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Report to the Chairman, Subcommittee
on Oversight of Government
Management, Committee on
Governmental Affairs, U.S. Senate

DESERT SHIELD/ STORM LOGISTICS

Observations by U.S. Military Personnel



91-15823



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United States
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National Security and
International Affairs Division

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November 13, 1991

The Honorable Carl Levin
Chairman, Subcommittee on
Oversight of Government Management
Committee on Governmental Affairs
United States Senate

Dear Mr. Chairman:

This report responds to your request that we determine the Department of Defense's ability to supply troops deployed to Saudi Arabia with the necessary support items and repair parts and the lessons learned by the services in the Desert Shield/Storm conflict. To accomplish this, we visited military units of the Air Force, the Army, and the Marine Corps deployed in Saudi Arabia and Bahrain that used a wide variety of weapon systems and services.

We are sending copies to appropriate congressional committees; the Secretaries of Defense, the Army, the Navy, and the Air Force; the Director, Office of Management and Budget; and other interested parties.

This report was prepared under the direction of Donna M. Heivilin, Director, Logistics Issues. She may be reached on (202) 275-8412 if you or your staff have any questions concerning this report. Other major contributors are listed in appendix II.

Sincerely yours,

Frank C. Conahan
Assistant Comptroller General



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Executive Summary

Purpose

Operations Desert Shield and Desert Storm involved the largest rapid movement of troops and supplies ever undertaken by the U.S. military. The Chairman, Subcommittee on Oversight of Government Management, Senate Committee on Governmental Affairs, asked GAO to report on the Department of Defense's (DOD) efforts to supply troops deployed to Desert Shield/Storm with necessary support items and repair parts. GAO's objectives were to summarize how DOD's logistics system supplied the land-based forces (GAO did not include Navy units or sea-based Marine Corps units) and to obtain observations on logistics support from military officials who had been involved in Desert Shield and Desert Storm. GAO sent a team to Saudi Arabia and Bahrain in April 1991 to gather these first-hand observations.

Background

Desert Shield, the protection of Saudi Arabia from Iraqi aggression and of U.S. vital interests, began on August 7, 1990, with the deployment of U.S. troops to Saudi Arabia. Desert Storm, the liberating of Kuwait, began on January 17, 1991, with the commencement of the air campaign. The ground campaign began on February 24, 1991. Both the ground and air campaigns ended on February 28, 1991.

DOD undertook a massive logistical task to transport, receive, and sustain a force of over 500,000 troops while overcoming tremendous distances, harsh desert environment, and absence of U.S. military troops stationed in Saudi Arabia. Also, logistical support difficulties were created by national policy and command decisions to (1) initially deploy combat forces in advance of support units, (2) revise mission requirements for some of the U.S. weapons systems, and (3) deploy certain new weapon systems without their full complement of spare parts and support material. Because of the short period of hostilities, Desert Shield/Storm did not test the supply system's ability to sustain a protracted campaign.

Results in Brief

The U.S. military's ability to move massive amounts of troops and material for Desert Shield/Storm was a significant achievement. As might be expected of such a huge and complex undertaking, however, not all went smoothly. GAO obtained observations from U.S. military personnel in the United States and in Saudi Arabia and Bahrain on what lessons could be learned to both avoid future occurrences of logistical problems and replicate the management practices and ingenuity U.S. military personnel used to overcome many of these problems.

Personnel in Desert Shield/Storm were able to maintain high readiness rates despite situations such as missing information on location and unit distribution of parts and supplies, transportation delays, and use of newly fielded weapons systems. Personnel used flexibility and ingenuity to meet the needs and maintain readiness. For example, critical parts were obtained by stripping inoperable equipment, trading with like units, and purchasing from the local economy.

DOD was able to adequately provide food and clothing to U.S. troops deployed to Desert Shield/Storm. Food and clothing can be significant morale factors in locations far from home, and some improvements are possible in terms of variety and quality of meals available to the Army and the Marine Corps and availability of desert uniforms and boots to personnel. The Army is reevaluating its feeding plan because of some of the shortfalls and inadequate industrial base response to increased requirements. While all troops obtained military clothing and chemical ensembles, not all received the proper size or the required types or amounts.

Prepositioning of supplies by the Air Force and the Marines was considered to be successful in achieving the rapid deployment of supplies to Saudi Arabia. In the Marine Corps, in some instances, supplies that had been predesignated for one unit were reallocated to other units (based on commander's decisions). The Marine Corps also had problems with the management of prepositioned supplies that were not used for Desert Shield/Storm missions.

Principal Findings

Repair Parts

Air Force personnel at units GAO visited said that they never missed a mission because of a shortage of repair parts. Readiness rates of aircraft during Desert Shield/Storm averaged 93 percent for Air Force aircraft and ranged from 90 to 97 percent for selected Army equipment during Desert Storm, according to Air Force and Army Central Command statistics. The Marine Corps units GAO visited estimated overall readiness rates ranged from 90 to 95 percent.

The Army, the Air Force, and the Marines all had supply lists/prepackaged kits with the repair parts and supplies essential to support and sustain combat until the supply system adjusted to the increased

demand. To obtain the high unit readiness rates, these lists/kits were supplemented. Desert Shield/Storm personnel interviewed by GAO made observations on how to better tailor these supplies to wartime needs.

All the units GAO visited described how they used intensive management, flexibility, and ingenuity to ensure that parts were obtained in a timely manner and high readiness rates were maintained. These efforts included obtaining parts from other units, rebuilding and reusing parts, buying parts and repair services on the local economy, taking parts from nonmission capable equipment, and managing transportation intensively to help lessen delays in obtaining needed parts.

The Army was able to maintain high readiness rates in part because of the high priority given to supplying parts to units, but it did not have visibility of repair parts at the unit levels in the Persian Gulf and thus could not readily redistribute parts among units. With the Marine Corps' initial priority of rapidly unloading the Marine Prepositioning Force ships to support the deployment of combat troops in August 1990, the Corps experienced some difficulty controlling inventories of repair parts. A Marine Corps headquarters official said this was due to a Central Command decision to send combat forces before support personnel. The Air Force directly addressed inventory problems, and by January 1991, it had a central computer system operating that provided spare parts visibility.

In addition, GAO was told of some instances of the inefficient use of the priority system for ordering repair parts and how some units overcame problems in obtaining needed parts for a communications unit and for newly fielded systems.

Food and Clothing

Due to restrictions from host nation cultural and religious practices, the provision of food and clothing was a very important factor in maintaining the morale of Desert Shield/Storm personnel.

Although each military service had a field feeding plan, the type and variety of food depended on the units' locations. For example, the Air Force, with fixed locations, had more fresh food available than the mobile Army and Marine units that used more packaged rations. All three services received significant contributions of fresh food from the host nation.

The Air Force's and the Marine Corps' feeding plans were met or exceeded during the operation. While the Army was not able to meet its feeding plan for all units, it did introduce a morale booster, the "wolfmobiles," which served hamburgers, hot dogs, and french fries. Army and Marine Corps units GAO visited verified the reported complaints about the quality and lack of variety in some of the meals served. A Marine Corps headquarters official attributed this to the tactical situation.

Personnel GAO talked to had uniforms, boots, and chemical gear, but there were some problems with the availability of sizes and amounts. Also, desert camouflage uniforms and desert boots were not always available, especially for Air Force personnel.

Other Desert Shield/Storm Logistics Issues

The Marine Corps' Maritime Prepositioning Force and the Air Force's Harvest Falcon prepositioning program were both successful in expediting the deployment of supplies and support equipment to Saudi Arabia. The Marines, however, did experience distribution and inventory problems due to the tactical situation.

GAO obtained information on a number of other supply issues, including needed items purchased outside the supply system in the United States for deploying units and by units in Saudi Arabia. Items were purchased before deployment because the items were not in the supply system or could be obtained sooner. Units purchased needed supplies and services such as food, potable water, fuel, and heavy transportation equipment in Saudi Arabia because (1) specific items were not available in the supply system; (2) it reduced the burden on the transportation system, both from the United States and in theater; and (3) the supplies were obtained sooner.

Recommendations

GAO is presenting observations of U.S. military personnel and is not making recommendations.

Agency Comments

GAO obtained oral comments on a draft of this report from DOD and incorporated them, where applicable. DOD generally agreed with the issues raised in this report.

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Abbreviations

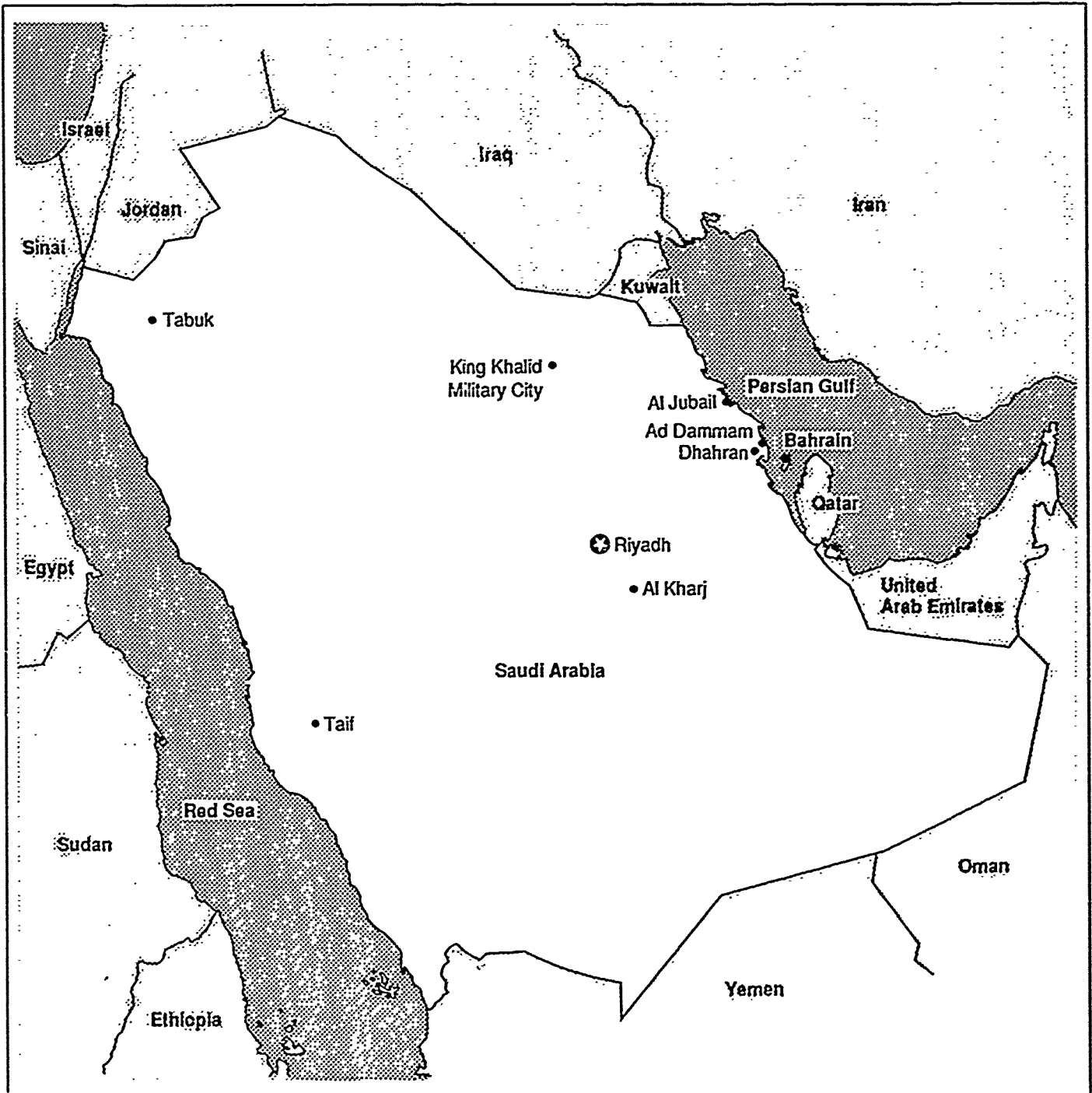
AWACS	Airborne Warning and Control System
DOD	Department of Defense
GAO	General Accounting Office
MICAP	mission capable
MORE	meal-ordered-ready-to-eat
MPF	Maritime Prepositioning Force
MRE	meal-ready-to-eat

Introduction

The deployment of more than 500,000 troops to southwest Asia in support of Operations Desert Shield and Desert Storm was the largest rapid deployment of troops and supplies in U.S. history. The magnitude of the logistical problem of receiving, moving, and sustaining a force of this size was enormous and included feeding, housing, and supplying troops; transporting troops and equipment; and maintaining troops.

