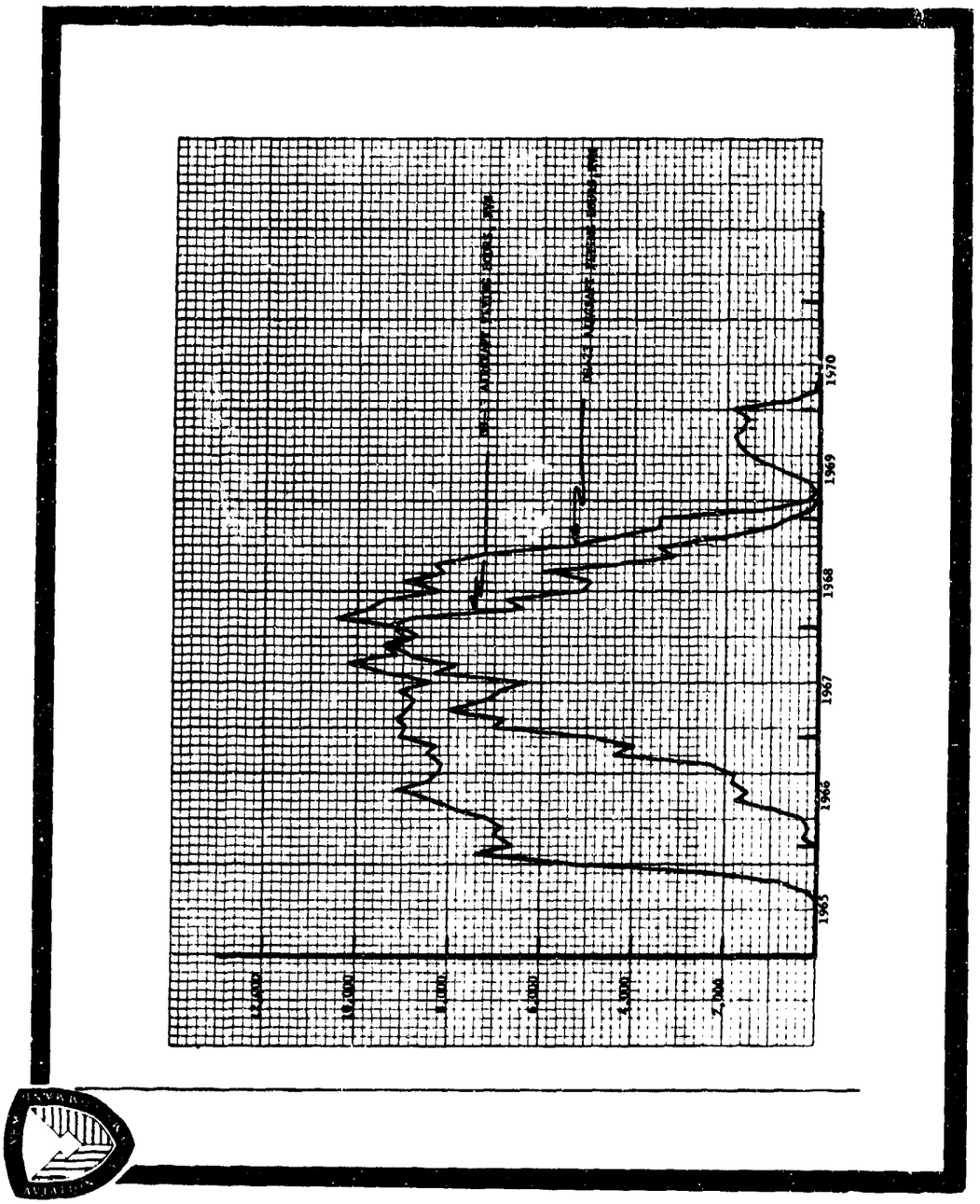
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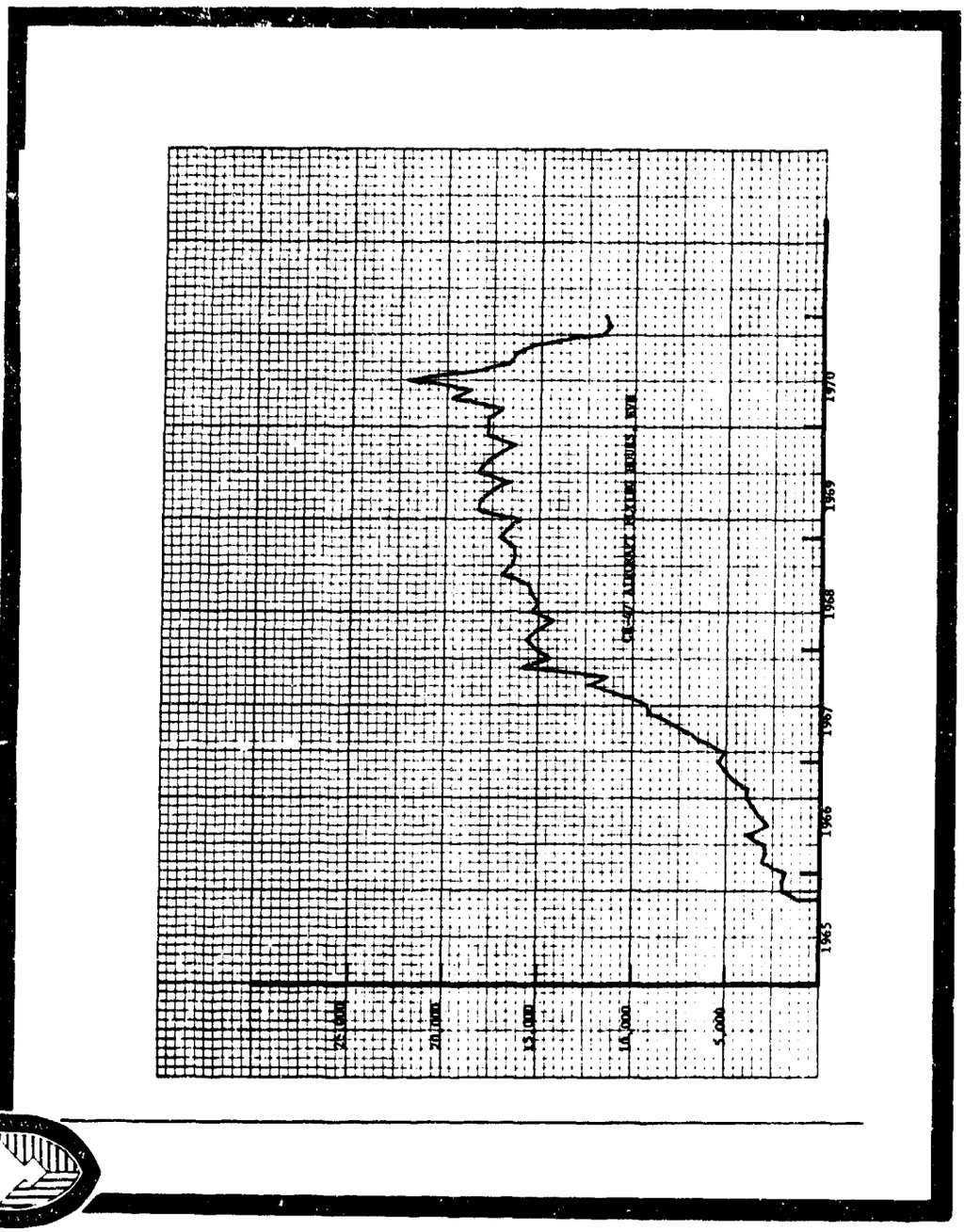
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5,000
1965
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