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supporting

The U.S. Army Corps of Engineers in the Persian Gulf War

Janet A. McDonnell

Cover photos:

Far left: Lieutenant Colonel Charles Cox inspects a life support area in Saudi Arabia.

Center: members of the Dhahran Area Office.

Top: Latrine, shower, and washstand assembly area.

Bottom: The 20th Engineer Brigade works on a new roadbed in Southwest Asia.

Cover design by Ria Pua, EEI, Alexandria, Virginia.

Supporting the Troops: The U.S. Army Corps of Engineers in the Persian Gulf War

by
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Foreword

Army engineer support to U.S. Central Command's joint maneuver force during the Persian Gulf War was massive and critical. Over 100 active and reserve component engineer units contributed significantly to the success of Operation DESERT SHIELD/DESERT STORM. These contributions are well documented in *Supporting the Troops: The U.S. Army Corps of Engineers in the Persian Gulf War.*

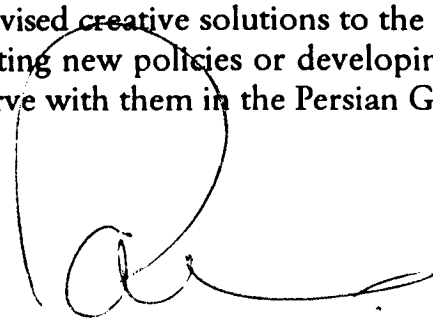
The Gulf War dramatically demonstrated the need to deploy engineers early so that they can determine the engineer requirements, communicate those requirements to the maneuver commanders, and take appropriate steps to bed-down and sustain U.S. forces. The delayed flow of engineers and their equipment into Southwest Asia directly affected the ability of the maneuver units to sustain themselves and operate effectively.

We are now moving toward a smaller, quality Army with rapidly deployable forces. There are fewer engineer units than in 1990, and a larger proportion of the engineer force is in the reserve components. As the active component force continues to shrink, we must insure that the reserve component engineer forces are well trained and ready to deploy on short notice.

During the Gulf War engineers provided the model for the Total Army concept, successfully blending Active Army, Army National Guard, Army Reserve, and Department of Defense civilian engineer capabilities. U.S. forces could not have succeeded in the Gulf without the assistance of the reserve components and civilians. The force structure of today's Active Army does not include a number of specialized engineer units needed to support a large-scale deployment. Nor do operational engineer units have all the special expertise that can be found in the U.S. Army Corps of Engineers.

As *Supporting the Troops* vividly illustrates, the contributions of the Corps' military and civilian members were diverse and significant. Over 160 Corps civilians, who voluntarily deployed to Southwest Asia, provided procurement, design, construction, and real estate support. Corps members worked diligently, often in difficult conditions, to provide for the well-being and safety of tens of

thousands of U.S. soldiers. They devised creative solutions to the problems they encountered, whether implementing new policies or developing new project designs. It was my privilege to serve with them in the Persian Gulf.



PAT M. STEVENS IV
Major General, USA
Acting Chief of Engineers

Preface

Although many books about the Persian Gulf War have been published, none adequately deal with the importance of the Army engineers during that conflict. My primary goal is to document and evaluate the activities of just one Army engineer agency—the U.S. Army Corps of Engineers. The Corps' role, however, must be placed in the broader context of Army engineer activities. Thus I have included some discussion of the engineer force structure and the activities of the engineer units that supported the echelons above corps. The story of the important contributions of the combat engineers who breached Iraqi obstacles on the battlefield, detected and removed mines, and constructed roads and facilities in support of the two Army corps in the Kuwait theater remains for another historian to write.

This book provides an overview of the Corps' critical missions during Operation DESERT SHIELD/DESERT STORM. As the Department of Defense's contract construction agent for the Kuwait theater, the Corps prepared and administered contracts for construction and construction design and leased real estate. Later in the operation, the Corps administered many contracts for the Saudi Arabian government under host nation support and a large contract for the Japanese government. Corps laboratories provided technologies that enabled U.S. forces to function more effectively on the battlefield.

The U.S. Army Corps of Engineers civilians who voluntarily deployed during Operation DESERT SHIELD/DESERT STORM gave the United States military capabilities and expertise that it would not otherwise have had.

Since the end of the Persian Gulf War, the United States has been involved in several military contingencies, such as Operation RESTORE HOPE in Somalia and Operation UPHOLD DEMOCRACY in Haiti. In these contingencies, the U.S. military has again drawn on the Corps' extensive contracting and real estate leasing expertise. My hope is that this book will provide some lessons learned that will enable policy makers and planners to respond more effectively in future military contingencies.

The Author

Janet A. McDonnell, a senior historian with the U.S. Army Corps of Engineers, received her Ph.D. from Marquette University. Dr. McDonnell has published *The Dispossession of the American Indian: Indian Land Policy, 1887–1934,* as well as several articles on Indian land policy. She has also published *The U.S. Army Corps of Engineers' Response to the* Exxon Valdez *Oil Spill* and *Response to the Loma Prieta Earthquake* and has written brief histories of Hurricane Andrew and Operation RESTORE HOPE (Somalia). She is currently completing a book on the U.S. Army's role in the reconstruction of Kuwait.

Acknowledgments

A number of individuals reviewed this book in draft form. Their comments and suggestions greatly improved the book's quality and accuracy. Steve Arnold, Barry Frankel, Cliff Longfellow, and Dale Ringer, all in Corps headquarters, read various chapters as did Hal Faulkner in South Atlantic Division and Tommy Hill in Savannah District. Jackie Bryant, Stephen DeLoach, Robert Knowles, F. David Lee, Fred Pessaro, and Dr. Jack N. Rinker from the Corps' Topographic Engineering Center reviewed the chapter on laboratory support. 1st Sergeant Herbert Pryor and Major Percy Gregory read the section on Prime Power.

Colonel Charles "Stoney" Cox, commander of Rock Island District; Harry Painton, with the Office of the Chief of Engineers–Pentagon; and Joan Kibler, Bill Brewer, and others in the Transatlantic Programs Center read the entire book and offered helpful comments.

Bill Baldwin, Jim Dunn, and Paul Walker with the Office of History and Charles Hendricks now with the U.S. Army Center of Military History carefully reviewed the book at various stages.

Marilyn Hunter, Office of History, skillfully edited the manuscript and prepared it for publication. Catherine J. Dettmar, the senior indexer at EEI in Alexandria, Virginia, compiled the index. Joan Kibler, Irene Davern, and Jackie Bryant provided photographs, and the U.S. Army Center of Military History provided a map.

I am particularly indebted to dozens of soldiers and civilians with the Middle East/Africa Projects Office (Southwest Asia), Dhahran Area Office, Transatlantic Programs Center, South Atlantic Division, Headquarters U.S. Army Corps of Engineers, Third U.S. Army, Forces Command, U.S. Central Command, ARCENT, and ARCENT SUPCOM who took time from their demanding schedules to share their knowledge and insights. Their discussions were always interesting and often compelling. They have given the book a depth of personal perspective that would otherwise be lacking.

A few friends and colleagues deserve special note. Their support for this project never wavered. Lieutenant Colonel Michael Fisher (ret.) and members of the Corps' crisis management team included me in their briefings and meetings, generously shared information, and responded with good humor to my repeated requests for documents. One team member, Frank Bizzoco, was

instrumental in arranging for me to travel to the Middle East to conduct interviews. He reviewed the entire book, not just once, but twice.

Lieutenant Colonel Gordon Quesenberry (ret.) carefully saved and organized Army engineer records in the Pentagon and made them available to me. He spent hours patiently educating me on engineer doctrine and force structure.

Both Major General Pat Stevens IV and Colonel William Miller (ret.) have given this project their full support. Miller proved to be a gracious host in Saudi Arabia and later in Atlanta, Georgia, answering questions, sharing information, opening up his files, and arranging interviews. At Miller's direction, Captain Ted Kientz spent three weeks transporting me around Saudi Arabia and Kuwait, always making sure that I got where I needed to be on time with plenty of tapes and batteries for interviewing.

Working with these people has been one of the best parts of this project.

Janet McDonnell

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INTRODUCTION
Setting the Scene

When Iraq invaded Kuwait on 2 August 1990, it had the fourth largest army in the world and a vast array of modern equipment. Over the next few months, the United States would deploy tens of thousands of soldiers to counteract the Iraqi threat. These soldiers would find themselves operating in an immense, forbidding desert the combined size of Florida, Georgia, and South Carolina. The challenges of deploying and supporting these troops would be great. The United States had no longstanding coalition or host nation agreements in Saudi Arabia upon which to build a military presence, as it had in Korea and Europe.

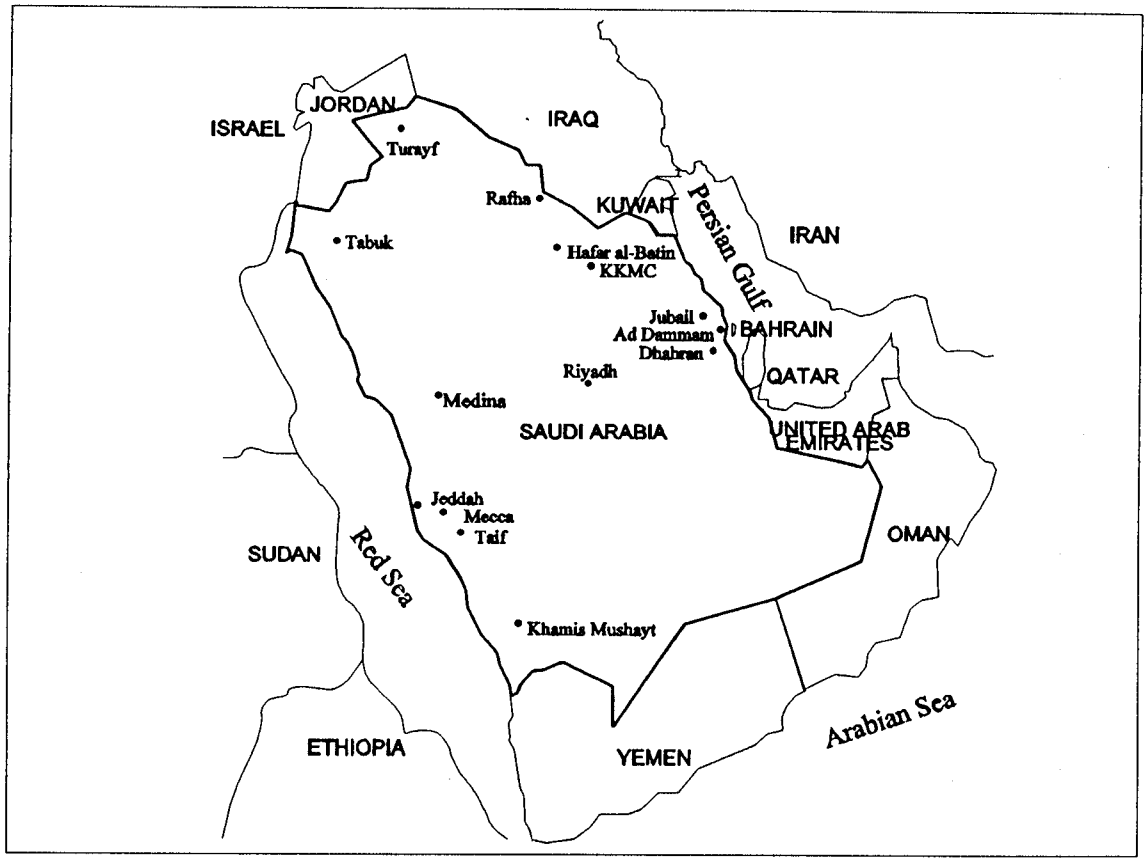
U.S. Central Command (CENTCOM), headquartered at MacDill Air Force Base in Florida, was responsible for military operations in most of the Middle East and Africa—except for Israel, Lebanon, Syria, and the Indian Ocean and Arabian Sea. CENTCOM, although designated a joint command, consisted of only a planning headquarters and had no forces assigned to it. It had to rely on forces supplied by other commands.[1]

Throughout the 1980s, CENTCOM planners had concentrated on a scenario involving a Soviet invasion of Iran. By 1990, changes in Eastern Europe and the declining influence of the Soviet Union in the Middle East made this occurrence less likely. The end of the long, mutually exhausting Iran–Iraq war that had weakened the Iranian military, Iraq's growing ambitions, and the disparity between the forces of Iraq and its neighbors indicated a potential regional threat to U.S. interests.

General H. Norman Schwarzkopf, the forceful, outspoken commander of CENTCOM, realized the Iraqis had replaced the Soviets as the major threat in the Persian Gulf and recognized that a regional conflict could threaten U.S. lives and interests.[2] In November 1989 Schwarzkopf directed his staff to revise its current operations plan for the region (OPLAN 1002–90) to reflect an Iraqi invasion of Saudi Arabia and Kuwait. The Joint Chiefs of Staff authorized CENTCOM to shift the focus to regional, non-Soviet threats to the oil supply in the Middle East. CENTCOM launched an effort to develop a plan to defend Saudi Arabia from a 22-division Iraqi threat and then take the offensive to recover any lost territory. Part of this process involved updating the list of forces to be deployed.

Revamping a war plan so extensively was a huge undertaking and often took years. Barring delays, CENTCOM planned to submit the final version to the Joint Chiefs of Staff in April 1991, 22 months after beginning work on the plan.

In March 1990 CENTCOM began preparing for a major, joint-command computer exercise to test the assumptions of its draft operations plan for the Middle East. The exercise, INTERNAL LOOK 90, ran concurrently at Fort Bragg, North Carolina, and Hurlburt Field, Florida. It was based on six Iraqi heavy divisions invading Saudi Arabia. CENTCOM simulated sending U.S. forces to the Middle East to deter an Iraqi attack, defend critical port and oil facilities, and defeat the enemy forces. The scenario gave the Army's XVIII Airborne Corps from Fort Bragg enough time to deploy and establish a defense in eastern Saudi Arabia before the attack began.



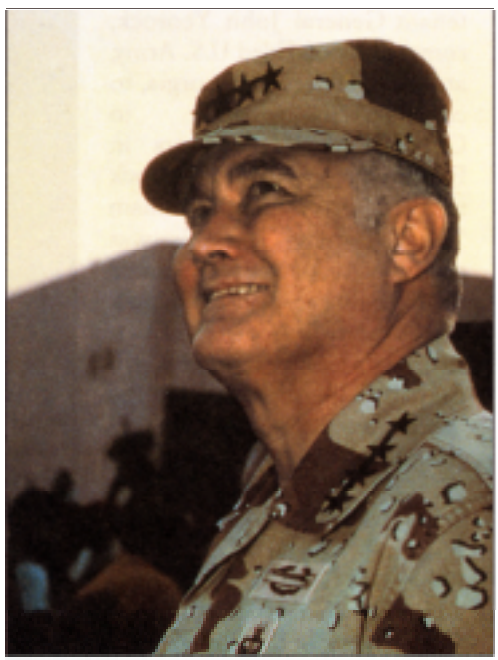
Southwest Asia

The exercise started at D+6 (day of ground attack plus 6), and by starting six days into the operation, CENTCOM planners assumed away potential logistics and engineer problems. Also the exercise scenario stayed close to the Persian Gulf coast where the infrastructure was fairly well developed, so planners did not have to worry about moving an entire corps across a desert. When U.S. troops actually arrived in Saudi Arabia later, however, they would quickly push out of Dhahran into the desert, with little infrastructure for housing or operations.

Completed in July, INTERNAL LOOK 90 validated the basic tenets of CENTCOM's operations plan. It illustrated that any intervening force in the

region would need considerable support from the Saudis. It also confirmed that the greatest risk came from the serious shortage of sealift capability. The exercise convinced General Schwarzkopf that he had to deploy ground combat units first if the events scripted in the exercise ever occurred.

As CENTCOM completed its exercise and began circulating its draft operations plan, events in the Middle East began to mirror the **INTERNAL LOOK** 90 scenario. On 18 July 1990, Iraq's president, Saddam Hussein, accused Kuwait of driving down the price of crude oil and reasserted Iraq's claim to oil in a disputed border area controlled by Kuwait. The discussions between the two nations to resolve the matter quickly failed. Meanwhile, General Schwarzkopf and his staff began preparing a response to a possible Iraqi invasion. On 31 July and **1** August, he presented deployment options to the Chairman of the Joint Chiefs of Staff, the Secretary of Defense, the President, and the National Security Council.

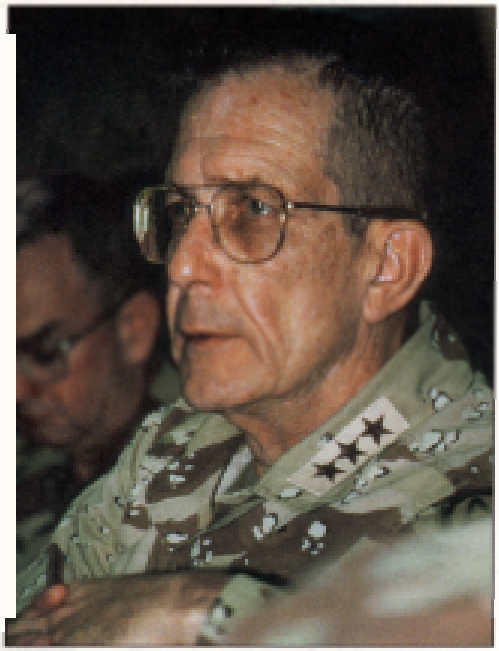


General H. Norman Schwarzkopf, Commander, U.S. Central Command. (U.S. Air Force photo by SSGT Wagner)

At 2:00 ***A.M.*** on 2 August 1990, three divisions from Iraq's elite Republican Guard (140,000 Iraq soldiers) pushed across the Kuwait border. Within hours they had taken control of Kuwait City and driven the royal family into exile in Saudi Arabia. Kuwait's ambassador to the United States asked for military assistance. General Schwarzkopf met with Secretary of Defense Richard Cheney, his key advisors, and the Chairman of the Joint Chiefs of Staff later that morning. He laid out two options for using U.S. military force to respond to the Iraqi threat: launch retaliatory air strikes against Iraq or deploy air and ground forces according to OI'LAN 1002-90. The same day, the United Nations Security Council passed Resolution #660, which condemned Iraq's actions and demanded the unconditional and immediate withdrawal of Iraqi troops from Kuwait.

During a 4 August meeting at Camp David, Schwarzkopf presented President George Bush with CENTCOM's plan to deploy a force to defend Saudi Arabia against encroachment. Bush decided that if invited, the United

States would deploy enough troops to deter further Iraqi attack. Meanwhile, General Schwarzkopf directed Lieutenant General John Yeosock, commander of Third U.S. Army, at Fort McPherson, Georgia, to come immediately to CENTCOM headquarters in Florida. Before he left, Yeosock told Major General William "Gus" Pagonis [Pagonis was promoted to Lieutenant General on 12 February **1991],** deputy chief of staff for logistics at U.S. Army Forces Command, to prepare a logistics plan that he could present to Saudi Arabia's King Fahd Bin Abdul Aziz.[3]



Lieutenant General John Yeosock, Commander, Army Central Command. (U.S. Army photo by SGT Ybanez)

On 5 August Cheney, Schwarzkopf, Yeosock, Deputy National Security Advisor Robert M. Gates, and other top administration officials flew to Saudi Arabia, at the direction of President Bush, to confer with King Fahd and to negotiate the deployment of U.S. troops. By that time, 11 Iraqi divisions were either in or on their way to Kuwait. At the 6 August meeting, Cheney made King Fahd three promises: the United States would deploy a force large enough to get the job done, stay as long as necessary, and leave when requested to do so. At the end of the meeting, the king formally invited the United States to send troops to reinforce his defenses.

When he returned to Washington the next day, Secretary Cheney informed the President that King Fahd had agreed to let the United States send forces to defend Saudi Arabia. In a nationally televised address on 8 August, President Bush condemned Iraqi aggression and announced the deployment of U.S. troops to Saudi Arabia in what was designated Operation **DESERT SHIELD.** The United States, he explained, demanded Iraq's "immediate and unconditional" withdrawal from Kuwait, the restoration of Kuwait's legitimate government, release of all hostages and free functioning of all embassies, and "the stability and security" of the Persian Gulf.[4]

CENTCOM's missions were clear: deter further Iraqi aggression, defend Saudi Arabia, enforce United Nations' sanctions, and develop an offensive capability to liberate Kuwait. The plan for the defense of the Arabian peninsula

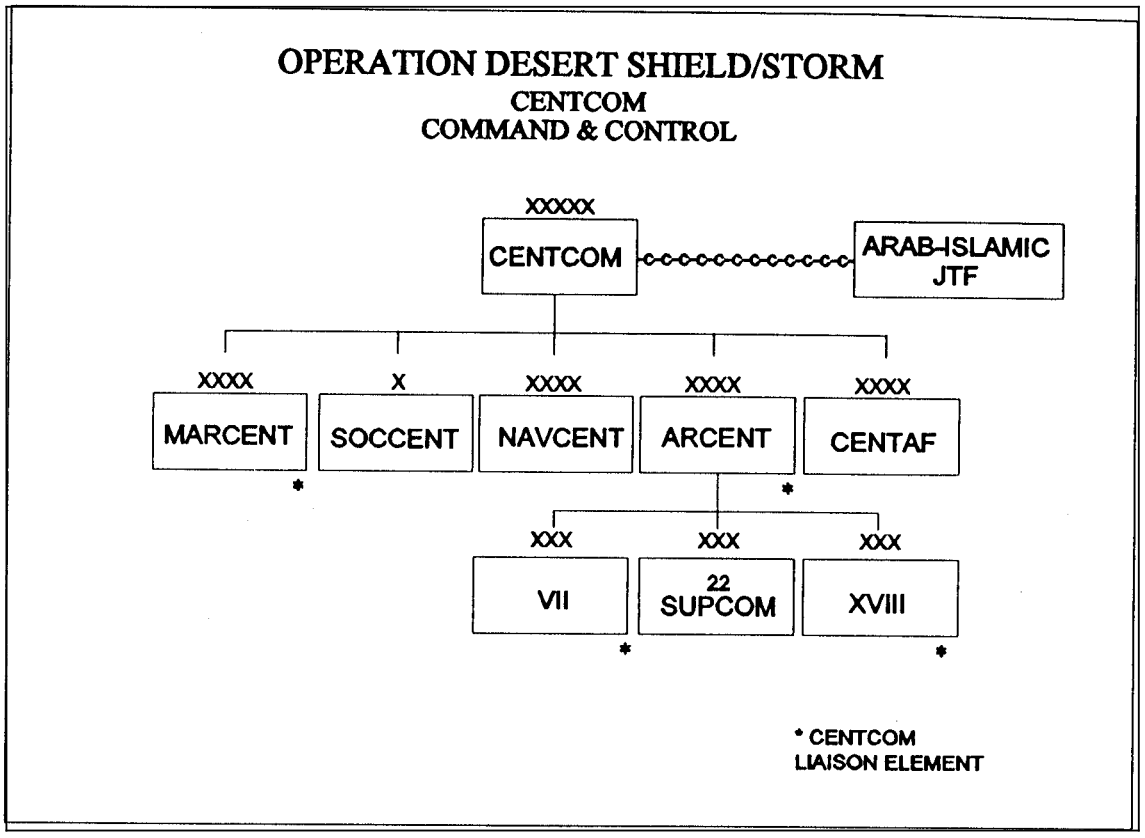
was incomplete and had not yet been reviewed or approved by the services or the Joint Chiefs of Staff. Since the plan had not been finalized, planners had not developed a comprehensive force list. It took time to identify all the requirements and match those requirements with specific units. Although INTERNAL LOOK 90 provided the framework, CENTCOM had to make ad hoc decisions about the details.

U.S. forces became part of an international coalition that had been quickly crafted to combat Iraqi aggression. Coalition members committed ground forces on 8 August. Of the nearly 50 countries—including Arab and Islamic nations such as Egypt and Syria—who would join this coalition, 38 would deploy air, sea, or ground forces. Together, coalition members would commit more than 200,000 troops, 60 warships, 750 aircraft, and 1,200 tanks. In addition, coalition members would contribute billions of dollars in assistance-in-kind and cash.

Never had the American military projected such a large force so far so fast. In the first six weeks of Operation DESERT SHIELD, the United States moved by air the equivalent of the entire Berlin airlift, an operation that had taken 65 weeks. The U.S. military built a massive logistics structure that stretched more than 8,700 miles. The operation was equivalent to moving Richmond, Virginia, and Des Moines, Iowa, more than 8,000 miles and setting them up in the desert.

The commander of Forces Command, General Edwin H. Burba, Jr., observed that it was "the greatest mobilization and the greatest deployment, given the time constraints we were under, that ever occurred in the history of the world." The Army deployed 295,800 personnel in six months (compared to 45,800 in six months during the Korean War and 168,400 in six months of 1965 during the Vietnam War). The United States ultimately deployed more than 500,000 men and women, with their equipment and supplies, from the United States and overseas locations.[5]

In Saudi Arabia the primary sea ports of debarkation were Dammam and Jubail, and primary aerial ports of debarkation were Dhahran, Riyadh, and King Khalid Military City. Saudi Arabia was well developed. Soaring oil revenues in the 1970s had enabled the country to invest heavily in public works. Dammam had one of the best ports in the world. Dammam and Jubail had modern facilities with immense capacities and staging areas. The airports, particularly the Dhahran Airport, were large and modern. Huge public housing projects—designed originally for a growing population of foreign workers and citizens migrating to the cities—stood largely unoccupied, so the Army had a potential source of troop housing near the ports of entry.



Although the Saudis had modern seaports, airports, and some modern roadways to receive deploying forces, no logistical infrastructure was in place to feed, shelter, and supply such a large force. Moreover, at the time of the invasion, the United States had no formal status of forces agreement with Saudi Arabia that provided for host nation support or authorized the use of its installations by U.S. forces.

When the invasion occurred, the United States had no forces deployed in the Middle East, except a few ships and a small administrative support unit in Manama, Bahrain, that managed ships entering and exiting the port. Yet the U.S. Air Force had spent more than $300 million to build warehouses in the Middle East to store equipment needed to sustain a force. The Army had no similar pre-positioning program in the theater, which meant it would have to bring everything it needed from the United States. The Marines had three naval transport squadrons with enough pre-positioned equipment and supplies to support the Marine expeditionary force for 30 days.[6]

The operations plan gave the United States a head start in preparing its defense of Saudi Arabia, but the Iraqis had the lead. Schwarzkopf's solution was to create the impression that the country was well defended until he could bring in heavy reinforcements. He ordered that deploying combat forces be given precedence over shipping ammunition, spare parts, and other items. Because of

this requirement, in the first weeks CENTCOM's force was incapable of moving very far or shooting for very long. Not until 24 September when the first heavy armored division was positioned in the desert was Schwarzkopf confident that he could repulse an Iraqi attack.[7]

General Yeosock's perspective was similar. He wanted to deploy a force that could, if necessary, start fighting as soon as it arrived. Since air transportation and host nation support were limited, he decided to deploy aviation units, air defense systems, and antiarmor weapons first, followed by heavy forces including combat engineer units.

Using this guidance, Army planners shaped the initial troop list. The rapidly deployable XVIII Airborne Corps and 82d Airborne Division were obvious first choices. To provide mobility and tank-killing capability, planners included the 101st Airborne Division (Air Assault) from Fort Campbell, Kentucky. To provide heavy armored capability, they added the 24th Infantry Division (Mechanized) from Fort Stewart, Georgia, and the 1st Cavalry Division from Fort Hood, Texas.

General Yeosock would command ARCENT-the Army component of CENTCOM. After arriving in Saudi Arabia on 6 August, he and his small staff established ARCENT headquarters in Riyadh to oversee the arrival, sustainment, and combat planning for deploying Army units. The first soldiers from the 82d Airborne Division deployed on 8 August, 31 hours after the initial

Secretary of Defense Richard Cheney talks with soldiers of the 24th Infantry Division from Fort Stewart, Georgia. ***(Photo by Jonas Jordan, USACE, Savannah District)***

alert order. When they arrived in Dhahran, they had no logistics structure to support them, no shelter in the 120-degree heat, and no sanitation facilities.

Meanwhile, a Marine naval transport squadron was already en route to Saudi Arabia, as were F-15 planes from the 1st Tactical Fighter Wing. Some heavier ground forces were airlifted while their tanks and other equipment came by sea. These units included the 101st Airborne Division (Air Assault), the 24th Infantry Division (Mechanized), the 1st Cavalry Division, and the 2d Armored Division. In the first seven days, an entire brigade--4,575 paratroopers and their equipment--arrived in Saudi Arabia ready to fight. By 24 August, more than 12,000 soldiers from the XVIII Airborne Corps were in the country. Shipment of material continued throughout August and September from five Atlantic and Gulf of Mexico ports.[8]

Tent city of the 82d Airborne Division.

Third U.S. Army had developed a list of the Army units needed, based on the INTERNAL LOOK 90 scenario, but the Iraqi threat to Saudi Arabia was so urgent that combat forces had to be on the ground before the Army could develop an adequate support base. The Army had to deploy many combat units quickly with only the most essential support units. To ensure that the greatest amount of combat power was available, the CENTCOM commander accelerated the deployment of combat forces and delayed the deployment of theater logistics forces. Thus, the first units had to rely on their organic supplies and equipment or on host nation support.

Army planners initially believed that the support command from the XVIII Airborne Corps could provide enough support, but the command was quickly overwhelmed. General Yeosock established a provisional theater support command headquarters in Dhahran-known as ARCENT (Forward)-to manage all theater logistics.