The deployment of troops to Saudi Arabia (see fig. 1.1) involved sending and sustaining forces in a country in which the United States had no troops stationed. Troops faced temperatures, wind, and sand of a harsh desert environment.

Figure 1.1: Southwest Asia



Desert Shield, the protection of Saudi Arabia from Iraqi aggression and of U.S. vital interests, began on August 7, 1990, with the deployment of U.S. troops to Saudi Arabia. Desert Storm, the liberating of Kuwait, began on January 17, 1991, with the commencement of the air campaign. The ground campaign began February 24, 1991, and lasted only 100 hours. Both campaigns ended on February 28, 1991. Because of the short period of hostilities, Desert Shield/Storm did not test the supply system's ability to sustain a protracted campaign.

Challenges Facing the Department of Defense

In Desert Shield/Storm, the military services of the Department of Defense (DOD) were asked to meet unexpected challenges. The Marine Corps operated as a land army in the eastern zone of Saudi Arabia and Kuwait; its supply lines extended up to 250 miles from Al Jubail to Kuwait City. Thus, the transportation and distribution of supplies became troublesome because there were insufficient transportation vehicles due to the unique logistics demands.

Similarly, the Army moved troops and supplies long distances in a desert environment. The desert conditions placed unique demands on the supply system. For example, the demand for oil filters, tires, batteries, and water purification units was high.

Air Force units also faced desert conditions and found that their flying profiles were different than normal (i.e., what they were used to flying at their home stations). Figures 1.2 and 1.3 illustrate (1) the flying hours and (2) the average sortie durations during Desert Storm compared to normal rates for selected aircraft.

Figure 1.2: Fighter Aircraft Flying Hours
During 30 Days of Desert Storm
Compared to Normal Rates

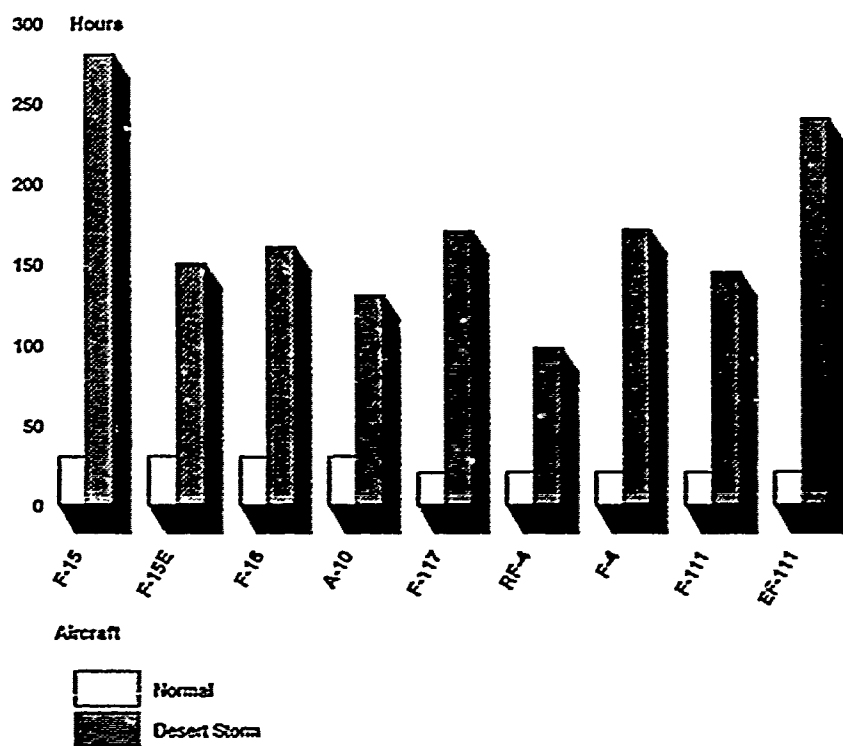
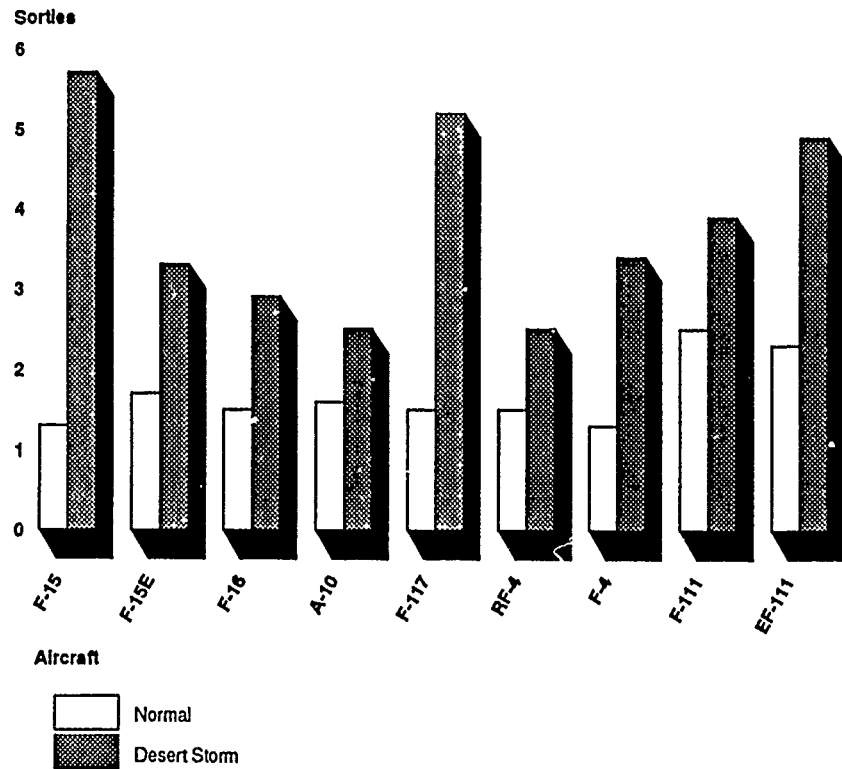


Figure 1.3: Fighter Aircraft Average
Sortie Duration in Hours During Desert
Storm Compared to Normal Rates



During the 43 days of Desert Storm, the Air Force's fighter aircraft flew more than 34,000 sorties covering more than 118,000 hours.¹

In addition to different operating conditions faced in Desert Storm, certain items of equipment performed missions that were not their primary roles. The Army's Patriot missile system (see fig. 1.4), which was planned to be used against high-performance aircraft and some missiles at all altitudes, was used against "SCUD" missiles. The Air Force's A-10 aircraft (see fig. 1.5), which has a primary role of providing close air support for Army ground troops, was used before the beginning of the ground campaign to provide battlefield air interdiction.

¹In addition to the 34,038 sorties flown by fighter aircraft, the Air Force flew 45,666 sorties moving passengers and supplies in theater and 17,331 strategic airlift (bombers, tankers, reconnaissance) missions.

Figure 1.4: Patriot Missile Site in Saudi Arabia

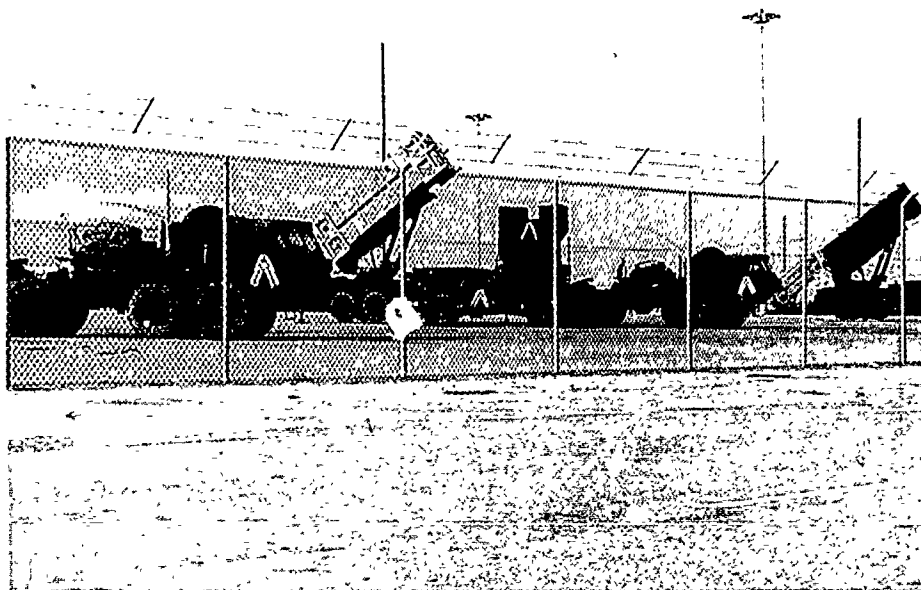
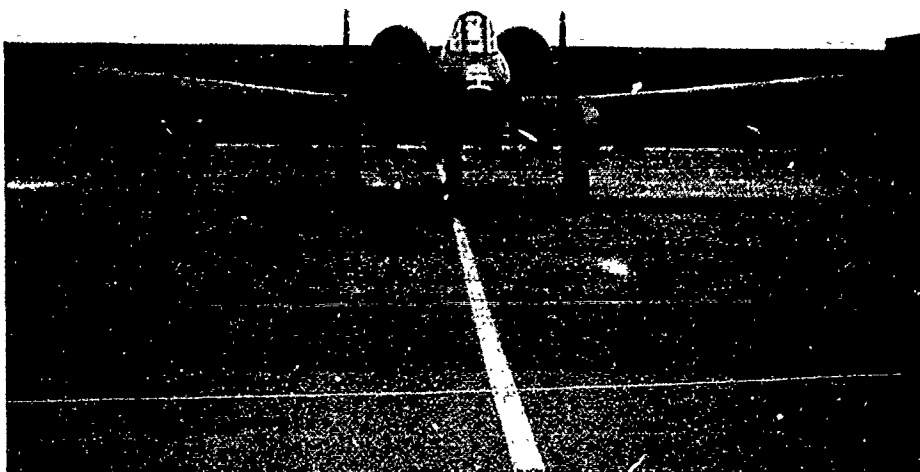


Figure 1.5: A-10 Aircraft in Saudi Arabia



In addition to military challenges, DOD faced the challenges of keeping its troops motivated and properly behaved for local customs. Islamic customs and laws placed restrictions on military personnel during their nonduty hours. Saudi Arabia forbids the importation, sale, or use of alcohol, non-Islamic religious items or media that may be construed by Islamic standards as pornographic.

Logistics System

The DOD inventory includes nearly 5 million different items valued at about \$102 billion. This inventory is used to provide replacement parts and other items for the military troops and their ships, aircraft, tanks, and other complex weapon systems.

An effective logistics system should provide a soldier in the field with supplies, maintenance, transportation, services, and facilities when and where they are needed and in the condition and quantity required. In addition to the supplies furnished by the DOD supply system, Saudi Arabia, as host nation, assisted in furnishing, free of charge, supplies such as food, water, and fuel. Some units purchased common commercial type supplies such as tires, batteries, and fuel pumps in the theater of operation.

Facilities in Saudi Arabia

A variety of conditions faced the troops in Saudi Arabia. Some troops lived in tents in the sand (see fig. 1.6) while others lived in housing near big cities, as in Riyadh (see fig. 1.7), or at air bases in modern housing. According to a Marine Expeditionary Force Supply officer, when the Marines arrived in August 1990, they occupied several vacant residential camps built for foreign nationals working in the petrochemical industries around Al Jubail. Using these camps enabled the Marine Corps to quickly shelter a portion of its troops.