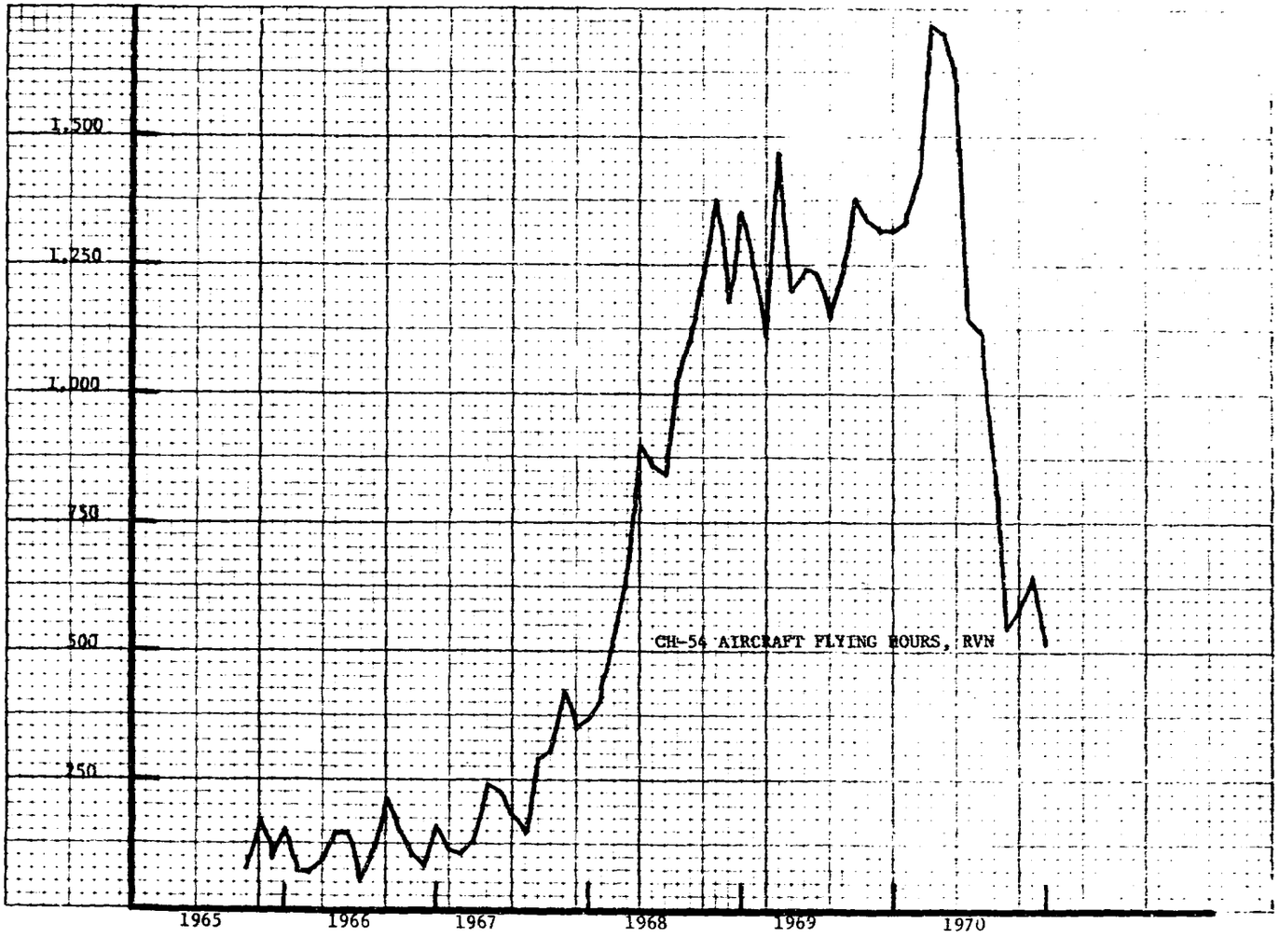
1970
CH-47 AIRCRAFT BUYING BEGINS HERE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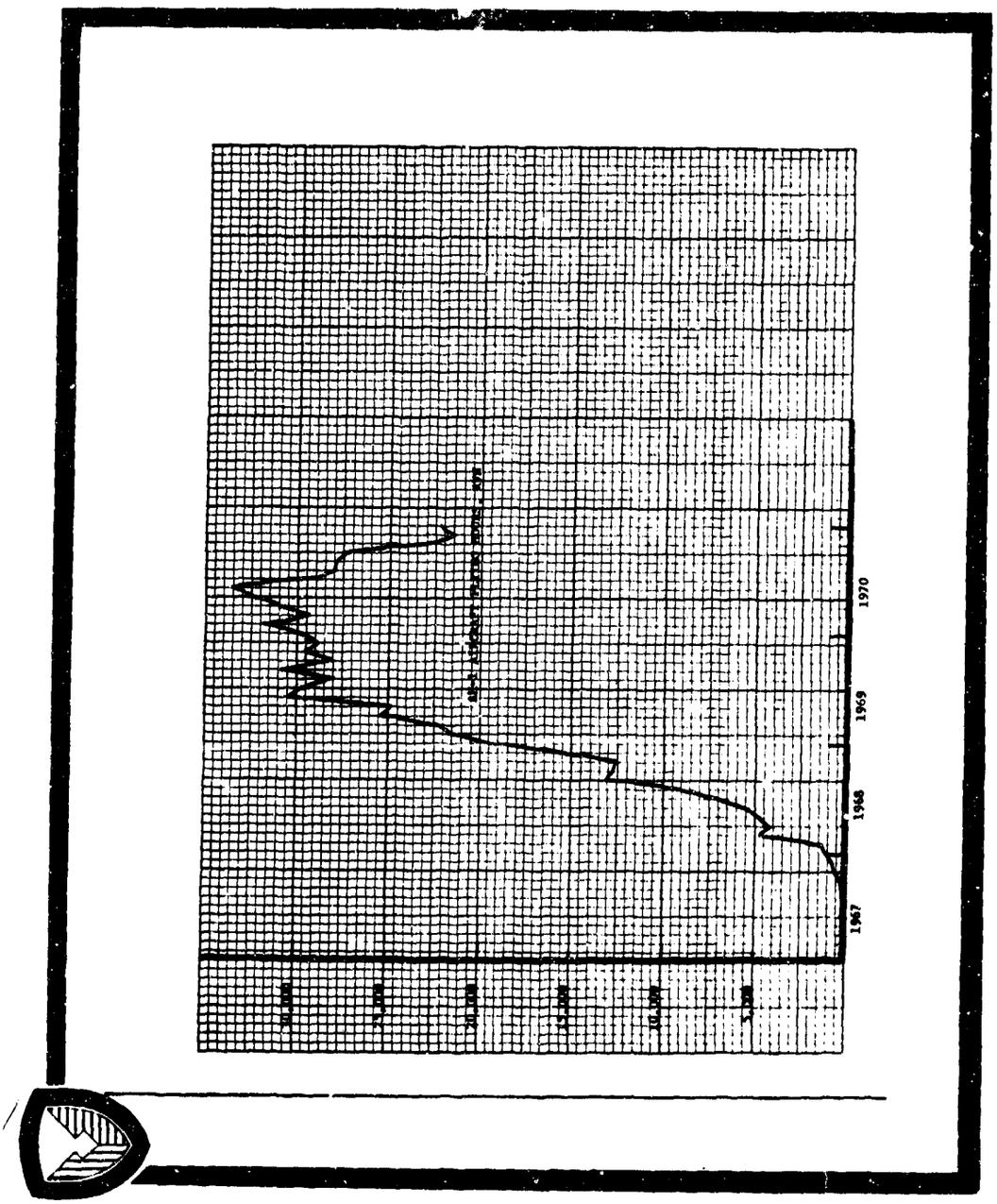
1970
CH-54 AIRCRAFT FLYING HOURS, RVN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