When Pagonis arrived on 8 August, he brought with him four talented logisticians-Colonels Stephen Koons, John Tier, and Robert Klineman, and Lieutenant Colonel James Ireland. This small, energetic group immediately began implementing a plan they had drafted on the flight over and became the nucleus of all logistics support for Army troops arriving in country. The rest of the 22-person team that Pagonis had selected at Fort McPherson arrived a few days later. He would grab additional personnel whenever he could. On 16 August, Yeosock appointed Pagonis as ARCENT's deputy commander for logistics. Three days later ARCENT (Forward) was formally designated as the provisional ARCENT Support Command (SUPCOM) with Pagonis as its commanding general.[9]

Pagonis' huge task was to receive, sustain, and house the XVIII Airborne Corps. He found soldiers sleeping in the sand and on handball and tennis courts in Dammam. Hundreds slept on the ground behind quarters occupied by the U.S. Military Training Mission. Between 10 and 25 August, Pagonis and his

Soldiers of the 24th Infantry Division set up temporary quarters in this warehouse after arriving in Saudi Arabia. ***(U.S. Army photo by Gil High,*** Soldiers Magazine)

small staff received 40,000 soldiers. The rapid influx of combat forces meant that a U.S. logistics command would have to coordinate the reception of troops while supporting incoming units and building logistics bases farther inland.

The need for engineers to support the logistics effort was also clear. When the Forces Command engineer, Colonel Julian E. "Emory" Pylant, discovered that General Pagonis was deploying without a staff engineer, he saw the need to get someone in the theater to highlight engineer issues. At the suggestion of Lieutenant General Henry J. Hatch, commander of the U.S. Army Corps of Engineers, and at the urging of Colonel Pylant, Pagonis agreed to add a Corps officer, Lieutenant Colonel James Walter, to his staff to do engineer planning.[10]

As the designated Department of Defense's contract construction agent for the Kuwait theater of operations, the U.S. Army Corps of Engineers would help fill the void in engineering capability and provide critical design, construction, contracting, and real estate support for the U. S. forces.

CHAPTER 1
Shaping the Engineer Force

During Operation DESERT SHIELD, each service was responsible for providing its own engineering capability for receiving and supporting troops. The large Army contingent had the most demanding engineer requirements, but because of a shortage of engineer planners and engineer troops in the theater, it was the least prepared to meet those requirements.

Air Force Construction Support

Upon arrival in Saudi Arabia, U.S. Air Force elements moved into excellent existing air base facilities and were soon ready for operations. Yet these facilities could not handle the size of the air forces deployed during the crisis—especially when a second wave of deployments began in November—without additional engineering support and temporary construction.[1]

The Air Force deployed a Prime BEEF (base emergency engineer force) team with or shortly after almost every flying squadron. These teams of 24 to 200 people specialized in rapid runway repair and force bed-down. They were supplemented in the theater by one and a half RED HORSE (rapid engineer deployable, heavy operational repair squadrons, engineer) civil engineering squadrons. Each RED HORSE squadron had 400 people and could complete major construction projects.

Prime BEEF, RED HORSE, and Prime RIBS (readiness in base services) teams, the key elements of base support, accommodated 1,200 aircraft and 55,000 Air Force personnel at more than 25 locations. The 3,700 engineers and 1,450 service personnel in these units erected air-conditioned tents, dining facilities, showers, and latrines; established water and electrical systems; constructed air traffic control structures and aircraft shelters; and extended runways, ramps, and aprons. During the Gulf War, they erected more than 5,000 tents; paved more than 2 million square feet to expand aircraft parking areas; and constructed 39 munitions storage, maintenance, and other facilities.

Marine Corps Construction Support

The U.S. Marine Corps operated along the Persian Gulf coast from existing Saudi bases, but needed some construction support. The Marine Corps had an engineer battalion with each of its two divisions in the theater plus other engineers. The Navy also provided four mobile construction battalions (or Seabees) that were placed under the operational control of MARCENT, the Marine component of CENTCOM.

Navy Construction Support

The U.S. Navy basically stayed afloat and operated from established permanent bases in Bahrain. Roughly 5,000 Navy Seabees expanded airfields, set up berthing facilities, built ammunition storage bunkers, and constructed roads and defensive barriers. In all, Navy construction forces built 14 mess facilities capable of feeding 75,000 people, a 40,000-person prisoner-of-war camp, 6 million square feet of aircraft parking aprons, 4 ammunition supply centers, and 4,750 other buildings. They improved and maintained 200 miles of unpaved four-lane highways in the desert.[2]

Army Engineer Construction Support

The Army was slow to deploy its combat and combat heavy engineer units. The Army engineer force in the Persian Gulf was shaped initially by several factors, including the mission itself. In the first weeks of August, the movement of Iraqi troops into Saudi Arabia remained a real possibility. CENTCOM's primary mission was to defend Saudi Arabia and deter Iraqi troops from pushing farther southward. One way was to convince the Iraqis that the United States could oppose them with overwhelming power. Tanks and fighter aircraft gave that perception, not engineers. Thus, the CENTCOM commander's priorities were his "trigger pullers."

When military leaders adopted a defend-and-deter posture, force planners could reduce the projected engineer force from 25,000 to under 6,000 soldiers. Only later when the United States decided to launch an offensive would planners restore a substantial engineer force. Force planners later conceded that while the CENTCOM commander's decision to move the maneuver force into Saudi Arabia was appropriate at the time, in hindsight, the maneuver force should have included more engineers.[3]

Besides the defend-and-deter mode, the engineer force was limited by the number of troops that could be deployed. In August there simply was not enough strategic lift available to transport all the forces stipulated by doctrine. As the XVIII Airborne Corps began deploying, it became clear that the entire troop list could not be transported by the deadline of mid-November. Army leaders would have to set priorities.

Engineer Doctrine

Army engineer units traditionally provide construction, construction management, real estate, combat, facilities engineering, water supply, and topographic support. Engineer units are organized into battalions, groups, brigades, and commands, which support the army in the field and are part of the divisions, corps, higher headquarters, and major commands of the Army.

Combat engineers with the corps and divisions perform combat support and construction missions in the corps and divisional area (combat zone) to facilitate the movement of friendly forces and impede the

movement of enemy forces. They maintain main supply routes, bridges, and airfields; clear minefields; and breach obstacles. Combat engineers also provide horizontal construction (roads and airfields) and vertical construction (buildings and base camps).

Combat heavy engineer battalions have the skills, tools, and equipment for a broad range of construction. They provide the bulk of the construction capability in a theater and perform tasks too dangerous for contractors. They have missions in both the corps rear area and the communications zone (COMMZ), which is the total theater area behind the forward-deployed combat units.

By doctrine, each Army division has an organic combat engineer battalion to perform engineer functions at the forward edge of the battlefield. At the corps level, an engineer brigade headquarters commands several engineer groups, each with two or more engineer combat battalions. The engineer groups provide direct support to each division.

Engineer troops are provided at echelons above corps to support both corps and rear-area units. Separate companies and detachments construct pipelines, drill wells, and provide utilities. A theater engineer command directs all engineer units at echelons above corps and supports the corps and division engineer units.[4]

Most of the engineer units assigned at echelons above corps are in the reserve components. The plan is that the active Army units support the active divisions and a corps plus provide limited support at echelons above corps, while reserve units support the National Guard divisions and additional corps plus provide most of the support at echelons above corps.

In 1990, the Army's force structure included two engineer commands—the 416th in Chicago, Illinois, and the 412th in Vicksburg, Mississippi—each responsible for providing engineer support in the COMMZ. Their primary mission is command and control of all engineer units assigned to echelons above corps. The number and type of engineer units assigned depend on the size of the sustainment base, existing support facilities, and availability of host nation support.

Engineers units assigned at echelons above corps typically maintain airfields; repair roads; and construct storage structures, pipelines, hospitals, and prisoner-of-war camps.[5]

Forces Command, which was responsible for furnishing troops to support the requirements of the theater commander, drafted a revised force structure in late August that called for a ceiling of roughly 140,000 Army troops, down from a doctrinal force of 220,000. Forces Command planners based the revision on the assumption that this represented a minimum essential force that would have shortages in selected support functions. Planners kept heavy combat multipliers—field artillery, air defense, chemical, and combat engineers—in the structure because they needed a long lead time to deploy. The understanding was that at the first sign of an Iraqi offensive, the Army would have to quickly deploy combat support service units.[6]

On 3 September, Forces Command planners met to determine which specific units were required in Saudi Arabia to support four and one-third divisions. The criteria for shaping the force were to provide only minimum essential support with a limited logistics base and use maximum host nation support. On 9 September, General Yeosock approved a minimum essential force of 140,000. As a result, engineer units that by doctrine should have

deployed were cut so maneuver units could be transported. Other engineer units were simply pushed back on the time phased force deployment list, drawn from an automated data base that controlled the flow of personnel and equipment into the theater.

By late September, concerns about having enough combat troops in the theater to defend Saudi Arabia were easing. Only then did planners turn their attention to the structure of the theater army at echelons above corps. The last of the 82d Airborne Division had arrived in the theater, two brigades of the 24th Infantry Division (Mechanized) were on the ground, and the 101st Division was arriving. Iraqi forces had not invaded Saudi Arabia but were digging in along the Saudi–Kuwaiti border. The minimum essential force had effectively deterred an Iraqi invasion of Saudi Arabia, and planning shifted to maintaining a long-term force in Saudi Arabia.[7]

Thus, in the first months of Operation DESERT SHIELD, ARCENT's mission was to create a force capable of defending Saudi Arabia with a minimum essential force. A defensive force required a smaller logistics base but could not deploy away from the coast. Meanwhile, planners reduced the number of support units at echelons above corps and assigned many of their duties to the corps' support command. Yeosock recognized the need to focus on the early introduction of combat forces and to bring in echelons above corps units at the last minute if necessary. He also decided to minimize the creation of functional commands at echelons above corps.[8]

Another factor shaping the engineer force was the inability to call-up reserve units until President Bush granted that authority. [*See* Individual Mobilization Augmentees, page 61.] Lacking such authority, Army leaders quickly had to modify the existing war plan to remove the reserve units. Much of the engineer capability at echelons above corps, including the 416th Engineer Command, was located in the reserves. OPLAN 1002–90 had provided for two increments of engineer units: one active component and one reserve component. Thus, all active component units were piled into the first increment for deployment with reserve component units to follow. All active component engineer units fell into the first package commanded by the 20th Engineer Brigade with its 36th and 937th Engineer Groups plus the 30th Engineer Battalion (Topographic).

On 22 August, President Bush issued an executive order granting the Secretary of Defense the authority to call 200,000 reservists to active duty for 90 days, with a 90-day extension if needed. The next day, Secretary Cheney granted the Army the authority to call up as many as 25,000 soldiers for combat support and combat service support. There were, however, limits to how quickly active component forces could absorb reservists and a reluctance to mobilize the reservists over the long term, particularly with the 90-day limit.[9]

Also shaping the engineer force was the decision by military planners in October and November to rely on contractors to provide construction services

rather than deploy combat heavy battalions and other echelons above corps engineer units. Planners assumed that contractors could handle many of the requirements normally met by engineer troops. If contracting and host nation support would fulfill some construction requirements, then the proposed troop structure could be reduced.

Planners, however, did not immediately recognize the limitations of host nation support, including the fact that no structure existed to tap it. As noted, the United States had no status of forces agreement in place with Saudi Arabia. CENTCOM planners had cut four combat heavy engineer battalions because they believed that contracting could fill that gap. But the CENTCOM engineer, Army Colonel John W. Braden, added that these same planners did not envision how and where the Army would operate.[10]

A final factor shaping the Army engineer force was the shortage of engineer staff in the theater who could determine the requirements for engineer troops and make these requirements known to military leaders. After Third Army deployed to Saudi Arabia as ARCENT, five of its eight engineer officers stayed in Dhahran to address the immediate problem of housing the arriving troops. This left only three officers in Riyadh to help CENTCOM estimate requirements for the entire theater and plan for the troop buildup.

Although Forces Command could encourage theater commanders to anticipate potential engineer requirements, the actual requests for engineers had to be generated by the theater commander. In August, ARCENT leaders requested combat support and combat service support units but did not call for engineers, especially at echelons above corps. Officials at Forces Command became concerned and warned that the lack of requirements for engineers could delay the deployment of or reduce the engineer force structure.[11]

The shortage of engineer staff in the theater was not confined to the Army. During his hour-long commute to MacDill Air Force Base each day, Colonel Braden thought about the fact that all services had inadequate engineer representation in the theater. After receiving phone calls from General Hatch, Colonel Pylant, and the director of Air Force engineering and services, Major General Joseph A. Ahearn, Braden realized that his frustration extended to the entire engineer community.

Concerned by the lack of senior engineer staff in the theater, in mid-August, Hatch offered to send his director of military programs, Major General James W. "Bill" Ray, to the theater to provide CENTCOM with engineering expertise. Braden recommended to his superiors that Ray be added as the Deputy Chief of Staff, Engineer, creating a separate staff element to represent engineer interests. When they rejected his recommendation, Braden decided to go to Saudi Arabia.

The decision of the CENTCOM leaders was understandable because Major General Dane Starling, CENTCOM's chief logistician, was already in the theater. A small engineer staff had set up operations in Saudi Arabia's Ministry

of Defense and Aviation building in Riyadh with four officers sharing a desk and ten sharing a phone.[12]

Officials in Third Army and Forces Command were partly to blame for the shortage of Army engineers in the theater. They assigned Third Army engineer, Lieutenant Colonel Donald M. Tomasik, as the ARCENT engineer. Tomasik, though very competent, did not have the requisite training and experience nor the rank of colonel. Although Tomasik had been a battalion commander, he had never served as the senior engineer for an Army major command.

When Tomasik arrived in Saudi Arabia, he located in Dhahran where the center of the military effort seemed to be. This had two effects. General Pagonis had established his headquarters in Dhahran, and typically anyone within Pagonis' sphere of influence ended up working for him to help shelter the arriving troops. Tomasik soon found himself focusing on operational requirements rather than planning. As influential as he was, Pagonis was not the ARCENT commander, and the ARCENT command group was working in the Royal Saudi Land Forces building in Riyadh. The ARCENT command group was making decisions about the force and the operation without any input from engineer planners.

Tomasik eventually recognized his error and moved to Riyadh in November, but by then the command staff relationships were well established. Tomasik's perspective coming from Dhahran differed from that of the ARCENT staff in Riyadh, and he could not convince them of the need for engineer planners.[13]

Army engineers were confined to working through their stovepipe rather than enlisting the support of maneuver commanders and operators. Colonel Philip W. Carroll, a member of the Forces Command engineer staff, observed that the engineers did not adequately express the need for engineers, in part because they did not have the rank or position to gain access to the decision makers. There were no Army engineer generals in the theater for the first few months of Operation DESERT SHIELD. All this led to the grim picture of an Army trying to get its own engineers on board, Braden said, "cut back from the very beginning, coming late, sometimes coming without equipment."[14]

Engineer Operations during the Defend-and-Deter Phase

On 16 August, at a planning conference at Fort Bragg, the commander of the 20th Engineer Brigade, Colonel Robert B. Flowers, met with the commanders of the 937th and the 36th Engineer Groups to coordinate follow-on engineer support. Lieutenant Colonel Tomasik, who would soon be deploying to Saudi Arabia, represented ARCENT at the meeting. Colonel Carroll represented Forces Command.

Participants agreed that the commander of the 20th Engineer Brigade, part of the XVIII Airborne Corps, would act as the theater army engineer and manage the flow of engineers into the theater until Forces Command activated

the 416th Engineer Command. Forces Command and ARCENT would send units in accordance with the brigade's requirements. The 20th would be prepared to devote a group-sized task force to ARCENT control to perform missions, command engineer units at echelons above corps, and perform other theater army engineer functions until the 416th Engineer Command was activated. Tomasik left the meeting greatly encouraged. "A spirit of cooperation prevailed," he reported. "I am sure any problems associated with engineer operations can be worked out on the ground."[15]

Upon its arrival in the theater in October 1990, the 20th Engineer Brigade became the senior engineer headquarters, performing missions in both the forward and rear areas. Although the unit's primary mission was to provide combat support to the corps, it found itself focusing on theater engineer matters as well. The brigade's missions included constructing main supply routes, access roads, heliports, ammunition storage areas, fuel storage points, and water storage points; improving base camps; drilling wells; and providing crash fire rescue. It did not have enough staff to plan for future operations, and the need for an engineer command to provide engineering and construction management was clear.

The 20th Engineer Brigade deployed without a mature operations plan. Although the unit had participated in the INTERNAL LOOK 90 exercise, some confusion existed at the time of deployment because the existing plan was not fully developed and no set time phased force deployment data existed.

Flowers and his staff worked with Forces Command to try to shape the deployment list, but the list changed daily and some engineer units that Flowers needed were dropped while new units were added. As Forces Command developed the minimum essential force, the situation became even more difficult. In some instances, units already had their equipment loaded on ships before they were taken off the deployment list.[16]

Flowers later conceded that before leaving Fort Bragg he had been naive about how procedures would work in the theater. He knew that his unit not only would have the mission of supporting the XVIII Airborne Corps but also would function as the Army's senior engineer headquarters in the theater. He assumed that upon arriving in Saudi Arabia, he could draw on existing ARCENT and ARCENT SUPCOM engineer staff and that he would have a voice in policy, construction standards, and other issues. Flowers quickly found, however, that other commanders in the theater were developing small engineer elements on their staffs and that procedures were already in place. Engineer staff elements at echelons above corps were already entrenched at ARCENT headquarters in Riyadh and at ARCENT SUPCOM in Dhahran, and none were willing to work under Flowers' direction because they were busy responding to their own commanders. These elements knew that Flowers controlled all the engineer troop assets currently in the theater and wanted the 20th to come under their direction. A lot of discussion and compromise was required.

Flowers met often with the various engineer staffs, and they resolved engineer issues without an engineer command at echelons above corps. Together they established theater construction priorities, briefed them to all senior commanders, and conducted monthly conferences for all engineer commanders in the theater.

Flowers later emphasized the need to deploy an engineer command early if the Army planned to deploy more than one corps. "I firmly believe," he later reported, "we need to rethink engineer command and control at echelons above corps and establish an engineer command and control mechanism that will work prior to deployment." At that time, General Yeosock had no senior engineer under him to whom he could turn. Flowers conceded that he could not be effective as both the corps engineer and the ARCENT engineer if the ARCENT commander did not recognize him as the ARCENT engineer. Moreover, with ARCENT headquarters in Riyadh and corps headquarters more than 200 miles away in Dammam, Flowers could not physically do both jobs without assistance.[17]

Like ARCENT headquarters in Riyadh, the ARCENT SUPCOM initially lacked a viable engineer planning staff. Without an engineer headquarters at echelons above corps, General Pagonis set out to create his own engineer capability. He borrowed engineers from ARCENT. Captain Tony Gardner from the 7th Transportation Group served as Pagonis' first engineer. When Lieutenant Colonel Kenneth Cargill, an engineer from Third Army, arrived in the theater on 14 August, Pagonis recruited him to serve as the ARCENT SUPCOM engineer. Although Cargill was called the ARCENT SUPCOM engineer and not the ARCENT engineer, he believed that at times he was performing both roles. In those first weeks, the ARCENT SUPCOM was essential to meeting engineer requirements. "Early on, we did everything," Cargill explained. "We, the Army and the SUPCOM, were everything. If you wanted something done, you did not go ask anybody. Pagonis told you to do it."

While Flowers controlled the engineer units who were with the XVIII Airborne Corps, Pagonis later indicated that he controlled most of the engineers at echelons above corps until the commander of the 416th Engineer Command arrived in the theater. He argued that a support command should have a "full fledged engineer cell" with one section for engineering and housing (or facilities engineering) issues and another for combat engineering issues.[18]

Few Army engineers, then, were in the theater those first weeks in August. No engineer command had yet arrived to manage construction requirements. Yet, the requirements for contract construction and real estate support were, as Colonel Braden later described, "immediate and massive."[19]

Representatives from the U.S. Army Corps of Engineers were among the earliest engineers arriving in the theater. Under authority of the 1982 Defense Department directive 4270.5, "Military Construction Responsibilities," the

Defense Department had designated the U.S. Army Corps of Engineers as its contract construction agent throughout the Middle East and Africa, except Somalia, Kenya, and Djibouti. Through its Middle East/Africa Projects Office (MEAPO) headquartered in Winchester, Virginia, the Corps would provide in-country engineering planning, facilities design, construction contract administration, and real estate services for the theater. It leased facilities, designed and awarded construction contracts, and contracted for engineering services and supplies. MEAPO (now called the Transatlantic Programs Center) included Army officers and civilian engineers, real estate specialists, contract administrators, and construction inspectors. With Army engineer units pushed down on the deployment list, MEAPO remained ARCENT's primary engineer force in the country until its engineer units arrived.[20]

By doctrine, an engineer command provides Army engineer support in the COMMZ and command and control of all engineer units at echelons above corps, but during the first months, getting the engineer command into the theater was very difficult. Forces Command tried to deploy the 416th Engineer Command in August so it could be on the ground to receive other engineer units, but ARCENT overturned this. Forces Command put the engineer command on alert again in late August and reversed the alert in early September.

Despite requests from the CENTCOM engineer, ARCENT leaders resisted calling up the engineer command. They were reluctant to bring in another general officer, especially when the 20th Engineer Brigade was already handling engineer requirements. Assuming that it was a defensive operation only with too little air lift capacity and too many troops to support already, ARCENT declared that it did not need an engineer command in the immediate future and that the 20th Engineer Brigade would function as the theater engineer indefinitely. Yet, as the CENTCOM engineer noted, an engineer command provides special skills not found in other units. For example, it contains a contract element, a staff judge advocate, design capabilities, and all the engineer elements needed to manage a theater army.[21]

In a 9 September letter to General Burba, Major General Terrence D. Mulcahy, the commander of the 416th Engineer Command, highlighted the capabilities and purpose of his unit. Mulcahy argued that the best way to provide the needed engineer support was to deploy the entire command, but perhaps anticipating some resistance to this recommendation, he also offered an alternative of deploying only 70 people. At full strength, he argued, his command could coordinate and prioritize all the engineer requirements in the theater. Master planning, he warned, required an overview of the total theater needs. Until an organization like the 416th Engineer Command was designated to provide that overview, the efforts would be fragmented and would result in "less than a happy relationship" with the host nation.[22]

Army officials finally became convinced of the need to deploy at least part of the engineer command. A 25-person advance party deployed on 31 October and set up operations in Dhahran. The ARCENT SUPCOM regarded it as a subordinate element, and the cell initially served as part of the support command's engineer staff. Colonel Alan J. Berg, the commander of the advance party, quickly concluded that his organization would have to be enlarged to handle the existing requirements. "Operation DESERT SHIELD mission accomplishment of echelon above corps engineering," he warned General Pagonis, "will be extremely adversely impacted if this does not occur."[23]

Planners assumed that Colonel Flowers would turn over management of the engineer units to the advance party. Flowers, however, convinced General Mulcahy that this was not a good idea because the small cell would have trouble managing all logistics functions for subordinate units. The advance party became part of the ARCENT SUPCOM and was pulled into day-to-day operations, so its ability to do engineering planning was limited. At first, each commander wanted his own engineers, but as the theater matured, Flowers convinced the commanders to give his brigade their engineer missions and let it coordinate with the engineer command.[24]

Initially, the engineers focused on life sustainment operations. In early September, ARCENT reported critical shortages in essential facilities such as latrines and showers. General Pagonis reported that his staff and the 20th Engineer Brigade were being overwhelmed by the amount of facilities work required. Some requirements extended beyond simple life sustainment. The need for both horizontal and vertical construction was great as requests for ammunition supply points, main supply route maintenance, site preparation, and helipads mounted. More and more Army divisions were requesting engineering support. Engineer units used leased equipment, but Forces Command suggested that a better solution was to give engineer units and their organic equipment a higher priority in the deployment schedule.[25]

Lieutenant Colonel Tomasik's repeated pleas for additional engineers were apparently ignored. In mid-September, Tomasik complained to the Forces Command engineers who helped shape the deployment list that he needed more administrative and engineer personnel to staff a cell at ARCENT and to support the ARCENT SUPCOM. Because of their small numbers, engineers could not get into the field as often as they should. Lieutenant Colonel Cargill, too, complained to the Forces Command engineers about the shortage of engineer troops, particularly combat heavy engineers.[26]

By late October, the shortage of engineer equipment was significantly affecting operations. Leasing construction equipment helped little because of the poor quality of some rental equipment and problems with maintaining it. Contracting construction was impractical because of funding constraints. At the time, the only construction assets available in the theater were four of the Navy's mobile construction battalions and roughly 50 people from the Air

Force's RED HORSE civil engineering squadron. No Army engineer units at echelons above corps had arrived in Saudi Arabia, though four combat heavy engineer battalions were en route.[27] The only Army engineer units in Saudi Arabia were the 618th Engineer Company (Light Equipment) and the 27th Engineer Battalion (Airborne) from Fort Bragg, and the 887th Engineer Company (Light Equipment) from Fort Campbell.[28]

Soldiers of B Company, 5th Engineer Battalion, attached to the 24th Infantry Division use the M-9 armored combat earthmover. *(U.S. Army photo by SPC Henry)*

Engineer Preparation for Offensive Operations

The United States initially committed only one Army corps to defend Saudi Arabia and deter Iraqi aggression, but after the first few months, the strategy changed. In October CENTCOM developed a plan for a two-corps attack deep inside the vast Iraqi desert west of Wadi al Batin. General Colin Powell and Secretary Cheney selected the armor-heavy VII Corps from Europe as a good match for Iraq's heavily armored forces. On 8 November President Bush announced that roughly 145,000 troops from the VII Corps would reinforce American troops in Saudi Arabia. This announcement was the first public indication that the United States was considering a ground offensive to liberate Kuwait. Theater priorities shifted to receiving incoming forces and moving forces, equipment, and supplies forward. VII Corps lacked robust combat support and combat service support, so it needed augmentation in engineering, heavy maintenance, supply, and transportation. Additional reserve units would

be called up to support the VII Corps, to include the 416th Engineer Command. With the arrival of the VII Corps, the Forces Command staff warned, Colonel Flowers could not serve effectively as the theater engineer. He and his staff would be overwhelmed. Forces Command recommended deploying the entire 416th Engineer Command.

The change from defend-and-deter operations to possible offensive operations led to significant changes in the structure at echelons above corps. In the defend-and-deter mode, military leaders accepted the risks of keeping low the number of support units at echelons above corps and giving priority to deploying combat units into the theater. Now with offensive operations possible, the structure at echelons above corps had to be expanded to support two corps for 60 days of mid- to high-intensity combat. Since the United Nations had set 15 January as the deadline for Iraqi forces to withdraw from Kuwait, the Army had fewer than 90 days to expand the theater-level support structure.[29]

When the time came to deploy VII Corps, CENTCOM and ARCENT planners considered the problems they had faced in the first phase of deployment. This time they focused on deploying combat support and combat service support units early. The deployment of support personnel and equipment from the first phase coincided with the deployment of additional combat forces from Europe and the United States. ARCENT was concerned that these support units would arrive too late to construct and operate facilities that the new corps would need.[30]

When the strategy shifted to offensive operations, the engineers began to focus less on survivability and general engineering and more on mobility.[31] The engineer priorities were now to construct areas to house and support troops; build forward heliports, airfields, and ammunition supply points; and develop main supply routes. Engineer troop units became even more important.

The theater construction program accelerated in November with the last scheduled arrival of combat heavy battalions from the United States. CENTCOM warned that the increases in U.S. forces from December to mid-January would produce extraordinary demands for aircraft shelters, expansion of ammunition supply points, maintenance of main supply routes, and development of water sources.[32]

In November, ARCENT planners recommended that the area around King Khalid Military City, southwest of Hafar al Batin, serve as a logistics center for the incoming VII Corps. In December and January, these soldiers would concentrate in the desert, east and south of King Khalid Military City, and west of the XVIII Airborne Corps. This would allow the XVIII Corps to continue its defensive mission while the VII Corps deployed and formed in the desert, but it also required the VII Corps to pass through the area defended by the XVIII Airborne Corps. Meanwhile, ARCENT would establish King Khalid Military City as a major forward operating and logistics base. Yet, the road net between

Dammam, where the troops would arrive, and King Khalid Military City was inadequate. The buildup at King Khalid Military City was needed to avoid giving away General Schwarzkopf's plan for a two-corps attack. Schwarzkopf hoped to trick Hussein into believing that the United States planned to attack Iraq through Kuwait's southern border area and had no intention of entering Kuwait by swinging west and north through Iraqi territory. To deceive the enemy about the intentions of the coalition forces, CENTCOM prohibited the construction of any bases or pre-positioning of equipment and supplies west of Wadi al Batin until Iraqi leaders had been blinded by an air campaign. This meant the massive logistics preparations would have to occur while a huge maneuver force with limited wheeled vehicles was being repositioned on a limited road net. Logistics bases would have to be established quickly.

Pagonis established a forward headquarters at King Khalid Military City. This headquarters provided logistics support to combat units, while the main headquarters in Dhahran managed the warehouses, port, and transportation of materiel forward. The ARCENT SUPCOM supported the movement of the XVIII Airborne Corps to the west and established a series of new logistics bases to support VII Corps to the northeast.[33]

Slowly the engineer force structure began to look more like that prescribed in doctrine. With the introduction of a second corps, the justification for deploying the entire 416th Engineer Command was stronger. In fact, General Mulcahy noted that deploying an engineer command before a two-corps theater had evolved might have been premature. The entire 416th Engineer Command was activated on 29 November and was operating in Saudi Arabia by 12 December. Mulcahy established his headquarters in Riyadh.