Figure 1.6: Army Tents in Saudi Arabia



Figure 1.7: Eskand Village Where Army and Air Force Troops Lived Near Riyadh, Saudi Arabia



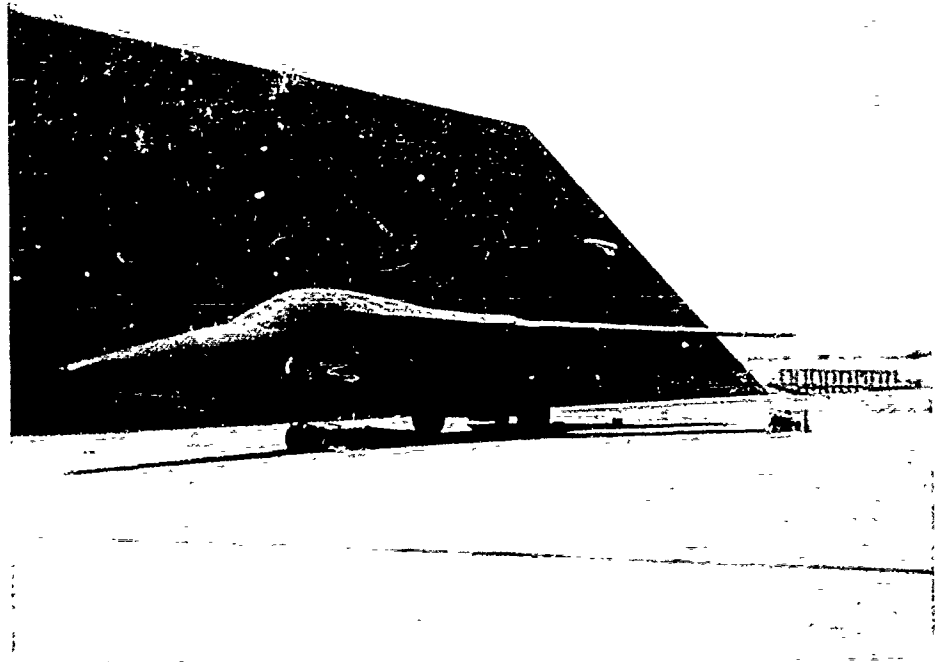
The Marine Corps used a new port at Al Jubail as its primary debarkation point and theater supply depot. This port has modern facilities (see fig. 1.8) and adequate mooring capacity, warehousing, and laydown areas. The port is served by a modern highway that connects the city with the primary Army port (Ad Dammam) to the south and the Kuwait border to the north.

Figure 1.8: Port Facilities at Al Jubail



In addition, the Air Force used a number of air bases, some of which had never been used. These air bases had airfields with hangars (see fig. 1.9), living facilities, and mess facilities.

Figure 1.9: U.S. F-111 by Hangar Facility
at a Saudi Arabian Airfield



Objectives, Scope, and Methodology

The Chairman, Subcommittee on Oversight of Government Management, Senate Committee on Governmental Affairs, asked us to examine DOD's ability to supply troops deployed to Saudi Arabia with necessary support items and repair parts. Our specific objectives were to

- examine how DOD's logistics system supplied the land-based forces and
- obtain observations on logistics support from military officials in the Persian Gulf and the United States who had been involved in Desert Shield/Storm.

We did not include the Navy units or sea-based Marine Corps units in our review.

To examine DOD's ability to supply troops, we discussed initial support plans and supply efforts with U.S. Army, Air Force, and Marine Corps headquarters representatives and with Defense Logistics Agency staff. We also discussed these plans and efforts with officials at two major Army installations—one at Fort Hood, Texas, and one at Fort Stewart, Georgia—that had deployed units to Saudi Arabia.

In addition to these discussions in the United States, we met with representatives of the Central Command headquarters of the Army, the Air Force, and the Marine Corps; 16 Air Force units at six air bases; nine Army units and their higher headquarters and support commands; and four Marine units and their support groups (see app. I) that were still in Saudi Arabia and Bahrain after the conflict was over. These units represented each type of major combat (armored, artillery, infantry, and air defense) and medical units for the Army and the Marine Corps. Air Force units included tactical, strategic, and military airlift units that flew F-16, F-15, F-111, F-4, C-130, KC-135, and Airborne Warning and Control System (AWACS) aircraft. During our meetings, we used a data collection instrument to interview operations and logistics officials made available by Central Command to meet our request for types of units to be visited and received official briefings on supply activities. We also reviewed and obtained available documentation such as mission statements, repair parts shortages, and purchase orders.

Our review was performed from October 1990 through May 1991 and included a visit to Saudi Arabia and Bahrain in April 1991. Our work was performed in accordance with generally accepted government auditing standards.

Needed Repair Parts Were Obtained, but Some Improvements Are Possible

We met with command and field officials from the Army, the Air Force, and the Marine Corps in the Persian Gulf. According to these officials, personnel in Operation Desert Shield/Storm were able to obtain needed parts and maintain high readiness rates. Nonetheless, they observed that there were lessons to be learned that could be applied to future operations. While each of the services had a prescribed plan of what repair parts were needed and how to deploy with them and units deployed to Desert Shield were given priority to obtain what they needed, some problems were encountered. The principal problems were lack of available repair parts for some newly fielded systems, lack of information on repair parts with the Desert Shield/Storm units, and transportation delays.

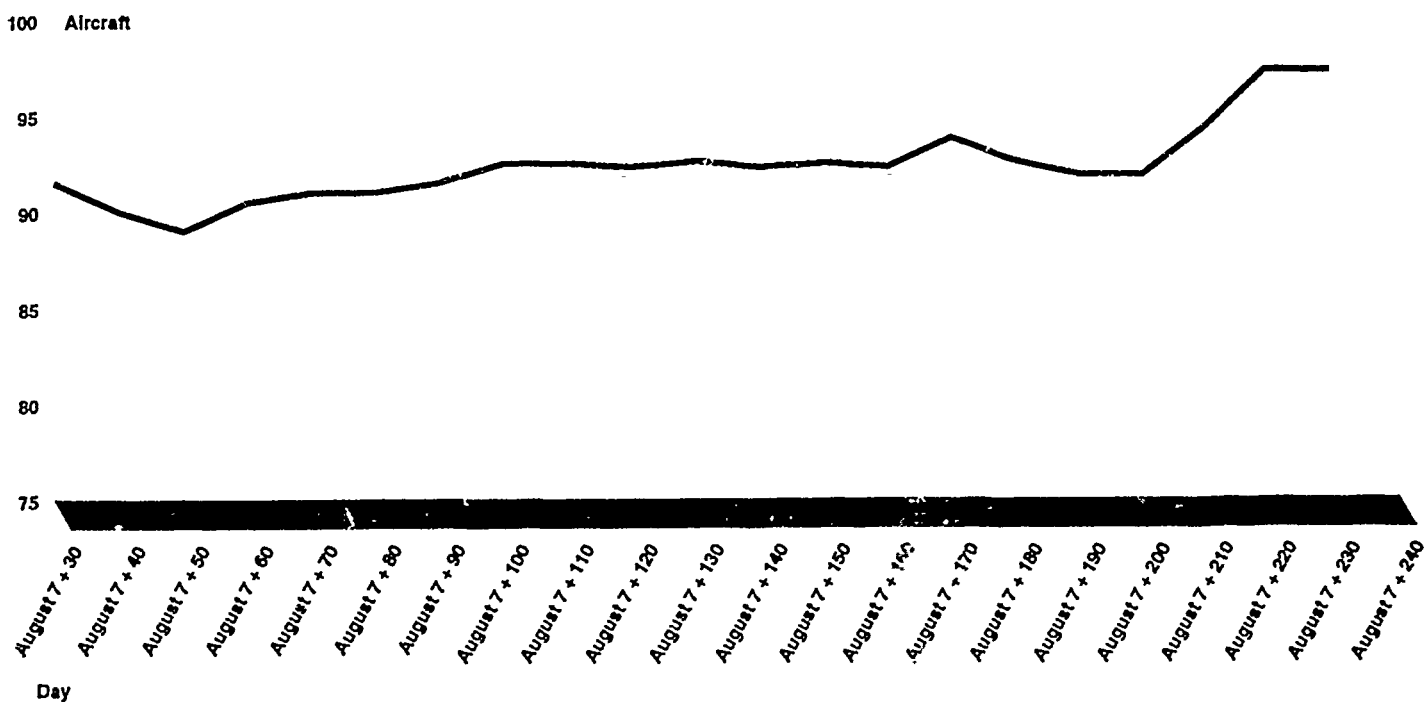
High Readiness Rates

The ability to maintain high readiness rates is the key test of whether needed repair parts were obtained. Reported readiness rates of equipment for all services in Desert Shield/Storm were at a high level.

Air Force personnel at units we visited said that they did not miss a mission because of repair parts. Readiness rates¹ for equipment were at high levels, as shown in figure 2.1 for the Air Force and table 2.1 for the Army. Marine Corps supply officials also told us that their equipment readiness rates were maintained at a high level, ranging from 90 to 95 percent mission capable.

¹Percentage of equipment capable of performing the missions or functions for which designed.

Figure 2.1: Air Force Aircraft Status for Desert Shield/Storm (Percent Ready to Fly)



C - Commencement date, August 7, 1990.

MC - Mission capable. These rates are the portion of total aircraft time that the aircraft is available to perform its mission

Source: Air Force Central Command

Table 2.1: Summary of Major Army
 Weapon Systems Equipment Readiness
 Percentage Rates for VII and XVIII Corps

Figures in percent

Army weapon systems	VII Corps		XVIII Corps	
	Percent G-Day	Percent G+4	Percent G-Day	Percent G+4
AH-64 Apache helicopter	95	94	90	88
AH-1 Cobra helicopter	86	79	92	92
CH-47 Chinook helicopter	75	81	95	96
M1A1 Abrams tank	92	91	97	97
M2 Bradley Infantry Fighting Vehicle	92	90	98	98
M3 Bradley Cavalry Fighting Vehicle	83	91	98	97
M109 howitzer	95	96	99	99
M110 howitzer	98	96	98	98
Multiple Launch Rocket System	93	91	98	98

G-day is the date the ground war began - February 24, 1991

Source: Army Central Command

In part, these rates were maintained because of the high priority given to supplying parts to units. Other means taken included purchasing parts locally, trading parts with other units, and rebuilding and reusing parts.

Repair Parts Planning

During combat, the services each use supply lists, prepackaged kits to ensure that equipment and supplies are available. The Army's Prescribed Load Lists² and Authorized Stockage Lists³ provide combat and support units the repair parts that are required to support and sustain combat until the supply system adjusts to the increased demand. The Air Force relies on War Readiness Spares Kits to provide needed parts and supplies to maintain its aircraft. The Marine Corps relies on the Maritime Prepositioning Force (MPF) to deliver large quantities of equipment and supplies to the theater in a short period of time.

Army Load Lists

The Prescribed Load Lists provided repair parts to sustain Army combat units until supplies could be obtained through their Direct Support Units with their Authorized Stockage Lists or other supply systems. An Army division's supply structure consists of a main Direct Support Unit and two or more forward Direct Support Units. Army policy stipulates that a division in the continental United States is authorized to stock a quantity of repair parts equal to a 15-day operating level, a 5-day safety level, and an order-ship-time factor equal to the quantity of an item needed to meet demands from the time it is ordered until it is received by the division. Divisions outside the United States are authorized to stock a quantity of repair parts equal to a 30-day operating level, a 5-day safety level, and a similar order-ship-time factor.

Officials at the support command and the four units we visited believe that the load lists should be reevaluated. Logistics personnel told us that the load lists need to be reevaluated because the lists are inadequate for combat missions. For example, fuel filters, according to maintenance officials, were needed in large quantities for Desert Shield/Storm. Also, officials at one unit noted that the Prescribed Load List needs to be augmented with a High Mobility Multipurpose truck cargo vehicle or large cargo truck to carry needed repair parts; 5-ton and 2-1/2 ton trucks

²Repair parts authorized for units. We did not attempt to validate these lists.

³Repair parts authorized for Direct Support and General Support Units as appropriate for deployment.

could not keep up over the long distances that the armored and mechanized vehicles traveled.