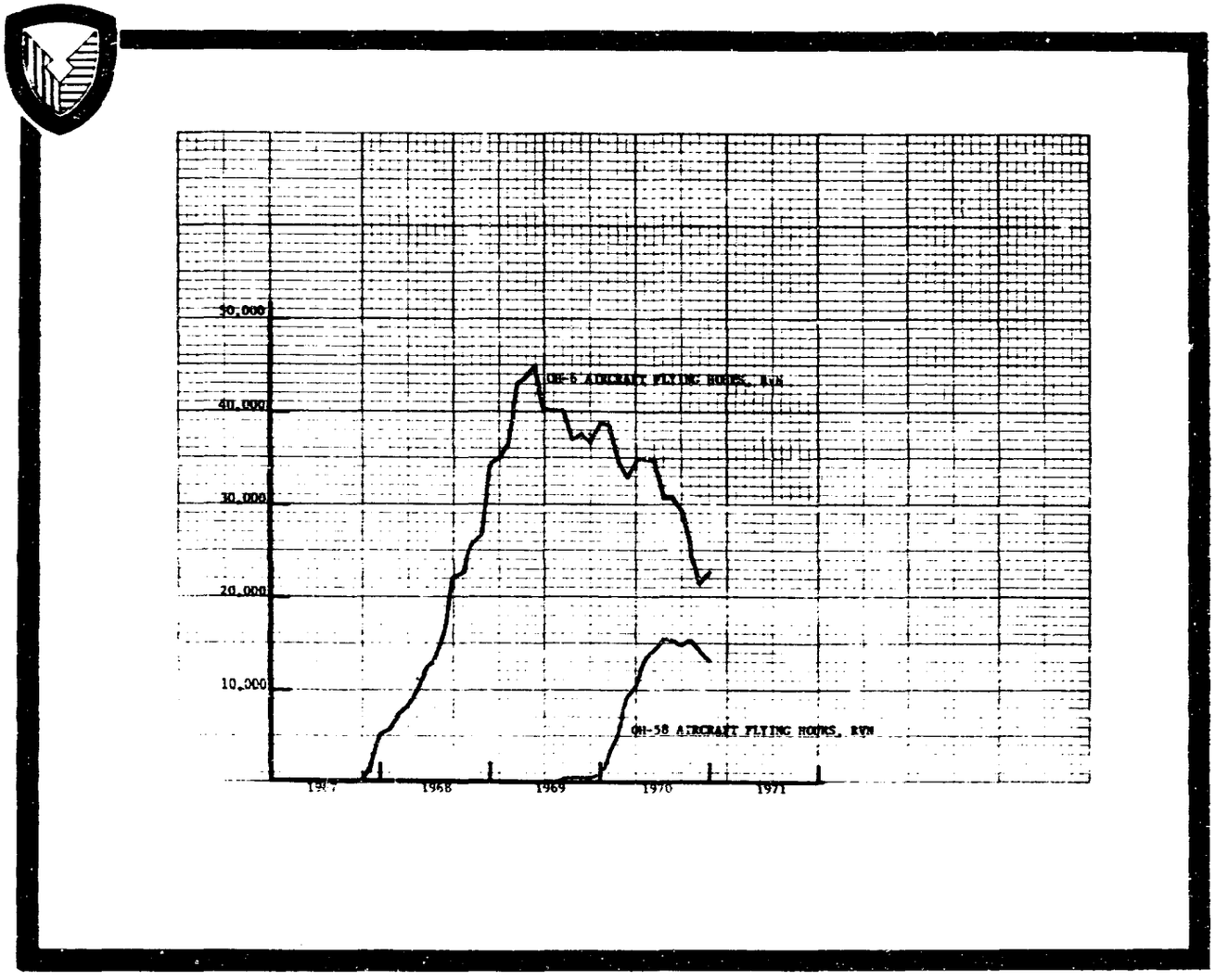
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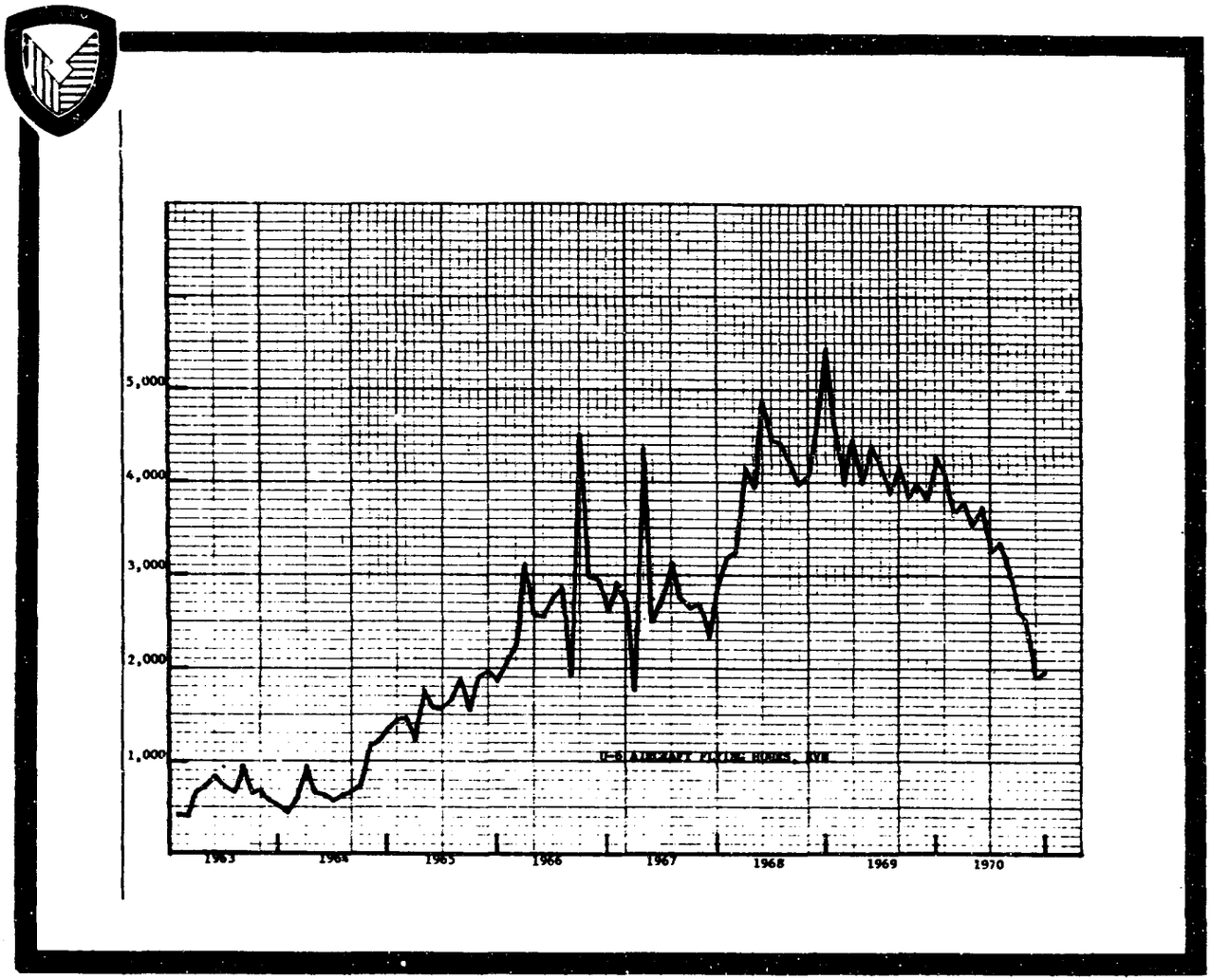
OH-6 AIRCRAFT FLYING HOURS, RVN
OH-58 AIRCRAFT FLYING HOURS, RVN
1967
1968
1969
1970