General Yeosock directed Mulcahy and his staff to focus on key elements required to support the troops in a very austere theater. He also asked them to use care and sound judgment on long-range planning. The command's activities had to reflect the 179-day restriction currently governing the reserve call-up. "Do not start activities or events that cannot be completed or effectively turn[ed] over to others within the 179 day window," he directed.[34]

Lieutenant Colonel Patrick Barry, who had deployed with the 416th's advance party, recommended against locating the entire engineer command in Dhahran. "My continued perception of the engineer office here remains one of polite tolerance," he reported. Barry did not feel that Lieutenant Colonel Cargill was particularly "forthcoming" or that SUPCOM engineers and the 416th were all "headed the same direction." Finally, he observed, "the train is moving so fast that commanders here feel you have to plan to play with what you have."[35]

Early on, maneuver commanders managed to get the engineer brigades assigned to the corps. Maneuver commanders wanted their engineers forward, so few engineers were left to support operations at echelons above corps. Instead of putting the 20th and 7th Engineer Brigades under the 416th

Engineer Command, the corps moved the engineers forward of the COMMZ, suddenly leaving the 416th with few engineers to control. But the Army needed some engineers in the rear area, so Colonel Flowers transferred the 62d Engineer Battalion (Combat Heavy) to the 416th Engineer Command to perform construction in the King Khalid Military City area. The engineer command, capable of controlling multiple brigades, would only control one, the 411th.[36]

By December, when the main body of the 416th Engineer Command arrived, most of the theater structure for construction management had been developed and the command first had to establish itself as the theater wartime construction manager, the theater engineer. The deployment of the entire engineer command raised the question of its theaterwide responsibility. If the 416th acted as the theater engineer, it would assume a joint role and place requirements on its own higher headquarters.[37]

Because of the limited engineer equipment in the theater and the long shipping distance, the two forward combat corps were given control of available combat engineers. Originally the plan called for a brigade headquarters, two groups, five combat heavy battalions, and numerous companies to support missions at echelons above corps. By mid-December, however, Mulcahy and other engineer leaders in the theater saw the necessity of placing additional engineers forward with the two corps, so the force structure changed. Only two combat heavy battalions were designated to support operations at echelons above corps. Three combat heavy engineer battalions and two engineer group headquarters were reassigned from the 416th Engineer Command to the two corps brigades.

Engineer Structure

	EAC	VII	XVIII
Brigade Headquarters	1	1	1
Group Headquarters	0	3	3
Combat Heavy Battalion	2	3	4
Corps Combat (Mechanized)	0	5	0
Corps Combat (Wheeled)	0	2	5
Combat Support Equipment Company	2	2	1
Construction Support Company	3	0	0
Pipeline Construction Company	3	0	0
Medium Girder Bridge Company	0	1	1

The 416th Engineer Command, with one brigade (411th), a topographic battalion (30th), two combat heavy engineer battalions (43d and 864th), and various engineer companies and detachments, began theater support operations. With these limited resources, the engineer command was responsible for engineer tasks in the COMMZ, which included a triangular area stretching from Dhahran to King Khalid Military City as the northern border, King Khalid Military City to Riyadh as the western border, and Riyadh to Dhahran as the southeastern border.

Engineer command liaison officers coordinated the review of project proposals with ARCENT and the support command, helped validate and approve projects, and facilitated the execution of the approved projects. The command also helped the U.S. Army Corps of Engineers with design, real estate inspections, construction inspections, and programming.[38]

The 411th Engineer Brigade, a reserve unit headquartered at Floyd Bennett Field outside Brooklyn, New York, was mobilized the first week in December, and by 20 December, Brigadier General Richard E. Storat, the brigade commander, had established a headquarters element in Saudi Arabia. The main body arrived in Dhahran on 27 December. The brigade had missions in both eastern and western provinces, with the centers of activity around the logistics bases. Storat organized two task forces: Task Force 864 and Task Force 43.

Task Force 864, with 1,200 soldiers, was led by the 864th Engineer Battalion, an active component combat heavy unit from Fort Lewis, Washington, and included the 515th and 808th Pipeline Companies, the 229th Combat Support Equipment Company from Wisconsin, and the 269th Construction Support Company. Headquartered at Logbase Bastogne in northeast Saudi Arabia, Task Force 864 was responsible for the eastern half of the brigade's area of operations. It maintained 200 miles of critical main supply routes that supported the forward movement of combat forces and installed nearly 290 miles of petroleum pipeline and 28 pumping stations. It constructed two prisoner-of-war camps, an 8,000-foot combat airstrip, and protective fortifications for Patriot missile batteries.

Task Force 43 was led by the 43d Engineer Battalion, an active component combat heavy unit based at Fort Benning, Georgia, with an asphalt platoon from the 13th Construction Support Company, the 155th and 259th Construction Support Companies, the 181st Combat Support Equipment Company from Massachusetts, and the 387th Pipeline Company from New Mexico. Headquartered at Logbase Bravo, south of King Khalid Military City, Task Force 43 was responsible for the western section of the brigade's area of operations. It constructed critical forward heliports and landing ramps to support allied aircraft. Elements of the task force constructed several all-weather supply routes, constructed or upgraded roughly 248 miles of roads, and built two prisoner-of-war camps.[39]

Thus, each battalion commander led a task force of 1,250 soldiers rather than the 550 to 700 who were in each battalion. To command the two task forces effectively, General Storat divided his 135-person staff between King Khalid Military City and Dhahran and moved a cell of 25 to 40 people forward to King Khalid Military City. The brigade managed most maintenance and logistics activities and administrative and special staff functions from its Dhahran headquarters. Storat divided his time between King Khalid Military City and Dhahran. At one point, he shifted the boundary between the two task forces some 74 miles from Logbase Alpha up to Hafar al Batin to expand Task Force 864's road construction responsibilities and more evenly distribute the workload.

The 411th Engineer Brigade was in general support of the ARCENT SUPCOM in Dhahran and received taskings and theater priorities directly from that organization. The support command element at Logbase Bravo, however, set the priorities for Saudi Arabia's western province. The brigade staff met daily with the support command engineers at each location to review priorities. There were weekly construction review meetings.[40]

Engineer doctrine did not justify inserting the brigade headquarters, Storat conceded, but if the 416th Engineer Command had been assigned theaterwide construction management responsibilities, deployment of the brigade to concentrate on command and control matters would have been doctrinally appropriate. The 416th, however, did not receive theaterwide construction management responsibilities, and the units originally envisioned for echelons above corps were reallocated to support the corps. These factors reduced the need for both an engineer command and an engineer brigade headquarters.[41]

The engineer command was tasked to develop a construction management process for tracking and accomplishing theaterwide missions. In response, it established theaterwide procedures to prepare and submit DD Form 1391, "Military Construction Project Data." The 416th processed 72 of these forms with an estimated construction cost of $278 million, and constructed 41 logistics storage and maintenance buildings between 17 January and 10 March 1991.

By the war's end, the engineer command and its units had built, upgraded, and maintained 2,000 miles of roads; installed approximately 290 miles of pipeline to move bulk petroleum; developed seven major logistics support bases; provided large-scale electrical power to critical facilities [*see* Powering the Theater, page 187]; and constructed four camps, which together could house as many as 100,000 prisoners of war.[42]

Engineer Operations During Operation DESERT STORM

On 12 January, Congress passed a resolution authorizing the use of military force against Iraq. The United Nations' 15 January deadline passed without any sign of an Iraqi withdrawal. As a result, before dawn on 17 January the United

States launched a major air offensive against Iraq, called Operation DESERT STORM. At the time, 93 percent of the XVIII Airborne Corps' engineer force and 54 percent of the VII Corps' engineer force were in place. By contrast, only 18 percent of the echelons above corps engineer force had arrived in the theater. ARCENT remained gravely concerned about the deployment of combat engineers. Further delays in transporting these units (particularly the 844th 527th and 365th combat heavy battalions), it warned, would hurt its ability to support future offensive operations and develop the sustainment base.[43]

The engineer priorities in late January were building and repairing roads, moving troops forward, and developing logistics bases in the north. Preparation for a possible ground offensive required the construction of 1,000 miles of main supply routes and Logbases Echo (to support VII Corps) and Charlie (to support the XVIII Airborne Corps).

M1A1 tank in Saudi Arabia.

Other types of construction were critical as well. After the rains began in January, soldiers found themselves living in mud holes. Wooden stakes for tents did not hold in the sand. Engineers had to put down large quantities of gravel and marl (a clay-type soil) to make conditions livable.[44]

Coalition partners launched the ground offensive on 24 February. During the ground war, engineers at echelon above corps continued their efforts in support of troop operations, while combat engineers who were far forward

Soldiers of the 72d Engineer Company, 24th Infantry Division, test a mine clearing rake attached to an M-728 combat engineer vehicle. *(U.S. Amy photo by SPC Henry)*

with the corps focused on breaching minefields and other obstacles, detecting and clearing mines, and constructing prisoner-of-war camps.

Observations

Ultimately, 141 Army engineer units deployed to the Gulf including an engineer command, 3 engineer brigades, 6 engineer groups, 32 engineer battalions, and 99 separate companies and teams. There were 19,453 engineers from the active component, 2,275 from the Army National Guard, and 1,953 from the Army Reserve, for a total of 23,681 engineers.[45]

This engineer force, however, was slow to evolve. Because of the late arrival of engineer units and the lack of engineer planners, the Army engineer force did not reach the appropriate strength until late in Operation DESERT SHIELD. The shortage of engineers led to a greater reliance on contractors; so much so that the CENTCOM engineer expressed concern that U.S. forces risked becoming overly dependent on contractors.

Wherever a large force deployed, General Mulcahy warned, engineer requirements would inevitably exceed capabilities. **"The Gulf War," he wrote,** "showed that the effective organization and management of engineer resources in the COMMZ is essential to the successful deployment of combat forces."

The engineer community at echelons above corps was treated, in the words of one engineer, as "an ugly stepchild."[46]

Along the same lines, General Storat complained that because engineers were not deeply involved in logistics or strategic planning, "virtually every aspect of engineer operations suffered." The 411th Engineer Brigade was often scrambling to react to a situation or requirement. Storat pointed out that early engineer involvement would have started the flow of much needed Class IV (construction material), and could better plan strategic construction.[47]

With the corps' engineer brigades placed forward and the resulting shortage of engineers at echelons above corps, the U.S. Army Corps of Engineers became crucial. MEAPO(Southwest Asia) personnel, though not formally in the chain of command of these engineer units, were the only ones who could accomplish some of the missions normally performed by combat heavy engineer units, such as providing large-scale technical assistance.

CHAPTER 2

The Corps of Engineers Responds

The U. S. Army Corps of Engineers has maintained a presence in Saudi Arabia since the 1950s and has been responsible for constructing facilities and infrastructure that were critical to the successful deployment and support of U.S. forces during Operation DESERT SHIELD/DESERT STORM. The Corps' longstanding relationship with the Saudis enabled Corps personnel to contract quickly for services and construction and lease facilities to accommodate U.S. forces. The challenges of deploying and sustaining Corps personnel overseas were great, but the support that they provided to U.S. forces was invaluable.

Corps' Presence in Saudi Arabia

The Corps first became involved in Saudi Arabia in 1951 when it began rebuilding an airfield at Dhahran, using U.S. Air Force funds. After its completion in 19.56, the airfield became an important stopover for U.S. Air Force and Navy aircraft. The Corps finished constructing the Dhahran civil air terminal at the Dhahran airfield in 1961. In May 1965, the U.S. ambassador to

In 1961 the Corps completed the U.S.-financed Dhahran civil air terminal.

Saudi Arabia and the Saudi minister of foreign affairs signed the Engineer Assistance Agreement in which the United States agreed to provide advice and assistance for construction of certain military facilities for the Saudi Ministry of Defense and Aviation.

The Corps worked on a fully reimbursable basis, with the Saudi government paying for all design and construction. Under the agreement, the Corps constructed three military cantonments: King Faisal Military Cantonment near the Yemen border, King Abdulaziz Military Cantonment at Tabuk south of the Jordanian border, and King Khalid Military City in the north. King Khalid Military City, finished in 1988, had facilities to support a projected population of more than 50,000, an airfield, a hospital, and an engineer center and school. Other work under the agreement included a headquarters complex for the Royal Saudi Air Force, an airborne and physical training school, King Abdulaziz Military Academy, the port at Ras al Mishab, and a headquarters complex and officers club for the Ministry of Defense and Aviation.

Beginning in the early 1970s, the Corps managed the design and construction of an expansion of Saudi naval facilities while the U.S. Navy acted as overall program manager. In the Royal Saudi Air Force program, the Corps provided contract and construction management support to the U.S. Air Force Logistics Command for two major efforts to upgrade aircraft support facilities.[1]

Through its Middle East Division, created in 1976 and headquartered in Riyadh, the Corps managed design and construction programs in Saudi Arabia that by the late 1980s totaled an estimated $14 billion. The Corps built many facilities that coalition forces would use during the Gulf War to include Shaikh Isa air base in Bahrain; Thumrait, Masirah Island, Seeb, and Khasab air bases in Oman; King Khalid Military City; King Faisal Military Cantonment at Khamis Mushayt and King Abdulaziz Military Cantonment; Jubail and Jeddah naval bases; and Taif, Tabuk, Khamis Mushayt, and Dhahran air bases.

As the program neared completion in the late 1980s, the Middle East Division was redesignated as the Middle East/Africa Projects Office (MEAPO), and its headquarters moved to Winchester, Virginia. At the time of the Iraqi invasion, MEAPO served as the Corps' design and contract construction agent for the Middle East and Africa. It provided engineering, design, procurement, and construction services for foreign defense forces and for other U.S. government agencies operating in the region. At the time of the Iraqi invasion, MEAPO had field offices in Egypt, Oman, Bahrain, Morocco, Saudi Arabia, and Kuwait.[2]

The decades-long reimbursable program in Saudi Arabia was designed not only to provide the host nation with military cantonments and naval facilities but also to prepare the Saudis to maintain them and to execute future

U.S. forces extensively used King Khalid Military City, a $6 billion facility near the Iraqi border.

construction programs themselves. Through this program, the Saudi Arabian and U.S. governments developed a bond of mutual trust that became important during Operation **DESERT SHIELD/DESERT STORM.** Some argue that the Saudis' experience with the Corps helped convince government officials that they could ask the United States to come into their country and that the United States would respect their customs, do professional work, and leave when the work was completed. The "nation assistance" benefits from the programs were critical to the success of the Gulf War.[3]

Corps' Presence in Kuwait

The Corps' involvement in Kuwait dated back to World War II when three Corps employees went to Kuwait to supervise the assembly of prefabricated barges used to transport war materials up the Tigris and Euphrates rivers. The Corps' next involvement came in the late 1970s and early 1980s when it sent personnel to locate building sites for the American International School. In the early 1980s, Middle East Division personnel helped build shelters for a Hawk missile system that the Kuwait Air Force had purchased from the United States.

The division established a small resident office in Kuwait headed by Ceasar Santucci. As the Hawk missile system work progressed, the Kuwait Air Force asked the Corps to evaluate the design it had proposed in a contract to expand its computer system. The Corps modified the contract and opened it to competitive bidding, saving Kuwait an estimated $500,000. Over the next six

years, the resident office helped Kuwait design and develop a flight training center and other facilities.

When Iraqi troops invaded on 2 August 1990, Santucci was in the United States on vacation, but four members of his staff were trapped in Kuwait City: Chito Gomez, an electrical engineer from the Philippines; Mohammed Khan, a civil engineer from Pakistan; Bobby Higgins, a civil construction representative from the United States; and Thomas Omar from India. Vernon Nored, an employee from the Corps' Europe Division was in Kuwait on temporary assignment to provide electrical engineering assistance. He had been scheduled to leave Kuwait in late July, but had agreed to stay on until Santucci returned from vacation. Ron Webster from the Corps' Construction Engineering Research Laboratory was in Kuwait on leave at the time. These Corps employees were among the more than 200 Americans trapped in Kuwait City by the Iraqis. Each has his own harrowing account of the invasion and its aftermath.

Ron Webster was awakened by loud blasts at 5:00 A.M. on 2 August and watched anxiously from his hotel room as Iraqi soldiers marched through the streets below. Webster became even more alarmed later that day when an unruly band of Iraqi soldiers looted and took over his hotel. On 18 August, the Iraqis moved Webster and the other Americans at his hotel to the American Embassy, so-called "Camp Kuwait." The captives scraped meals together out of the embassy's emergency food supply. Temperatures at the crowded embassy reached more than 120 degrees. When the air conditioning system gave out, the captives congregated outside around the pool.

Webster, a professional engineer, helped keep the facilities running, especially the water supply. When the Iraqis shut off the embassy's water, the captives dug a well. Webster installed a well casing that he crafted from 55-gallon drums and set the pumps. The residents used the brackish well water for bathing and laundry. On 9 December, the Iraqi Ministry of Foreign Affairs picked up the few Americans remaining at the embassy, including Webster, and flew them to Baghdad, Iraq. From there they flew on to Frankfurt, Germany, and to freedom.

Bobby Higgins, who had been in Kuwait since 1987 monitoring the construction of training facilities for the Kuwait Air Force, was also jolted awake by the sound of gunfire on 2 August. Realizing the danger, he left his home only once during the next three days. Eventually Higgins and his wife Odessa moved into the embassy compound. Iraqi officials indicated that after 24 August they would no longer recognize the embassies in Kuwait. On 23 August, the U.S. ambassador decided to move the Americans to Baghdad in a caravan.

Higgins and his wife planned to join the caravan. The American hostages who set out before dawn on 23 August tried to drive fast and keep their vehicles close together to prevent the Iraqi escorts from cutting in and separating them.

When an Iraqi vehicle abruptly pulled into the five-car caravan, Higgins crashed into the car in front. His wife was rushed to a Kuwaiti hospital with a broken hip while the rest of the caravan continued on to Baghdad. When the first hospital could not treat her, she and her husband were taken to a second hospital filled with Iraqi soldiers carrying machine guns.

As Bobby Higgins left the embassy on 24 August to visit his wife in the hospital, the ambassador warned him to return before noon or he would be on his own. With his injured wife confined to the hospital, he knew he would not return. Later, three Kuwaiti ambulance attendants told Higgins they were moving his wife and asked him to turn over their identification and wallets. The attendants carefully bandaged his head and arm. As the ambulance raced through the streets, he realized that he and his wife could be killed if caught. The drivers took them to yet a third hospital. The hospital director indicated that Higgins could remain as long as he wanted "under observation for a concussion."

Days later, the Canadian Embassy said that the Iraqis had promised to take them to Baghdad on 1 September and release them. Although Higgins and his wife were skeptical when soldiers arrived on 1 September to transport them to Baghdad, they went along. They flew from Baghdad to Paris on the same flight as the Rev. Jesse Jackson who had been trying to secure the release of some of the American hostages. On 2 September, they arrived safely in Washington.

Vernon Nored, a former Marine, remained inside his hotel until 15 August, observing Iraqi troop movements and marking map coordinates to locate bunkers and stored ammunition for the U.S. Embassy. When Nored finally ventured out, Iraqi soldiers stopped him at a checkpoint, commandeered his car, and made him chauffeur them around. Like Higgins, Nored moved to the American Embassy and joined the caravan of Americans that headed for Baghdad on 23 August. Rather than releasing the hostages when they arrived in Baghdad as promised, Saddam Hussein detained them in buildings at or near the U.S. Embassy. Days were filled with uncertainty and boredom.

Nored worked as chief of maintenance and repair, servicing alarms, air conditioners, refrigerators, washers, and other items in the nine buildings. During the long months of captivity, Nored repeatedly risked his life leaving the embassy compound to search for food and water. On 9 December Nored and the other hostages were taken to Baghdad's airport where they joined the Freedom Flight carrying Webster and the remaining hostages from Kuwait to Frankfurt and on to the United States[4]

Mohammed Khan had taken his first assignment with the Corps in 1963 as a State Department employee and had worked in Saudi Arabia for 13 years and in Kuwait for 5 years. Twenty-eight days after the invasion, Khan and his wife Saeeda left Kuwait, traveling through Baghdad to Amman, Jordan, and on to their home in Pakistan. He would return to work in Kuwait in May 1991 as chief of the contract administration branch.

Chito Gomez was assigned to the Kuwait resident office in 1987 to work on the flight training center. He had just returned from vacation in the Philippines when the invasion occurred. Gomez was stunned when he received an early morning call on 2 August informing him that the Iraqis had invaded. He had always considered Kuwait "one of the safest countries in the world." Gomez quickly contacted his supervisor, Bobby Higgins, who advised him not to leave his apartment. The Philippine Embassy also directed him to stay put. Gomez, who lived near the Kuwait International Airport, saw his first Iraqi tank around 10:00 A.M. He quickly bought all the canned goods and rice that he could for his neighbors and friends.

He burned his Kuwait Air Force identification card in a skillet on the kitchen stove. Gomez had heard that the Iraqis were arresting and questioning Filipinos who worked for the Kuwait Ministry of Defense. He kept his American Embassy identification card and his passport but arranged to get a travel document so if stopped by the Iraqis, he could avoid showing them his passport. Gomez also knew that Iraqi soldiers were stealing cars, so he kept his rental car filled with gas near his apartment building where he could watch it and be ready to escape across the border if given the opportunity.

The situation in Kuwait City became increasingly menacing during the second week of the occupation. Previously Gomez had visited with Nored whose hotel was nearby, but Nored's visits became too dangerous. Nored, an English-speaking African–American, drew too much attention in Gomez's Filipino neighborhood, and Iraqi soldiers had begun arresting Westerners and Europeans.

Hussein announced first that he would allow Kuwait residents to cross the southern border into Saudi Arabia, as long as their vehicles were registered in the driver's name. Since Gomez's car was rented and he had nothing to prove ownership, he worried that Iraqi soldiers would detain him at the checkpoints. Moreover, the Philippine Embassy warned its citizens not to flee because Iraqi soldiers at the checkpoints were reportedly dragging Filipinos from their cars and assaulting them.

Hussein closed the Saudi Arabian border and announced that Kuwait's residents could flee to Jordan, but only after going through Baghdad. On 23 August, anticipating Hussein's closing of the foreign embassies in Kuwait, the Philippine Embassy directed its citizens to leave the country. Gomez and his neighbors now decided to head for Jordan. Pooling their food and fuel, they formed a convoy of six cars.

Iraqi guards detained Gomez at the checkpoints because he did not have the required car registration. When the guards demanded documentation, Gomez pretended he did not understand what they wanted. Meanwhile, women in the convoy tried to distract the guards with water and food. The guards let Gomez pass and after a long, frightening drive, the group arrived safely in Baghdad. Gomez hired a bus to take his group on the next leg of their

journey. They entered Jordan early in the morning on 27 August. American Embassy officials put Gomez on a flight to the Philippines. Gomez's commitment to his work was so great that he returned Saudi Arabia in mid-November to work in the Corps' Dhahran office as an electrical engineer. He returned to his apartment in Kuwait City in mid-March only to find that the Iraqis had stolen all his belongings, except a few family pictures.[5]

The Corps Deploys to Southwest Asia

The Department of Defense had designated the U.S. Army Corps of Engineers as its contract construction agent throughout the Middle East and Africa, except Somalia, Kenya, and Djibouti. MEAPO was the Corps' executive agent for this mission in Saudi Arabia. In 1986 the Corps had signed a memorandum of agreement with Third Army, which established the Corps' role in providing engineer assistance to Third Army. In the memorandum, Third Army agreed to fund all the Corps' work on its behalf during peacetime and contingency operations. [*See* Funding Corps Activities, page 63.] The Corps agreed to provide an organization in the theater under the operational control of the 416th Engineer Command.

On 2 August, when the MEAPO commander, Colonel William Miller, heard that Iraq had invaded Kuwait, he knew immediately that his staff would be deeply involved. The next evening, they began planning an organization that could support the operation. Miller's predecessor, Colonel Fred Butler, had been keenly interested in contingency planning, and MEAPO drew on those earlier plans for the Middle East. As Miller and his staff developed their plans that first week, they addressed such issues as how to recruit and prepare volunteers and what kind of equipment would be necessary.[6]

At the time of the invasion, MEAPO's new deputy commander, Lieutenant Colonel Charles "Stoney" Cox was vacationing with his family at Myrtle Beach, South Carolina. Cox had served as Jacksonville District's deputy engineer for Puerto Rico and the Virgin Islands until his transfer to MEAPO on 1 July 1990. On 2 August he looked up from his golf game to watch A–10 attack planes from the Myrtle Beach air station fly training missions overhead. At the time, he little suspected that a month later he would watch the same A–10s fly out of King Fahd International Airport in Saudi Arabia.

Cox returned to work the following Monday to find that MEAPO's emergency operations center was open and planning was well underway. Miller decided to send Ben Wood, a project management chief, to deploy with Third Army and also to prepare Cox to deploy in case Third Army officials preferred a military officer. MEAPO's logistics staff provided them with all the necessary equipment, and its engineering division put together a deployment package including generic construction designs; mapping data on Saudi Arabia and Bahrain; engineer data files; and lists of construction contractors, construction material suppliers, architect engineers, geotechnical firms, surveyors, and well

drillers in Saudi Arabia and Bahrain. The engineering division also assembled all available data on well drilling (including existing water wells in Saudi Arabia) and other issues.

In the first week, MEAPO sent Cliff Longfellow to CENTCOM headquarters to represent the Corps. Longfellow reported daily to the South Atlantic Division headquarters in Atlanta and to the Corps headquarters in Washington, D.C.

In drafting an organization, Lieutenant Colonel Cox drew heavily on his recent experience after Hurricane Hugo in Puerto Rico and the Virgin Islands. He also drew on the expertise of some of his senior staff who had experience in the Middle East. Together they combined their disaster response and mobilization planning experiences. MEAPO planners knew they would need real estate, contracting, and construction capability. Yet, they had little good information about how many troops would deploy, the estimated length of their deployment, or what their mission would be. They also knew from their experience with overseas operations that they needed a flexible organization to communicate and coordinate between MEAPO headquarters and its forward element. They crafted an organization of 36 positions to serve in Saudi Arabia as MEAPO(Forward).[7]

Meanwhile, Colonel Miller conferred regularly with his immediate superior, Major General John Sobke, commander of the Corps' South Atlantic Division. Sobke directed Miller to draft plans for integrating his staff into the military air flow.

During the first week after the invasion, Corps members and Third Army representatives had frequently discussed ways to fund the Corps' activities in support of Operation DESERT SHIELD. At first, Third Army officials indicated that they would not support the Corps. They saw no urgent need for a Corps' presence in the theater and did not want the expense of paying salaries to Corps civilians. As the discussions bogged down, Colonel Miller called Third Army's chief of staff, Colonel John Jorgenson, a former Army War College-classmate and close friend, and pleaded for financial support. Jorgenson reluctantly transferred $100,000 to MEAPO to cover initial operating costs. [*See* Funding Corps Activities, page 63.]

At that point, General Hatch; Major General Peter Offringa, the assistant chief of engineers; and Colonel Pylant convinced Third Army that the Corps should at least deploy a small advance party. Miller wanted a few people in the theater to demonstrate how the Corps could provide services.

Miller, Cox, and Wood decided that Wood should deploy first while Cox stayed to organize the flow of other people. Wood was selected because of his overall project management experience and familiarity with the MEAPO staff. In addition, he had 16 years of experience in the Middle East and detailed knowledge of the facilities the Corps had constructed in Saudi Arabia in the 1980s. Wood later conceded, however, that the Saudis were not using and

maintaining some of the facilities as originally intended, so familiarity with certain Saudi officials proved more beneficial than knowing the facilities. Wood traveled to Fort McPherson on 10 August to deploy.[8]

Wood and Lieutenant Colonel Kenneth Cargill from Third Army waited two days for a Military Airlift Command flight. After being repeatedly bumped from military flights, the frustrated travelers returned to MEAPO headquarters. At the direction of General Hatch and at the expense of the Corps, MEAPO put the two men on a commercial flight from Dulles International Airport to Riyadh on 13 August. Arriving in Riyadh the next day, Cargill and Wood were met by personnel from the Corps' Ordnance Program Division who steered them through customs and provided them with accommodations for the night and a rental car. [*See* the Ordnance Program Division, page 57.]

After visiting ARCENT headquarters the next morning, Cargill and Wood left for Dhahran. When they arrived, they found their way to the headquarters for ARCENT's support command in time for General Pagonis' evening "sit-down" briefing. They found Pagonis and his small staff operating in a small auditorium in the U.S. Military Training Mission's recreation center. Cargill and Wood received a chilly reception from Pagonis, who wanted to know why they were there. Pagonis was irritated by a recent letter from Forces Command indicating that he would be "irresponsible" if he did not use MEAPO assets. Pagonis directed Wood and Cargill to return early the next morning to explain how they could assist him. Soon after that meeting, Wood set up operations at a table in the corner of the auditorium.[9]

On 11 August Forces Command had directed the Corps to deploy a five-person team to provide contracting capability for construction, real estate, and other engineering support that ARCENT required in Saudi Arabia. The team was to report to Pagonis by 16 August. Soon after, the ARCENT engineer, Lieutenant Colonel Tomasik, told Miller not to deploy any more Corps personnel. He explained that Pagonis saw no need for them at the time and refused to fund their deployment. At that time Pagonis did not fully understand what MEAPO was or what it could contribute. Initially unaware of the services the Corps could provide, other military officials also resisted deploying Corps personnel. ARCENT was concerned about the potential expense of using Corps civilians.[10]

Cox arrived in Riyadh on 15 August with an advance team—contract specialists Julius "Bo" Bounds from MEAPO and Ed Slana from the Mobile District, real estate specialist John R. "Rick" Thomas from the Savannah District, and construction representative Ceasar Santucci. Contracting, real estate, and construction were the areas where the Corps expected work. These people became the nucleus of MEAPO(Forward) or MEAPO(Southwest Asia) as it came to be called.