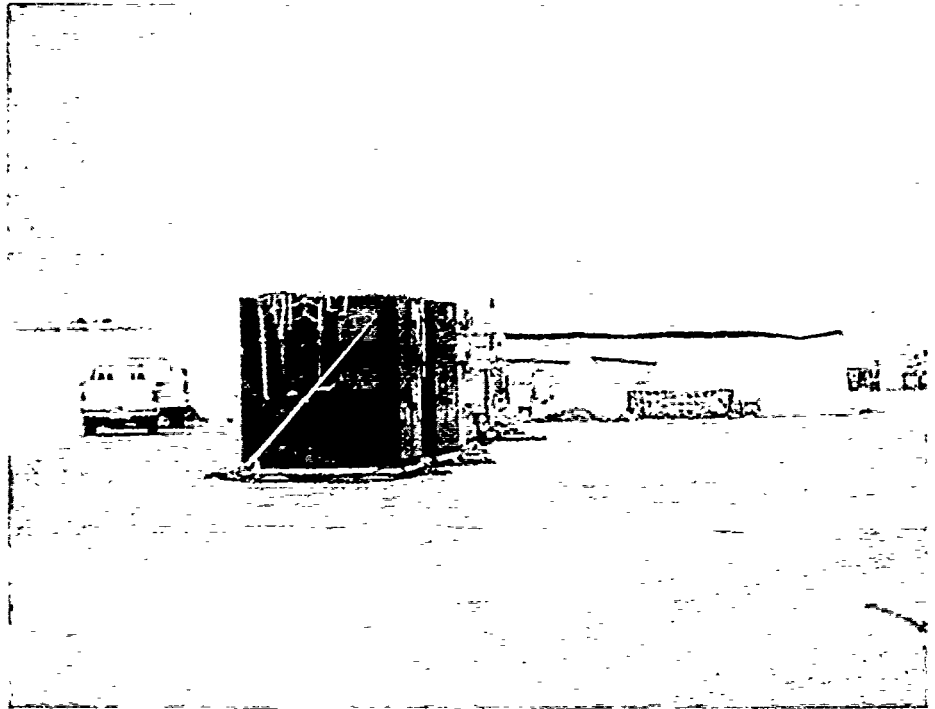
According to officials at the Army's Materiel Management Center in Saudi Arabia, some Reserve and National Guard units deployed without their Authorized Stockage Lists. Army National Guard peacetime Authorized Stockage Lists are computed based on current support structures and are owned by the state. According to the National Guard Bureau, the Army National Guard has not federalized nondivisional maintenance units with Authorized Stockage Lists, and by Army regulations, Guard and Reserve Direct Support Units will be issued supplies from theater assets as the units arrive in theater. Materiel Management Center officials stated that these units would have had a problem if they had gone to war immediately upon arrival. To resolve this situation, the Center requisitioned the necessary parts through the supply system. The officials said Reserve and National Guard units need to deploy with their Authorized Stockage Levels.

Air Force War Readiness Spares Kits

Air Force units were able to deploy and sustain operations by relying on War Readiness Spares Kits (see fig. 2.2). Each unit's kits are configured to provide the parts and the supplies that are needed to maintain aircraft and sustain operations for 30 days. According to Air Force Manual 67-1, the kits are configured to provide the spares, repair parts, and related maintenance supplies a unit needs to support planned wartime use of weapon or support systems for a specified period of time pending resupply. The kits, according to Air Force Central Command officials, were developed and validated through exercises called "Coronet Warrior."⁴

⁴During Coronet Warrior exercises, units are isolated and they fly their wartime rates for 30 days to validate the kit parts and levels required for combat.

Figure 2.2: Air Force War Readiness
Spares Kits in Saudi Arabia



In addition to these exercises, Air Force units convene annually for War Readiness Spares Kits conferences. The conferences serve to provide information on (1) suggested changes to the packages and (2) other issues affecting which items to stock and at what levels.

The units generally deployed with kits that had most of the repair parts in the prescribed amounts, according to officials of the units we visited. Of the 16 units visited, 4 were active duty units based in Europe that did not have prepared kits since the units were not planned for deployment outside of Europe during wartime. Thus, before deploying, they developed high priority mission support kits that were designed to fit a southwest Asian scenario. The kits for the European-based units were built up by (1) obtaining parts from inventories maintained by units not deploying on their bases, (2) using the priority code for units deploying to Desert Shield/Storm to obtain expedited delivery of parts from supply depots, and (3) taking parts off aircraft assigned to units that were not deploying at their bases. These means were also used by deploying units to replenish their kits.

Of the 16 units we visited, 7 units took parts off aircraft to build up their kits for deployment to southwest Asia. In addition, units obtained

greater quantities of selected items (above War Readiness Spares Kits levels) that were in high demand due to the operating environment. For example, at one F-15 base we visited there were additive special levels (i.e., extra parts) for such items as radar transmitters and receivers.

To supplement the War Readiness Spares Kit packages, the Air Force sent some follow-on spares kits to Saudi Arabia that were tailored to the units' needs in the operating environment. Also, most units that we visited benefited from being colocated with similar units at the same base.⁵ For example, the units had access to other kits on their bases to use in sustaining operations.

Officials from two units mentioned that when they initially deployed there was insufficient airlift to transport their full complement of kits and that they had to send some of their kits into the theater when airlift became available. One of these units noted that the lack of adequate airlift impaired its ability to get up to speed in all areas. After arrival, parts requirements precipitated a special request for a C-141 to expedite the delivery of the remaining kits from the home station.

Marine Prepositioning Force Ships

Marine Corps officials told us that Marine Corps MPF ships⁶ were instrumental in delivering the bulk of repair parts needed by the Marine Corps in Desert Shield/Storm. MPF provided the theater with three Marine brigades⁷ worth of equipment and 30 days of sustainment supplies.

Logisticians from a Marine Force Service Support Group, a Marine division, and three units believed that the MPF inventory, which is designed to maintain combat capability, contained many of the wrong items and insufficient numbers of items in high demand in southwest Asia. For example, the MPF inventory did not have sufficient quantities of items in high demand directly related to the desert environment (e.g., filters and supplies for water purification units). A Marine Corps headquarters official said that the MPF inventory is designed for global requirements and is meant to be augmented.

⁵Only 2 of the 16 units we visited were not colocated with similar units at their bases.

⁶Additional information on MPF is presented in ch. 4.

⁷Each Marine Corps brigade has approximately 16,500 Marines.

The Marine Corps' Force Service Support Group's general account balance analysis for February 28, 1991, showed its inventory⁸ in theater totaled about 24,000 separate line items (the bulk of which were repair parts); 19,000 of the line items, however, had never been requested by units in the theater. Therefore, the general accounts officer concluded that the MPF inventory contained many items that were not needed. A second official told us that of the 18,000 line items aboard the ships in one MPF squadron, only 800 matched needs in theater. Conversely, the general accounts officer told us the Force Service Support Group had received 10 or more requisitions for over 3,000 line items that were not in the MPF inventory.

These logisticians recommended that the number of items in the MPF inventory be reduced and that quantities of needed items be increased. A Marine division supply officer claimed that 90 percent of the requisitions in the theater were for 10 percent of the MPF stock items.

Marine Corps headquarters officials said that the configuration of the MPF inventory is based on Marine Corps usage in theaters worldwide. Thus, each type of supply would not be needed for every military operation. Marine Corps officials met in August 1991 to review the configuration of the MPF inventory.

Management and Ingenuity in Obtaining Needed Parts

Each of the units we visited used flexibility and ingenuity to ensure that they obtained needed parts in a timely manner. As a result, high readiness rates were maintained.

Army Personnel Used Intense Management for Repair Parts

All nine of the units we visited reported shortages of repair parts. These shortages included modules and cables for the Patriot system, filters, generators, and tires for 5-ton trucks; and a solenoid part needed for a 5-kilowatt generator for electricity. According to supply and maintenance personnel at these units, they obtained needed repair parts by (1) trading parts with other units, (2) using the DOD supply system, (3) rebuilding and reusing parts, or (4) purchasing parts locally in the host nation. The unit commander of a defense artillery unit stated that because the Patriot system was managed intensively, the unit obtained repair parts when needed from the DOD supply system. For other service

⁸Includes all items except subsistence, ammunition, and material to support nonmilitary programs.

items in short supply, such as filters, the unit (1) shared parts with its sister battalion, (2) purchased parts locally in the host nation, and (3) made direct calls to the continental United States to supply system personnel.

Some units deployed with full Prescribed Load Lists but experienced repair part shortages in theater. Supply and maintenance officials, however, told us the mission of their units was not affected since they were able to obtain the parts needed. For example, armor unit logistics officials said that they accomplished their mission and maintained a 90-percent operability rate due to the homework that the unit's maintenance personnel did in determining the compatibility of parts between the M1 and the new M1A1 tanks prior to the unit transitioning to the M1A1 during Desert Shield/Storm.

During a briefing given to us, field artillery unit officials said they also experienced critical repair part shortages due to the supply structure in the theater. For the first 30 days that the unit was in theater, the unit was not supported by a Direct Support Unit. After the first 30 days, the unit was supported by about 10 or more Direct Support Units from 2 Corps at different times, but the support units did not have the Authorized Stockage Levels needed to support an artillery unit. Maintenance officials said that when the requisitioned repair parts arrived, they were not there to receive the parts because of the unit's constant movement and the parts were not forwarded to their new location. Despite these problems, the unit was able to accomplish its mission because maintenance personnel were able to find parts to make the necessary repairs.

Air Force Personnel Used Flexibility to Obtain Needed Parts

The Air Force handled its critical needs for repair parts by being flexible. Personnel at three of the six bases visited stated that delays in receiving parts were due to transportation problems, specifically in theater, not to supply system problems. According to Air Force personnel at units we visited, once the Air Force computer system providing visibility to repair parts became operational in January 1991, they could obtain unit level information on the availability of parts within 24 hours. However, transportation sometimes took weeks, especially once an item got in theater. Therefore, units often sent personnel to the major entry points in Saudi Arabia to collect parts rather than wait for the parts to be delivered.

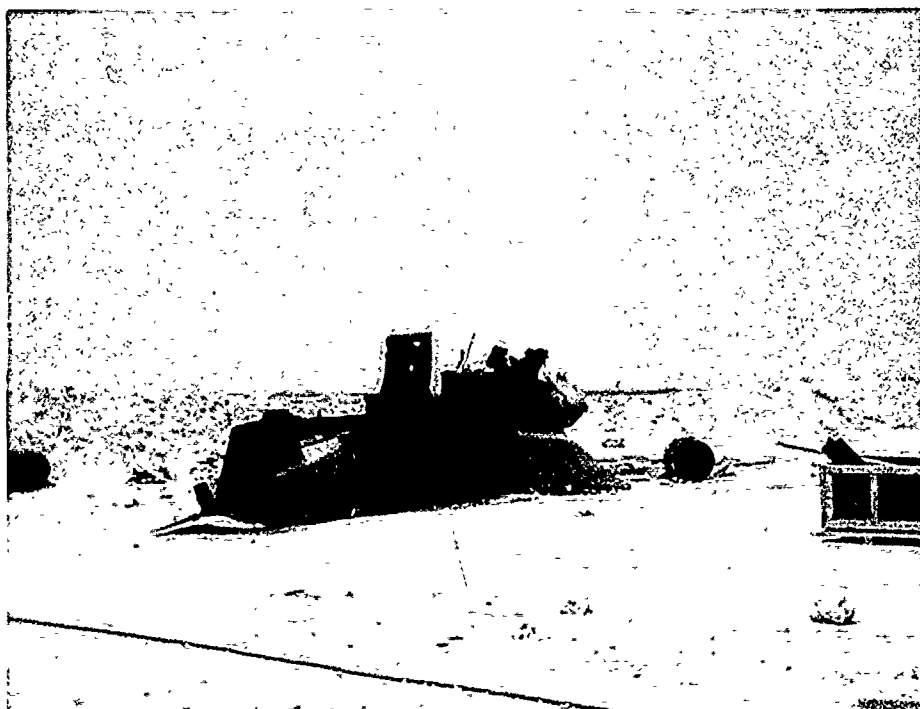
Personnel said that with the advent of Desert Express,⁹ the time to transport items to Saudi Arabia was reduced but intratheater transportation delays continued. Thus, they still tracked their critical parts, and they often sent personnel to pick up the parts at the Dhahran and Riyadh airfields where the Desert Express aircraft landed every day.