1971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1963
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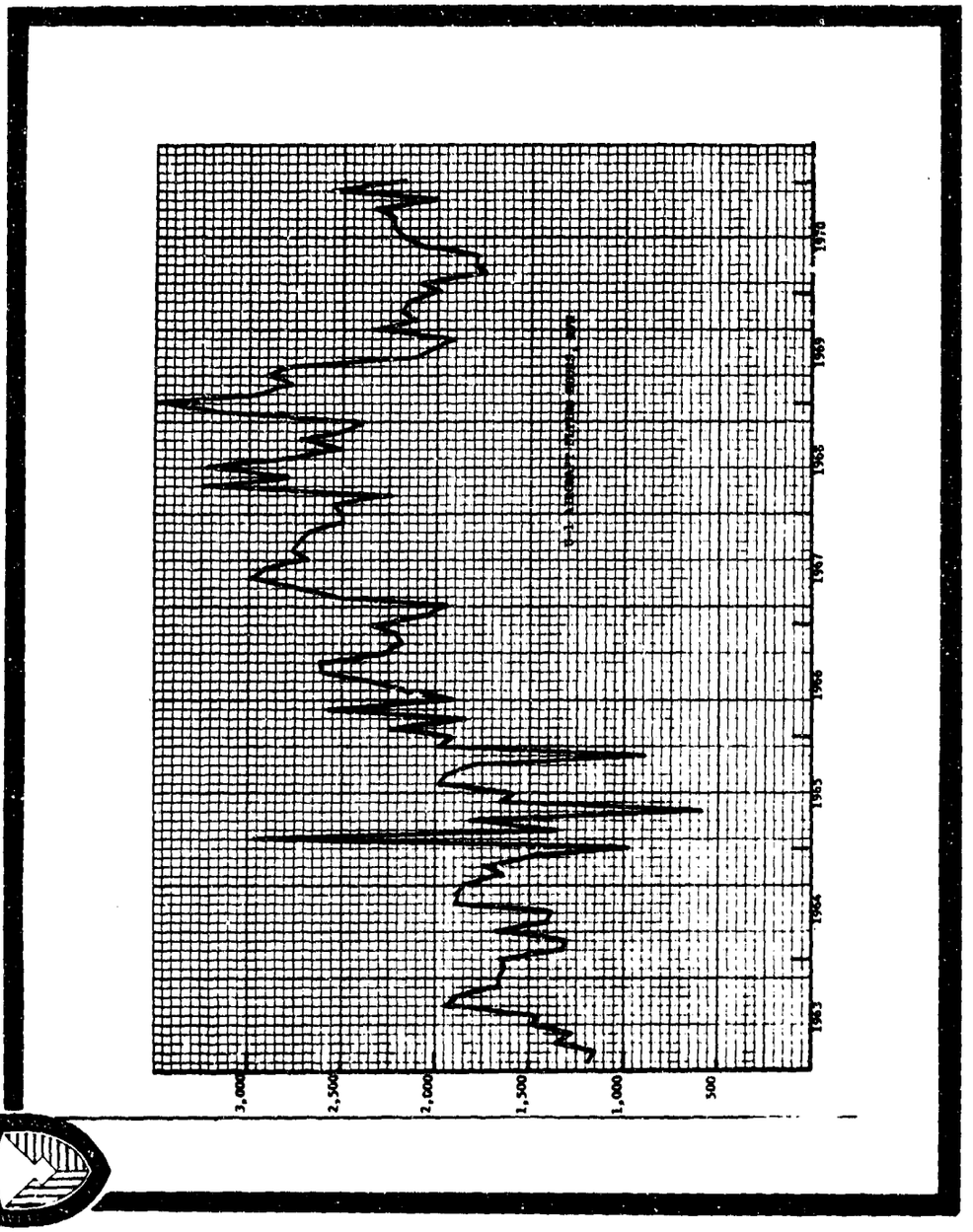
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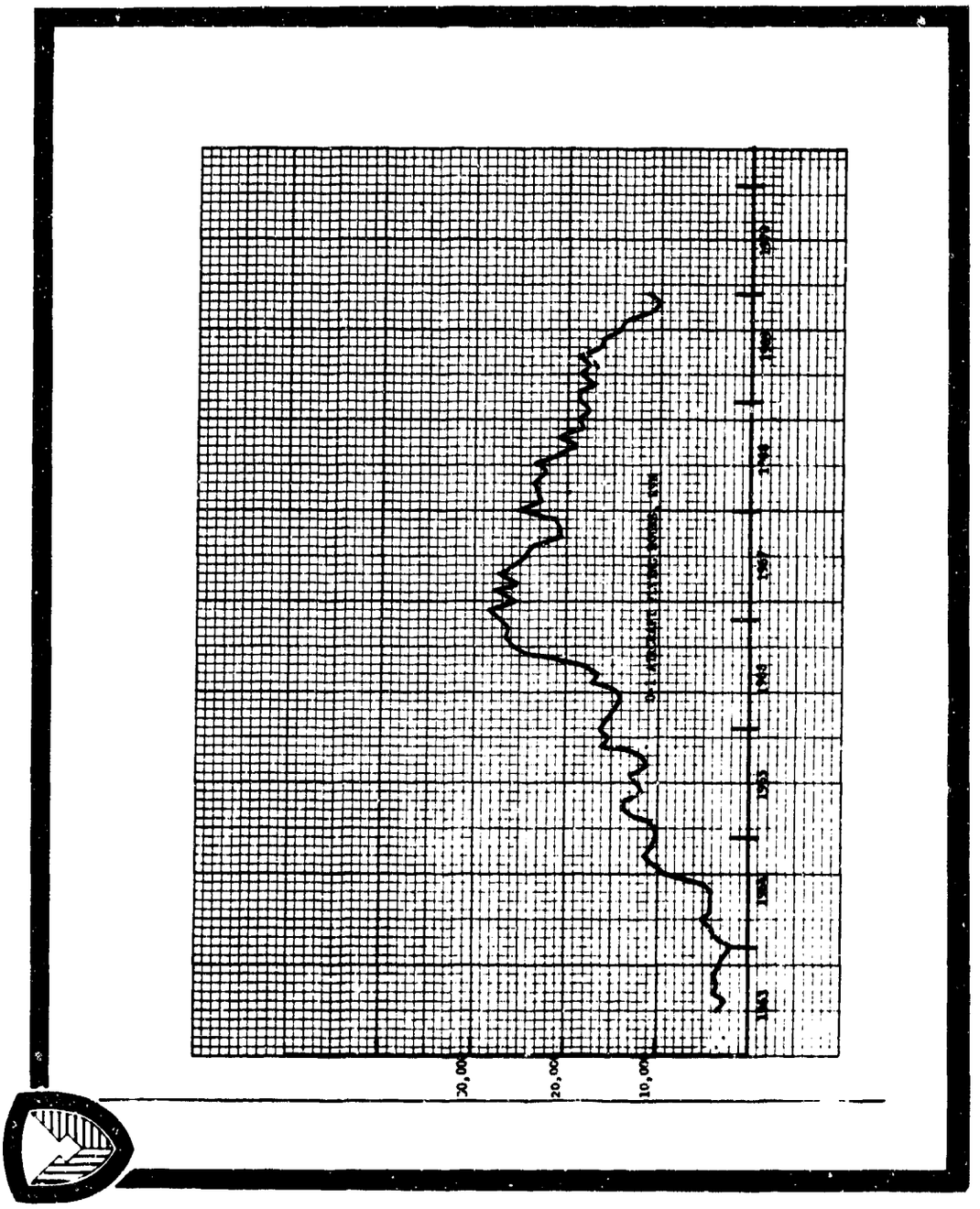