Ordnance Program Division personnel met the team at the airport and provided accommodations, rental cars, facsimile machines, and other materials

needed to set up operations in Dhahran. They also provided start-up funds for MEAPO(SWA) and hired local workers as support staff. Meanwhile, Cox met with CENTCOM officials to discuss the current situation.[11]

Cox and his team drove to Dhahran on 17 August. Arriving in Dhahran, Cox went immediately to the support command headquarters to report to General Pagonis. Pagonis curtly asked Cox why he was there. What could the six Corps people do for him, he queried. Cox indicated that he wanted to bring in the rest of his advance party, but the general showed little support. Instead, he quickly tasked Cox to lease facilities for arriving troops. Pagonis and his staff knew they had to get units out of the sand and sun so they could operate effectively.

At the time, the only engineers in the theater were from the 307th Engineer Battalion (Airborne), 82d Airborne Division, from Fort Bragg. These engineers had no equipment with them and no real capability to execute the growing engineer construction workload. Units arrived daily with no place to stay. Cox immediately recognized a large real estate requirement. So did Pagonis' engineer, Lieutenant Colonel Cargill. "As soon as we got into the real estate business," Cargill explained, "the flood gates opened." Cargill sat at the "engineer desk," a picnic table in the middle of the auditorium, and took requests from units all day long.[12]

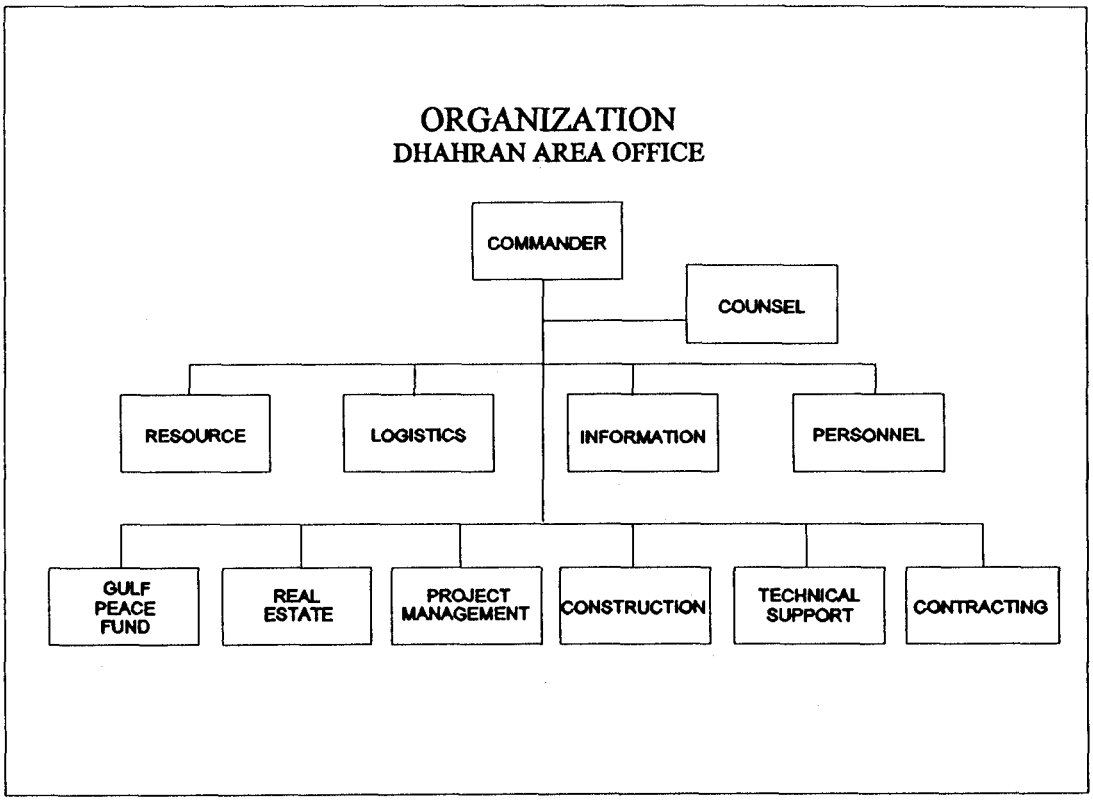
Cox returned from Pagonis' briefing the next morning with an even longer list of taskings, including the construction of sunshades. Troops from the 101st Airborne Division arrived daily with their Black Hawk helicopters that had to be reassembled. If left unprotected from the searing desert sun, the helicopters became too hot for mechanics to touch.

Other early requirements were field latrines. Units pushing into the desert needed adequate sanitation facilities. Pagonis directed Cox to work with an engineer from the 7th Transportation Group, Captain Tony Gardner, who had been detailed as Pagonis' engineer. Pagonis instructed Gardner to build a burn-out latrine similar to those used in Vietnam, but the young captain did not understand. Pagonis finally asked Gardner to recall the latrines used in "Platoon," a Hollywood movie about Vietnam. Gardner put together the first engineer contract, a supply contract for latrines, showers, and washstands. On 20 August, MEAPO(SWA) awarded contracts for latrines and sunshades.[13]

Cox and his team successfully demonstrated to Pagonis they could contract for the facilities that he needed. Forty-eight hours after giving the Corps these missions, Pagonis authorized Cox to bring in the rest of the advance party, up to 30 people. The only question that remained was who would pay for deploying and maintaining the Corps personnel. Pagonis had several phone conversations with General Hatch who agreed to provide the necessary funds until the matter was resolved. Eleven more people deployed on 22 August. The first six had operated out of the U.S. Military Training Mission's headquarters at King Abdulaziz air base for the first week until Pagonis took over that

building for his headquarters. Cox then moved his growing staff into the Al–Bustan compound in Dhahran.[14]

After assessing the situation firsthand, Cox modified the organization that he had helped build back in Winchester to include more real estate specialists. The Corps' organization in Dhahran took the shape of a mini-district in which Cox functioned as the district engineer. Bo Bounds managed the contracting operation and acted as the personnel officer. Wood headed the engineering technical branch and served as Cox's deputy. Santucci served as the chief of construction.



The small staff worked long hours, under intense pressure. They had little information about existing engineer assets or anticipated troop arrivals. Troops poured in so quickly that the staff had difficulty meeting the immediate requirements and no opportunity to plan for future needs. "We were so busy putting out fires in Dhahran," Cox explained, "and no one was looking ahead."[15]

The first week and a half was confusing for the MEAPO(SWA) personnel. They received verbal taskings at Pagonis' morning briefings. Wood then defined the taskings from a technical viewpoint, and Bounds and Santucci shaped the requirements into a contract package that they could put out for bid. These

verbal taskings could change between the evening briefing and the next morning briefing.[16]

In late August, as the number of Corps people in the theater approached 30, Hatch and Sobke decided they needed a senior colonel at CENTCOM headquarters in Riyadh. Cox had little time to travel between Dhahran and Riyadh. Sobke and Hatch instructed Miller to deploy to Riyadh and support CENTCOM. Specifically, Hatch directed Miller to sort out fragmented construction requirements, serve as the Corps' liaison with the senior staff at CENTCOM and ARCENT, and be assertive as the Defense Department's contract construction agent. Hatch also told Miller to make sure the Corps provided real estate support to all services, not just the Army. Miller would not run the Corps' operation in the theater but would act as its senior representative. He would set up a small organization in Riyadh and leave Cox to manage the day-to-day operations from Dhahran.[17]

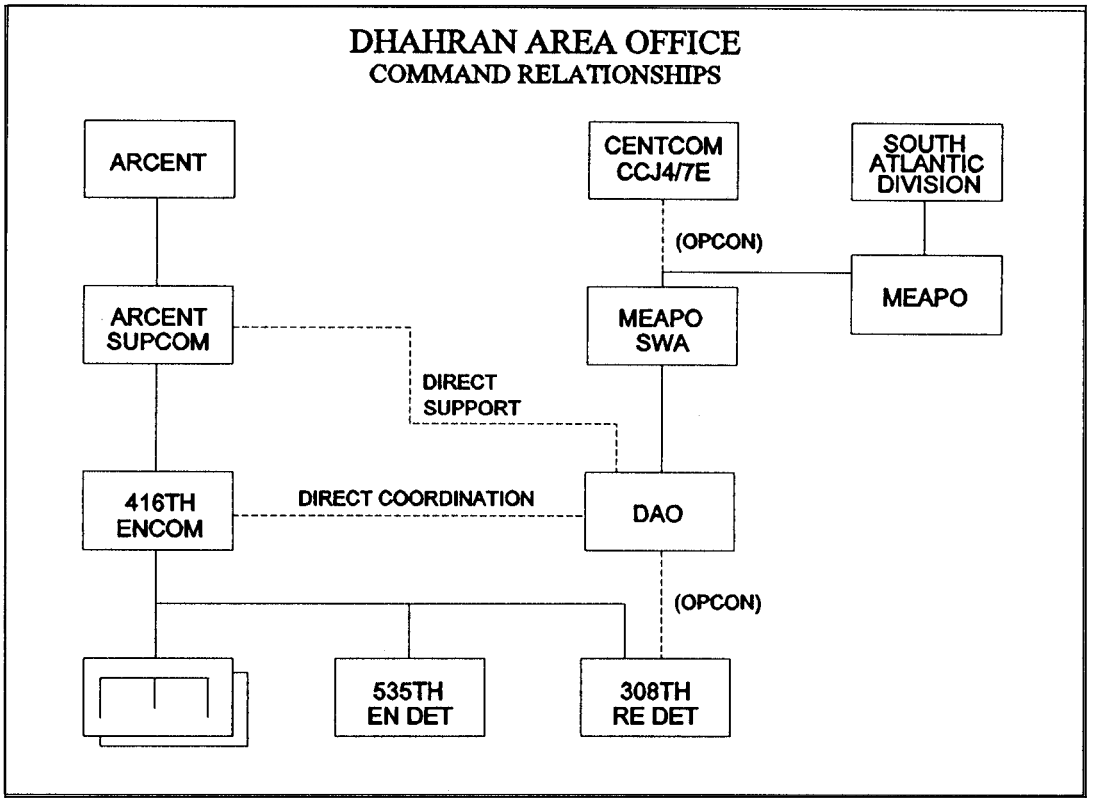
Colonel Eilliam Miller, commander of MEAPO(SWA), set up operations at CENTCOM headquarters in Riyadh.

Miller arrived in Riyadh the evening of 1 September to find chaos at CENTCOM headquarters. Staff officers were staking out claims for office space and equipment. Both the ARCENT and CENTCOM staffs were preoccupied with finding desks, office space, and telephones, leaving little time for engineer planning. Miller convinced the CENTCOM engineer, Colonel Braden, who had just arrived, that he needed to be nearby and adeptly located himself next to Braden in the Gulf Cooperative Council building.

The day after his arrival, Miller visited with Brigadier General Abdulaziz Al-Otaishan, the director general of the Ministry of Defense and Aviation's General Directorate of Military Works, with whom he had worked as a young officer during the Saudi construction of the 1970s. In a cordial but strained two-hour meeting, the old friends discussed engineer support of Operation **DESERT SHIELD.** General Al-Otaishan indicated that he would provide "full support to the United States, anything needed," but complained that U.S. commanders had not effectively made their requirements known. Later that

day, Miller met with the ARCENT deputy commander and chief of staff, Brigadier General Robert Frix, and the ARCENT staff logistician, Brigadier General James W. Monroe, to discuss MEAPO support.[18]

On 6 September, Miller drove to Dhahran where he found Cox's office running smoothly. Miller attended the evening briefing at which Pagonis expressed his satisfaction with the Corps' support. "We found out," Pagonis told his assembled staff, "how essential it was to have MEAPO in the flow early." Returning to Riyadh, Miller reported to General Sobke that the support mission was expanding as troops poured into the theater. He warned that the South Atlantic Division and MEAPO had to prepare to deploy "significantly more people" in late September and early October to handle base camp construction. On 11 September, the MEAPO(SWA) operation in Dhahran—now with 37 people—formally became the Dhahran Area Office.[19]



Command and Control Issues

Some confusion existed initially about who controlled MEAPO(SWA). Contingency plans specified that it would work directly under the 416th Engineer Command, but the 416th had not yet deployed. The war plans said nothing about MEAPO(SWA) working directly for ARCENT. As the Department of Defense's contract construction agent, MEAPO(SWA) had to be able to support all services.

Jim Ellis and Ben Wood share space in the Corps' Dhahran Area Office

On 3 September, Miller had a strained meeting with General Starling. Starling was upset that General Pagonis had unfairly "grabbed" MEAPO(SWA) to work for him and insisted that it be a theater asset under CENTCOM's control. Starling directed Miller to position the Corps' people to support CENTCOM. Starling and others were particularly concerned that Cox's staff in Dhahran would only respond to Army needs-specifically to Pagonis. Pagonis had, in fact, already said that Cox worked for him, and Cox responded to direct taskings from Pagonis. Miller agreed with Starling that the Corps could best support all services by operating at the CENTCOM level.[20]

While in Dhahran on 7 and 8 September, Miller discussed command and control with Pagonis. During a car ride with the general, Miller explained that the Corps' mission was to support all services, but he added, supporting the Army was the primary mission because it had the largest force. Therefore, Miller was dedicating Cox's office to him. He assured Pagonis that the Dhahran office would remain in place and provide direct support to him. Yet, Miller cautioned Pagonis, if necessary, he would pull some of these resources to support the Navy or Marines.

Pagonis acknowledged that MEAPO(SWA) was a theater asset and as such should be aligned under CENTCOM. But, he noted, if he felt he was being slighted, he would complain to Miller. Only once did Pagonis complain that the

Dhahran Area Office did not have enough resources to support him, and Miller quickly resolved the problem by bringing in additional real estate specialists.

Colonel Miller had a fine line to walk as he tried to satisfy the requirements and expectations of all the services. During the early months, other services charged that their requirements were being subordinated to ARCENT. Miller conceded that Lieutenant General Walter E. Boomer, the top Marine commander in the Gulf, "was just as loud as General Pagonis if he didn't get what he needed." In that first week, Miller and Boomer reached an understanding on how they would operate. Miller directed some of his real estate specialists to handle Marine requirements.[21]

CENTCOM placed MEAPO(SWA) under its control while the Dhahran office remained in direct support of the ARCENT SUPCOM. This arrangement was necessary, Colonel Braden explained, "to keep a theater perspective of engineer priorities, while ensuring that the level of support to ARCENT would not diminish." Once these mechanisms and command relationships were in place, Braden added, theater construction program management was "extremely smooth." Situated in Riyadh, MEAPO(SWA) could better sense CENTCOM's priorities and provide engineering design and administration support. Meanwhile, the Dhahran office provided the day-to-day support that the ARCENT SUPCOM required.[22]

Some confusion apparently continued, for in late October the ARCENT engineer requested clarification of MEAPO's command and control relationships. According to the memorandum of agreement between the Corps and Third Army, he indicated, MEAPO was to receive planning guidance from Third Army during peacetime and come under the operational control of the 416th Engineer Command during contingencies. MEAPO would respond to requests from all services through the engineer command. "It was our understanding that MEAPO would be OPCON to ARCENT during Operation DESERT SHIELD unless the 416th ENCOM was mobilized," he added.[23]

General Starling and Colonel Braden, however, continued to insist that MEAPO(SWA) remain a theater asset, whether the 416th deployed or not. MEAPO needed to be accessible to all services and able to influence engineer activity at the CENTCOM level. This could not be done if MEAPO(SWA) was under the control of ARCENT and the 416th Engineer Command.[24]

Communications Issues

Confusion in command and control was exacerbated by problems with communications. The Dhahran Area Office staff found that non-secure, commercial communication was readily available; and by late August, they had special phones to transmit classified information. The Corps' commercial communication system, however, did not mesh well with the tactical communication capabilities of Army troop units, and this hampered coordination. The Dhahran Area Office staff had excellent communication with

troops located at fixed facilities but could not communicate with units in the field who were on the tactical phone network.

Cox's staff discovered a way to tap into the tactical phone system. Using a commercial number, they dialed the switchboard at the support command headquarters that connected them with the tactical phone system. But with so many people using the tactical phone switch, Corps personnel had trouble getting their calls through. The process was time consuming and frustrating. Occasionally the Dhahran Area Office staff actually had to go to the ARCENT SUPCOM headquarters to call on a tactical phone. Corps personnel at remote offices compensated somewhat by communicating with hand-held portable radios.[25]

Communication with Corps offices in the United States posed additional challenges. The South Atlantic Division and the Corps headquarters staff developed an insatiable appetite for information. In the first weeks, the Dhahran Area Office staff spent a great deal of time answering requests for information. Even though the office provided a 12 to 15 page situation report each day, it received a constant battery of questions. The queries detracted from the mission and burdened personnel already working 15 hours a day.

At times the staff felt overwhelmed with requests for information. One frustrated official complained that they spent more time reporting than actually working. To make matters worse, Corps headquarters and South Atlantic Division personnel sometimes contacted the offices in Saudi Arabia directly rather than sending questions through proper channels—specifically through MEAPO in Winchester.

The situation in the theater changed so rapidly that people from different offices calling 30 minutes apart could get conflicting information, which caused confusion back at MEAPO, South Atlantic Division, and Corps headquarters. In December, Colonel Miller expressed frustration at having officials from Corps headquarters call him or Lieutenant Colonel Cox directly. He announced that Corp personnel in Riyadh and Dhahran would no longer respond to any direct inquiries, no matter the source. Miller or his staff would answer all queries in writing through the proper channel or refer them to MEAPO.[26]

Recruiting, Processing, and Deploying Corps Civilians

Most of the 1,500 civilians the Army that deployed to the Gulf during Operation DESERT SHIELD/DESERT STORM came from the Army Materiel Command and the U.S. Army Corps of Engineers. The Corps is a predominantly civilian organization without enough military personnel to provide all the required engineer support functions. In addition, Corps civilians have unique capabilities not readily found among military personnel. They have expertise in contracting, real estate, damage assessment, well drilling, dredging, electrical power supply [*see* Powering the Theater, page 187], and other fields.

Recruiting and preparing Corps civilians for deployment and supporting them posed unique challenges and prompted a review of some major policies and practices. South Atlantic Division prepared an action plan giving general guidance on meeting personnel requirements. The plan specified that MEAPO would send its personnel needs to the division's human resources directorate, which would do the recruiting. The plan specified that each person on temporary duty would receive a per diem allowance to cover housing and meals. The plan's appendix included a checklist for preparing overseas replacements.[27]

The primary responsibility for staffing the Corps' operation in Saudi Arabia rested with MEAPO. The South Atlantic Division's human resource specialists helped MEAPO establish procedures and were in constant communication with that office. Daily contacts and recruitment were up to the MEAPO staff who established a data base with the names and job skills of all volunteers. The data base enabled them to generate computer listings for specific positions as requirements became known. By early December, MEAPO had entered roughly 700 candidates into the data base.

Staffing began when Miller or Cox identified a requirement for a particular expertise. The MEAPO and South Atlantic Division staff reviewed and further defined the requirement. The MEAPO staff then searched the data base. If they could not find a volunteer with the required skills, they tried to fill the requirement informally by contacting other Corps offices. After exhausting its own resources, MEAPO called on the South Atlantic Division for assistance. If division officials could not meet a requirement after canvassing their headquarters staff and subordinate commands, they passed it on to Corps headquarters.[28]

In the first months, the Corps did not deploy any women. Colonel Miller directed that no women deploy because of housing shortages, safety concerns, and dictates of Saudi culture. Based on previous experience, the Corps knew that its people would often be working directly with Saudi men who might be uncomfortable dealing with women. Also women were not allowed to drive in Saudi Arabia.

In those early weeks, planners were gravely concerned about the potential for hostilities. When hostilities did not materialize after the first few months, Corps leaders and Army staff increasingly questioned the restriction on deploying women. South Atlantic Division officials also had some misgivings about the restriction, but initially were reluctant to counter a policy established by the commander on the ground. Miller reevaluated his policy and agreed to deploy the first women. This policy change came none to soon. There was a critical need for contract specialists willing to deploy in December, and MEAPO could not recruit enough men.

Colonel Miller established a policy that called for a 90-day temporary duty assignment in Southwest Asia followed by a 10-day break in the United States

and a possible additional 90-day assignment. Miller adopted this policy because of uncertainty about the length or magnitude of the Corps' involvement in the Gulf War. The Corps' policy was in contrast to the Army Material Command's, which deployed personnel on 180-day assignments. Corps leaders weighed the additional airfare of the 90-day tour against the disruption that 180-day tours caused for the families of the volunteers and the increased need for emergency leave.

Initially the Army sent all of its volunteers in temporary duty status and most ate their meals at military dining facilities. In contrast, civilians from the Army Material Command lived in tents and ate their meals with troops. It was impractical for civilians from the Corps to billet with or share meals with troops at military facilities. They worked closely with Saudi contractors, property owners, and government officials, and would lose time driving back and forth to their work sites. Per diem payments for Corps civilians included an allowance for meals.

On 23 August, however, the Joint Chiefs of Staff directed that all services convert their civilians from temporary duty with per diem to temporary duty under field conditions with government meals and quarters provided. CENTCOM quickly directed all services to comply, but some were slow to do so. On 8 November, ARCENT directed those organizations that had not yet complied to initiate contracts for meals, quarters, and laundry services immediately. Colonel Miller set a target date of 10 December to convert all of his civilian personnel to temporary duty under field conditions, though he noted some exceptions for personnel serving at remote construction sites. Although Corps personnel were not happy about losing their meal allowance, they adjusted to the new situation.[29]

Other pay issues such as danger pay and foreign post differential (additional pay for duty overseas) had to be resolved. Title 5, U.S. Code, Section 5928, authorized the Secretary of State to determine when civilians would get danger pay and in what amount. The secretary did not approve danger pay for Army civilians initially. Army civilians in Saudi Arabia, however, could receive a foreign post differential, which amounted to 20 percent of their base pay. The differential was payable to permanent duty employees on their first day in country and to temporary duty employees beginning on their 43d day in country.

With some prodding from the Corps, on 24 January 1991, the U.S. State Department finally authorized danger pay of 25 percent for the eastern province of Saudi Arabia, Dhahran, and Riyadh. The Defense and State departments authorized danger pay retroactively from the beginning of Operation DESERT SHIELD for all federal workers in the theater. Meanwhile, the foreign post differential was reduced. On 24 February 1991, the Defense and State departments authorized payment of foreign post differential to all federal

workers, including those on temporary duty, beginning the day they arrived in country.

With so many important pay and entitlement issues to be addressed, the Corps needed a human resource specialist in the theater. Forces Command already had a civilian personnel office in Riyadh, and the Army Materiel Command later sent a human resource advisor. However, the Department of the Army provided no overall coordinator to handle such thorny issues as pay and allowances, benefits, entitlements, training, and equipment.[30]

Corps officials selected MEAPO to serve as the center for processing all Corps personnel deploying to the Middle East. MEAPO had a long history of deploying people to that part of the world but had never processed anyone for duty overseas in a military contingency. MEAPO staff found it necessary to develop and implement procedures to prepare overseas replacements. They handled the final processing; issued forms, identification cards, equipment, clothing, and chemical defense equipment; and provided orientation. Each deploying civilian had to have a current inoculation record, a valid passport, a recent physical exam, a Geneva Convention Card, and later, a panographic x-ray. Each also had to be fitted with nuclear, biological, and chemical equipment and protective clothing.

Every person deploying before 8 September 1990 received at least six hours of training and equipment fitting and usage. MEAPO borrowed Fort Meade's commandant for nuclear, biological, and chemical training to prepare the lead element for deployment. An officer from the headquarters of the Third Battalion, 116th Infantry, 29th Infantry Division, Virginia National Guard, trained the next group of deployees. He was assisted by John Grove, a MEAPO employee who had served three years as the chemical noncommissioned officer for the same unit. Eventually Grove took over all the training for deployees.

By mid-September, most of the Corps' deployees came from outside the South Atlantic Division and MEAPO. They were required to have their training from a qualified military source near their home district before arriving at MEAPO for deployment. MEAPO provided backup training if the previous training was inadequate. Its safety officer, who had previous experience in the Middle East, briefed deployees on potential security threats in Saudi Arabia, and the public affairs office provided information on Saudi Arabia's history and culture.[31]

The Corps not only trained and equipped its civilians before they deployed, it also developed a unique and effective program to assist their families. Although the Army had an active support mechanism in place for the families of its soldiers, it had no similar system for families of its civilian deployees. The Corps developed and implemented the Army's first and only family assistance plan for civilians serving in Operation DESERT SHIELD/DESERT STORM. Under this plan, MEAPO and each of the other districts with personnel assigned to the

Corps volunteers received nuclear, biological, and chemical training and were issued protective clothing at MEAPO *headquarters in Winchester, Virginia, before deploying to Saudi Arabia.*

Gulf had a designated family assistance officer to provide the families of deployees with assistance and information. MEAPO established a toll-free number and a weekly newsletter to give families current information.

In mid-October, representatives from the Army's directorate of civilian personnel and the U.S. Total Army Personnel Command (PERSCOM) visited MEAPO headquarters to learn how the Corps processed its civilians. The team had already visited Aberdeen Proving Ground, where the Army Material Command processed its civilian deployees. They were gathering information to establish centralized operations to prepare overseas replacements at Fort Jackson, South Carolina, and Fort Benning, Georgia. The team found that the Corps' operation compared favorably and that the Corps' family assistance program surpassed anything they had heard about or seen elsewhere.[32]

On 6 December, the personnel command presented the Corps and other Army commands with its proposal for processing all Army civilians through replacement centers in the United States. In mid-December, the deputy chief of staff of the Army for personnel directed the Army 'Materiel Command, Forces Command, and others to process all Army civilians deploying for Operation DESERT SHIELD out of Fort Jackson beginning 22 January 1991. The replacement centers would provide quarters, meals, and transportation to the departure point; verify the deployment readiness of Army civilians; issue

clothing and equipment required in the theater as well as chemical defense equipment; conduct training for the theater—to include basic nuclear, biological, and chemical training; and oversee all personnel in the center from arrival to departure.[33]

Corps leaders vehemently opposed deploying their staff through the replacement centers. They argued that the Corps already had its own system in place and was deploying people in "an expeditious and responsive manner." The Corps had been deploying people in as few as three days, including a stop at MEAPO headquarters in Winchester, Virginia, for processing and training. By contrast, the proposed system would require a 10-day notification period, through its channels, followed by a 4-day layover for deployees at Fort Jackson. The Corps was currently deploying its members three times a week, but under the new plan, the Army would deploy personnel only on Fridays. Using the centers would impede the Corps' operations in the theater. Finally, the Corps prided itself on personalized care for its employees and their families. "We know the unique requirements our members can expect, from our long history of meeting engineering needs in this overseas area," explained the Corps' deputy chief of engineers, Major General C. E. Edgar, "and we are in the best position to help our members fulfill their mission requirements."

Cox complained that using replacement centers would make it impossible to manage personnel flow. He would not have firm arrival dates, and thus could not project departure dates for people completing their tours. With billeting already scarce, he could not accommodate overlaps between arriving and departing personnel. Also MEAPO had resupplied its Dhahran office by sending excess baggage with deployees, but the processing centers placed tight restrictions on baggage. In sum, Cox noted, "We've managed for 120 days without help. Suggest we continue."[34]

The two Army commands deploying the most civilians—the Army Materiel Command and the Corps—opposed the proposal to establish Armywide replacement centers, while the U.S. Army Training and Doctrine Command and Forces Command, which deployed the fewest civilians, supported it. At a meeting with Corps representatives on 7 January, the personnel command's officials indicated that, despite the opposition, the Army's deputy chief of staff for personnel wanted to establish replacement centers in the United States because commercial flights to Southwest Asia were expected to be discontinued. As military deployments continued, the Army commands would find it harder to secure the equipment they needed for their deploying civilians.

The personnel command's representatives were not unhappy with the way the Corps was processing its people. In fact, one official noted that the centers had adopted the Corps' checklist for preparing overseas replacements as the basis for equipping all Army civilians. The Corps representatives argued for processing their own people and noted that the Army needed to continue the high standard set by MEAPO of caring for its civilian deployees. The Corps'

arguments apparently impressed the personnel command's officials. On 24 January they notified the Corps that they had decided to make processing of civilians through Fort Jackson an elective action for the Army commands.[35]

The curtailment of commercial travel to Southwest Asia had little impact on the Corps' deployments. The Corps rarely experienced delays on military flights from the Dover air base and the Norfolk naval base. However, it occasionally ran low on equipment for deploying personnel. At one point, MEAPO had to purchase some brown and tan battle dress uniforms from the private sector because few were available from the military system. By mid-February, logistics specialist Edward Massimo concluded that having enough equipment available for deploying personnel was "an extreme problem." Shortages existed for masks and chemical protective suits. Army headquarters had diverted all available stocks of chemical protective equipment to the replacement centers, and MEAPO's requests for chemical protective equipment had low priority. MEAPO eventually acquired chemical suits from Fort Riley, Kansas.[36]

Corps leaders were concerned about the safety of MEAPO(SWA) and Dhahran Area Office staff. Colonel Miller placed a high priority on the safety and well being of his staff. In late September, he recommended that South Atlantic Division and MEAPO identify a team of soldiers who could be quickly deployed to replace the Corps civilians. Miller developed plans to evacuate all but the essential civilians if Iraqi troops invaded Dhahran and to replace these civilians with soldiers.