Other measures cited by personnel follow.

- One F-15 fighter squadron from North Carolina not only sent personnel to Riyadh to pick up repair parts but also had personnel from its home unit drive the parts to Charleston, South Carolina, and put them on the next Desert Express. They estimated that this reduced transportation time by a day.
- An A-10 unit in Saudi Arabia said an A-10 unit in South Carolina would drive to Charleston, South Carolina, every day to deliver A-10 repair parts needed in Saudi Arabia. The A-10 unit also made daily runs from where the A-10s were based to Dhahran (about an hour away) to pick up Desert Express deliveries.
- The AWACS wing relied on its home base, Tinker Air Force Base, to send requested War Readiness Spares Kit items to Saudi Arabia on one of several planes flying between Tinker and Riyadh, Saudi Arabia. Also, the wing often stripped AWACS planes returning to the United States of nonessential parts to replenish War Readiness Spares Kit levels or it sometimes borrowed needed parts from the Royal Saudi Air Force that operated AWACS aircraft from Riyadh.
- One KC-135 unit we visited sometimes tried to use planes returning from air bases in Moran, Spain, or Mildenhall, England, to Riyadh Air Base to deliver needed parts. These air bases were used for planned periodic maintenance work and were major supply bases.
- An F-4 that crashed in Saudi Arabia was moved to Bahrain and used to supply repair parts for the F-4s based there (see fig. 2.3).

⁹Desert Express was a distribution system operated out of Charleston, South Carolina, in which high priority parts were placed on C-5 and C-141 aircraft and flown to Saudi Arabia on a daily basis. This service began in late October 1990 and lasted throughout the operation.

Figure 2.3: Crashed F-4 Used for Repair
Parts in Bahrain



In addition to delivery problems, units we visited had critical repair parts shortages for combat essential equipment. F-16 units cited shortages of halon gas and electronic countermeasures equipment, KC-135 units cited shortages of aircraft brakes, and A-10 units said they needed hand-held radios to communicate on long runway areas. Halon gas and radios were purchased on the local economy, and aircraft equipment was obtained by closely tracking the incoming items and taking parts from other aircraft.

Marine Corps Used Ingenuity and Cannibalization to Handle Parts Shortages

Each of the Marine combat units we visited experienced some shortages of critical repair parts. Shortages included oil and fuel filters, tires, batteries, fuel injectors, and electronic components. However, unit supply officers told us the units continued to report and maintain high readiness rates by implementing the following workarounds.

- Obtaining parts from adjoining U.S. Army units.
- Renovating and reusing parts.
- Purchasing parts from the local economy.

- Cannibalizing¹⁰ parts from equipment that was already down for maintenance.
- Turning in equipment, such as trucks and armored personnel carriers, that needed a number of repair parts for new equipment from war reserve stocks.

Conversely, the Marine Corps maintenance battalion in Al Jubail did not experience problems obtaining repair parts. This battalion conducted third and fourth echelon¹¹ maintenance.

Visibility Over Assets

The Army did not have systemwide visibility over its assets. The Marine Corps also experienced visibility problems. However, starting in January 1991, the Air Force had visibility information on its repair parts down to the unit level.

Army's Visibility of Unit and Division Supplies

Officials of the Army's Materiel Management Center in Saudi Arabia stated that they did not have visibility over on-hand stocks at the unit and division levels. These officials stated that they were operating in a vacuum deciding how much of an item to order. They believe better visibility of on-hand stocks at units is needed at all material management levels. They also believe managers at the various levels need to share supply information to make the supply system work efficiently.

Officials of a Corps support command told us that they did not have an intransit system for tracking cargo after it was shipped. The Army's present system does not have the capability to trace cargo from the time it is shipped until it is received by the requester. Thus, the officials had to keep personnel at the ports so that when cargo arrived they could determine where the cargo was to go and what was in the containers.

While we did not address this asset visibility issue as part of our review, officials from the Materiel Management Center in Saudi Arabia and an artillery unit provided the following observations.

- Materiel Management Center managers need better visibility over on-hand stocks at all levels.

¹⁰Cannibalizing means taking a needed part from one piece of equipment to another.

¹¹The Marine Corps has five levels of maintenance: user, organizational, divisional, intermediate, and depot. The third and fourth levels include the exchange and the repair of parts of major weapon systems, other equipment, and their components.

- A supply system that allows supply personnel the ability to follow requisitions through the system is needed.
 - Requisitions for units placed under another unit's support need to be redirected to the unit's new location when it moves.
-

Air Force's Special System for Visibility

In January 1991, the Air Force began managing parts support through a computer system operated by the Air Force Central Command Supply Support Activity based at Tactical Air Command headquarters, Langley Air Force Base, Virginia. Specifically, this activity (1) maintained accountability and control of mission capable (MICAP)¹² parts orders and inventories, (2) provided assistance in locating critically needed parts through the MICAP Automated Sourcing System,¹³ (3) coordinated data base and records transfers, and (4) provided accounting and finance interface between the Air Force and the various base commands. The computer system used not only familiar computer hardware and software from the Air Force's Standard Base Supply System but also communication circuits, including a dedicated channel on a dedicated military satellite.

During Desert Shield/Storm, many of the parts requisitioned by units were filled by their home units. Starting in January, requisitions were managed by the central computer system so that the Tactical Air Command headquarters at Langley could maintain control over inventories and transportation/distribution schedules. Delivery of critically needed parts was handled by the Desert Express system.

Marine Corps' Visibility Over Assets

Marine Corps logisticians experienced computer capability and compatibility problems during Desert Shield/Storm. For example, the computerized inventory systems of MPF and the Force Service Support Group were not compatible. However, Marine Corps logisticians were able to reconcile the two data bases before the arrival of the second MPF squadron.

A Marine Expeditionary Force supply official told us there was a lack of computer resources to track the distribution of MPF equipment and

¹²MICAP parts are needed to maintain an aircraft in a mission capable status.

¹³The MICAP Automated Sourcing System is an automated supply system that can access parts inventories of all U.S. Air Force bases in the world. The data base contains information on parts inventories, locations of parts, and maintenance schedules of repairable items.

repair parts in theater. Due to the "sheer size and pace of the deployment," some units did not send their computer equipment from the United States to southwest Asia and other units could not find their computer equipment upon arrival. Further, a Force Service Support Group did not receive its small mainframe computer, which Marine Corps logisticians discovered had insufficient capacity, until mid-September. The Marines did not have adequate computer capabilities to monitor assets in the theater until the Regional Automated Service Center arrived in early February 1991.

Use of the Priority System During Desert Shield/Storm

Defense Logistics Agency officials said that in the initial phase of Desert Shield they were overwhelmed with high priority requisitions for the items they managed. Thus, until they received distribution guidance from the designated theater managers, they issued items on a first-come, first-serve basis. Military officials in Saudi Arabia also told us that the high priority code was used for most requisitions made in country.

The deputy commander for maintenance at one Air Force base we visited stated that to have the supply system work, the wing, on a limited basis, ordered MICAP parts before parts had broken or reached their change-out date. Therefore, the wing would not have to wait for the aircraft to be down before the parts were ordered. However, he said that according to regulation, a part can only be designated as MICAP if it has caused a plane to be grounded.

Marine Corps supply officials reported the use of the high priority code on most requisitions. Marine Corps supply battalion officials told us that, because there were no budgetary constraints on Desert Shield/Storm, and because units were preparing to conduct their wartime missions, the use of the high priority code was widespread. One maintenance battalion official said that up to 98 percent of all requisitions were categorized as high priority. This practice increased delivery times for critical repair parts in the theater. Because each requisition was categorized as high priority, the priority on each requisition was the same, and no requisitions were higher priority than others. DOD headquarters officials noted that Desert Express provided discrimination in priority of requisitions.

Overcoming Problems Supporting New Systems and Communications Systems

All three services cited examples of problems encountered when trying to support new systems. Newly developed systems, such as the F-15E, the M1A1 tank, and a Marine Corps forklift, had more repair parts problems than more mature systems. This situation occurred largely because the repair parts were not available to fully support the systems. Headquarters officials noted that field commanders requested these new systems knowing that support for them was not fully adequate.

Personnel from two Army units visited told us that they did not have a problem obtaining sufficient repair parts to maintain their equipment. While in theater, the units transitioned from the M1 tank to the M1A1 tank, which was fielded without all of its repair parts. The Chief of Staff of one unit's headquarters told us that the unit maintained a 90-percent operability rate because the maintenance personnel determined parts compatibility between the tanks.

Air Force F-15E maintenance personnel said since many of the parts on the new F-15E are peculiar to the E model, such as different avionics, they could not rely on F-15C units to supply all their needed parts. They said F-15E spare parts were purchased based on engineering studies of estimated mean time between failures, and the parts have not met those mean time between failure standards.

In the beginning, there were many shortfalls for F-15E repair parts. The first squadron that deployed to Saudi Arabia had about a 26-percent fill rate for its War Readiness Spares Kits and had to take 462 items from aircraft to reach a 67-percent fill rate before it left. As a result, maintenance officials said that seven aircraft from other units were put in a nonoperational status. When the second squadron of F-15Es deployed to Saudi Arabia, it needed 350 parts for its spares kits. Thus, they said 11 aircraft from another unit were left in a nonoperational status to allow the squadron's deployment with acceptable levels of repair parts. Also, in some cases, parts were taken off the assembly line to get a squadron ready to deploy. Furthermore, avionics test equipment was brought to Desert Shield/Storm to make sure F-15Es would be able to fly, resulting in the home station sending parts to depot maintenance or the manufacturer for repair.

A Marine Corps maintenance battalion in Al Jubail received a new 10,000 pound forklift to use during Desert Shield/Storm. A battalion maintenance official told us that the forklift was difficult to maintain because it lacked repair parts. He explained that because the forklift

was new to the Marine Corps, there had been insufficient time to compile repair parts into Initial Provisioning Packages, which usually accompany new equipment when it is fielded. Therefore, the battalion had to purchase hydraulic seals, which were in high demand throughout the theater for a variety of equipment due to the environment, on the local economy. A Marine Corps headquarters official noted that it was a command decision to field the forklift without all the needed repair parts.

One Air Force combat communications squadron commander told us that his squadron was unable to obtain repair parts because the Air Force did not have sufficient quantities of War Readiness Spares Kits for combat communications units. It lacked repair parts because it allocated some of its parts to units that had deployed earlier. When the squadron deployed, it only had 45 percent of its authorized level of repair parts. While the squadron did not lose any communications time for lack of repair parts, it had to dedicate one supply person full time to search for parts throughout the theater. The commander claimed that without this full-time search the unit would have experienced considerable downtime.

Adequate Food and Clothing Provided, but Some Improvements Are Possible

We met with U.S. Army, Air Force, and Marine Corps headquarters representatives and Defense Logistics Agency staff in the United States to discuss their initial supply efforts and the shortages of some types of food and clothing. Also, we met with food service and logistics officials made available by Central Command in Saudi Arabia to obtain their observations on the food and clothing provided.

Because of the Islamic cultural restrictions placed on military personnel, certain factors, for example, having a variety of food in Saudi Arabia, were important in sustaining troop morale. The DOD supply system and the host nation met this goal because they were able to adequately provide food for the troops. Mobile kitchen facilities, in addition to existing eating facilities, were also used to achieve this goal. However, Army and Marine Corps personnel told us of problems with food variety and sizing problems with uniforms, boots, and chemical equipment.