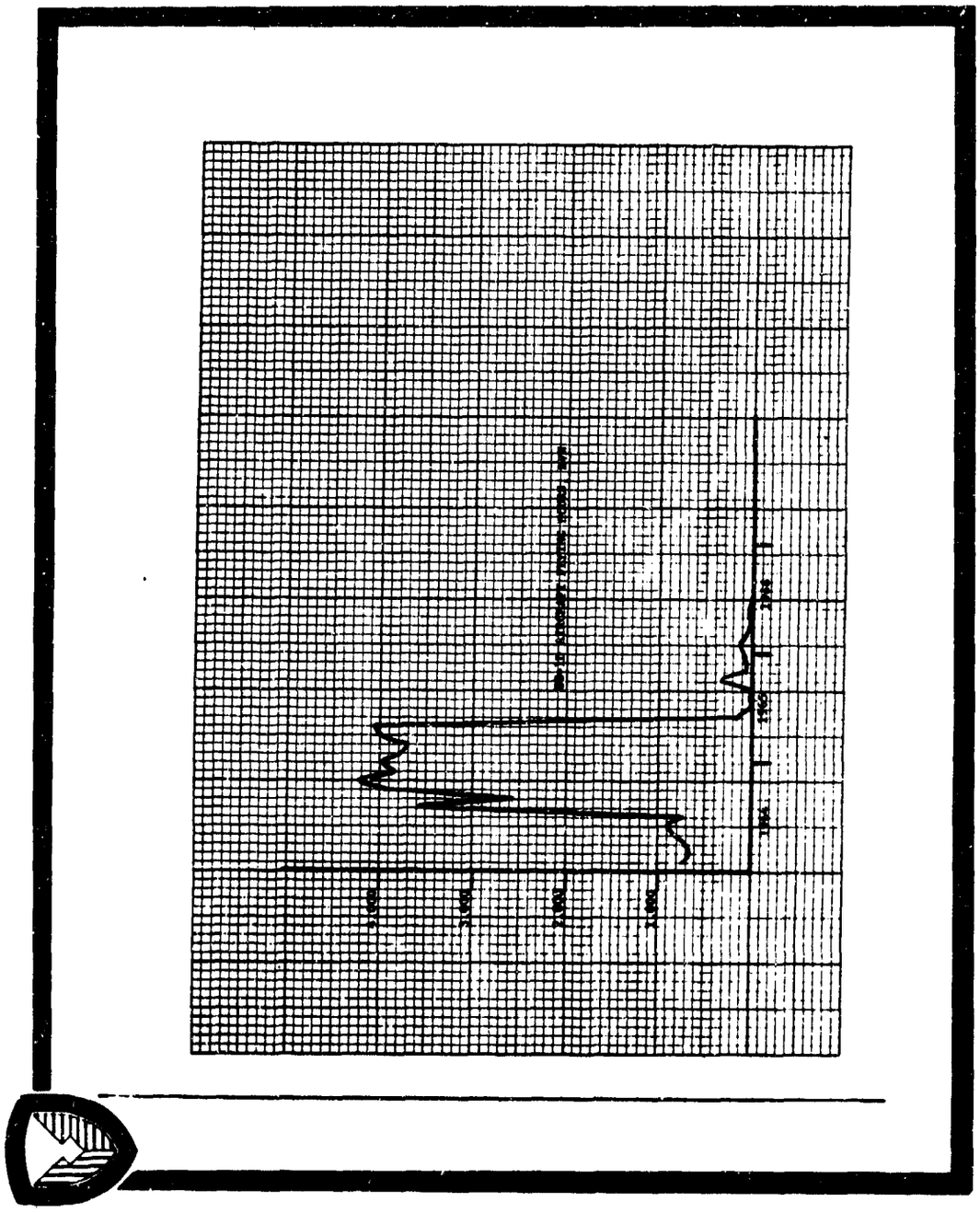

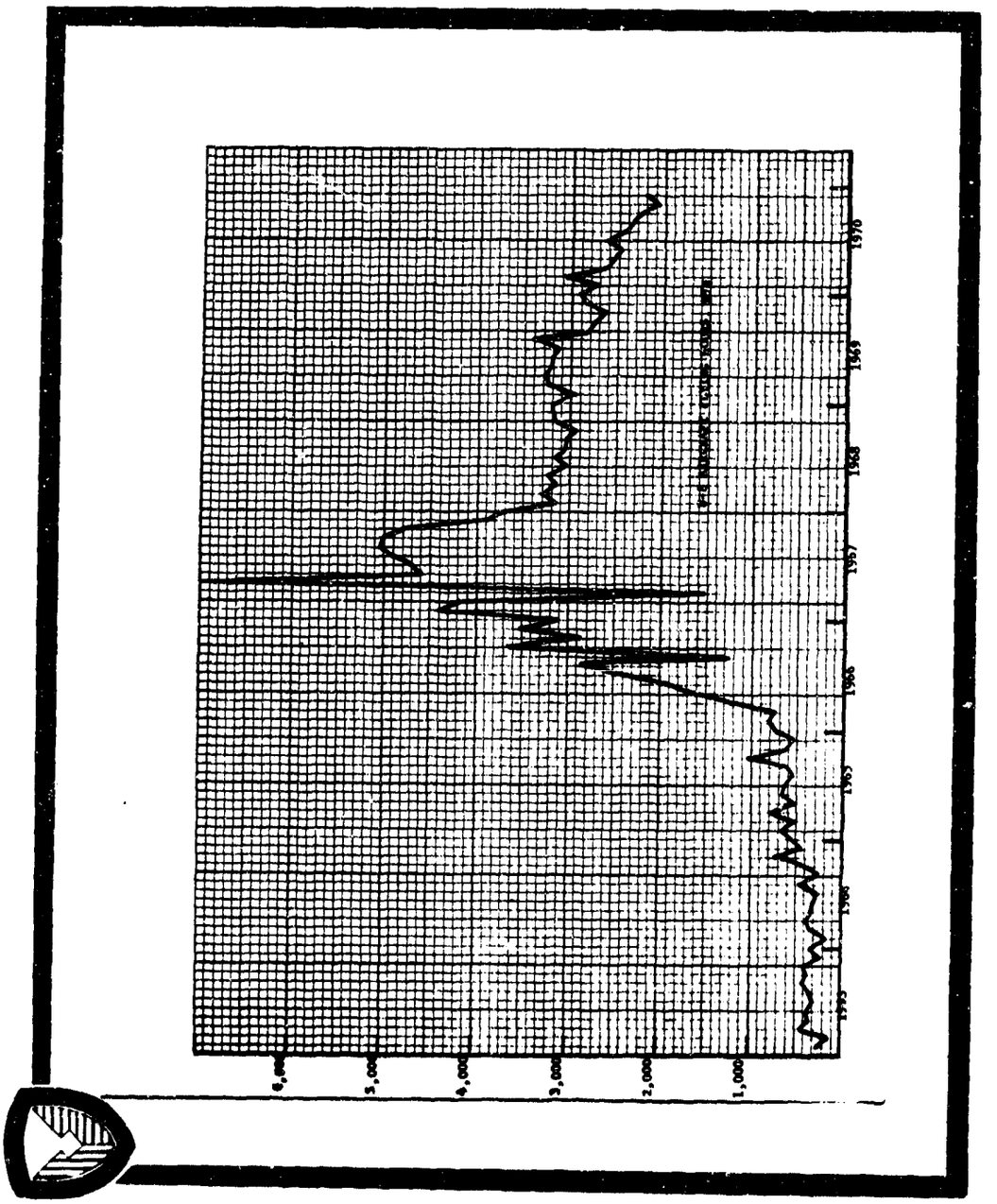
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