This plan was feasible when the Corps had only 20 to 30 civilians deployed, but as the organization grew, it became impractical to arrange a military replacement for every position. The military did not have the same skills the civilians had. That was why the Corps had sent civilians in the first place. Thus MEAPO and the division never reached the point where they could commit to replacing every civilian with a soldier. A more realistic plan called for the Corps to evacuate 37 civilians and replace them with soldiers if necessary and to leave 17 "emergency-essential" civilians.[37]

Evacuation of civilians from a theater would be decided under Defense Department regulations, but the State Department would issue the actual evacuation order. Defense Department regulations specified that Army civilians occupying emergency-essential positions were exempt from an evacuation order and would remain until released by the appropriate commander.

Miller and Cox never believed the danger in Saudi Arabia was grave enough to justify pulling out the civilians, especially since the State Department never ordered an evacuation. However, they continually trained the civilians in protective measures. At certain points, when the situation was particularly threatening, Miller and Cox told the civilians they could leave if they felt they had to. As a testament to the courage of the Corps civilians, not a single person asked to leave after the air war started on 17 January. When an Iraqi missile hit

a barracks half a mile from the Dhahran Area Office headquarters on 25 February—killing 28 U.S. soldiers and wounding almost 100 more—Corps personnel were shaken, but no one asked to leave.[38]

In a 4 January policy message, the headquarters of the Department of the Army noted that an Army civilian could be directed to perform duties essential to the military mission in Southwest Asia, either before or during hostilities. Similarly, an Army civilian on duty in Southwest Asia could be directed to remain there, whether or not he or she had signed an emergency-essential agreement. (All Corps civilians deploying to Saudi Arabia signed an emergency essential agreement to stay at their posts during a crisis.) If an Army civilian refused assignment to Southwest Asia or left without proper authority, the appropriate commander could take adverse action—the civilian could be separated from federal service or disciplined.

In response to this harsh policy, General Hatch reassured his command that he intended to rely on voluntary deployment. The Corps' 90-day rotation policy was working well, and there were enough volunteers to keep positions filled.[39]

Some of the soldiers in the Dhahran Area Office had never worked with civilians and some of the civilians had never worked with soldiers. Despite the lack of familiarity, the two groups worked well together. Although there were a few rough spots, the soldiers and civilians learned to respect each other and to define their separate responsibilities more clearly. Major James Brooks, an experienced combat engineer, quickly found that he had to satisfy the basic quality-of-life requirements of the civilians so they could focus on the task at hand. The soldiers respected the courage it took for civilians to leave their comfortable homes, go through training as overseas replacements, and travel half way around the world to an uncertain, dangerous environment. In January and February, civilians and soldiers alike went to bed wondering when and where the next Iraqi Scud missile would hit.[40]

Observations

Over 160 Corps members served in Saudi Arabia during Operation DESERT SHIELD/DESERT STORM. They came from many disciplines such as engineering, real estate, and contracting and represented 36 of the Corps' major subordinate commands, districts, and laboratories. Those who deployed were supported by hundreds of Corps members back in the United States.

Corps civilians were and will continue to be needed to support contingency operations overseas. They made up 90 percent of the construction management and real estate capability in the Gulf War. Yet, no policy existed that clearly outlined the support structure necessary for civilians in a hostile environment. The Defense Department and the Army had comprehensive regulations governing the uniformed military but had no equally comprehensive policies governing the deployment, sustainment, and rights of civilians in a war zone.

With little experience in deploying civilians for overseas contingencies, Corps leaders rapidly set up the necessary mechanisms to ensure these civilians were well prepared and protected. The contributions of Corps personnel—civilian and military—were great. They provided desperately needed design, contract construction, and real estate capabilities.

Ordnance Program Division

For 25 years, the Corps' Ordnance Program Division (OPD) had provided direct and general support maintenance and supply to the Saudi Arabian Army Ordnance Corps. The division, an element of MEAPO headquartered in Riyadh, Saudi Arabia, executed and administered maintenance contracts and managed foreign military sales cases for the Saudi Arabian Army Ordnance Corps. When the Iraqi invasion occurred, the Ordnance Program Division was the only Army element in Saudi Arabia that had permanent advisors throughout the country. Its personnel assisted arriving U.S. forces and helped the Saudis provide critical logistics and maintenance support to the Royal Saudi Land Forces.

Assistance to Arriving U.S. Forces

OPD's involvement with Operation DESERT SHIELD began on the evening of 6 August when Lieutenant General Charles Horner, acting for the CENTCOM commander, called all U.S. military commanders in Saudi Arabia to a meeting at the U.S. Military Training Mission facility in Riyadh and informed them that American troops would be arriving. The military commanders were then assigned as advisors to arriving CENTCOM general officers. The OPD commander, Colonel Brent Laurence, was assigned to General Starling whom he accompanied to the Ministry of Defense and Aviation's headquarters to arrange to receive the 82d Airborne Division. Meanwhile, an OPD officer, Captain Tim Bilderback, hurried to Dhahran to coordinate the troop arrival with the Saudi area commander. By the next night, the Saudis had pitched tents for the 82d Airborne Division and had food and water ready.

In those first chaotic weeks, OPD personnel acted as U.S. sponsors for many incoming units, helping them adjust to the harsh, unfamiliar environment. They continued to assist CENTCOM generals who had arrived without their support staffs. Colonel Laurence helped CENTCOM establish its command center in the basement of the Saudi Ministry of Defense and Aviation building.[1]

Assistance to Saudi Arabian Forces

The Ordnance Program Division's primary mission, however, was to advise and support the Saudi Arabian Army Ordnance Corps. Specifically, it helped ensure that the Royal Saudi Land Forces' equipment was well maintained and available. As Operation DESERT SHIELD progressed, the base maintenance directorates at Hafar al Batin, Dhahran, and Jeddah, and the ordnance depot at Al Kharj faced increased workloads. These directorates formed the basic maintenance organization for the Royal Saudi Land Forces. Each directorate included Saudi soldiers, OPD civilians, and Saudi Operations and Maintenance Company contractors.

In late August, the maintenance backlog at the Hafar al Batin base maintenance directorate mounted because of the increased pace of operations near the border. By February, this directorate had become the main support of Arab forces at the front.

At OPD's northern province base maintenance directorate, Major Knute Hankins worked with the forward support maintenance units to support the Saudi maneuver brigades and the directorate. He introduced aerial resupply missions to the furthermost deployed Royal Saudi Land Forces unit. With the 526th Special Forces Unit, he instructed more than 2,000 Saudi soldiers in individual chemical defense.

Major Ed Decker divided his time between the base maintenance directorates at Dhahran and An Nu' ayriyah. These directorates repaired battle-damaged equipment and served as a collection point for captured enemy equipment.

Farther to the west at the Taif base maintenance directorate, Captain Kurt Slocum divided his efforts between Jeddah and Taif. He met dozens of ships at Jeddah and oversaw the offloading of thousands of pieces of tactical and combat equipment for the Royal Saudi Land Forces. As the only U.S. Army security assistance officer at the Port of Jeddah, Slocum became the keystone for the massive amounts of arriving Army equipment that Saudi Arabia had purchased from the United States.[2]

Other OPD personnel working at the Saudi Arabian Army Ordnance Center and School were heavily involved in preparing to field the Bradley tank and establish a training base for the new series of vehicles and equipment arriving in Saudi Arabia in response to the crisis. OPD representatives remained heavily engaged in supporting the Saudi war effort. They rebuilt engines and processed repair parts at Al Kharj and repaired tanks and heavy equipment transporters at Khamis Mushayt and Tabuk.[3]

Logistics Support for Saudi Arabian Forces

The Ordnance Program Division's two most significant actions were facilitating the large purchase of trucks and establishing comprehensive logistics support supply agreement cases to provide repair parts and major assemblies for the Royal Saudi Land Forces.

As the Royal Saudi Land Forces began moving north, Saudi officials informed the OPD that they needed trucks. The Saudi Arabian government initially requested 7,413 tactical wheeled vehicles—valued at $84.3 million—to support themselves and coalition forces. At the request of the chief of the U.S. military training mission, multiple foreign military sales cases were combined into a single case that provided 10,000 trucks. Congress approved the sale in November 1990. In December, the Royal Saudi Land Forces requested that the case be modified to include additional vehicles. The monumental effort to acquire trucks was successful. The Saudis' short-term and long-term needs were met. OPD helped the Royal Saudi Land Forces purchase nearly 17,000 tactical vehicles from the United States for $1.7 billion.[4]

The Ordnance Program Division also helped the Saudi Arabian Army Ordnance Corps purchase from the United States desperately needed repair parts for the Saudi and coalition forces' equipment. OPD ensured that a logistics support agreement worth $400 million was in place. Before 2 August 1990, the Saudis had requisitioned repair parts at

a rate of $500,000 a month. After 2 August, requisitions rose to roughly $15 million a month. To keep up, OPD began processing a $157.4 million increase to an existing $770 million foreign military sales case.[5]

The Ordnance Program Division helped a team of supply experts from Al Kharj depot rescue a failed general supply operation at the eastern province base maintenance directorate, thus averting a maintenance disaster for the Royal Saudi Land Forces defending the area. OPD was the only U.S. representative in place to coordinate the arrival, inspection, and in processing of the equipment that the Saudi Arabian government had purchased from the United States. OPD personnel ensured that the 2,000-person technical service contract, vital to the Royal Saudi Land Forces, continued to function in a hostile environment. They devised procedures to recruit and mobilize roughly 100 highly skilled technical contractor employees per month during the crisis.[6]

Strengthened Relationship with Saudi Arabia

The Ordnance Program Division's activities during the Gulf War helped strengthen the relationship with the Saudis. The division's leaders found that Saudi officials became more receptive to their advice. Before August 1990, the Royal Saudi Land Forces was a garrison-type army and rarely deployed to the field. If deployed, it moved its tanks on heavy equipment transporters. But in August 1990, when officials found that they had to move a large force forward, they sought advice from OPD. The Saudis also grappled with the problem of performing maintenance in the field. At OPD's suggestion, they outfitted vans with repair parts to service the forward units.[7]

The Ordnance Program Division's activities not only helped ensure that Saudi and coalition forces were adequately equipped during the Gulf War, they also helped forge stronger relations between American and Saudi forces that continued long after the war ended.

Individual Mobilization Augmentees

As the first U.S. troops deployed to Saudi Arabia in mid-August 1990, the U.S. Army Reserve Personnel Center in St. Louis, Missouri, issued guidance that individual mobilization augmentee (IMA) officers could be ordered to active duty under a presidential 200,000-person call up, partial mobilization, or full mobilization. The center directed organizations to identify—but not yet request—IMAs to be mobilized under each contingency outlined.

In response, the Corps' resource management directorate instructed each field activity to identify its requirements, though no funding or authority existed yet to bring IMAs on active duty. At the time, only the Corps' Engineering and Housing Support Center at Fort Belvoir, Virginia—now the U.S. Army Center for Public Works—responded with a requirement. Meanwhile, MEAPO went directly to the Army Reserve Personnel Center for approval for two IMAs.

The Corps was slow to call up its IMAs to support Operation DESERT SHIELD/DESERT STORM for various reasons. One was lack of authority. President Bush did not authorize a 200,000-person call up initially. Moreover, during the first months of Operation DESERT SHIELD, Army headquarters refused to grant the Corps authority to call up IMA officers on an involuntary basis. The Army's deputy chief of staff for operations directed that major commands call up only critically needed IMAs in direct support of Operation DESERT SHIELD. The use of IMAs was to be kept to a minimum in those early months because the hostilities might continue after their 90- to 180-day tours of duty expired.

Despite some of these obstacles, the Corps brought in a few volunteers. The Office of the Assistant Chief of Engineers used them to help staff the engineer desk in the Army's operations center in the basement of the Pentagon. Field elements used IMAs for a broad range of functions. For example, two supported the Engineering and Housing Support Center, one served in MEAPO as a nuclear, biological and chemical officer to train and equip deploying personnel, and two helped staff the South Atlantic Division's emergency operations center.

The system within Corps headquarters for managing IMAs was cumbersome and confusing. No office in the headquarters was responsible for managing the program. No office was responsible for setting priorities, identifying IMAs, beginning the staff action to activate them formally, and coordinating with the Army Reserve Personnel Center. [The Corps' field offices generally used their emergency operations centers or their equivalents to do this.]

Engineer Regulation 140–1–2, dated 3 March 1986, tasked the director of civil works to manage and oversee the IMA program, but other offices and directorates also had certain responsibilities. When individual offices identified a need for support, the resource management directorate verified that need. It also maintained the mobilization tables of distribution and allowances. The human resources directorate processed the personnel actions required to activate the IMAs. Each directorate or office independently

requested and negotiated the assignments. The Assistant Chief of Engineers for Mobilization, Reserve Affairs, and Logistics had some undefined responsibilities for IMAs but did not manage the program. Corps officials did not complete the required administrative procedures for activating IMAs or reach an agreement as to which staff element was responsible for the program. None of the staff elements wanted to assume the additional workload and responsibilities.

After months of delay, in early January, Army headquarters approved three IMAs to support Operation DESERT SHIELD in the Corps headquarters on an involuntary basis. Two of them supported the crisis management team in the headquarters and one worked in the Pentagon on the staff of Major General Gary Stemley, an IMA brought in to serve in the newly created position of Deputy Chief of Engineers for DESERT SHIELD. Stemley served as a link between the Army staff and Forces Command and worked with the Office of the Secretary of Defense and the Joint Chiefs of Staff. He held regular meetings in his Pentagon office with engineers from the other services to improve communication and coordination.

At the end of January, the Army staff approved 6 of the 11 IMAs the Corps headquarters had requested for involuntary call up for duty in the Washington, D.C. area, and indicated that the voluntary Temporary Tour of Active Duty Program would provide the rest. After the Gulf War, several IMAs continued to work in the Corps' military programs directorate and its emergency operations center to support the Kuwait recovery operations .[1]

Funding Corps Activities

The standard financing procedures were not flexible or responsive enough to deploy Corps personnel. Initially—in accordance with a 1986 memorandum of agreement—Third Army officials provided $100,000 to cover the cost of deploying Corps personnel.[1] On 11 August, Third Army tried to pull the funds back saying that deploying Corps civilians was unnecessary and too expensive and the Corps should fund all its own costs. The chief of staff, Colonel Jorgenson, now indicated that the agreement was invalid. The Corps responded that it had already acknowledged receipt of the $100,000 and would not return it. Meanwhile, General Hatch, who was concerned about the lack of contracting and real estate support in the theater, agreed to use the Corps' operation and maintenance, Army (OMA) funds to deploy up to 30 people by commercial air and sustain them temporarily until the Corps and Third Army could sort out the funding issue.

Corps officials scrambled to find money wherever they could. This was difficult coming so late in the fiscal year. Also, unlike the commanders of other Army major commands, the Chief of Engineers did not have a separate OMA fund for his headquarters. He had to rely on his districts and divisions to return OMA funds that they had not already obligated.[2]

Faced with opposition from Third Army, the Corps tried unsuccessfully to arrange funding through other sources such as Army headquarters. Forces Command said that it had no OMA funds available to cover the Corps' costs. General Pagonis recommended that the Corps use its own funds to support MEAPO.[3] Pagonis apparently did not understand that General Hatch had agreed to cover the cost of deploying the first MEAPO personnel, not the cost of maintaining them indefinitely.

The Corps was not the only Army agency experiencing funding difficulties. On 14 August, the Army's vice chief of staff, General Gordon R. Sullivan, directed all secretariat and Army staff elements and their field operating agencies to eliminate all nonessential fiscal year 1990 programs. He also asked them to estimate the amount of money they could withdraw from their budgets. The director of the Army staff, Lieutenant General Ellis D. Parker, explained that since it was unclear what additional funds the Office of the Secretary of Defense and Congress would provide, this withdrawal was "essential to provide support to Operation DESERT SHIELD."[4]

By the time Corps personnel had received the vice chief's message, they had already begun pulling back unobligated OMA funds to support their Gulf operations. The Corps had already spent roughly $2.5 million on Operation DESERT SHIELD. Now, after reviewing its programs as General Sullivan requested, the Corps offered up an additional $800,000 to the Army's assistant secretary for financial management. Sullivan was pleased with the response from the Army agencies and major commands. Virtually all staff agencies and activities had cut their funds, and together they had returned nearly $2

million. He warned, however, that the 1991 fiscal year would also present "difficult fiscal challenges."[5]

The Corps ultimately paid for all its costs—such as labor and transportation—except construction and leasing costs that ARCENT paid. Third Army never reimbursed the Corps for its operating costs. From 2 August to 30 September, MEAPO costs approached $2 million. To raise that money, as noted, Corps headquarters reprogrammed existing OMA funds. MEAPO suddenly received a large sum of OMA money from Corps headquarters that it had to obligate by the end of fiscal year 1990. Since the money came in increments, the MEAPO staff did not know exactly how much it had at any given time and had difficulty planning expenditures. To complicate matters further, the OMA money came from different programs. MEAPO personnel, who normally handled only small amounts, quickly had to familiarize themselves with the appropriate funding regulations and procedures.[6]

Meanwhile, the Defense Department and Congress looked for a way to cover the increasing cost of deploying and maintaining U.S. troops in the Persian Gulf. Both were anxious that the allies share the cost of the conflict. From the Defense Department's perspective, the financial assistance that other countries provided would encourage them to stay involved in the Persian Gulf region.

On 1 October 1990, as part of the continuing appropriations bill for fiscal year 1990, Congress expanded the Secretary of Defense's authority to accept contributions of money and property from individuals, foreign governments, and international organizations. Congress also established a special defense cooperation account in the U.S. Treasury for these contributions, which would be the "source of first resort" for covering Operation DESERT SHIELD costs. The law specified that Congress had to appropriate these funds from the account before the Secretary of Defense could allocate them to the services.

The Defense appropriations act for fiscal year 1991 authorized the transfer of $1 billion from the account to the services to defray the cost of Operation DESERT SHIELD. The Army received $600 million as its share of the $1 billion appropriation. The Corps was anxious to tap into any Defense Department reimbursements for its DESERT SHIELD costs. Corps officials asked the Defense Department's comptroller to reimburse the military construction funds used to construct six life support areas in Saudi Arabia and the operation and maintenance funds it had used for MEAPO's activities.[7]

Money from the defense cooperation account, however, did not cover all the Army's costs. The Army staff planned to withhold fourth quarter, fiscal year 1990 funds from its major commands and use the money to fund Operation DESERT SHIELD until Congress passed a supplemental appropriation. These fourth quarter funds combined with the defense cooperation account allocation would presumably let the Army fund its operations through late March. If Congress passed a supplemental appropriations bill, Army officials planned to return these funds to the major commands. If Congress did not pass a supplemental appropriations bill by the end of March, however, Army headquarters could be responsible for over obligating funds. Army officials recognized the risk involved but believed it was appropriate considering the urgency of the requirements.

On 22 February 1991, on the eve of the ground war against Iraq, the Bush administration finally submitted to Congress its request for an emergency supplemental appropriations bill to fund the incremental costs of Operation DESERT SHIELD/DESERT STORM. Specifically, it requested $15 billion in budget authority for the Defense Department for fiscal year 1991. The supplemental budget request included $30 million for the six life support areas and $5 million in military construction funds to pay for the Corps' planning and design work.

On 13 March, the House approved an appropriations bill, which the Senate amended a few days later. On 21 March 1991, both houses passed a compromise supplemental appropriations bill, which authorized transferring to the Defense Department the current and future funds deposited in the defense cooperation account.[8]

CHAPTER 3

Saudi Arabian and Japanese Support

The anticipated cost of deploying and maintaining the massive American military force was staggering. As noted, political and military leaders were anxious that other nations bear some of the burden. Military officials developed two mechanisms, in addition to American funded contracts and troops construction, for meeting the needs of the troops: host nation support from the government of Saudi Arabia and support from the Japanese government's Gulf Peace Fund. The U.S. Army Corps of Engineers assumed a key role in administering host nation support and a Gulf Peace Fund contract with Bechtel International Systems, Inc. Together these mechanisms provided essential construction and services for the troops and saved the American government millions of dollars.

Host Nation Support

Defense Department and Army policy is to use host nation support whenever possible. Army doctrine stipulates that whenever troops deploy to a foreign country, the United States will solicit support from that country. The United States has an elaborate structure of host nation support agreements focused especially around the North Atlantic Treaty Organization alliance in Europe and Korea in the Far East. These agreements let U.S. officials make plans during peacetime for wartime requirements. The idea is entrenched that allies of the United States must contribute to the support of U.S. military forces that are defending them. The formal, prearranged agreements define the kind and amount of support the host nation will provide and the conditions for authorizing such support.

Although hundreds of host nation support agreements were in place or being developed at the time of the Gulf War, none had ever been invoked. No such agreement covered the U.S. presence in Saudi Arabia. The Saudi Arabians had an abundance of food, water, facilities, and other assets, but the United States had no management or procurement system to use those assets. U.S. logisticians had to acquire host nation support while devising appropriate procedures for doing so.

The Saudi business environment and infrastructure was well suited to supporting U.S. troops. Saudi Arabia's oil industry had developed an infrastructure in the 1970s and 1980s to support its operations. Saudi Arabians were familiar with western-style contracting, and half of the country's 16 million inhabitants were foreign workers. U.S. firms had been in Saudi Arabia since 1920 as both independent contractors and partners with the Saudis. Saudi Arabia was also used to having many foreign visitors. Every year, hundreds of

thousands of Muslims visit the holy cities of Mecca and Medina. These pilgrims require food, water, and transportation.

As soon as U.S. forces arrived, they began using their own operation and maintenance funds to purchase supplies and services from Saudi Arabia and other Gulf states. The primary intent was to reimburse the military with Saudi funds deposited in the U.S. Treasury. Congress, however, maintained that this process would be unconstitutional because Congress exercises its authority over the military through the appropriations process. Congress prohibited the armed forces from accepting cash directly from foreign powers. Cash contributions from foreign nations went directly into the defense cooperation account and could not be used without congressional authorization and appropriation.

To get around this restriction, the Joint Chiefs of Staff decided to ask foreign powers to contract for the supplies and services rather than spend U.S. funds and seek reimbursement later. General Starling's staff became a clearinghouse for receipts because CENTCOM had to keep track of every dollar that the Saudis agreed to reimburse.

In the first weeks, U.S. logisticians laid out initial requirements for host nation support in 20 functional areas: accommodations, airports, construction, communication, facilities, fuel, hygiene, medical, maintenance, materiel, seaports, security, services, specialized equipment, storage, subsistence, supplies, transportation, utilities, and water and ice. The only major item missing from the list was ammunition.

As host nation requirements grew, it became clear that the United States needed a formal organization to request, acquire, and integrate Saudi resources into the existing U.S. support systems. The Saudi government established an element within the Ministry of Defense and Aviation to administer host nation support called the Joint Forces Support Unit. The new organization headed by Brigadier General Abdul Aziz Al-Hussein would coordinate and implement all Saudi host nation support efforts.[1]

As the needs of deploying U.S. troops became apparent, military officials quickly developed a system to take advantage of host nation support. To prevent the services from competing with each other for Saudi resources, General Schwarzkopf gave the Army responsibility for procuring the logistics support for all the services. General Pagonis assumed responsibility for all host nation support activities in Saudi Arabia through his position as ARCENT's deputy commander for logistics.

On 15 August Pagonis set up a staff section for host nation support in his headquarters under Colonel Roger W. Scearce. Scearce served as the principal point of contact for logistics between the government of Saudi Arabia and U.S. forces. He located land for base camps and logistics bases; wells and other sources of water; bus and truck companies; and suppliers of lumber, bottled water, tires, cots, photocopiers, and administrative supplies. Scearce arranged for Saudi liaisons to work with the Dhahran Area Office and helped resolve

contract conflicts. He also prioritized the host nation support requests and coordinated with other staff agencies and the Saudi liaison officers.[2]

On 20 August, Forces Command sent a request through the ARCENT SUPCOM to the Joint Staff for an assessment of host nation support capabilities in the area. A week later, the support command replied that the Saudis were giving without hesitation all the support that the U.S. forces needed. By late August, it was understood that Saudi Arabia was behaving generously. It had provided free use of its ports, warehouses, and real estate to house troops, plus vast quantities of fresh fruits, vegetables, and water.

While Pagonis' organization provided much needed logistics support, military leaders recognized the need to establish a formal agreement to use Saudi resources. On 6 September 1990, Secretary of State James Baker traveled to Saudi Arabia where he met with King Fahd to discuss the possibility of the Saudi government's sharing the cost of maintaining U.S. forces in Saudi Arabia. King Fahd indicated that his government would pay for fuel, water, food, and transportation.

At a follow-up meeting in Jeddah, Baker asked Saudi officials to provide an initial $2.1 to $2.5 billion for U.S. military involvement and $300 million a month after that. Saudi Arabia's foreign minister, Prince Saud Al-Faisal, confirmed that his government would pay for all fuel, transportation, and water. But Saudi officials took no action to implement the Jeddah agreement. Frederick C. Smith from the Office of the Assistant Secretary of Defense for International Security Affairs for the Near East and South Asia Region urged Deputy Secretary of Defense Donald J. Atwood to contact Saudi Arabia's ambassador to the United States, Prince Bandar Bin Sultan, to clarify the understanding.[3]

Atwood apparently pursued the matter. In an 11 October letter to Atwood, Prince Bandar alluded to the earlier agreement with Secretary Baker. The Saudi ambassador agreed to a plan to deploy a team of six or seven Americans headed by a general officer to work out procedures for host nation support.

Meanwhile, at Corps headquarters, General Ray was reprogramming his military construction funds to support construction in Saudi Arabia. Ray had commanded the Corps' Europe Division from 1985 to 1988 and then served as the senior engineer for the U.S. Army in Europe. When he became the Corps' director of military programs in early September 1990, the first thing to cross his desk was a request to reprogram $30 million of military construction funds for six base camps in Saudi Arabia. The next day he received another request for $23 million to finance MEAPO operations there.

Ray realized the Corps could not continue using its military construction funds for Operation DESERT SHIELD. Ray concluded the Saudis should provide facilities the way host nations in Europe did. Ray knew that King Fahd had agreed to provide fuel, food, water, and transportation to U.S. troops. He discussed the matter with General Hatch and then with Assistant Secretary

Susan Livingstone and David Berteau, the principal deputy to the Assistant Secretary of Defense for Production and Logistics.[4]

On 14 September 1990, Hatch recommended to the Assistant Secretary of the Army for Financial Management that the military establish a procedure authorizing the theater commander to request support from Saudi Arabia directly in such areas as leases, temporary accommodations, temporary construction, food, water, fuel, and transportation. Hatch further recommended that the Joint Chiefs of Staff, in coordination with the State Department, authorize the theater commander or his designee to present the Saudi government with requirements directly. Providing direct support, he argued, "would be the most responsive, avoid normal U.S. funded (slow, uncertain) procedures, and best support our troops."[5]

On 6 October General Ray attended a meeting between the Under Secretary of Defense for Policy, Paul Wolfowitz, and Prince Bandar. The prince acknowledged that facilities should be part of the support that the Saudis provided to U.S. forces, in addition to food, fuel, water, and transportation. The participants agreed that military construction in Saudi Arabia should be part of the host nation support agreements being developed, rather than paid for out of U.S. funds. They also agreed that Ray should bring a team to Saudi Arabia to arrange for this support.

The director of the Joint Staff, Air Force Lieutenant General Michael P. C. Carns, sent Ray to Saudi Arabia to establish a system that used Saudi money to pay for fuel, water, transportation, and other items. Ray's team included a Navy captain from the Joint Staff, who was a host nation support expert; a Navy captain from the Office of the Secretary of Defense, who was a logistics expert; an attorney from the Secretary of Defense's general counsel office; two individuals from the Secretary of Defense's comptrollers office; one from the Department of Defense's contracts office; and one from the Secretary of Defense's international logistics division. Meanwhile, Colonel Miller met with General Al-Otaishan on 14 October to lay the groundwork for Ray's visit. The team had the authority to commit the U.S. government to the necessary arrangements, which perhaps accounted for much of its success.[6]

The team arrived in Riyadh on 17 October and began developing procedures for assistance-in-kind in five areas: fuel, facilities, food, water, and transportation. Its mission was to satisfy the objectives of both the Department of Defense and Joint Staff, which differed slightly. The Department of Defense intended to develop a framework that could use Saudi resources to support the troops. By contrast, the Joint Staff's goal was to organize the operation so U.S. forces could buy the resources they needed, then use Saudi money to pay for them. Carns envisioned an organization that would work directly for the theater commander, rather than CENTCOM's director of logistics, and provide a focal point for the services.[7]

Ray dealt primarily with Major General Abdul Aziz Al-Sheik, deputy commander of the Combined Forces Command that had been formed in response to the Iraqi invasion. Ray had commanded the Corps' Middle East Division from 1984 to 1985 and had served as the Chief of Engineer's special assistant responsible for Saudi Arabia from 1985 to 1987. Thus, he already knew some of the Saudi officers with whom he now dealt and had some understanding of Saudi culture.