Adequate Food

According to the Deputy Commanding General for Logistics in Saudi Arabia, providing fresh food was necessary for troop morale. The DOD supply system and the host nation were able to adequately provide food for the troops, and in some instances, the food exceeded the services' feeding plan standards. Although each service had a field feeding plan, commanders in the theater were allowed to feed the rations best suited for their locations. The feeding options included

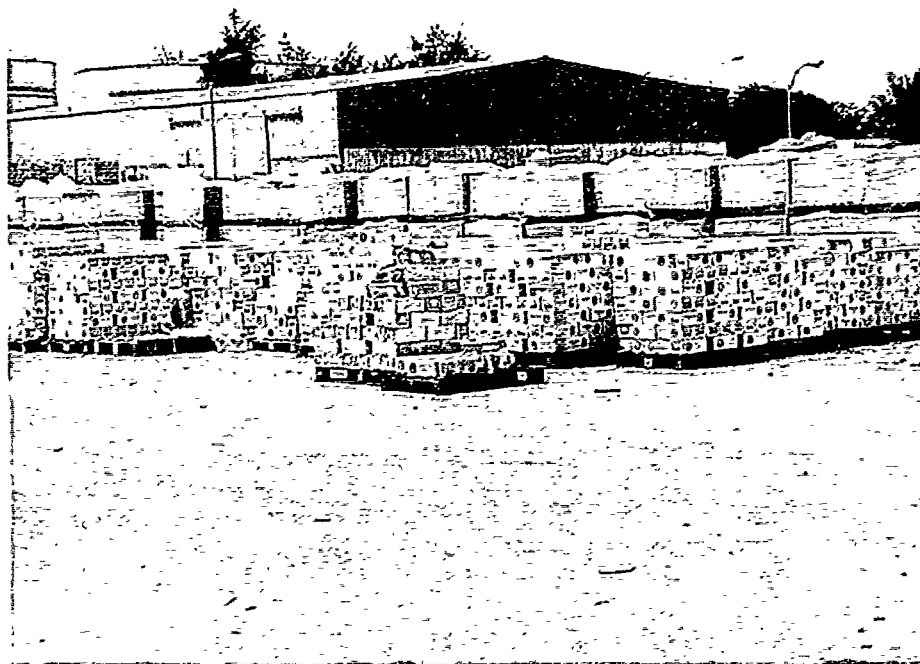
- A-rations, which are fresh or frozen food;
- meals-ready-to-eat (MREs), which are single servings of food;
- T-rations, which are tray-packed meals consisting of an entree, vegetables, and a dessert;
- B-rations, which are dehydrated or canned food; and
- meals-ordered-ready-to-eat (MOREs), which are prepackaged ready-to-eat foods in individual serving sizes found in the commercial market.

The variety and type of food provided to the units depended upon the units' locations. For example, the Air Force units ate fresh food supplied by host nation contractors because the units were at fixed locations, whereas the Army and the Marine units that were moving throughout the operations, due to the tactical situation, ate MREs and T-rations supplemented with fresh food if available. All three services received fresh or frozen food and other supplements, such as fresh fruit and juices, from Saudi Arabia. Food was stored either inside warehouses or tents (see fig. 3.1) or outside (see fig. 3.2).

Figure 3.1: Food Stored Inside Marine
Corps Warehouse



Figure 3.2: Food Stored Outside Air
Force Food Tent



The Army never met its daily feeding plan of one MRE and two hot meals, which were to be provided by the T-rations, because the production base could not keep up with the demand for T-rations. As a result, the Army began to use B-rations and MRES, which resulted in a shortage of components for B-rations, such as meats and vegetables, due to the industrial base not being able to meet demands. In response to the shortage, the Army developed and used MORES. According to supply officials, this ration was well received by the troops and helped troop morale. Another morale booster for Army troops in the field was the "wolfmobiles," which were used to serve short order meals consisting of hamburgers (wolfburgers), hot dogs, and french fries (see fig. 3.3).

Figure 3.3: Army Wolfmobile



DOD recognizes that the Army's field feeding plan requires revision to overcome shortfalls and the apparent inability of the industrial base to respond to dramatically increased requirements on short notice.

The Marine Corps' feeding plan of one MRE and two hot meals each day was met. In fact, the first ground forces received fresh fruits and juices compliments of the host nation 4 days after they arrived in theater; about 1 week later, the Corps served its first hot meal; 1 month later it was serving two hot meals a day.

The Air Force's feeding plan was met or exceeded. Of the six Air Force bases we visited, three received four hot meals a day,¹ two were provided three hot meals and one cold meal a day, and one was provided two hot meals and two cold meals a day. Initially, the Air Force sent rations that had been withdrawn from prepositioned storage sites to the bases to ensure units received sufficient MREs and B-rations. Air Force food service personnel stated that prepositioning of B-rations, MREs, and Harvest Falcon² kitchen equipment worked well for Desert Shield/Storm.

In addition to using B-rations that were replenished from theater stocks on a request basis, Air Force bases used host nation contractors who provided fresh food every day, beverages, and cleanup personnel. At some bases, contract workers also were used as cooks. However, reliance on contractor personnel could cause problems. For example, personnel at five of the six bases visited said that the contractor personnel did not report for work for several days because of safety concerns when the conflict started. Upon their return, the Air Force furnished gas masks.

Food Management

The Army's Materiel Management Center in Dhahran was the designated theater manager for food. The Center, according to the Army Subsistence Division action officer in Washington, D.C., set stock level objectives and determined the mix of food items the services would need on a monthly basis. It then provided the objectives and the mix of food items to the Subsistence Division, which calculated the amount of each ration needed to maintain the stock level objectives for the theater.

The Center was scheduled to assume this responsibility 60 days after the start of the conflict, or October 6, 1990. However, Support Command officials said that the Army did not begin managing the food until late October 1990 and that the Center started supplying the Marine Corps in November 1990. The Marine Corps food service officer told us that the Center did not start supporting the Marine Corps until 60 days later than planned. This delay resulted in the Marine Corps having to rely on its own supply system and host nation support past the first 60 days of its supply.

¹Maintenance operations were 24 hours.

²Harvest Falcon was the Air Force program for prepositioned supplies and equipment and is discussed in ch. 4.

Lack of Food Variety

The lack of food variety was reported by the media during Desert Shield/Storm. This complaint was voiced by Army and Marine Corps personnel at units visited. For example, during one period, soldiers in one Army unit had to eat the same T-ration meal for 7 consecutive days. According to the Army Support Command theater food advisor, the problem could be attributed to the manner in which the rations were packed before shipment. Individual pallets were loaded with a single meal type instead of a variety. Even though the units soon discovered that pallets contained only one meal type, the manifests were always accurate, which further frustrated efforts to diversify a unit's feeding plan.

The food advisor stated that he tried to group rations for units in theater before distribution to the troops; however, it was too labor intensive. There were about 16 million meals to be organized, and he could only reorganize about 30,000 a day.

Officials of the First Marine Expeditionary Force and at the four Marine units we visited also complained about the food variety, as well as the poor quality of rations, some of which were provided by the host nation. These officials said that units sometimes had rice twice a day or every day and that units had the same meal for breakfast every day for several days. In terms of quality, they said that the meat was tough and that the rice was either over- or undercooked. Marine Corps supply officials at one unit stated that many of the problems could be attributed to a lack of supervision, a lack of experience in preparing large quantities of food, and/or a general laziness by kitchen staff.

Disposition of MREs and B-Rations

Due to the short duration of Desert Storm, there were more MREs and B-rations than needed in Saudi Arabia in April 1991. An Army Support Command official told us that the Army was projecting a minimum of 16 million excess MREs. According to a Support Command official, the Air Force had about 50 to 70 containers of B-rations containing 1 million meals, valued at about \$4,500,000. At the time of our visit, the Marine Corps had about 3.5 million MREs in theater and 2 million MREs aboard ships in the region.

Because of these excesses, a Support Command official told us that each soldier was encouraged to take home a 3-day basic food supply of MREs and that the remainder would be given to the World Bank for redistribution to needy countries. The commander of the Support Command said

that B-rations were needed for Iraqi refugees. The Marine Corps planned to turn in its excesses to the Army, the theater manager for food.

Food Service Equipment

Army food service officials said that the mobile cooking trailer was fragile and only worked well in ideal situations. The trailer did not have protection from the environment, and sand was constantly getting into the trailer unit. They said that the heaters to keep food warm did not work well.

Air Force food service personnel stated that prepositioning of B-rations, MRES, and Harvest Falcon kitchen equipment worked well, particularly the Harvest Falcon field kitchens. They noted, however, that the Air Force should have prepositioned more repair parts for the kitchen equipment because the parts were competing with other high priority items, such as aircraft parts, for airlift space. Thus, the repair parts were difficult to obtain. Also, the Air Force did not have ovens at all bases, so many of the baking supplies received could not be used.

Food service personnel at one air base we visited stated that, in the future, conventional power (e.g., electricity) to the kitchens should be set up as soon as possible. The field kitchens mainly ran on generators with 500-gallon fuel tanks. The fuel purchased for the generators in Saudi Arabia, however, only came in 5-gallon containers. As a result, it was a time-consuming process to fill the generators with fuel. When possible, Air Force kitchen equipment was converted to electrical power to overcome inefficiencies that occurred with gasoline-fired burners.

A Marine Expeditionary Force food service officer also told us there was a shortage of repair parts and generators to support the food preparation equipment. However, the Marine Corps was able to meet its feeding plan.

Individual Clothing and Boots

Soldiers deploying to southwest Asia were to be issued clothing and boots for a desert environment instead of the woodland (green) camouflage uniform and the leather or jungle boots normally worn. The desert uniform has six different colors, ranging from light tan, to dark brown, to black. However, the DOD supply system could not meet the demand for the desert camouflage clothing and boots. The threat of a major conflict was considered to be a European scenario. Therefore, the camouflage uniforms being purchased were predominately in the woodland (green) pattern. With the increased demand for the desert camouflage uniforms,

material and other supplies were not available in the quantities needed. Consequently, some soldiers wore woodland camouflage uniforms and jungle boots.

Defense Logistics Agency supply officials told us that they met the services' initial demand for desert clothing by changing the material being used by the contractors from woodland green to desert brown clothing, increasing contractor capacity, and adding new contractors. However, production could not keep up with increased demand for the desert uniforms. One item for the desert uniform in particular was causing a problem—the buttons. The previous sole-supplier of the sturdy buttons went out of business, and his assets were tied up in litigation when Desert Shield started. Contracts were placed with two other manufacturers; however, they could not fully meet the requirements.

Army and Marine Corps officials told us that wearing the desert camouflage uniform was a positive morale factor. The soldiers wanted to be a part of the team, and wearing the desert uniform created troop camaraderie. Personnel at two Air Force bases we visited said that although they would have liked to have had desert uniforms and boots, they realized that Army and Marine Corps ground troops should get priority on available uniforms.

Of the nine Army units visited, seven were issued the desert uniform and boots. The Army's Common Table of Allowance 50-900 requires personnel in Army units to deploy with two camouflage uniforms. Of the nine units visited, seven deployed with two to three sets for each soldier. The two units that did not receive the uniforms told us that the lack of uniforms did not affect their ability to accomplish their mission.

Only 2 of the 16 Air Force units we visited received the desert uniforms and boots before deployment, and they were limited to two sets a person. These two units deployed early in the operation—August and September 1990. Personnel at the other 14 units did not receive the desert uniforms and boots after arrival in the theater. According to an official at one Air Force base visited, about 95 percent of the desert uniforms and boots were sent to the Army and Marine ground forces closer to the front. As a result, few desert uniforms were available to Air Force personnel.

Air Force supply officials told us that replacements for the woodland pattern uniforms were sometimes in short supply because (1) orders were filled sporadically, (2) contract laundry facilities damaged

uniforms when cleaning them, and (3) flight line personnel tended to wear out the uniforms rather quickly. At the time of our visit to one base in April 1991, some Air Force personnel were wearing uniforms that were torn, boots with holes in them, and tennis shoes because their boots had worn out. The base's Chief of Supply said he had returned the replacement uniforms and boots to the unit's home base in March 1991 because he believed the unit would be returning shortly. However, the unit was to remain in the theater for an undetermined amount of time.

Marine Corps supply officials told us that the Corps did not have sufficient quantities of the desert uniforms and boots because of a lack of supply due to industrial base support problems. Supply officials at three of the units visited stated that the uniform shortage did not affect mission readiness; however, one official said that some Marines wanted the uniform to be in vogue. He further explained that arguments could be made both for and against the desert uniform. The reason for having the desert uniform is to blend into the desert environment. However, the desert is so barren, a soldier can be spotted even when wearing the desert uniform. In fact, the Army found a desert uniform that has only three colors is better than the one that was used with six different colors, and the six-color uniform is being replaced.