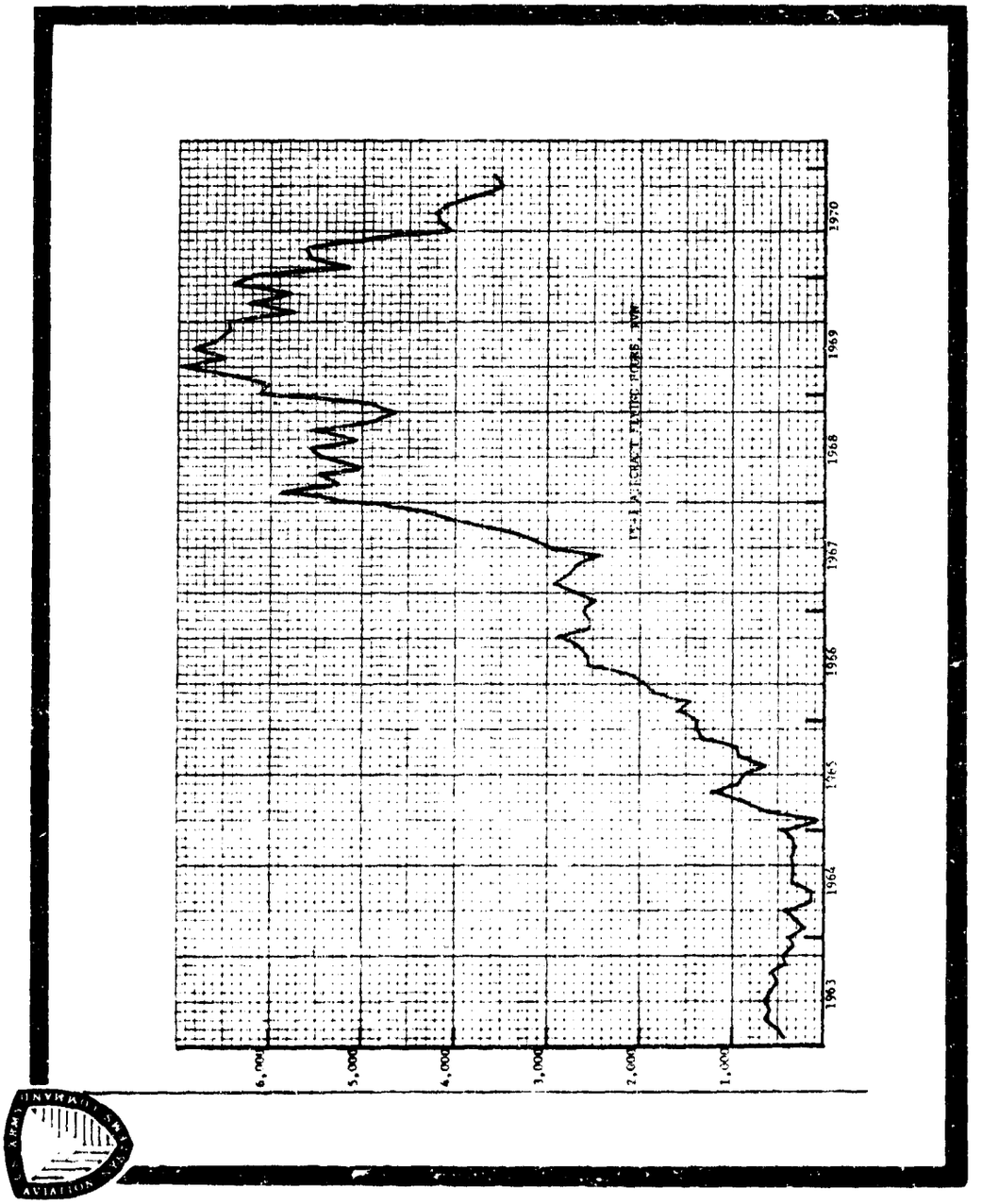
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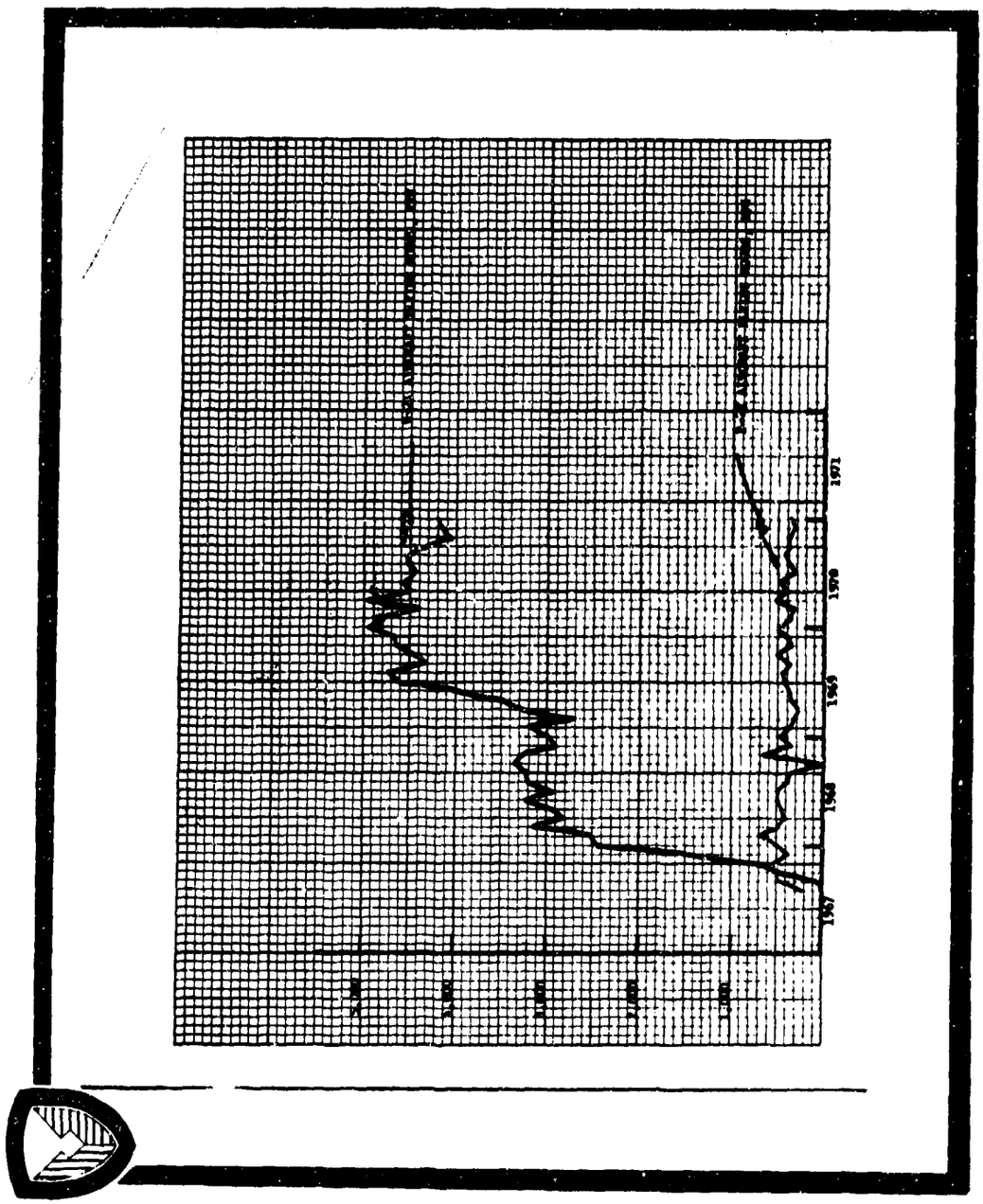