The team quickly discovered that there were no written commitments other than Prince Bandar's letter to Atwood, though the Saudis acknowledged that the king had agreed to pay for certain things. The team's mission was not to negotiate a formal international agreement but to develop workable procedures to take advantage of the king's pledge to provide support. The final document that emerged was called the "Implementation Plan for Logistics Support of United States Forces in Defense of the Kingdom of Saudi Arabia." By drafting a plan rather than a formal agreement, the team avoided certain bureaucratic delays. The plan confirmed the five areas of support, but did not define them.

The next task was to arrange for the Saudi government to take over (and pay for) all contracts that the United States had already negotiated in the theater. The team had to determine how much Saudi Arabia should pay to reimburse the United States for what it had already spent to develop the theater. Team members consolidated the estimated costs from all the military services and presented the total bill in a letter from Ray to the deputy commander of the Joint Forces Support Unit. The United States asked for repayment of $2.66 billion for fuel, food and water, transportation, accommodations/facilities, and other logistics support.

Saudi officials returned the bill with two objections: the Saudi government could reimburse only when presented with the original invoices and it would assume financial responsibility only from the time the U.S. forces arrived in the country or in Saudi waters. It would not pay the expensive cost of transporting U.S. troops to the Middle East.

The team replied that there were no original invoices, and the Saudis' redoing their work would not change the results. In response to the second objection, the team submitted a separate bill for in-country expenses. On 30 October a Saudi representative presented General Ray with a check for $760 million to cover in-country expenses of the United States between 7 August and 1 November. The cost of deploying U.S. forces from the United States and from Europe was apparently much greater than the cost of maintaining them in the theater.[8]

The discussions progressed smoothly, for the most part. Ray's team and its Saudi counterpart had little trouble agreeing on an implementation plan. The team concentrated on costs incurred in Saudi Arabia or its surrounding waters and left several issues—such as who would pay the deployment costs—to be resolved later by the Defense or State departments. Based on its expenditures

in the first few months, the United States concluded that it needed more than $346 million a month for logistics support.

General Al-Sheik, however, indicated that he had no authority to offer more than $300 million a month. Any figure above that would have to be discussed at a higher level. On 3 November General Ray presented the revised estimates to General Al-Sheik to conform to the Saudi-imposed limitation of $300 million a month. He explained that the United States reached the lower figure by cutting requirements in various areas or by funding those requirements from alternate sources. He warned, however, that if the U.S. force in Saudi Arabia increased, so would the cost.

General Starling and General Al-Sheik signed the plan on 5 November 1990. The Saudis agreed to provide, at no cost to the United States, fuel, transportation, water, food [freshly prepared meals—known as Class A meals in the Army], and facilities to support U.S. forces from the time of initial deployment. The United States reserved the right to negotiate contracts if the Saudi contracting effort did not meet the needs of U.S. forces, but it would pay for those contracts and later seek reimbursement from the Saudi Arabian government.[9]

Before departing, General Ray's team recommended that the theater commander establish a 16 to 17 person cell, headed by a brigadier general, to help General Starling oversee host nation support and assistance-in-kind and to coordinate these issues with Saudi Arabia, Japan, Germany, and other countries providing support. CENTCOM asked the Army to provide a general officer to head this cell, and the Army's chief of staff, General Carl Vuono, selected Brigadier General Pat M. Stevens IV, the commander of the Corps' North Pacific Division. Stevens traveled to Saudi Arabia a few weeks later to serve as the deputy director of logistics and security assistance under General Starling.[10]

Contracting Process

Meanwhile, representatives from MEAPO(SWA), ARCENT, and the Ministry of Defense and Aviation had begun more detailed discussions on how the new plan would affect construction contracting and leasing. The Saudis wanted to ensure that the U.S. projects were valid since they would be paying for them, but CENTCOM officials did not want the Saudis to be in the position of validating projects that supported U.S. troops.

On 4 November the representatives from the ministry and the Corps met in Riyadh and drafted a general outline of how the Corps would work with the ministry's contracting process. Each service would determine its requirements and submit a DD Form 1391 to CENTCOM for validation. CENTCOM regulations provided that a combined civil-military engineer board made up of representatives of the Joint Forces Support Unit, the CENTCOM engineer office, and MEAPO(SWA) would then determine whether American soldiers or contractors would do the construction.[11]

For new requirements, U.S. contract specialists prepared plans and specifications, advertised an unfunded solicitation, and evaluated the resulting proposals. They passed the proposals and recommendation for a vendor to the local Joint Forces Support Unit representative. The support unit evaluated each proposal and coordinated the contract award with the responsible contracting officer.

After the contract award, MEAPO(SWA) monitored the construction to ensure that the contractors met U.S. requirements and reported any problems to the local Joint Forces Support Unit representative. If the contractor performed poorly, the support unit terminated the contract and awarded a new one. Contractors sent their invoices for supplies or services to the local support unit representative who provided it to the Ministry of Defense and Aviation's finance office for payment.

For construction requirements, the Saudis were supposed to award a contract within 15 days of receiving the design package, but this process usually took 30 days. To meet emergency requirements, CENTCOM could put a U.S. contract in place rather than wait, but the Saudi government had to agree to the contract before it would be obligated to reimburse the United States.

CENTCOM officials met with Major (later Lieutenant Colonel) Mohammed Al-Shonaify, head of the construction section of the Joint Forces Support Unit, twice a week, and ARCENT officials met with Saudi representatives each Wednesday evening. At these meetings General Yeosock and Lieutenant General (Prince) Khalid Bin Sultan Al-Saud, who commanded the Arab forces, and their staffs planned Saudi support activities. For example, they might discuss obtaining access to a hospital, building prisoner-of-war camps, or hooking up electrical power.[12]

The host nation process was slow and frustrating. Soon after the implementation plan was signed, Yeosock complained about delays in getting Saudi approval and directed his engineer, Lieutenant Colonel Tomasik, to resolve this issue. MEAPO(SWA) had turned 11 design packages over to the combined civil-military engineering board for construction contracts, but none of these contracts had been transferred to the Ministry of Defense and Aviation. Corps personnel complained that the system was experiencing "growing pains."

General Stevens later reported that Saudi contracting procedures had often been "unresponsive to the pace of requirements that we've had as we built up this force and prepared to go to war during DESERT SHIELD and then got into the combat period in DESERT STORM." If U.S. forces grew frustrated with the time it took the Saudis to purchase water, they could buy it themselves. But if they were unhappy with the pace of Saudi contracting for construction, they had no alternative because they could not legally enter contracts for construction that cost more than $200,000.[13]

Delays occurred in part because the Ministry of Defense and Aviation's Joint Forces Support Unit had no funding source of its own. It had to go back

to the ministry's officials to make sure that they wanted to fund a particular project and get the finance officials to allocate the money. While the process seemed painstaking and time-consuming to U.S. officials, Cox observed that the Saudis broke their own records for speed, especially because Saudi financial resources were strained. Moreover, the Joint Forces Support Unit had only a small field organization. The lone Saudi lieutenant assigned to the Corps' Dhahran Area Office had six projects to oversee. Cox usually had one person for each project.

Another reason for delay was that the Saudis and the U.S. military sometimes had different perceptions of the scope of work. Some of the contractors were not capable of completing the required work in the specified time. U.S. Army units with urgent requirements did not always understand how Saudi officials thought and operated. Paying contractors on time was not as important in the Saudi culture as it was in the American culture. Before the Saudis paid the contractors, they wanted assurance that the work had been done in accordance with the contract. Because of the inability or refusal of the Saudi government to pay its contractors in a timely manner, many contractors became unwilling to provide support to U.S. forces. The Saudis, in turn, had difficulty comprehending the magnitude of the U.S. effort. They did not understand at the time why the requirements were so massive.[14]

Faced with frustrating delays, the services chose to buy what they needed and send the Saudis the bill later, even though the Saudi money would go directly into the defense cooperation account not the services' budgets. The Saudis, however, disliked being billed for services or supplies that they had already agreed to provide. Saudi officials interpreted their king's pledge to provide food, for example, to mean they should provide the actual food, not pay the United States for food it had already purchased. They preferred to take over the contracts the United States already had in place rather than reimbursing the United States for those contracts. Arranging for the transfer of the contracts, however, was difficult and complex.

On 27 October, General Al-Hussein, Colonel Sameer Al-Turki, and Lieutenant Colonel Abdullah Al-Mourey from the Ministry of Defense and Aviation met with representatives from the Office of the Secretary of Defense, CENTCOM, and MEAPO(SWA) to review existing and future Corps contracts before assumption by the ministry and to discuss the procedures to be followed. Bo Bounds opened the meeting by outlining U.S. construction contracting procedures and reviewing the status of all ongoing Corps construction contracts. Colonel Miller then explained the difference between construction contracts and service contracts. He observed that construction contracts often required numerous modifications. Contracting officers had to execute these modifications quickly to avoid delays and contractor claims.

General Al-Hussein agreed to place an official in the Dhahran Area Office who had authority to modify contracts. He conceded that he did not know

when funds for construction would become available. When Colonel Braden indicated that he wanted to set a date after which CENTCOM would use U.S. funds for its priority projects and seek reimbursement later, General Al–Hussein responded that he hoped this would not be necessary.[15]

Transferring Contracts to Saudi Arabia

Under the host nation support plan, the Saudi government agreed to assume responsibility for U.S. contracts in five specific areas. The implementation plan included an assignment agreement that allowed the U.S. government to transfer its contracts to the Ministry of Defense and Aviation. The arrangement for the Saudi government to take over contracts negotiated and awarded by the United States proved to be complex and controversial.

Representatives of both governments and the contractor had to sign the agreement. MEAPO(SWA)'s counsel, George Kingsley, did not believe the existing U.S. contracts could legally be assigned to third parties, with or without the contractor's consent. Nothing in the federal acquisition regulations or in the Corps' contracting officer warrants gave the contracting officers express authority to assign U.S. government contracts. "Accordingly," Kingsley argued, "it is our opinion that the contracting officer has no authority to execute the subject assignment agreement." Kingsley recommended terminating the existing contracts and letting the Saudis award their own.

He added that the assignment agreement was unenforceable. The U.S. government could not legally require a contractor to waive his rights to payment for work performed under a U.S. government contract while the contract was still in full force and effect. If the U.S. government refused to pay for work performed after 1 November, it would be in breach of contract, entitling the contractor to abandon his work and sue the U.S. government for damages.[16]

Corps attorneys thus raised three objections: contracting officers could not assign U.S. government contracts; the U.S. government could not require a contractor to waive his right to payment for work performed; and contracting officers had no authority to indemnify or hold harmless the Saudi Arabian government.

The CENTCOM and Air Force attorneys who reviewed Kingsley's decision argued that the contracting officer's authority was not limited to federal acquisition regulations. Baker and Fahd had entered an international agreement regarding the support of U.S. forces in Saudi Arabia, and both countries had signed an implementation plan providing for the transfer of existing U.S. contracts. The federal acquisition regulations expressly recognized that contracting actions may be affected by treaties and executive agreements.

The Baker–Fahd agreement and the implementation plan, they concluded, provided the legal authority for transferring U.S. contracts to the Saudi government. The assignment agreement was a three-party agreement. By

signing the agreement, the attorneys continued, the contractor indicated his concurrence with the proposed terms. Contrary to the Corps' opinion, the U.S. government was not "requiring" the contractor to waive his rights. Further, after the contractor agreed to the transfer, the contract became a Saudi contract subject to Saudi rules and laws, not the federal acquisition regulations.[17]

CENTCOM and Air Force attorneys made minor changes in the wording of the assignment document. Meanwhile, MEAPO's chief counsel, Matthew D. Thomason, provided a new assignment document with different wording. The service contracting officers used the CENTCOM and Air Force version, which was acceptable to the Saudi government, to transfer their contracts. Corps contracting officers used their version, which CENTCOM and Saudi officials opposed.

As a result, MEAPO(SWA) had been unable to transfer any contracts to the Saudi government. During November, it spent $5.2 million in Army operation and maintenance funds and Army military construction funds. Although the Saudis would eventually reimburse this money to the U.S. Treasury, it would be lost to the Army budget. "The Army is mad," Miller reported, "and I am under great pressure to transfer contracts." Miller warned that he planned to start transferring contracts on 4 December using the CENTCOM assignment document, despite objections from MEAPO's lawyers.[18]

ARCENT did not transfer any existing contracts to the Ministry of Defense and Aviation. The Corps transferred contracts only after its chief counsel, Lester Edelman, issued an opinion supporting this action. The Corps would later defend its actions in court. No contractors wanted to sign the assignment document, but they did so under duress. They feared that the ministry would not award them any contracts for defense work after the war ended.

By early December, CENTCOM had approved 51 construction projects and forwarded them to the Saudis. Of these, 29 were under construction or pending contract award and 19 were at various levels of design by MEAPO.

The process of turning these contracts over to the Saudis was neither smooth nor easy. Some contractors resisted this action. On 28 October, the Corps had awarded a contract to Bin Zehefa to rent construction equipment (dump trucks, dozers, graders, loaders, water distributors, light sets, and generators) to the 20th Engineer Brigade. The Corps modified the contract to increase the amount of equipment and encompass additional locations. It further modified the contract to extend the performance period 45 days to 23 January 1991.

On 10 December, the contractor formally requested that his contract remain with the U.S. government, and Dhahran Area Office officials quickly explained the reasons for assigning the contract to the Ministry of Defense and Aviation. Ali Saad Zehefa, general manager of Bin Zehefa, replied that when he had signed the assignment agreement, he was under the impression that the basic elements of his contract would remain unchanged. He refused to provide

the equipment agreed to in the second modification and began removing his equipment from various work sites. Maneuver commanders urgently needed the equipment to conduct their missions, and there was no time to mobilize a new contractor.

Zehefa explained that although he had signed the assignment agreement, he could not accept working with the Ministry of Defense and Aviation because the ministry cut his price in half and made him pay for all maintenance and spare parts. Zehefa withdrew his equipment because of the uncertainty about whether the United States or the ministry had his contract.

In December, William Brewer, the Dhahran Area Office's chief of contracting, directed Zehefa to stop negotiating with the Ministry of Defense and Aviation, encouraged him to deliver the rest of his equipment, and assured him that the Army would pay him. On 1 January, Zehefa reminded Brewer of this promise and again asked for payment. Brewer responded that the Joint Forces Support Unit had informed the Dhahran Area Office that the ministry would retain responsibility for paying Zehefa. Thus the Dhahran Area Office had no authority to make payments.

A market analysis concluded that Zehefa's prices were reasonable, but the Saudis compared his prices to the costs during normal times. They refused to consider the risk associated with the lease. The 20th Engineer Brigade ultimately took Zehefa's equipment into Iraq where it was damaged.[19]

On 6 January Miller met with Major Al-Shonaify to discuss contract turnovers. Al-Shonaify was reviewing all the contract packages that MEAPO(SWA) had turned over on 23 December and was checking the vouchers against the contract scope of work. He had not yet signed any of the transfer documents and was going through each contract in minute detail, trying to understand and reconstruct each action and modification. Apparently the major was personally and financially responsible to the Ministry of Defense and Aviation's finance office for the accuracy of the financial data, so he would not accept the Corps' figures without completely understanding them. Major Al-Shonaify was frustrated by having to handle transfer actions in addition to the new contracts.[20]

The Dhahran Area Office had to identify the contract value and quantity and then determine the exact quantity shipped, received, and paid for. Shipping documents had to be accurate before Al-Shonaify would approve payment. If the amounts and quantity did not add up, he could not receive reimbursement from the Ministry of Defense and Aviation's finance office.

The ministry instituted a new procedure that required Major Al-Shonaify to submit contract award packages to General Khalid Bin Sultan first for review and approval. If the general approved, he sent the contract to the Ministry of Defense and Aviation's finance office for budgeting, and the Dhahran Area Office returned the contract to Khalid for final approval and issuance of the notice to proceed.

The Ministry of Defense and Aviation's processing took at least five days. At one point, Miller complained that all the critical projects were "caught in this web." Nine contracts including the construction contract for life support areas with Mechanical and Civil Engineering, Saudi Arabia, Ltd. were formally transferred to the Saudis on 10 January 1991.[21] Transferring contracts, however, remained difficult and time-consuming.

MEAPO recognized that its role would not end with the transfer of the contracts. On 29 January 1991 MEAPO signed a memorandum of agreement with the Joint Forces Support Unit to provide quality assurance, technical oversight, and contract administration services. The agreement established the procedures under which MEAPO would provide these services to the support unit. The support unit agreed to manage the contracts that it awarded and administered to ensure that contractors produced quality products within the specified construction time. MEAPO agreed to help in this effort.

The Joint Forces Support Unit would furnish contract data outlines on a "Ministry of Defense and Aviation Contract Award Status" form within three days of the award, provide a contracting officer representative to work at the Dhahran Area Office or other locations in Saudi Arabia, give MEAPO a copy of the contractor's progress schedule within seven days of the award, and provide a project engineer. MEAPO in turn would perform technical oversight, provide a quality assurance representative, participate in site visits, and record progress and deficiencies.[22]

Although MEAPO(SWA) and the Joint Forces Support Unit maintained a cordial, cooperative relationship, procedures for host nation support continued to pose significant challenges.

Support from the Government of Japan

The United States also received support from European and Asian nations. Japan wanted to contribute to operations in the Persian Gulf but did not want to give money directly to the United States or provide any resources that would contribute to warfare. In late August, the Japanese government pledged $2 billion to support the coalition efforts as part of Operation DESERT SHIELD, including about $1.7 billion in cash and assistance-in-kind to support U.S. forces. Through an exchange of notes between the secretary general of the Gulf Cooperation Council (an organization made up of Saudi Arabia, Bahrain, Qatar, United Arab Emirates, Oman, and Kuwait formed in 1981 as a reaction to the Iran–Iraq war) and the Japanese ambassador, the Japanese government established the Gulf Peace Fund's administrative committee to manage a fund in support of coalition forces engaged in DESERT SHIELD/DESERT STORM.

The Japanese government deposited money into the Gulf Peace Fund account, and the administrative committee apportioned funds to various countries and multinational forces. The fund was to be used specifically for projects outside Saudi Arabia that were not funded by host nations, projects and

equipment in Saudi Arabia that U.S. forces might recover or relocate during Operation DESERT SHIELD, and contracts in Saudi Arabia for materials to fulfill urgent needs of U.S. forces that the Saudis could not meet.

Japan limited its contributions to noncombat support, specifically materials and equipment to protect against the harsh environment, material and equipment for potable water, noncombat vehicles, construction and communication materials and supplies, office materials and equipment, materials and supplies for accommodations, and food and medical supplies.[23] The fund not only let the Japanese government make contributions within its domestic political and legal constraints but also served as additional proof that Iraq was opposed by a broad coalition.

The Defense Department submitted a list of required items to Japanese officials who generated a list of items their government could provide. During a 5 September 1990 meeting in Japan, Japanese officials offered to construct a 200,000-person camp in lieu of or as part of the items on the list. They agreed to provide materials and engineer advisors if U.S. troops provided the labor. CENTCOM proposed instead that the Japanese construct several base camps using modular facilities. Believing that the modular buildings could be acquired more cheaply in local markets or in the United States, the theater commander recommended that Japan provide the funds and let the United States contract for the construction of the base camps.

At CENTCOM's request, the services identified their requirements for base camp construction and modular buildings. CENTCOM planners estimated that ARCENT forces would need more base camps than the six already planned. They realized that given the current financial and legal constraints on military construction, Japanese government contributions might be the only way to fund the construction of these base camps.[24]

The Joint Staff directed CENTCOM to use Japanese support rather than U.S. funds but left it up to the theater commander to determine the mix between Japanese financial assistance and assistance-in-kind and to determine the type of support required.

Although CENTCOM's first priority was to construct base camps, it identified other useful items that the Japanese could provide such as vehicles, fax machines, computers, television sets, video cassette recorders, forklifts, and water purification systems. Troop units needing materials submitted a DD Form 1391 to CENTCOM headquarters, with site plans, host nation approval, required delivery date, and location.

Japan provided equipment, materials, and supplies worth nearly $500 million—hundreds of 4-wheel-drive vehicles, water trucks, refrigerator vans, fuel vehicles, and television sets for the troops. The Japanese embassy in Riyadh awarded contracts for the delivery of tons of construction material—asphalt, concrete, lumber, and other building supplies. The Japanese contracted directly with suppliers for delivery of the items. CENTCOM authorized units to deal

directly with a vendor who was under contract to the Japanese to get the materials. The Japanese worked closely with U.S. Forces, Japan, and CENTCOM to identify requirements.[25]

The Corps' involvement with the Gulf Peace Fund began on 10 October when Lieutenant Colonel Cox met with the American consul in Dhahran, the Japanese ambassador to Kuwait, and other Japanese officials. Together they toured the port at Dammam where they watched soldiers unload 4-wheel-drive vehicles and pickup trucks that the Japanese government had donated.

Later the U.S. ambassador to Saudi Arabia, the consul, several Japanese representatives, and Cox flew by helicopter to the austere desert camp of the 197th Infantry Brigade. The brigade commander escorted them to his tactical operations center where he briefed them on his command's activities. After treating the distinguished visitors to a lunch of prepackaged "meals ready to eat," the commander led them to a nearby site where his troops were clearing ground for a planned base camp—or life support area as it was now called. They discussed current shortfalls in the construction contract and the need for additional life support areas.

The group returned to Dhahran to meet with General Pagonis. Military officials discussed the progress of the six life support areas underway and the 18 more under consideration and then asked the Japanese representatives to assist in funding the camps. The Japanese officials listened attentively, asked questions, but made no commitments.[26]

Meanwhile, CENTCOM continued to use Japanese funds for small troop construction projects (under $2.5 million). It negotiated the contracts for these projects, but the Gulf Peace Fund awarded them. By mid-November, CENTCOM had $32 million in indefinite delivery contracts in place or under negotiation for lumber, concrete, asphalt, aggregate, structural steel, electrical components, and plumbing supplies. By early January the CENTCOM engineers had negotiated and the Gulf Peace Fund had awarded roughly $350 million in contracts to support construction, mostly for lumber, concrete, and other materials that vendors delivered to troop projects.[27]

Although the host nation support implementation plan provided for construction contracts within Saudi Arabia, CENTCOM's area of operations included Bahrain, United Arab Emirates, Oman, Egypt, and other countries, and U.S. funding was the only mechanism for doing military construction in those countries. As more Air Force and Navy projects developed in those countries, Braden, Cox, and Miller saw the need to rely more heavily on the Gulf Peace Fund.

In mid-October, as use of Japanese assistance-in-kind increased, CENTCOM began to establish the necessary contracting procedures to take advantage of the Japanese offer for facilities support. Braden worked to ensure that part of the Gulf Peace Fund's money supported the engineer effort. A support plan generated at MacDill Air Force Base had predicted that the

Japanese officials visit the base camp of Colonel Ted Reid's 197th Infantry Brigade.

facilities requirements in the theater would cost more than $1 billion. Braden also knew that the military had no good way to fund construction projects above $200,000.

In early December, Braden and Miller discussed how to use the Gulf Peace Fund more effectively. Braden considered having the Japanese deposit locally some money that U.S. forces could draw on. But he did not know how much he could get. He wanted to have a single, responsive contractor working directly for CENTCOM. Could they develop such a contract? Could they put it in place in time for it to be useful- i n other words, before the ground war began? What kind of mechanism could they set up? Miller suggested that they use an international three-party agreement, similar to some MEAPO had used before. Braden asked the Corps to help develop procedures to use Japanese funding to construct temporary facilities for U.S. forces outside Saudi Arabia.

FIDIC **Construction Contract**

Matthew Thomason proposed using a Federation Internationale Des Ingenieurs-Conseils (FIDIC) contract, advanced by the International Federation of Consulting Engineers, for construction in the theater. Cox recommended to

Braden that CENTCOM use the FIDIC format in conjunction with a foreign military sales case to fund MEAPO's administrative costs.

The FIDIC construction contract was between the employer and the contractor. A third party was the "engineer" who acted as a neutral party to decide any disputes that arose between the employer and the contractor. The engineer was similar to a contracting officer, except a contracting officer was party to the contract and responsible for paying the contractor. As the contract administrator, the engineer ensured that specifications were complied with, certified progress payments, issued changes and time extensions, accepted the completed work, and made the initial decisions when disputes arose. As in any construction contract, the contractor built the project according to the contract specifications within the time allowed. The employer paid the contractor after the engineer had certified payment.[28]

Although the Corps used the federal acquisitions regulations and had little experience with a FIDIC contract, MEAPO had used one to build an air base for the Bahrain Defense Force. When Miller asked his staff in Winchester how quickly they could implement such a contract, they answered they could do it in just 30 days. At that point, Miller and Braden decided to ask the Japanese to contribute $100 million. They met with three Japanese representatives who carried the request back to Tokyo, where government officials quickly approved it.

While MEAPO officials in Winchester identified potential contractors, Braden and Miller met with Dr. Tomihiko Furuta, the deputy executive director of the Gulf Peace Fund's administrative committee on 10 December. Japanese officials had no experience with cost-reimbursable contracts and worried that the proposed contract would exceed their budget. Miller had difficulty explaining how cost-reimbursable contracts worked in part because of the language barrier. The participants agreed that if Japan accepted a cost-reimbursable contract, the Corps would have a primary role in administering it, and the United States would recommend one firm to Japan for award of the contract.[29]

On 18 December, Braden directed the Corps to solicit proposals from U.S. firms for a $10 million to $100 million cost-reimbursement contract for engineering, engineering management, and construction services. Interested firms had to be able to mobilize within 30 days of the contract award in Bahrain, United Arab Emirates, Qatar, Oman, and Egypt. The Gulf Peace Fund would award the contract.

Braden directed the Corps to evaluate the proposals and rank the contractors by their ability to perform the work. The Corps would then recommend a firm to CENTCOM and Gulf Peace Fund officials. It would also prepare a proposal for the Corps to act as the Japanese government's agent to administer the contract on behalf of both the Japanese government and

CENTCOM. The proposal would include an estimate of the cost of the Corps' services. Braden hoped to award the contract by 15 January 1991.[30]

At Braden's direction, MEAPO prepared a standard cost-reimbursable construction contract, using the FIDIC format. The project would be controlled by task orders, which tracked scope, time, and cost until the contractor completed the task. Using a data base of U.S. contractors interested in work in the Middle East and *Engineering News Record's* lists of the 400 top contractors and 400 top construction firms, MEAPO identified 15 candidates. It considered only firms with $200 million in contracts, foreign experience, and the ability to mobilize within 30 days.

On 18 December, a MEAPO selection board developed a short list from the 15 candidates. The criteria for evaluating companies on the short list included $100 million in foreign contracts, current activity in the Middle East, and experience in horizontal construction—specifically airfields. Only four contractors—Bechtel, Brown and Root, Inc., CRSS Constructors, Inc., and Perini Corporation—met the criteria. On 21 December, MEAPO gave each a draft contract and a scope of services and invited each to give an oral presentation to its selection board. The board rated them on past experience and performance with cost-reimbursable contracts, ability to mobilize within 30 days, and capability to provide services in the Middle East. After careful review, the board selected Bechtel on 4 January. MEAPO officials completed negotiations on 9 January.[31]

Three days later, MEAPO personnel in Winchester transmitted a complex, 76-page contract to Bechtel's Tokyo office. Miller commended his staff for the hard work. "CENTCOM," he proudly observed, "was impressed that you were able to pull it off."

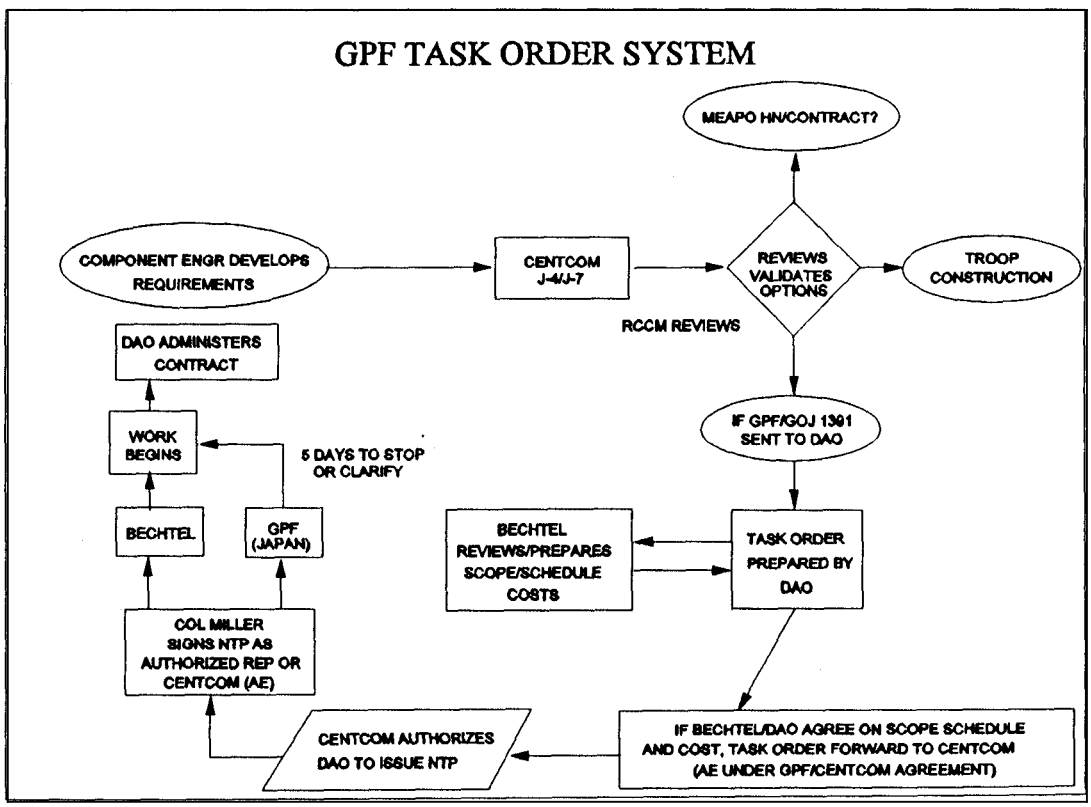
Gulf Peace Fund officials and Bechtel representatives held discussions in Tokyo from 12 January to 18 January when they resolved the last of their differences. The Gulf Peace Fund agreed to give Bechtel an advance based on a 30-day estimate of the work. The Corps would issue task orders to Bechtel and the Gulf Peace Fund simultaneously, and the Japanese government had five days to issue a stop order if it disapproved of the task. Gulf Peace Fund officials had insisted on checking all equipment and materials before purchase but now agreed to review the invoices that the United States submitted for payment instead.