Arguments can also be made both for and against the need for desert boots. Specifically, the leather and jungle boots have steel plates, making them heavier and more difficult to maneuver in the sand than desert boots; the leather boots are black, making them hotter than desert boots; and jungle boots have holes to let moisture out, but these holes allow sand to enter the boots. Marine Corps officials told us that desert boots are no better than the leather ones, noting that desert boots wear out faster. A Marine Corps headquarters official noted that this issue is being studied.

In addition to a lack of desert uniforms and boots, the services had clothing sizing problems. Supply officials told us that the distribution of sizes of uniforms was not representative of the military population as a whole. However, because the range of clothing sizes needed to equip the troops in Saudi Arabia was different than the standard distribution used to order and stock clothing, there were not enough of certain sizes. For example, less than a representative number of female Marines deployed (since they are not in combat units), yet a representative number of small sizes were sent.

Officials at five of the seven Army units visited said that they experienced sizing problems with the desert uniforms. However, they said the problem was corrected by trading desert uniforms with other units or issuing larger sizes.

Personnel at four of the six Air Force bases visited said that they had problems in obtaining the needed sizes of uniforms and boots. However, in general, personnel could get uniforms and boots, although not desert ones.

Adequate Chemical Protective Equipment

We found that chemical protective ensembles³ were provided for the troops that we visited. Most of these units deployed with the required issue of the protective ensembles. However, some Army and Air Force units had problems with obtaining the correct size chemical protective overgarment and masks and Army units had problems getting sufficient quantities and maintaining gear.

Army Experience With Chemical Ensembles

Army officials in Saudi Arabia cited some problems with chemical gear working. For example, an Army Nuclear, Biological, and Chemical official said that upon arrival in the theater, he checked the chemical masks for other units to determine if they were working properly. He had to repair about 300 masks.

At one of the Army hospital units visited, hospital officials told us that patients entering the hospital were required to bring their chemical protective gear. However, some patients did not bring their suits. Thus, the hospital had to provide suits. Hospital officials believe that the Army's doctrine for outfitting patients needs to be addressed.

Three of the nine units visited experienced sizing problems with the chemical protective overgarments. However, only one unit was able to correct its sizing problems by trading with another unit. The III Corps chemical logistics officer, Fort Hood, Texas, said that the clothing size distribution the Army used was not representative of Fort Hood's population. He stated that the troops needed a greater percentage of medium size and a lesser percentage of the smaller sizes.

³Consists of protective mask, overgarments, gloves, protective overboots, decontamination kit, filter elements, hood masks, detecting kits, and cotton inserts.

Sizing was also a problem in issuing masks. An Army supply center official in Saudi Arabia stated that obtaining extra small masks was difficult.

Air Force Chemical Ensembles

Tactical Air Command Regulation 67-2 requires that a ground crew deploy with three sets of protective overgarments. The Air Force units generally deployed with enough chemical protective overgarments for three sets a person, plus about a 10-percent back-up stock. As a result, the overall inventory of chemical ensembles⁴ was sufficient for sustaining operations throughout the conflict.

Although the Air Force units we visited generally deployed with sufficient chemical protective clothing, tape, and monitors, many had to borrow ensembles from other personnel and units that were not deploying. For example, Air Force units in the United States that did not deploy also furnished chemical ensembles to ensure that on-hand quantities were sufficient.

Of the 16 units we visited, 14 deployed with three or more chemical ensembles per person. The remaining two units only deployed with one chemical ensemble per person. However, chemical ensembles were available at the base supply offices in Saudi Arabia to meet needs.

One unit we visited was partially staffed with personnel from Kadena Air Force Base, Japan, that had been deployed with less than two complete chemical ensembles per person. The Pacific Air Force Command issued chemical ensembles to the first deploying units from Kadena. However, once the Command discovered its ensembles would not be replaced, it stopped issuing them. As a result, units deploying from Kadena either picked up the ensembles on their way to Saudi Arabia or obtained ensembles from stocks at base supply offices once they arrived in theater.

Air Force personnel we visited provided the following observations about chemical ensembles.

⁴The ground crew ensemble contains one protective mask, three protective overgarments, six sets of gloves, six sets of protective overboots, three decontamination kits, six filter elements, six hood masks, three M8 paper detecting kits, three M9 tape detecting kits, and six cotton inserts.

- Personnel at one base stated that about 25 percent of the decontamination kits in the C bags⁵ were unserviceable because bags had cracked and burst in the heat. This condition was the result of the base having very few fixed facilities; consequently, many items had to be stored outside, in tents. Thus, many items were protected against rain and sand, not against the desert heat.
- Personnel at one unit stated that they received insufficient training in how to use the chemical ensembles and what precautions to take.
- Personnel at one air base said the newer suits' zippers were more fragile than the old ones and would sometimes tear.
- Personnel at one unit noted that the Air Force was in the middle of a transition to a new gas mask. Thus, those who wore glasses could not switch back and forth from the old to the new model because the eye glass inserts were not compatible.
- Some filters for the new masks were in short supply.
- Some insect repellant would set off the chemical monitors.

Marine Corps Chemical Gear

The Marine Corps had adequate quantities of chemical protective equipment available in theater in the event of a nuclear, biological, or chemical attack. According to Marine Corps supply officials, forward units were assigned three chemical protective overgarments (one of which was the British Mark IV) and rear units were assigned two suits per person. They believed that this was adequate to meet the threat.

Marine Corps officials said forward units entered Kuwait wearing the U.S. suits instead of the British Mark IV. Initially, there were problems with the sizing of the British Mark IV suits and the labeling of sizes. For example, a British large size was equivalent to a U.S. medium size. One of the lessons learned cited by a support command and units we visited was the need to change the distribution of sizes for the U.S. suits and the M-17 masks to better reflect the current Marine Corps force structure.

⁵The C bag contains the chemical protective ensemble.

Use of Prepositioning and Local Purchasing

We met with command and field officials from the Army, the Air Force, and the Marine Corps in Saudi Arabia to discuss the prepositioning of supplies and equipment and how this helped achieve Desert Shield/Storm objectives and the purchasing of supplies and services from the local Persian Gulf economy as well as from U.S. markets. To determine the extent of purchasing needed items outside the supply system, we visited two major Army installations that had deployed units to Saudi Arabia and discussed the local purchases made for deploying troops as well as talked with deployed troops in Saudi Arabia.

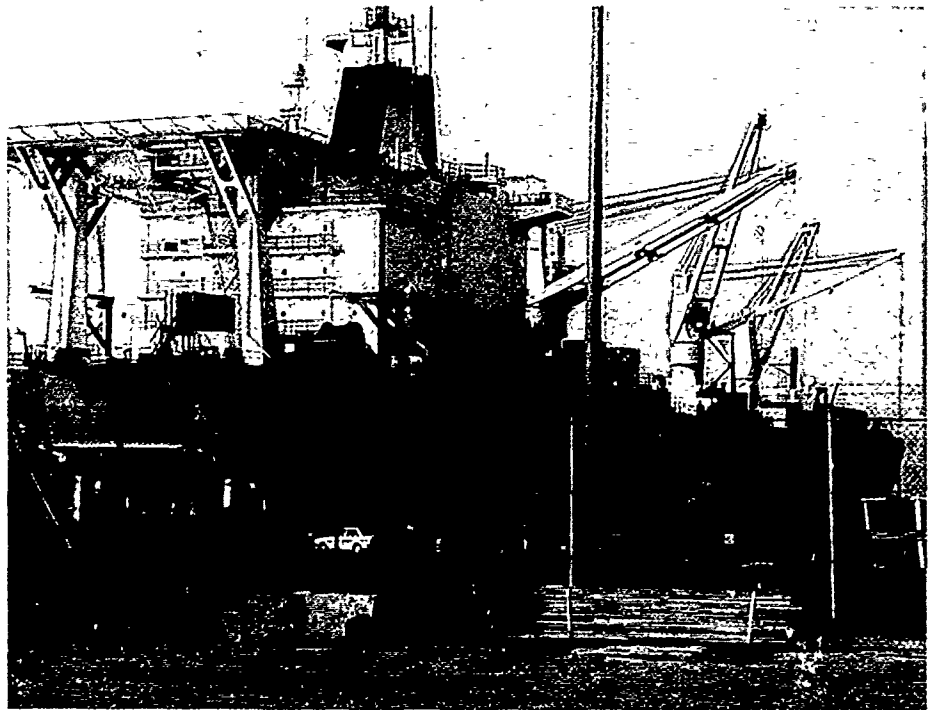
Marine Corps officials said the MPF ships were instrumental in enabling the Marines to quickly achieve a supported ground presence in Saudi Arabia. Also, the Air Force's Harvest Falcon program was successful in providing support to Desert Shield/Storm.

Use of the Maritime Prepositioning Force

According to Marine officials, MPF was successful in delivering large quantities of equipment and supplies to the theater in a short period of time. However, they said the ships' inventory, particularly the repair parts inventory, and the management of supplies could be improved. A Marine Corps headquarters official noted that the MPF inventory is being refined constantly.

The Marine Corps established MPF, a floating maritime prepositioned capability, to enable the United States to respond rapidly to international crises. MPF consists of three squadrons totaling 13 ships with each squadron attached to a specific Marine expeditionary brigade. The ships can support three types of missions: combat, political/diplomatic, and humanitarian. Figure 4.1 is an MPF ship at the port of Al Jubail.

Figure 4.1: MPF Ship at the Port of Al Jubail



The ships provided the theater with equipment and 30 days of sustainment supplies for about 50,000 Marines. Items on the ships included tanks, trucks, artillery, food, clothing, and repair parts. Figure 4.2 shows MPF containers in Saudi Arabia.

Figure 4.2: MPF Supply Containers at the Port of Al Jubail



The Marine Corps Central Command Chief of Staff claimed that the key logistics lesson learned from Desert Storm for the Office of the Secretary of Defense was the validation of the maritime prepositioning concept. The MPF concept of operations is the rapid deployment and assembly of a Marine air-ground task force in a secure area using a combination of strategic airlift and forward deployed prepositioning ships. The Chief of Staff said the prepositioned supplies helped the Marine Corps achieve high readiness rates in the theater.

Marine Corps supply officials at the command level and the units, however, told us the advantages of MPF were not maximized because of (1) the inability to maintain control over the assets, (2) maintenance required on some equipment before use, and (3) the inclusion of large numbers of items that were not used (see ch. 2 for a detailed discussion). Also, they told us that there were problems with allocating MPF assets among units in the theater. For example, according to a Marine Expeditionary Force supply officer and several unit supply officials, MPF items designated for specific units were occasionally diverted to other units. The supply officer explained that decisions from higher commands and other operational concerns often overrode whether a unit received the designated equipment.

The reallocation of MPF assets in theater was a source of complaint in several units.

- A light antiair missile battalion failed to receive sufficient quantities of tires for its 5-ton trucks, the primary transportation asset of the unit.
- An artillery battalion official claimed that 25 5-ton trucks designated for the unit were reallocated to infantry units.
- A Marine Air Control Group official claimed that the group received only 30 percent of the designated items expected from MPF. Therefore, he had to ask units deploying in December 1990 to bring their own tents, because all 138 of the MPF designated tents had been allocated elsewhere.

There Were Initially Insufficient Logistical Personnel to Manage MPF Supplies

Marine Corps logistics personnel suggested that a better mix of combat and logistics personnel in the initial wave of deployments could have improved the way the MPF supplies were distributed. To meet the Iraqi threat in August 1990, Central Command decided to (1) send primarily combat troops in the first wave of deployments and (2) deploy units and their equipment to the field as rapidly as possible. The delayed arrival of logistics support personnel to the theater had two effects. First, equipment was not properly inventoried and controlled when unloaded from the first MPF ships. Second, the Force Service Support Group initially lost control of the MPF inventory of equipment and supplies once they were unloaded from ships because it did not have sufficient personnel to manage the MPF items.

Use of Prepositioned Harvest Falcon Supplies and Equipment

The Commanding General of the Air Force Central Command praised the support provided through the Harvest Falcon program in southwest Asia. The logistical support provided through Harvest Falcon items was generally praised throughout the theater.