FLYING HOUR DATA

	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
TOTAL FIXED WING FLYING HOURS RVN.												
FY 63			No Record				3983	3977	5062	4900	5234	4769
FY 64	8542	8135	9045	9418	8229	8117	7073	7393	8587	7832	3790	4602
FY 65	8871	8721	8474	10005	8004	5495	12296	10548	12317	11949	12122	11686
FY 66	13728	17451	20087	20509	20770	21591	23758	25401	29339	30155	29074	29929
FY 67	32862	27191	32209	34317	31236	32973	27284	26322	22800	31301	30030	29111
FY 68	32671	37754	40553	41967	41560	44388	46617	43195	47306	43713	47871	44983
FY 69	43527	43064	38427	38921	40448	46997	43571	38609	44769	43197	44974	41959
FY 70	39971	41954	38157	39077	37421	39629	39354	35217	38588	36468	37186	33505
FY 71	33595	31850	30227	25850	25395	26064						
TOTAL	2529155											
TOTAL ROTARY WING FLYING HOURS RVN.												
FY 63			No Record				3552	3388	3929	5132	5281	6572
FY 64	7516	7638	7401	9176	9522	10607	10149	9131	11083	10268	10129	9810
FY 65	10837	11878	13257	16456	13849	20515	18775	18517	20833	20909	24095	25326
FY 66	24029	25782	31711	48567	52789	50837	64146	63533	70628	73754	80525	84167
FY 67	87045	88168	89699	100457	101630	104997	112139	112930	129498	127843	136408	132470
FY 68	154392	154489	160052	172860	183850	201300	205200	193750	203848	198621	209432	201365
FY 69	210661	224213	216111	213151	204033	232613	228449	218097	250361	250775	269209	255696
FY 70	254472	266448	243514	257181	248480	255353	264145	247704	263328	262786	278955	252407
FY 71	246673	242392	232672	204409	187845	189513						
TOTAL RW	11760088											

	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
GRAND TOTALS												
FY 63			No Record				7535	7365	8991	10032	10515	11341
FY 64	16058	15773	16446	18594	17751	18724	17222	16524	19670	18100	13919	14412
FY 65	19708	20599	21731	26461	21903	26010	31071	29065	33180	33031	36044	37012
FY 66	37757	43233	51798	69076	73559	72428	87904	88934	99967	103909	109599	114096
FY 67	119908	115358	121908	134774	132866	137970	98453	139252	152298	159144	166438	161581
FY 68	187063	192243	200605	214827	225410	245688	251817	236945	251154	242334	257303	146348
FY 69	254188	267277	254538	252072	244481	279610	272020	256706	295130	293972	314183	297655
FY 70	294443	308402	281671	296258	285901	294982	303499	282921	301916	299254	316141	185912
FY 71	280268	274242	262899	230259	213240	215577						
TOTALS FW & RW		RVN 14289243										

FLYING HOURS BY TYPE A/C ON A MONTHLY BASIS: RVN

TO-1D							720	684	713	824	900	742
FY 64	3571	2579	3922	4209	3866	3988	3780	3703	3999	4058	159	00
FY 65	4	00	312	50	54	82	124	55	4	13	13	00

	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
O-1												
FY 64											3417	2589
FY 65	3719	3639	3839	3276	2650	1679	3193	4183	5040	4443	4316	4217
FY 66	5598	9235	10354	11381	10552	10123	10352	11804	13782	13645	11907	12249
FY 67	13029	11132	11978	16122	15473	16050	15455	14742	14010	14442	17255	16498
FY 68	18745	23528	25920	26598	26416	27181	28028	25522	27812	25305	27334	25708
FY 69	24704	23836	20684	20906	21273	25246	23161	19949	23712	22675	23307	20880
FY 70	19343	20881	18592	18930	17935	18688	18833	17193	18839	17987	18815	16613
FY 71	16175	14733	13839	10806	10426	11415						
OV-1							436	514	640	593	624	588
FY 64	504	549	404	416	340	378	215	317	414	146	140	348
FY 65	343	334	348	330	339	482	42	630	861	1205	939	874
FY 66	640	916	973	1326	1378	1377	1591	1436	1846	1950	2108	2550
FY 67	2548	2643	2869	2504	2513	2600	2480	2728	2936	2756	2675	2399
FY 68	2953	3172	3574	4010	4417	5175	5876	5266	5454	5008	5436	5545
FY 69	5077	5583	4850	4652	4983	6109	6041	6376	6996	6512	6823	6574
FY 70	6443	6479	5754	6237	5801	6394	6219	5158	5563	5624	4958	4098
FY 71	4188	4210	4035	3720	3508	3593						

	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
U-6												
FY 63							423	418	676	748	863	737
FY 64	677	956	646	691	577	509	460	600	945	655	636	586
FY 65	648	699	756	1173	1226	1336	1449	1470	1225	1778	1566	1541
FY 66	1680	1897	1540	1896	1973	1850	2067	2256	3116	2579	2570	2754
FY 67	2893	1922	4508	2983	2942	2621	2917	2709	1778	4386	2504	2737
FY 68	3131	2743	2640	2681	2326	2887	3171	3256	4165	3950	4897	4446
FY 69	4427	4204	3982	4094	4671	5439	4597	3991	4442	3991	4400	4135
FY 70	3895	4170	3832	3974	3813	4262	4101	3658	3793	3530	3739	3258
FY 71	3361	3076	2626	2499	1921	1991						

U-8												
FY 63		No Record					246	161	434	344	336	302
FY 64	333	396	381	401	261	329	180	308	467	424	413	371
FY 65	484	396	382	734	438	545	662	507	795	529	651	617
FY 66	567	605	1032	635	537	736	825	773	1205	1611	1932	2390
FY 67	2852	1303	3674	2891	3520	3114	4406	4193	1537	6993	4599	4716
FY 68	4915	5044	5009	4791	3898	3684	3860	3154	3302	3168	3244	3037
FY 69	3185	3086	3038	2960	3160	3201	3210	2957	3267	3284	3220	3212
FY 70	3160	3407	2876	2741	2628	2851	2925	2735	3081	2603	2542	2498
FY 71	2637	2452	2337	2258	2097	2202						
FY												