The Corps reworded the contract to reflect these changes and to limit the contractor's performance to Saudi Arabia, Qatar, Bahrain, United Arab Emirates, Egypt, Kuwait, and Oman rather than "other Gulf countries as required." Because the Gulf Peace Fund refused to finance projects that supported combat operations, it remained unclear whether the contractor could construct airfields.[32]

Bechtel signed the $100 million contract with the Gulf Peace Fund on 22 January 1991 for an undetermined number of task orders, just two weeks after

the original solicitation. At a meeting the next day with the Bechtel's project manager in the theater, John N. Vanderschaaf, Miller issued the first task order directing Bechtel to develop a management plan. The second task order issued on 25 January directed the contractor to mobilize. Meanwhile, CENTCOM officials reported, "This program provides responsive construction support while conserving valuable troop labor assets for forward engineer missions."[33]

The process for handling a task order was well defined. The component engineer initiated the requirement for a project by submitting a DD Form 1391 to General Starling's staff. The regional contingency construction management team made up of engineers representing the various services and the Department of Defense's contract construction agent, the U.S. Army Corps of Engineers [specifically MEAPO (SWA)], reviewed the form and recommended that the CENTCOM engineer validate it. The team also recommended whether the project should be constructed by troops, contracted through MEAPO/host nation support, or assigned to the Gulf Peace Fund/Bechtel contract. Generally it reserved the Bechtel contract for projects outside Saudi Arabia.



Colonel Braden validated the project and CENTCOM's deputy commander, Lieutenant General Calvin Waller, approved it. CENTCOM entered the project in its approved project priority listing. The approved DD Form 1391 went to the Dhahran Area Office where the staff prepared the task

order and the commander signed it as the "authorized representative of the architect (CENTCOM)." The Dhahran Area Office forwarded the task order to Bechtel.

Bechtel provided the scope of work, estimated the cost, and scheduled the requirements. It then prepared the second part of the task order, which was the concept for accomplishing the work, plus the estimated cost and schedule. If the Dhahran Area Office and Bechtel agreed on the scope, cost, and schedule, the task order went to CENTCOM for review.

Miller reviewed the task order and prepared a cover letter recommending Colonel Braden's approval. Once Braden approved the order, Miller signed the "notice to proceed" for CENTCOM. The completed task order with a notice to proceed was faxed simultaneously to the "contractor" (Bechtel) and the "owner" (the Gulf Peace Fund's administrative committee). Bechtel was to begin work as soon as it received the notice to proceed. Gulf Peace Fund concurrence was not required. Under the contract, it had five days to stop the work if it had objections.

The MEAPO staff helped CENTCOM develop criteria, concept designs, and other elements that formed the basis of a tasking to the contractor. The Dhahran Area Office had no contracting officer authority or responsibility. Bechtel performed the Corps' traditional management functions—cost control, subcontracting, and engineering—and the Corps monitored these activities.[34]

To administer the contract effectively, the Dhahran Area Office established a Gulf Peace Fund resident office next to its headquarters with engineers, contract specialists, procurement specialists, and program analysts. Bechtel co-located at the resident office. During peak operations, the resident office included seven people from the Corps and 60 from Bechtel. At one point, it simultaneously administered eight major projects.

Within the first few weeks, the Gulf Peace Fund resident office issued 11 task orders for Bechtel. Two were to mobilize, six were for civil construction, one was an electrical project, and two were to repair existing facilities. Bechtel completed airfield expansions, runway improvements, parking aprons, storage yards, vehicle wash racks, and hazardous waste collection and disposal facilities in five countries.

From 26 January to 28 March, Bechtel received task orders to pave a 35,000-square-meter parking apron and install utilities at Doha, Qatar, pave a 24,000-square-meter parking apron at Fujairah in the United Arab Emirates, construct a 7,000-square-meter slab for an expedient structure (warehouse) at Fujairah, evaluate an asphalt plant and a rock crusher plant at King Khalid Military City, and apply 8,000 square meters of dust palliative for a helicopter pad in Hurghada, Egypt. In addition, Bechtel built an 86-station wash facility at a cost of $5 million for soldiers to wash and disinfect wheeled and tracked vehicles before redeployment. Vehicles had to conform to U.S. Department of Agriculture standards before they were returned to the United States[35]

One major area of the Gulf Peace Fund's contract work—environmental assessment and cleanup—continued long after the war ended. ARCENT was CENTCOM's executive agent for the theater environmental program, but in the first months, the focus was on deploying and sustaining troops. Environmental concerns were secondary. On 6 March 1991, General Stevens and General Al-Hussein met to discuss funding the disposal of hazardous wastes generated by U.S. forces in Saudi Arabia. Because it was an immediate requirement associated with redeployment, General Waller suggested that U.S. forces execute a contract to remove hazardous waste and arrange for Saudi reimbursement later.[36]

The Gulf Peace Fund contract, however, offered a better mechanism. CENTCOM directed Bechtel to assess the environmental impact of U.S. troops in the theater and to collect hazardous wastes left behind in Saudi Arabia and other Gulf countries. Bechtel specialists managed the collection, identification, storage, and disposal of oils, solvents, hydraulic fluids, battery acids, lubricants, coolants, and medical wastes. Wastes were consolidated in a collection yard and later either placed back in the Army system to be reused or disposed of in an approved facility.[37]

As troops withdrew, MEAPO(SWA)'s responsibilities for administering the environmental program increased. CENTCOM logisticians asked MEAPO for a qualified environmental engineer to ensure that the United States did not mismanage the politically sensitive environmental contracts with Bechtel. The 416th Engineer Command forwarded to the Dhahran Area Office technical guidance for initial environmental assessments.[38]

After the bulk of the U.S. troops and equipment had redeployed, the Gulf Peace Fund contract with Bechtel was terminated. At the time, Bechtel had been paid $50 million. Another $50 million was left in the Gulf Peace Fund account.

Observations

The Gulf Peace Fund gave the Corps an effective way to fund work in and outside Saudi Arabia. It was faster and more responsive than host nation support. Bechtel had an organization in Dhahran with many of the same capabilities that Cox had at the Dhahran Area Office. Cox praised Bechtel for its responsiveness and recommended in future operations using a contractor who would work on a cost-plus basis. This "combat heavy contractor" could perform the functions of a combat heavy battalion. Miller concluded that the contract worked "beautifully" and was "an absolute success." Miller and his staff had set up in just 34 days a contract that normally took four months to develop. Mobilizing Bechtel so quickly, Braden conceded, was a "high point" of his tenure in Saudi Arabia. The Gulf Peace Fund activities, he observed, "exceeded our expectations in every point."[39] Although Japanese assistance-in-kind contributed significantly, the Gulf Peace Fund contract with Bechtel came too late to have a major impact on the war or its outcome.

Host nation support, like Japanese assistance, was a valuable asset, but it had weaknesses. It worked well in developed areas such as Dhahran, Riyadh, and Jubail, but not in undeveloped areas with no infrastructure. The system was slow, and some contractors stopped work when hostilities threatened.

The chief contracting official for ARCENT SUPCOM, Colonel Charles D. Bartlett, was particularly critical of host nation support. "From the very commencement of the operations," he observed, "there were extreme difficulties in obtaining timely support from the host nation." This, he explained, was because the Saudis lacked the necessary contracting infrastructure and the same sense of urgency in meeting U.S. requirements. "Consequently," Bartlett conclude, "our requirements were questioned and our commander lost valuable flexibility in providing responsive contracting support to U.S. forces."

In addition, the procedures for transferring a contract to the Saudi Arabian government were very bureaucratic. Saudi officials always tried to get a better price, often awarding contracts automatically to the lowest bidder. U.S. contracting officials did not always do this if the bidder did not have the management structure or technical expertise to complete the contract. On a positive note, contracts that took six months in the United States could sometimes be expedited in six days in Saudi Arabia. A solicitation could open for only 3 to 5 days rather than the usual 10 to 30.[40]

After the war, the Defense Department reported to Congress that host nation support was "absolutely critical" to the rapid deployment of forces. It let the United States military deploy substantial combat power early in the process when the risks were greatest. "Had support in the form of host nation or assistance-in-kind not been provided by coalition partners and other responsible allies and friends," defense officials added, "some combat units would have had to have been displaced by support units when that did not seem prudent."[41]

The Defense Department estimated that the Gulf operations cost $61 billion. By 11 March 1992, coalition countries had provided an estimated $53 billion to offset these costs (more than $47 billion in cash). Two-thirds of this came from Saudi Arabia and the other Gulf states directly threatened by Iraq. The rest came largely from Germany and Japan. Saudi Arabia funded roughly 75 percent of the construction projects. Besides port facilities and telecommunications, it provided 4,800 tents, 600 buses, 1,073,500 gallons of packaged petroleum products, 333 heavy equipment transporters, 20 million meals, 20.5 million gallons of fuel per day, and bottled water. Saudi Arabia provided U.S. forces with more than $16 billion in assistance-in-kind and cash contributions.[42]

Without assistance from Saudi Arabia, Japan, and other nations, the United States government would have had to raise taxes or add to its already unwieldy budget deficit. More important, U.S. troops might well have faced severe shortages in facilities, equipment, and supplies.

CHAPTER 4
Engineer Construction

During the first months of Operation DESERT SHIELD, as policy makers worked to resolve the issues surrounding host nation support, military leaders carefully shaped the appropriate procedures and standards for engineer construction. Because of the harsh environment and the shortage of engineer troops and equipment, meeting the construction requirements of the theater posed a significant challenge.

Theater Construction Management

By doctrine, the theater commander established the construction priorities, allocated resources, managed the procurement and use of materials, assessed the progress, and planned future construction. Construction could be controlled at the theater level by a theater wartime construction manager. A particularly large theater could have several regional wartime construction managers. The theater manager oversaw both troop and contract construction, integrated each of the service commander's priorities into an overall construction program, and set priorities for U.S. requests for host nation construction support in the region.

During Operation DESERT SHIELD/DESERT STORM, General Schwarzkopf was responsible for engineering support, coordination, and priorities. Rather than delegate this authority to one service, Schwarzkopf retained overall responsibility for managing the theater construction program. However, he delegated to his engineer, Colonel Braden, the responsibility for managing the day-to-day construction planning, programming, and execution.

Managing joint construction in the Kuwaiti theater of operations was complex. It included setting priorities for all construction requirements that exceeded the capabilities of engineer troops or contractors, reallocating construction assets to support these priorities, validating military construction funding requests from the services, providing engineer planning for the commander in chief, and establishing and monitoring reporting requirements and construction standards.[1]

Previous operations plans provided for two regional wartime construction managers—ARCENT and NAVCENT (specifically the Naval Facilities Engineering Command). ARCENT further delegated its construction management responsibility to the 416th Engineer Command. This concept, which General Schwarzkopf never implemented, would have the 416th manage construction for both ARCENT and CENTCOM, thus clouding issues of command and control. Also, the engineer command could possibly be located some distance away from the joint command that it supported.

In the weeks before Operation DESERT SHIELD, CENTCOM had, in fact, abandoned the concept of having two regional wartime construction managers. In late July/early August, it had developed a new concept that appeared in the draft regulation 415–1, "Military Construction/Engineering in the USCENTCOM Area." CENTCOM used and disseminated this draft regulation, which had not yet been formally approved.

As specified in the draft regulation, CENTCOM adopted a new concept—regional contingency construction management. Each service would be responsible for its own engineering and construction support. Under this process, the CENTCOM engineer and a team of engineers representing each service and the Department of Defense's contract construction agent, the U.S. Army Corps of Engineers, would help General Schwarzkopf set theaterwide construction priorities and standards and allocate critical construction support. This regional contingency construction management team would monitor the way each service executed its engineering and construction program. It handled all items that were beyond a service's capability, perhaps reassigning projects to another service.

The team also managed the overall contingency construction program for host nation support. One of its main functions was to consolidate, validate, and prioritize contract construction at the theater level and maintain a theater construction priority list. All services had equal access to the team for construction beyond their own capabilities. The Army and the Marine Corps were the biggest customers initially because they had difficulty supporting deployed and deploying troops.[2]

CENTCOM first activated the regional contingency construction management team on 7 August at MacDill Air Force Base to help deploy engineer resources. The original team was an element of CENTCOM's engineer division, augmented with representatives from each service and the Department of Defense's contract construction agent, the U.S. Army Corps of Engineers. Initially, it included two representatives from ARCENT, none from the Special Operations Command, and one each from the Navy, Marines, and Air Force. Cliff Longfellow from MEAPO represented the Corps of Engineers.[3]

Colonel Braden and one of his staff members, Lieutenant Colonel John Trelease, along with four team members, deployed to Riyadh on 29 August and quickly set up operations at CENTCOM headquarters. Longfellow followed the next day. The team validated Army requests for 133 major construction project requests estimated at more than $500 million.[4]

Civil Engineer Support Plan

One important tool for identifying construction requirements was the civil engineer support plan. The plan, produced jointly by the services, was oriented toward the COMMZ and addressed requirements generated by relatively stationary forces. It described the engineer effort required—including the

required facilities and Class IV (construction material) and the critical engineer tasks—to execute the operations plan. The plan's generator, an automated system, let planners weigh alternatives and compare the projected and actual engineering requirements.

The civil engineer support plan was outlined in Annex D, "Civil Engineering Support Plan," of CENTCOM's OPLAN 1002–90. But because the plan had not been completed, no data was available until after the operation started. Operation DESERT SHIELD was the first time planners would use the plan's generator to prepare for a real event.[5]

Planners had developed the civil engineer support plan process in 1980 to determine, in advance, the engineer requirements at echelons above corps for each potential theater of operations. Civil engineer support planning was later assigned to two Army Reserve engineer commands. One of these, the 416th Engineer Command, was designated as the wartime construction planning headquarters for Southwest Asia.

A team from the 416th reported to CENTCOM(Main) headquarters in Tampa in August 1990 to work on the civil engineer support plan for Operation DESERT SHIELD and remained there until October. Early engineer planning at CENTCOM focused on running the civil engineer support plan's generator against the time phased force deployment data.[6] After planners in Tampa prepared the plan, they sent it to CENTCOM's forward headquarters in Riyadh where the staff used it to validate the need for facilities and the associated costs.

After soldiers from the 416th arrived in Saudi Arabia, they used the plan's results and planning factors to develop the actual requirements for the theater. They estimated the number and size of the facilities needed to support arriving troops and equipment. These requirements were translated into labor hours, quantities of construction materials, shipping weights, and costs for each project. These figures helped planners estimate requirements for engineer troops, contractors, and construction materials. They were the basis for ordering the shipment of materials, scheduling troop labor or awarding contracts, and obtaining prior approval for the projects. The civil engineer support plan's generator fairly accurately predicted the actual requirements. It anticipated construction requirements at $1.2 billion. At one point, actual requirements from the services reached $1.1 billion.[7]

Processing Engineer Requirements

The procedures for identifying, validating, and prioritizing engineer requirements were complex. Initially, with the regional contingency construction management team still at MacDill Air Force Base, CENTCOM had no organization in the theater to process the services' construction requirements. Thus General Pagonis and his staff handled all Army construction requirements. During the first months, Army units submitted their requirements

to the ARCENT SUPCOM engineer on DD Form 1391, "Military Construction Project Data." Pagonis approved or signed the form for ARCENT, and CENTCOM validated the project. That process kept the CENTCOM engineer in control of his projects and reassured Army headquarters and the Defense Department that the colonel concurred with the construction request. Meanwhile, Pagonis sent the forms to the Corps' Dhahran Area Office which began working with the troop units. Cox and his staff kept the general well-informed about the status of Army projects so he understood their relationship to other projects.[8]

Formal procedures for processing the services' engineer requirements did not really evolve until late November and early December when all the units responsible for processing the engineer requirements had arrived in the theater. Army units submitted their requirements on a DD Form 1391 through engineer channels to the corps level where they were consolidated with other requirements and passed on to the ARCENT engineer. He asked the U.S. Army Corps of Engineers to provide cost estimates within 48 to 72 hours. Miller and Cargill agreed to pass the requirements simultaneously to Forces Command, for information purposes, and to MEAPO(SWA), for cost estimates.

The Dhahran Area Office staff received the requirement as a two to three line mission statement. Using this brief description, they either prepared the estimate themselves or passed the requirement to MEAPO headquarters in Winchester, depending on the request's complexity and urgency. Once completed, the estimate went to ARCENT so the information could be entered on the formal DD Form 1391. After the ARCENT staff approved the form, they forwarded it through Forces Command and MEAPO to Army headquarters.[9]

Each service prioritized its own requirements and forwarded those exceeding its capabilities to CENTCOM headquarters in Riyadh. There the regional contingency construction management team consolidated, validated, and prioritized the requirements from all the services. Service representatives on the team met twice a week to explain their priorities. Colonel Braden, working with General Starling, established the initial priorities and made the recommendations. CENTCOM officials compiled the master priority list for the theater, integrating Army priorities with those of the other services. New projects were added at the bottom of the list each week, unless Braden or Starling decided to move a project up on the list.

Once a project appeared on CENTCOM's priority list, the Dhahran Area Office staff began designing it. The staff provided the designs, rough scopes of work, and cost estimates to ARCENT. The priority system was not always clear and precise. A high-priority project sometimes took longer to design than a low-priority project, which could already be under construction.[10]

Initially the theater commander had to approve all construction requirements exceeding $200,000, which caused delays. Schwarzkopf had

neither the time nor the inclination to pour over all of those requirements. In November, General Waller indicated that he would approve the construction requirements exceeding $200,000, and the approval process became more responsive and flexible. Waller was more accessible than Schwarzkopf.[11]

When the main body of the 416th Engineer Command arrived in the theater in early December, procedures changed slightly because the command took over managing the approval process for major new Army construction projects. Under the new procedures, unit commanders identified the construction projects they needed and provided the details to the engineer units that supported them.

The 20th Engineer Brigade, 7th Engineer Brigade, ARCENT SUPCOM engineer, and 411th Engineer Brigade helped the units define their requirements and provide the 416th with descriptions of needed materials, project location, projects sketches, and maps. The 416th commander validated the requirement, verified the scope, obtained unit costs, assigned a project number, and selected the appropriate design entity. The engineer command prepared the final DD Form 1391 to submit to CENTCOM and recommended the priority that ARCENT should give the proposed project.[12]

After early November when the Saudi Arabian government formally agreed to provide extensive host nation support, construction could be done either through Saudi or U.S. contracts or by U.S. troops. CENTCOM created a board to integrate Saudi officials into the planning process. The combined civil–military engineer board made up of representatives from the Ministry of Defense and Aviation's Joint Forces Support Unit, CENTCOM's engineer office, and MEAPO(SWA) met twice each week to review the status of projects and determine how to meet new requirements. After considering the resources available and the urgency of the requirements, the board recommended the appropriate method for completing each project. The board worked from CENTCOM's priority list. This list of 100 to 150 approved projects served as a menu from which the United States could get construction from the Saudis. After the board validated the requirement, it went directly to the Ministry of Defense and Aviation for execution.[13]

After Waller blessed a construction project, Braden sent out a message indicating that CENTCOM had approved the project at the estimated cost. Then either the Saudis or the services handled the project. The services used troop labor and materials supplied by the Saudis or purchased. Braden's staff continually reviewed proposals to ensure the projects were still valid and could be accomplished in time to benefit troop operations.[14] By 25 November, the services had submitted 79 proposals—estimated at $878 million. CENTCOM officials had validated and approved 53 projects—costing $351 million.[15]

After CENTCOM officials prioritized and approved the DD 1391 forms, Colonel Miller transmitted the project priority list to the Dhahran Area Office staff so they could begin design work. Miller forwarded design and contract

specifications for the projects that were designated for host nation support to the Ministry of Defense and Aviation for contract award.

MEAPO(SWA) provided technical oversight of the ministry's contracts to ensure the work met U.S. requirements. Each Wednesday morning Miller and representatives from the Joint Forces Support Unit poured over the design packages. Corps personnel told the Saudis how each project should look, where it was located, and what it would cost. After receiving all this information, the support unit budgeted for and advertised the project, received and evaluated the bids from contractors, and awarded the final contract. After the support unit awarded the contract, MEAPO(SWA) placed some of its personnel on-site to ensure that the contractors built the projects according to the specifications. For example, Captain Steve Adams and his staff oversaw construction at King Khalid Military City, while another Corps representative performed the same function at the air base in Riyadh.[16]

Representatives from MEAPO and the Joint Forces Support Unit signed an agreement on 29 January 1991 that defined the responsibilities for project management, engineering, and construction management supporting the Gulf operations. The support unit agreed to use construction contracts to procure facilities at various locations throughout Saudi Arabia. MEAPO and the support unit would provide the quality assurance and technical oversight for these contracts.[17]

Construction Standards and Design

In general, construction standards determine the types of materials and the techniques that engineers use to construct facilities. During the first months of the Gulf operation, however, the services were somewhat confused about construction standards. At the time of the invasion, Army planners had not yet established minimum construction standards for the Kuwaiti theater of operations. Such standards affect the number of engineer troops and the amount of host nation support, construction equipment, and construction supplies needed in the theater.

In developing minimum standards for the theater, planners failed to follow the Army's own standard design system—the Army Facilities Component System. Moreover, information about standards was not readily available to engineer planners when they arrived in the theater. The lack of clear guidance about construction standards delayed construction decisions.[18]

Recognizing the confusion, Braden directed the services to follow construction standards contained in OPLAN 1002–90. On 6 September, CENTCOM directed that facilities supporting troops in the Persian Gulf would be constructed to "initial standard" and only be upgraded to "temporary standard" with Braden's approval. The military defined initial standard as austere facilities with minimum engineer construction effort, intended for only one to six months of use. By contrast, it defined temporary standard as

minimum facilities intended to increase the efficiency of operations, intended for up to 24 months of sustained operations. Braden indicated that he would only approve exceptions to initial standards on a case by case basis.[19]

Braden maintained that the published definitions of initial and temporary standards were broad enough to meet the needs of the services. He noted that services should submit to the regional contingency construction management team any questions they had about how the definitions applied to particular types of construction—such as prefabricated modular structures. The standards, he explained, were "not intended to restrict construction, but rather to control the quality and consistency of construction and to manage the visibility the construction gives to the duration of the operation."[20]

General Schwarzkopf was anxious that the operations not appear to be permanent. The Bush administration had assured the Saudis that the U.S. troop presence was temporary, and the theater commander wanted to reinforce this message. Any construction that indicated permanency, such as base camp construction with hard stands and concrete slabs, was "politically unacceptable." The engineer community, Braden observed, came under a lot of pressure "to keep from gold-plating the theater." CENTCOM's decision to adopt austere construction standards—the minimum required to support the troops and the operation—limited the number and scope of the services' construction requirements.[21]

On 16 September the theater commander established a more detailed strategy for moving from initial to temporary construction standards. As the focus changed from deploying to supporting and sustaining troops, Schwarzkopf announced a plan to move to temporary construction standards to enhance living and working conditions.

In the first 90 days of the operation, the services were to bed down forces to initial standards using their organic assets supplemented by leased facilities or facilities provided by the Saudi Arabian government. If necessary, temporary standard latrines and showers could be built using contract construction, host nation support, or troop labor.

From 90 to 120 days, housing, medical, maintenance, and other key facilities would be upgraded to temporary standards using expedient shelter systems and contract construction. Power distribution systems would be developed for the base camps, and power generation detachments and equipment could replace unit generators. [*See* Powering the Theater, page 187.] Troops would drill or improve water wells.

Over time, troops would need better facilities to operate effectively, and the cost of leasing would become prohibitive. Recognizing this, the theater commander stipulated that after 120 days, the services could upgrade all facilities to temporary standards and construct additional base camps to reduce the number of people using facilities leased with U.S. funds. Existing camps would be improved through a combination of contracted construction, troop

labor, and prefabricated modular buildings. Additional camps would be built by troop labor, contractors, or both.[22]

The theater commander continued to emphasize austere construction. In mid-December, General Starling issued revised guidance on theater construction. The arrival of VII Corps prompted CENTCOM to reevaluate its immediate objectives concerning infrastructure. Its priority now was to satisfy "the most urgent requirements" of arriving forces. Starling directed that the engineer force and other construction resources in the theater be applied only to requirements that would directly enhance combat readiness and sustain the force within the next 60 days.

Therefore, construction to house and support troops should remain at initial standards unless otherwise authorized. Construction should focus on projects that were required to support combat—ammunition supply points, airfield improvements, heliports, helicopter refueling/rearming points, main supply routes, and forward supply areas. Only critical troop facilities—particularly latrines, showers, and dining facilities—should be upgraded. The theater commander would evaluate requests for upgrades to other facilities on a case by case basis.

Rudimentary roads and maintenance and storage hardstands could be constructed only to sustain operational effectiveness. U.S. forces might use temporary, relocatable structures such as K–Span buildings to meet the requirements for large maintenance and storage facilities in the rear areas. In sum, CENTCOM directed, "this is to remain a lean theater that takes care of the personal needs of our troops, has the capability to provide flexible logistics, and is prepared for warfighting."[23]

Policy makers and planners carefully avoided anything that appeared to be long-term construction. For example, plans for the first life support areas included a concrete block building at each site to be used as a mess hall. These buildings provoked questions at Corps headquarters and in Congress because the cement/masonry structures looked permanent. Concrete block buildings, however, were cheaper to build in Saudi Arabia than portable construction, provided better protection, and were cooler than wooden structures. Officials allowed the Dhahran Area Office to build cement/masonry structures at the base camps but only because they were cheaper than alternatives and could be leveled after the operation ended.

After seeing the austere structures that the contractors provided, Ben Wood argued that it might have been better to build more permanent structures that the Saudis could have used later for joint training exercises and other purposes. "Temporary" construction, he observed, was not necessarily "cheap" construction in a desert environment. In a region where afternoon temperatures soared to 130 to 140 degrees, insulation and cooling became part of the initial standards. By the time contractors provided enough insulation to make the facilities inhabitable, Wood added, they had built "a fairly formidable

Cement masonry building under construction at a life support area.

structure." He also noted that designing a structure from scratch was easier than paring back a standard Army design.[24]

MEAPO designed the CENTCOM-approved projects that were not designed by troops. The submission and approval of a DD Form 1391 was MEAPO's signal to begin design. The design work involved conducting a preliminary site investigation, determining layout requirements, developing the site-specific layout, preparing the government estimate and specifications, and performing a quality assurance review.[25]

The Army Facilities Component System was the Army engineer planning and design system developed in 1951 for use in contingencies worldwide. It consisted of engineer planning data on facilities requirements for all deployable Army units, standard designs for austere facilities, and bills of materials for construction. The system provided construction standards, construction phasing, standard plans, and general guidelines. It provided information on construction materials and techniques plus digitized drawings of individual facilities or entire installations. Designers could not easily substitute materials prescribed by the system- such as lumber-with other construction materials readily available locally.[26]

Differing systems hampered the communication of standards and design data among the services. The Army Facilities Component System, the Advanced Base Functional Components System used by the Navy and Marine Corps, and the Air Force Design Manual provided construction drawings with varying interpretations of the Joint Staff's construction criteria and standards. The existence of three distinct systems strained the joint-level validation process and created difficulties for the Department of Defense's contract construction agent,

the U.S. Army Corps of Engineers. After the Gulf War, the CENTCOM engineer recommended that the Joint Staff coordinate with service engineers to establish a common set of drawings and specific construction standards for facilities.[27]

Design was an evolving process. The Dhahran Area Office often modified the Army's standard designs to shorten the construction time and cut costs. Fortunately, the office shared a building with an engineering firm that could print drawings and documents overnight. The Dhahran Area Office staff's knowledge of the types of material available in the Middle East proved to be very helpful when designing projects.[28]

The actual design work was not particularly complicated. Corps personnel skillfully adapted the generic specifications and design criteria to specific situations. They did their best to respond to unique and rapidly changing requirements. A small group of engineers in the Dhahran Area Office soon dubbed their work area the "ballpark" because other staff members continually asked them, "Can you give us a ballpark estimate of what this will cost?"[29]

Although the level of design was mostly simple field design, the Dhahran Area Office sometimes created designs that were too elaborate. Shifting gears from peacetime construction to wartime construction could be difficult. Troops needed facilities that could be built quickly, Lieutenant Colonel Cox observed, not ones that would last 50 years.