The Harvest Falcon program is designed to turn a bare aircraft strip into an operational base. The program provides supplies for maintenance shops, offices, hangers, billets, and electrical and water systems for a total of 55,000 personnel. (Fig. 4.3 shows a portable hangar.) These items are owned by the Air Force Central Command, and portions of them were prepositioned in southwest Asia. For example, Harvest Falcon desert tan tents were used to house personnel (see fig. 4.4).

Figure 4.3: Portable Harvest Falcon
Hanger in Saudi Arabia

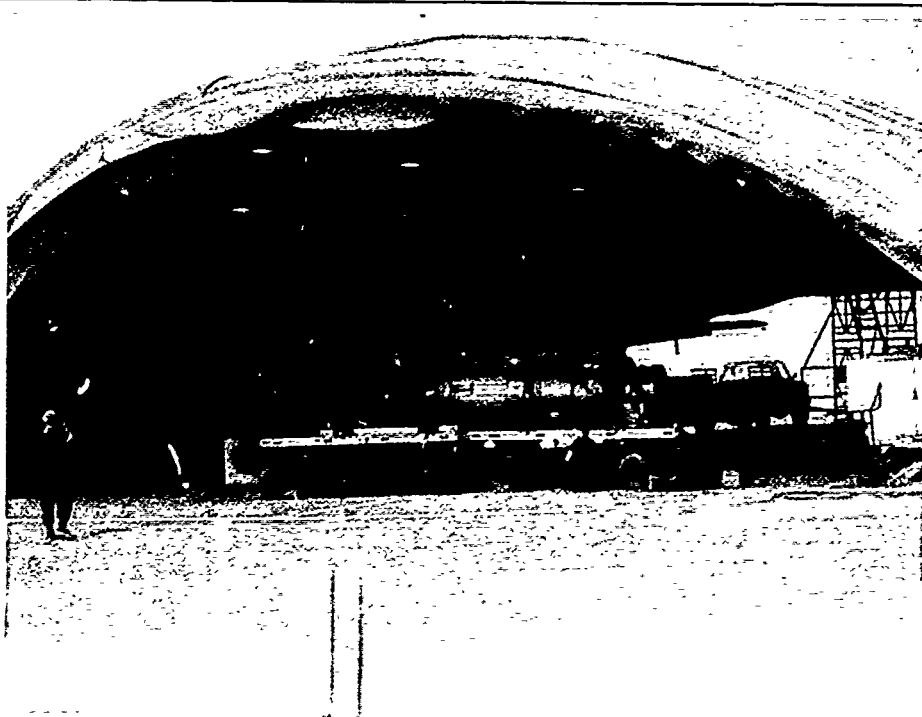
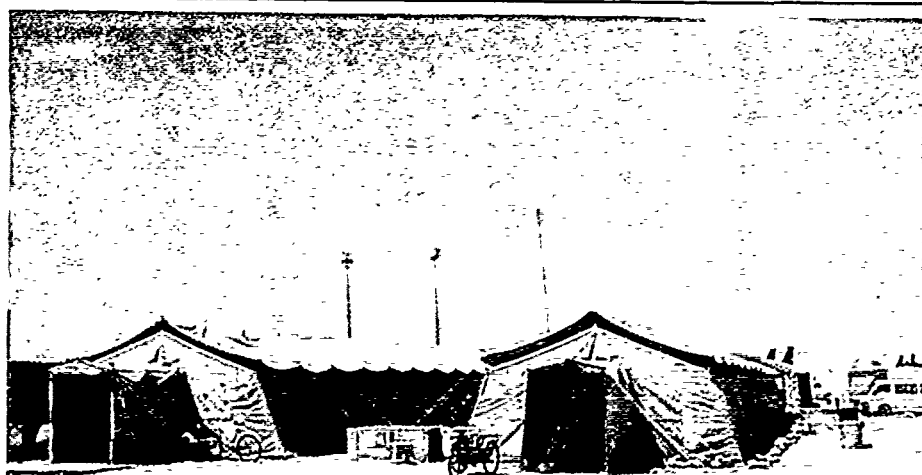


Figure 4.4: Harvest Falcon Tents in Saudi Arabia



The prepositioning of items facilitated the rapid deployment of tactical aircraft squadrons to the theater and the sustainment of the squadrons after their arrival.

Medical Supplies

Prepositioned and prepackaged medical supplies were sufficient according to the medical officials we visited. Some medical equipment may have been outdated and some medications may have expired; however, the units we visited were able to obtain the necessary equipment and supplies.

Army officials at an evacuation hospital in Saudi Arabia stated that the medical equipment and supplies may not have been what medical personnel were accustomed to using, but the equipment and the supplies were adequate to get the job done. These officials also stated that some changes may be needed. For example, Army doctrine specifies that a stethoscope should be used when taking a patient's blood pressure. However, due to the noise created from hospital generators and planes flying over the hospital, medical personnel could not use stethoscopes when taking patients' blood pressures because they could not hear the pulses. Consequently, the hospital purchased "Dinamaps" (state of the art technology) from the local economy, which enabled medical personnel to take patients' blood pressures without using stethoscopes.

Marine Corps medical supply officials told us that availability of medical supplies was not a problem. They said that prepositioned supplies contained outdated medical equipment and expired medications; however, they added that the problems were identified and addressed early in Desert Shield by requisitioning and obtaining additional supplies.

According to the medical officials we interviewed, the availability of medical supplies was not an issue. In those cases where supplies (e.g., straps for stretchers or third generation antibiotics) were not in the prepositioned modules, officials were able to requisition and quickly obtain them. Further, medical officials stated that they were aware of some of the problems with medical supplies (e.g., expired medications) early in Desert Shield and, therefore, sent additional medications. A medical supply officer with a Force Service Support Group stated the opinion that medical personnel anticipated that as much as 45 percent of the medical supplies aboard the MPF ships, especially the nuclear, biological, and chemical drugs, would be expired. Medical officials also requisitioned some new equipment that was not part of the prepositioned modules (e.g., equipment to immobilize bones and to take blood pressure).

Some of the medical officials interviewed believe that the obsolescence of some medical equipment could be avoided if the medical prepositioning module review process were changed. Currently, a team of Navy Medical Material Support Command personnel reviews one-fourth of the prepositioned modules every 2 years; therefore, 8 years are required to complete a review cycle. The medical officials interviewed believe that doctors need to be part of the team and the cycle needs to be shortened.

The medical officials we interviewed concurred with a supply battalion lesson-learned report that stated:

"many of the . . . [medical] . . . issues i.e., unfamiliarization, inadequacy of contents, obsolescence of material, ignorance of T/E [table of equipment] . . . requirements, maldistribution of . . . [medical equipment] . . . between Medical Battalion companies, inefficient deployment and retrograde, etc. are due to a lack of adequate field training with . . . [deployed medical equipment] . . . while in garrison."

Marine Corps medical officials cited two principal reasons for inadequate training. First, it is difficult to get doctors out of hospitals and into the field for training because of a shortage of military doctors and the expense of getting civilian replacements or providing medical care at a nonmilitary facility. Second, often during training exercises, medical personnel only plan how they would use the supplies; they do not actually work with the supplies (e.g., set up the equipment).

Supplies Obtained Locally

Each of the services obtained supplies and services locally in the United States and the Persian Gulf. Prior to deploying, the services purchased navigational equipment and radios to meet supply needs and clothing and office supplies to meet routine needs. In country, they purchased batteries, aviation gases, fuel injectors, and water to meet both repair parts and supply needs and office supplies and construction material to meet routine needs. Services procured locally included automotive repair, waste removal, and transportation.

Supplies Purchased in the Persian Gulf

Army personnel procured items from the local commercial market in the Persian Gulf. In addition to the repair parts discussed in chapter 2, the Army units purchased such items as grease guns, lumber products, office supplies, and tools.

Air Force contracting personnel at each of the bases we visited bought items and services on the local commercial markets in the Persian Gulf.

The purchases included those goods and services necessary for setting up and sustaining operations at a new location. The first goods and services the contracting officers worked to obtain on the local commercial markets were (1) quarters in which personnel could stay, (2) transportation, (3) food services, (4) potable water, (5) fuel, and (6) heavy equipment to move supplies arriving in the theater. In addition, Air Force units purchased gases such as halon and argon locally.

The benefits of local purchases, according to supply officers in the Air Force and the Marine Corps, were (1) such purchases reduced the burden on the transportation system, both from the United States and within the theater; (2) supplies were obtained sooner than from U.S.-based sources; (3) equipment not available from the supply system was obtained; and (4) transportation costs were avoided. According to two contracting officers, it could take as long as 2 months to receive some noncombat essential supplies because the priority was on providing supplies necessary for obtaining and sustaining combat effectiveness. In addition, items procured through the local markets saved airlift for higher priority cargo such as aircraft parts.

Although it was more timely to obtain items locally, Air Force contracting officers stated that prices were generally about 10 to 20 percent higher than those of the normal supply channels. Marine Corps supply officials told us the costs of locally procured supplies ranged from 5 to 30 percent higher than those of supplies procured from the United States. They said the reasons for the higher costs were (1) the demand for limited supplies, (2) the local distributors' cost, and (3) the transportation expense of delivering western goods to Saudi Arabia.

Supplies Were Purchased in the United States Prior to Deployment

We visited two bases—Fort Hood, Texas, and Fort Stewart, Georgia—that purchased items outside the supply system in the United States for deploying troops because items either were not available through the regular supply system or could not be issued before deployment. Fort Hood's contracting office had purchased a total of \$12.7 million of items as of March 1991 for deploying troops and Fort Stewart's contracting office had purchased a total of \$16.1 million of items as of April 2, 1991. The items included navigational hand-held equipment, secure voice radios, computers and software, clothing, sundry items, and paper supplies.

Three Army units we visited in Saudi Arabia purchased supplies locally in the United States prior to deployment. One unit purchased about

1,000 gallons of bottled water from its commissary because its commander had heard of water difficulties in theater and wanted the unit to be prepared. The other two units purchased a variety of clothing and construction and personal supplies locally because the supply system could not provide these items in time for deployment.

Two Air Force units and one Marine Corps unit also purchased items locally before deploying. According to a supply official from one Marine division, some units purchased a few isolated items such as motorcycle repair parts and computer supplies.

Commands and Units Visited in Saudi Arabia

Central Command	U.S. Army, Central Command U.S. Central Air Forces U.S. Marine Corps, Central Command
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U.S. Army	XVIII Airborne Corps Headquarters and Headquarters Battery
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Command/Units	1st Cavalry Division 1st Battalion 5th Infantry 1st Battalion 8th Armor 1st Battalion 32nd Armor 3rd Battalion 32nd Armor 75th Field Artillery Brigade 1st Battalion 17th Field Artillery
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Units	8th Evacuation Hospital 85th Evacuation Hospital 2nd Battalion 43rd Air Defense Artillery 336th Medical Detachment
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Support Groups	22nd Support Command 321st Materiel Management Center 1st Corps Support Command
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U. S. Air Force	354th Tactical Fighter Wing 706th Tactical Fighter Squadron 511th Tactical Fighter Squadron 139th Tactical Airlift Group 166th Tactical Airlift Group 463rd Tactical Airlift Wing 4th Tactical Fighter Wing 33rd Tactical Fighter Wing 35th Tactical Fighter Wing (Bahrain) 52nd Tactical Fighter Wing (Bahrain) 69th Tactical Reconnaissance Wing (Bahrain) 48th Tactical Fighter Wing
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Appendix I
Commands and Units Visited in Saudi Arabia

335th Tactical Fighter Squadron
53rd Tactical Fighter Squadron
4409th Operational Support Wing
552nd AWACS
1703rd Air Refueling Wing
169th Tactical Fighter Group
174th Tactical Fighter Group

U.S. Marine Corps	1st Marine Expeditionary Force 1st Marine Division
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Command/Units	2nd Marine Division 5th Battalion 10th Artillery 2nd Battalion 12th Artillery
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Units	2nd Tank Battalion 2nd Light Armored Infantry Battalion 3rd Marine Air Wing
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Support Groups	1st Force Service Support Group Marine Aircraft Group 13 Marine Aviation Logistics Squadron 13 Marine Aircraft Group 13 Forward Marine Wing Support Group 37 Marine Aircraft Control Group 38
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