	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
U-1												
FY 63			No Record				1187	1150	1350	1280	1488	1468
FY 64	1948	1889	1651	1656	1590	1608	1308	1320	1675	1400	1393	1891
FY 65	1885	1847	1640	1742	1488	987	2958	1361	1816	581	1657	1587
FY 66	1984	1946	1793	897	1970	1911	2247	1747	2570	1912	2158	2363
FY 67	2609	2628	2273	2192	2417	2345	2036	1950	2539	2724	2997	2761
FY 68	2688	2762	2469	2680	2498	2502	2546	2247	3288	2898	3229	2804
FY 69	2518	2724	2518	2397	3109	3539	2958	2782	2905	2784	2102	2024
FY 70	1906	2346	2107	2189	2161	1993	2084	1746	1810	1796	2065	2174
FY 71	2235	2231	2338	2008	2716	2175						
RU-8D			No Record				52	77	71	66	92	13
FY 64	78	50	88	120	180	175	144	117	109	70	87	87
FY 65	45	152	110	82	00	91	73	128	85	93	131	151
FY 66	116	200	00	393	423	310	473	393	489	520	606	443
	FLYING HOURS COMPILED WITH U-8 figures FY 67 on.											
CV-2B												
FY 63			No Record				919	973	1060	988	928	877
FY 64	1363	1675	1882	1898	1341	1103	989	1028	978	1079	962	1319
FY 65	1743	1654	1097	2618	1992	1182	3795	2214	2491	2380	2584	2709
FY 66	2959	2689	4395	3981	3937	5284	6201	6942	6331	7938	7793	7180
FY 67	8932	7562	6247	7625	4371	6243						

	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
FLYING HOURS ROTARY WING AIRCRAFT:												
CH-21C												
FY 63			No Record									
FY 64	2821	2913	2161	2252	2196	1842	2677	2700	3041	3083	2643	2579
FY 65	00	00	00	00	00	00	1826	1683	1524	1429	1223	288
CH-37B												
FY 64		No Record		69	00	77	48	14	35	52	52	80
FY 65	135	104	136	127	116	95	177	146	169	222	174	202
FY 66	171	116	132	120	129	91	18	12	66	00		
UH-1A												
FY 63			No Record				574	566	48	00		

	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
UH-1B												
FY 63			No Record				301	122	849	2039	2638	3993
FY 64	4695	4725	5175	6920	7326	8688	8275	7434	9524	8787	8798	9442
FY 65	10702	11774	13121	16327	13783	20420	18598	18374	20664	19307	20687	20539
FY 66	18509	17129	16316	20517	21139	20184	24136	24026	26913	26599	28687	26906
UH-1D												
FY 65					No Record						3362	5817
FY 66	5324	7737	11484	20547	22012	21988	29635	29582	33207	34382	38504	43343
UH-1 TOTALS												
FY 63			No Record				875	688	849	2039	2638	3993
FY 64	4695	4725	5175	6920	7326	8688	8275	7434	9524	8787	8798	9442
FY 65	10702	11774	13121	16327	13783	20420	18598	18374	20664	20687	23899	25124
FY 66	23833	24866	27800	41064	43151	42172	53771	53608	60120	60981	67191	70249
FY 67	72961	73947	75179	82894	84239	85435	90873	90682	105390	103609	111168	108354
FY 68	125748	123777	130101	137278	148964	161358	162751	150069	160600	154156	161666	150432
FY 69	155910	160346	153851	151101	140044	156212	152945	142223	162235	162373	174438	166572
FY 70	165668	174501	158870	170411	162067	165138	170442	159183	168872	164287	173262	154683
FY 71	154871	151540	145181	129630	118792	119241						

	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
OH-13												
FY 66	00	800	2535	5320	7377	6614	6956	6833	7058	7808	8520	9100
FY 67	8453	8221	8155	8414	8282	9042	8993	9066	8882	8756	9042	8381
FY 68	9507	10193	9145	9414	8989	9333	8768	6389	6740	5076	4914	5959
FY 69	4238	3158	3557	1849	759	491	76	3	00	00		
FY 70												
FY 71												
OH-23												
FY 66	25	00	00	00	00	00	287	209	303	887	1789	1562
FY 67	1852	1839	2326	4399	3993	4998	6996	6824	7945	7227	6934	6320
FY 68	8304	7881	8927	9394	8756	9314	10442	9763	9435	8257	8963	8138
FY 69	8296	7269	5347	4394	3471	3443	1131	205	16	203	622	1185
FY 70	1463	1711	1813	1765	1622	1552	1876	615	75	00		

	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
CH-47												
FY 66			1167	1890	2039	1803	3040	2808	2892	3935	2783	3201
FY 67	3660	3974	3911	4648	5033	5357	5162	6248	7154	8011	9035	9206
FY 68	10684	12351	11333	15708	14407	15144	15642	15126	14334	15280	15133	15371
FY 69	15616	16992	16592	16384	16459	17100	16650	15998	18267	18210	17525	17141
FY 70	18215	17976	17206	16321	17723	17787	17709	17130	19746	18861	22163	18581
FY 71	16593	16372	15176	11907	11339	11636						
CH-54												
FY 66			77	173	93	157	74	70	89	143	145	55
FY 67	114	187	128	102	83	165	115	110	127	240	229	209
FY 68	149	287	306	419	356	371	431	533	664	896	863	848
FY 69	1028	1103	1239	1377	1107	1350	1254	1114	1463	1198	1232	1225
FY 70	1146	1231	1377	1337	1317	1319	1329	1420	1718	1700	1589	1142
FY 71	1117	859	545	579	639	513						
AH-1G												
FY 68	00	00	240	642	706	729	1334	4756	4206	4777	5635	7438
FY 69	9612	13196	12739	12511	15574	19563	21444	22300	25338	24957	30481	29422
FY 70	27924	30848	27086	29511	18920	29841	31827	29452	30989	32418	33607	28950
FY 71	27978	27833	27487	22511	21502	22241						
U-21												
FY 68	00	22	441	704	1625	2468	2546	3162	2856	2944	3247	2950
FY 69	3230	3261	3355	3242	2908	2990	3231	2699	3279	3468	4054	4628
FY 70	4763	4274	4495	4655	4669	4961	4806	4388	4992	4510	4592	4445
FY 71	4531	4537	4386	4033	4148	4207						

	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
P-2E												
FY 68	239	484	500	503	380	491	690	488	429	440	484	493
FY 69	386	350	00	670	344	473	373	324	291	362	386	428
FY 70	461	397	501	351	414	483	383	339	510	418	475	318
FY 71	390	426	379	368	321	355						
YO-3												
FY 71	78	185	287	158	258	126						
OH-6												
FY 68			00	5	1672	5051	5832	7114	7869	10179	12258	13179
FY 69	15961	22149	22876	25535	26619	34454	34949	36257	43039	43834	44911	40151
FY 70	40056	40053	36915	37602	36591	38812	38767	34555	32901	34856	34971	34701
FY 71	30691	30661	29311	24633	21499	22845						
OH-58												
FY 70	00	128	247	234	270	874	2810	5349	9027	10664	13363	14350
FY 71	15423	15137	14972	15149	14074	13037						