Normally, Cox stressed three priorities for each project: quality first, then cost and time. During the Gulf operations, however, he directed his staff to emphasize time first, then quality and cost. Occasionally, the staff completed projects in 30 days that normally would have taken six to nine months. To expedite construction, the staff drew on their knowledge of the types of materials available in the region and grappled with shortages of some critical materials and equipment, particularly heavy-haul equipment. They completed designs in 24 hours that might have taken three months. Normally project design could take up to a year, but the average design time during Operation DESERT SHIELD/DESERT STORM was four days from the receipt of the project to the reproduction of the drawings.[30]

MEAPO lacked sufficient in-house design capability to support the requirements in Saudi Arabia, so it awarded indefinite delivery contracts to four or five design firms. Ollie Werner, chief of MEAPO's engineering division, and Roger Thomas, chief of MEAPO's project management and planning branch, stipulated that all potential contractors should have expressed an interest in providing support services for Operation DESERT SHIELD and should have previous experience working in the Middle East, preferably with MEAPO. At least one firm should be located within 100 miles of Winchester to provide immediate response, and at least one firm should be located in Saudi Arabia to provide minor design and engineering support services to the Dhahran office.

Three additional firms should be able to design airfields, industrial type facilities, and water and power supply and distribution plants and be able to do master planning. Of the 19 firms that expressed an interest in supporting Operation DESERT SHIELD, MEAPO selected Leo A. Daly; STV/Lyon Associates; Stanley Consultants, Inc.; Zuhair Fayez and Associates; and Daniel, Mann, Johnson, and Mendenhall.[31]

After MEAPO signed the contracts, either the Dhahran Area Office staff, MEAPO personnel in Winchester, or one of these architect–engineer firms performed the design work. Problems developed because the designs that MEAPO and its contractors produced did not have the level of detail normally contained in Corps' solicitations. Also Saudi contractors lacked the capability to complete design and build packages, and office personnel spent much time helping the contractors develop the construction details. Since the Dhahran office did not have a large enough staff to continue helping the contractors with the design work, it determined that its designs would have to provide Saudi contractors with sufficient detail.[32] After the host nation support implementation plan was signed on 1 November 1990, office staff turned the designs into packages that the Saudis could award and fund.

South Atlantic Division's procedures required that it review and approve the designs that MEAPO produced. Division personnel also reviewed, in a secondary capacity, the designs developed by MEAPO's contract architect–engineer firms to have an overview of all the designs in MEAPO's programs.

Because of the urgency of the Gulf operations, the division modified its required procedures. The division retained its oversight responsibility but only intervened directly when there were potential problems. MEAPO provided an information copy of each design to the South Atlantic Division's engineering division. However, it often submitted copies of each of its major technical designs to the division for approval. A "major design" was any project that would cost more than $150,000 to construct.[33]

The project engineer or construction representative who would be monitoring the work on-site evaluated the plans and specifications to determine if they were feasible. He addressed such issues as correct elevation, adequate utilities, adequate drainage, and suitability to the environment. The project engineer or construction representative did not have much time to review the plans and specifications. If his review was favorable, he directed the Dhahran Area Office to award the contract. The office's construction division monitored the contract after it was awarded. Construction representatives were on-site every day and fed information back to the project managers.

The Corps brought in several officers—Captains Paul Cudney, Ted Kientz, Dana Patterson, and Steve Adams—to act as project engineers. They provided the necessary oversight and, in return, gained valuable experience. They sometimes had the rare opportunity to see projects through from start to finish.

For example, Captain Cudney worked on as many as nine different projects in various stages of completion in the United States, but in Saudi Arabia for the first time he steered a single project through the various stages towards completion.[34]

The Dhahran Area Office staff encountered significant problems during the design process—to include difficulties developing design criteria and obtaining access to project sites. When staff members received a project, they could not always visit a site because of the great distance or a heavy workload. Sometimes the site visits were made by engineers who had no design experience from other offices, so the Corps received incorrect data. Corps personnel found that it was important for the designer to inspect the site and talk directly with the user. Also, because of the fast-paced design cycle and problems with the design process, some design projects had deficiencies.[35]

Construction Materials

The availability of construction materials was a major factor in project designs. The Army Facilities Component System designs might be difficult to construct because required construction material was unavailable. In the Middle East, engineers could easily draft a great design only to find that they could not acquire needed materials. If the standard materials were unavailable, the Dhahran Area Office staff developed designs that provided for substitutions, for example, a shower constructed of local materials. Corps personnel tried to ensure that the materials they specified were available locally and would not have to be ordered from the United States. When a contractor for one project indicated that the specified materials would have to come from the United States and would take six months to get, office staff quickly modified the contract to allow a substitution.

Units often requested wood construction because all the temporary structures described in the Army Facilities Component System were wood, but wood was scarce and very expensive in Saudi Arabia. As the Army bought up the available supplies of wood, prices soared even higher, particularly the cost of plywood and 2x4s. In other instances, the specifications called for a certain number of inches of asphalt, but asphalt was also scarce. The Dhahran Area Office had the contractors compact the existing material and put asphalt on top.[36]

Critical construction materials such as cement, asphalt, prefabricated shelters, pipeline components, sand grids, airfield matting, dust palliatives, lumber, and barrier materials were scarce. The civil engineer support plan had not accurately forecast most of the required construction material.[37] By late August, the supply of local construction materials was rapidly diminishing. Competition for scarce construction materials resulted in soaring prices. The cost of a bag of cement jumped from $2.13 to $8.00.

Base course stockpile area for work at KingFahd International Airport. The lack of an adequate source of base course in the eastern province of Saudi Arabia forced contractors to haul material from Abu Hadryiah, 100 kilometers away.

The limited capability of the services to produce asphalt, concrete, or crushed rock resulted in heavy reliance upon host nation assets and delayed essential construction projects. No service brought into the theater adequate resources to produce asphalt, concrete, or crushed rock, either because they had underestimated the need for these resources or because of the limitations on transporting heavy equipment.

The civil engineer support plan's generator assumed that all construction materials would be transported to the theater of operations. In reality, local contractors provided most of the Class IV construction materials. The severe shortage convinced Colonel Flowers that in the future the Army should establish strategic stockpiles of such materials.[38]

The 411th Engineer Brigade reported that obtaining Class IV material was a major challenge. Planners had expected to obtain construction materials through the DD Form 1391 process, but this process could not react quickly enough for critical projects. The brigade requested materials to establish Class IV yards and to obtain aggregate and asphalt products. Local contractors had to purchase these materials. After the Gulf War, the commander of the 411th would report, "The shortage of Class IV material proved to be critical to the mission." He recommended that engineers be activated early to obtain key equipment and supplies for their projects.[39]

Asphalt was particularly critical. Units needed asphalt pavement to control the dust and sand around helipads, airfields, hardstands, wash racks, warehouses, large "festival" tents, and other relocatable structures. Yet engineer

construction support companies were deployed without their asphalt production and paving equipment and had to rely on Saudi asphalt plants and compaction equipment. This equipment was in very poor condition, the stock of repair parts was limited, and maintenance crews were scarce. Each combat heavy battalion had only two asphalt distributors, not enough to meet the demand. Saudi contractors provided some asphalt pavement, but at a high price.[40]

The paving capabilities of Task Force 43, the task force made up of the 43d Engineer Battalion (Combat Heavy) and various engineer companies, were seldom fully used because asphalt was scarce. At one point, the task force had three asphalt platoons, but it could not keep them supplied. An asphalt platoon from the 13th Engineer Company (Combat Support) arrived on 24 December 1990 but had no asphalt production equipment. The frustrated engineers sat idle until 5 January when contractors began to provide asphalt. Even then, the problems continued. The asphalt shipments sometimes did not arrive on schedule. Often they contained oversized aggregate and were delivered cold.

After 12 January, asphalt deliveries stopped altogether. With war approaching, contractors had difficulty finding drivers who would deliver the asphalt to the construction sites. In January, the 155th and 259th Engineer Companies joined Task Force 43, so it now had three asphalt platoons with six paving teams. The 155th put an old asphalt plant at King Khalid Military City back in operation. It took time before the plant produced at its capacity of 150 tons per hour. Even at peak capacity, the plant produced only enough to supply one of the three asphalt platoons, so the task force continued to rely on commercial sources for asphalt.

In addition, there was a small asphalt plant at Hafar al Batin and a larger plant at Majma'ah. The Majma'ah plant, however, was a long distance from the construction sites, and the hot-mix asphalt cooled during transportation causing quality control problems. An asphalt plant north of King Khalid Military City, operated by one of the Corps' contractors, was dedicated to paving operations at that installation.[41]

The 416th Engineer Command, using in-house logistics capabilities; civilian contracting expertise; and civil engineer support plan requirements, projections, and requisitions procedures, managed the procurement of Class IV materials for all the services. U.S. forces ultimately acquired and used 5,000 cubic meters of gravel, 170,000 metric tons of asphalt, and 93,000 cubic meters of ready-mix concrete at a cost of $64 million. This did not include construction materials that the regional contingency construction management team procured with funds from the governments of Saudi Arabia and Japan.[42] Although support from the host nation and Japan helped considerably, the shortage of construction materials sometimes delayed or stopped critical construction projects.

Obstacles to Construction

As American soldiers moved into the interior of Saudi Arabia, away from the port areas and major cities where the oil industry had developed infrastructure in the 1970s and 1980s, they required road networks, staging areas, ammunition supply points, heliports, warehouses, and other facilities. Most construction requirements were for the Army, rather than the Air Force and Marines. Yet, the late deployment of its engineers severely limited the Army's ability to construct the necessary facilities.[43]

The shortage of engineer troops and equipment was particularly great in horizontal construction such as roads, hardstands, and heliports. By the time combat heavy engineer battalions arrived in the theater, Braden observed, the requirements for Army engineer work were "massively weighted" toward horizontal construction. Many of the engineers in combat heavy battalions, who normally performed vertical construction, were diverted to horizontal construction. Carpenters, plumbers, and electricians operated dump trucks or other engineer equipment. Each engineer company had one horizontal construction platoon and two vertical construction platoons, but there was little need for vertical construction in the Middle East. Senior engineers later observed that it would have been better to have had two horizontal platoons and one vertical platoon per company.

With combat heavy engineer units arriving in the theater late, the corps divisions needed much support. The divisions took their organic engineer battalions with them to the forward areas. As a result, the ARCENT SUPCOM had to rely heavily on construction contractors. The shortage of engineer troops continued until February, and some projects were left undone, particularly road construction and maintenance.[44]

Military leaders decided to place the limited heavy construction assets forward with the corps engineer brigades and risk shortfalls at the echelons above corps because of the well-developed infrastructure in Saudi Arabia and the availability of contractors and host nation support. Combat heavy engineer battalions were normally assigned at echelons above corps and did not support the corps, but the corps needed their horizontal construction capabilities. The first combat heavy battalions in the theater went directly into the desert to support the 20th Engineer Brigade. Ultimately, four combat heavy battalions supported the XVIII Airborne Corps, three supported VII Corps, and only two supported echelons above corps.[45]

The preponderance of horizontal work posed a challenge for engineer units. The commander of the 411th Engineer Brigade, General Storat, complained that his units were "stretched thin" on their horizontal work at echelons above corps. To cope with the heavy workload, the brigade leased or purchased extra commercial equipment.[46]

The harsh environment further hampered construction. Engineer productivity suffered in the intense heat. Operating a bulldozer or fork lift in

the desert was difficult. Often, engineers had to develop roads to get to their work sites and then had to level 3-foot to 4-foot sand dunes before beginning construction. Grading was expensive and time-consuming, something many officials in the United States did not realize.[47]

Another obstacle to construction was the restriction on funding. [*See* Funding Corps Activities, page 63.] Initially CENTCOM had no way to fund anything other than minor construction. Funding new construction projects that cost more than $200,000 was a major challenge. Four basic legislative authorities could be used to expedite the release of military construction funds during contingency operations—Title 10, U.S. Code, Sections 2803, 2804, 2805, and 2808. These laws required a tedious process of submitting detailed justification for all military construction projects that cost more than $200,000. The laws had been designed in part to ensure that taxpayer dollars were spent appropriately, but this goal had to be balanced with the maneuver commanders' urgent needs for authority to fund large construction projects.

Title 10, U.S. Code

Section 2803, "Emergency Construction," authorized each service secretary to reprogram up to $30 million in military construction funds for a military construction project not otherwise authorized by law. The major command requesting the project had to submit a DD Form 1391 to its service secretary, and Congress had to be notified.

Section 2804, "Contingency Construction," provided that within the amount appropriated for such purpose, the Secretary of Defense could carry out a military construction project not otherwise authorized by law or authorize a service secretary to carry out such a project. The secretary had to notify and get the approval of the appropriate congressional committees 21 days beforehand.

Section 2805, "Unspecified Minor Construction," authorized service secretaries to carry out minor military construction projects that Congress had not yet authorized, but specified that no more than $200,000 in operation and maintenance funds could be used for each project. Section 2805 also required a 21-day advance congressional notification. While ARCENT could approve projects under $200,000, projects over that amount had to be forwarded to CENTCOM for approval.

Section 2808, "National Emergency Construction Authority," gave the Secretary of Defense broad authority to spend all the unobligated military construction funds, but only after the President issued a declaration of war or national emergency. Each service submitted a DD Form 1391 to the Defense Department to obtain approval and funding for a specific project. The Secretary of Defense had to notify Congress about the project and its estimated cost, but there was no waiting period. The project could begin as soon as Congress was notified.[48]

Soon after the United States committed troops to Saudi Arabia, the Assistant Chief of Engineers, General Offringa, submitted a request to reprogram fiscal year 1990 military construction funds under Section 2803 to construct basic shelter and support facilities for soldiers in Operation DESERT SHIELD. The Secretary of the Army and the Deputy Secretary of Defense approved the use of Section 2803 authority to construct six base camps. Offringa recommended reprogramming $30 million from four military construction projects in the United States—Price Support Center, Illinois; Fort Monmouth, New Jersey; Picatinny Arsenal, New Jersey; and Fort Knox, Kentucky.[49]

On 24 August, the Department of Defense comptroller, Sean O'Keefe, asked the chairmen of the House and Senate appropriations subcommittees on military construction to approve the reprogramming action. The Senate subcommittee did so with the understanding that these funds would not be used to construct any permanent facilities without its approval. It also asked the Defense Department to seek host nation funding for projects as much as possible. The House subcommittee also approved the reprogramming action.[50]

Military planners quickly recognized that the $30 million reprogramming authority in Section 2803 would not provide enough funding. They began to push for the broader authority of Section 2808. General Pagonis argued that ARCENT had "critical" construction requirements that would not be met without both operation and maintenance funding and military construction funding. There was, he reported, an "urgent need" for emergency construction authorized under Section 2808.[51] On 30 October, the Deputy Assistant Secretary of the Army for Installations and Housing, Paul Johnson, asked the Corps for a list of military construction projects in the United States that could be canceled to pay for construction in the Persian Gulf if the President invoked Section 2808 authority. The Corps identified 13 projects that could be canceled if necessary to fund $98 million of ARCENT's military construction requirements.[52]

Sections 2803, 2804, and 2808 gave the service secretaries special authority to carry out military construction faster than normal procedures allowed. Yet, this authority required special processing of funding requests and congressional notification and took too long to meet the needs of the maneuver commanders in the Gulf. The only funds immediately available were operation and maintenance funds. These funds could not normally be used for work classified as military construction, but as noted, Section 2805 authorized the use of operation and maintenance funds for military construction under $200,000.

The $200,000 did not go far in an environment where a single water well cost $340,000, a sunshade cost from $143,000 to $162,000, and a 50-helicopter heliport cost more than $2.6 million and where $200,000 would only buy one 16,000-square-foot, bare-bones K–Span building or 0.65 miles of road. Corps members quickly became frustrated by the $200,000 limit and

requested that it be raised to $5 million. Pagonis argued that the limit prevented urgently needed construction and robbed him of any flexibility to react quickly to the requirements of all the services. In late September, ARCENT officials joined Pagonis in requesting that the funding limit be raised to $5 million per project.[53]

In early October he again complained that critical construction requirements existed in eastern Saudi Arabia, such as sunshades, main supply routes, water wells, and heliports, but the $200,000 limit on operation and maintenance funds did not provide enough flexibility to support U.S. forces. He requested that the limit be raised from $200,000 to $5 million. Forces Command also complained about this limit, noting that construction of heliports, helipads, and wells was being delayed.[54]

Army officials found strong support for their position at CENTCOM headquarters. Colonel Braden observed that the normal process for approving and funding military construction projects was "not responsive to the operational requirements in a contingency environment." Raising the funding limit would enable the services to complete many critical projects. On 9 October the theater commander sent a message to the Joint Chiefs of Staff supporting ARCENT and Forces Command requests for relief from the $200,000 limit. He argued that the limit did not allow for the construction of tactical bases and facilities that the services needed immediately or facilities that the troops needed for their health and welfare. He recommended that the chairman of the Joint Chiefs of Staff ask Congress to increase the limit to $5 million.[55]

To raise the limit, however, the Office of the Secretary of Defense would have to secure special legislation, and the Joint Staff's director of logistics, Vice Admiral Jimmy Pappas, warned that the mood of Congress was to "get allies to provide needed support." Rather than approach Congress, he indicated, they would have the Secretary of Defense's staff ask the Office of Management and Budget to expedite approval of the request for a Section 2808 presidential declaration of national emergency so the services could tap all unobligated military construction funds.

After receiving a less than satisfactory response from the Joint Staff, Yeosock directed the ARCENT staff to pursue every funding method—host nation, operation and maintenance, military construction—to accomplish his priorities.[56] The funding situation eased somewhat after 14 November 1990 when President Bush issued Executive Order 12734, declaring a national emergency and invoking the emergency construction authority under Section 2808.

Raising the $200,000 limit was not the only controversial issue. There was some disagreement about how to define "military construction." When should operation and maintenance funds be used, as opposed to military construction funds? Could military construction funds be used to pay for projects on Saudi-

owned land? Could operation and maintenance funds be used to construct "permanent" structures?

Title 10, U.S. Code, Section 2801(a) defined military construction as "any construction, development, conversion, or extension of any kind carried out with respect to a military installation." Not all structures could be easily categorized as "permanent" or "semipermanent." For example, the comptroller general considered a runway a permanent structure, but a helipad or easily removable sunshade might not be. Corps leaders instructed Colonel Miller to use operation and maintenance funds for projects that cost more than $200,000 only when the facility could reasonably be classified as semipermanent.[57]

The Corps' chief counsel, Lester Edelman, concluded that construction in Saudi Arabia could be considered military construction if it was performed in relationship to an activity that was under the operational control of the Secretary of Defense. In other words, U.S. ownership of the land was not a prerequisite for military construction, as long as the land was under the operational control of U.S. forces. He also maintained that military construction funds could be used for temporary facilities. The question remained, however, as to who determined that the land was under the Secretary of Defense's operational control. Construction related to a military installation—defined as an activity under the operational control of the Secretary of Defense—was appropriately funded with military construction funds.

Edelman advised that the Corps could legally use operation and maintenance funds to construct authorized semipermanent facilities. These funds were legally available for projects that did not exceed $200,000 and construction in Saudi Arabia that did not fit the definition of military construction.[58]

Lieutenant Colonel William Hagan, ARCENT SUPCOM's staff judge advocate, endorsed Edelman's opinion. Though Edelman's position was liberal, Hagan explained, his "special position to comment makes his opinion worthy of the weight we have given it." He concluded that it was appropriate to use operation and maintenance funds to construct a badly needed heliport at King Abdul Aziz Air Base, even though the base was not under the control of the U.S. military.[59]

Colonel Tonu Toomepuu, ARCENT's staff judge advocate, however, criticized Edelman's position. The conclusion that operation and maintenance money was appropriate, he argued, did not necessarily follow from the premise that military construction funds could not be used. "If the contemplated construction is completely on Saudi owned and controlled property in which we have no legal interest, such as right to enter and use, we may not pay for it at all with military funds," he concluded. "If it is construction for our benefit we must pay with MCA [military construction, Army], more than $200,000, or we may pay with OMA [operation and maintenance, Army] funds under $200,000 per project." Building temporary structures that could serve the

United States may be classified as acquiring supplies, he added, and supplies may be purchased with operation and maintenance funds.[60]

As the debate continued, Colonel Miller requested permission to award an indefinite delivery order contract to provide a 5.1-centimeter layer of asphalt over 1.1 million square meters currently being used as a temporary heliport at King Fahd International Airport. This $3.5 million project was urgent. Workers had recently applied a chemical spray as a dust palliative, but the surface could not withstand heavy vehicle and aircraft traffic. The dust at the temporary heliport endangered personnel and equipment. Four incidents of "hard landings," where pilots cut off their engines before safely setting their helicopters on the ground, had occurred because blowing dust obscured visibility. Each incident had jeopardized a $12 million piece of equipment and put its crew in danger. Yet, MEAPO could not award the dust palliative contract because of the $200,000 limit.[61]

General Sobke urged the Corps' director of military programs, General Ray, to give MEAPO authority to award a contract and begin construction using operation and maintenance funds. The project was in support of military operations and the facility would not be permanent, he argued, so this funding was appropriate. Ray refused to grant Sobke's request because he was awaiting an opinion from the Office of the Secretary of Defense's general counsel, Terrence O'Donnell, on the use of these funds. O'Donnell determined they could not be used for a dust palliative contract at King Fahd International Airport. Saudi funds were eventually used for some projects at the airport.[62]

Host nation support and Section 2808 authority did much to alleviate the problem of funding construction, but funding MEAPO's planning and design work was another matter. Paying U.S. personnel directly involved in administering design and construction activities could only come from two sources—project funds or cost reimbursement. The Corps could either use military construction funds or planning and design funds to pay its personnel who were involved in the design and construction of facilities used by U.S. forces.

In mid-November Sobke asked Corps headquarters for specific guidance about the type of funding the Corps should use. Since no funds had been specifically designated for planning and design, Sobke requested $2 million in military construction funds to pay for MEAPO's support of host nation construction. MEAPO had already received $250,000 to plan and design the life support areas, $150,000 for an ammunition supply point, and $50,000 for a heliport project.[63]

The Corps provided the Saudis with construction support under the host nation support agreement to ensure that the facilities that the Saudis constructed satisfied the requirements of U.S. forces. Military construction funds were scarce, and the Corps believed its support functions should be funded with operation and maintenance appropriations.

Edelman maintained that military construction planning and design funds were appropriate to manage projects that the Saudis constructed, that operation and maintenance funds were appropriate for advance planning activities, and that no authority existed to perform comprehensive designs for projects to be constructed by foreign governments. He concluded that Title 10, U.S. Code, Section 2807 did not authorize the use of military construction funds to plan and design projects that foreign governments funded and constructed.

Edelman added that since Section 2807 explicitly provided for the funding of construction management of foreign-funded projects using planning and design funds, those were the only funds available for that purpose. Section 2807 authorized the Secretary of the Army to provide construction management services for projects that the Saudis executed for Operation DESERT SHIELD, he added, and the military construction planning and design account was the appropriate source of funds for these services. He believed that the Corps could appropriately use operation and maintenance funds to complete the advance planning activities necessary to ensure that the projects the Saudis executed met the needs of the military department using the facility.

Edelman's legal opinion went to the Army's general counsel on 7 December 1990. The Corps proposed that the fiscal year 1991 DESERT SHIELD supplemental budget request authorize the use of operation and maintenance funds for planning, design, and construction management of DESERT SHIELD projects that were going to be funded by foreign governments and thus preserve scarce military construction resources.[64]

The Army's general counsel determined that Section 2807 authorized the use of military construction funds for planning and designing projects that were funded and constructed by foreign governments. It should be used for all Corps activities supporting projects that the Saudis funded and constructed. This would result in a direct dollar-for-dollar reduction in the design and construction of authorized non-DESERT SHIELD military construction projects.

Faced with a potentially devastating impact on military construction resources, the Chief of Engineers asked Assistant Secretary Susan Livingstone to help get the Army's general counsel to reconsider his position.[65] On 20 March 1991, Corps headquarters released more than $2.6 million in military construction funds to MEAPO for design and construction management support for projects being performed by the Saudi government and under the Japanese government's Gulf Peace Fund contract. By the end of the ground war, MEAPO had expended $5,954,000 in operation and maintenance funds, $1,796,000 in military construction funds, and $748,000 in connection with the Gulf Peace Fund, for a total of $8,498,000.[66]

Operation DESERT SHIELD clearly demonstrated that funding procedures for wartime construction were cumbersome and placed severe limitations on commanders in the field. Initially, funding regulations, such as the $200,000 limit on operation and maintenance funds, severely hampered the Corps'

operations. Until mid-November, when Section 2808 authority was granted, the Corps basically could not construct any projects costing more than $200,000. Thousands of troops arrived each day with no place to go, and the Corps was trying to function within the normal peacetime regulations. Ultimately, CENTCOM was able to house 44,000 troops in the Dhahran area because there were real estate vacancies. But the question remains, if those vacancies had not existed, where would the troops have gone?

Colonel Miller later recommended that during wartime, the authority to approve military construction expenditures be decentralized and that Congress approve a lump sum of military construction dollars under emergency legislation for expenditures in the theater. Section 2805 authority, he observed, would have been responsive to a prehostility environment if the $200,000 limit had been increased. If the Section 2808 authority had been delegated to the theater commander, he would have had the necessary authority in the theater. Neither of these actions occurred.[67]

Miller and others continued to argue that the limit on operation and maintenance funds for individual projects be raised to $5 million. Colonel Pylant also recommended that wartime military construction funding approval authority should be decentralized and that the operation and maintenance funding ceiling for individual projects should be raised to $5 million.[68] After the war, Pagonis called the $200,000 limit a "tremendous barrier to a commander faced with the prospect of war in a theater with little infrastructure." Once again, he recommended that the authority limit be raised to $5 million.[69]

In their final report to Congress on the Persian Gulf War, Defense Department officials recommended that procedures be implemented to raise operation and maintenance funding limits during contingencies and activate Section 2808 authority quickly to ensure responsive construction funding support to the combat commander.[70]

Observations

The procedures that CENTCOM established to coordinate and prioritize the construction requirements of the services was effective. By the time the regional contingency construction management team was deactivated on 3 April 1991, it had successfully coordinated a joint construction program valued at more than $600 million. The CENTCOM engineer called the team a "success" and recommended that it be maintained as a tool for contingency construction. The team, he added, had "served with distinction." Pentagon officials would later report to Congress that the regional contingency construction management concept worked well.[71]

Although managing the theater construction process with the regional contingency construction management team was very effective, the actual project execution was more difficult. U.S. forces found themselves ill-equipped to meet the large volume of urgent construction requirements that they faced

in the Middle East. Moreover, there remained some confusion about construction standards. Often existing standards were ill-suited to the situation in the theater. Problems such as the shortages of engineer troops, engineer equipment, and construction material and the limitations on funding prompted the military to rely increasingly on civilian contracts to meet construction requirements.

CHAPTER 5
Construction Contracts

Contracting became a widely used and reasonably successful alternative to troop construction. Contractors performed much of the rear area construction under the supervision of the theater engineer. Contract construction requirements ranged from meeting the simple needs of soldiers, such as life support areas, to combat needs, such as helipads. As the Defense Department's contract construction agent in Southwest Asia, the U.S. Army Corps of Engineers awarded and administered these construction contracts through MEAPO(SWA). The mission was to support the requirements of all the services, and MEAPO(SWA) struggled to ensure that everyone's needs were met.

Engineer troops and contractors sometimes worked together. Occasionally, using contractors was cheaper than having troops lay asphalt themselves with leased equipment, and it freed troops for other tasks. Sometimes, troops performed the initial grading, leveling, and compacting, and hauled the marl. Contractors later laid the asphalt.

At the 24th Infantry Division (Mechanized) area at Thadj, Saudi Arabia, engineer troops put down M–2 matting for helipads, but they had only enough matting to install one pad for each helicopter, not enough to cover the entire area. A contractor applied dust palliative around those individual pads. In another instance, the Dhahran Area Office staff modified the design of the helicopter ramp at Ras al–Mishab to include greater troop effort. MEAPO(SWA) sometimes called on local commanders to augment contractors with military engineers when the contractor could not finish the project quickly enough to meet the theater requirements. Task Force 43, for example, assisted contractors on some projects.[1]

Life Support Areas

The Corps' first and largest construction contract was for six base camps. The contract was urgent because troops in the desert needed the facilities as quickly as possible, and the emergency military construction funds authorized under Title 10, U.S. Code, Section 2803, that would be used to fund the base camps, had to be obligated by 30 September 1990, the end of the fiscal year. Cox's staff had only four weeks to develop the criteria and advertise and award the contract.

From the beginning, Army planners recognized the need to construct base camps for arriving troops who would otherwise be camping in the sand. In late August, the chief of staff of the XVIII Airborne Corps, Colonel James Frederick, informed General Pagonis that the XVIII Airborne Corps might need

as many as twenty 5,000-troop base camps to stage and base troops in its sector, and he listed locations for the first three.[2]

Without conferring with any of the engineers in the theater, both ARCENT(Rear) and Forces Command planners at Fort McPherson prepared three DD Form 1391s to construct six initial standard base camps (each housing 5,000 troops with a mess hall and showers) for Army forces deployed in Saudi Arabia at an estimated cost of $30 million in military construction funds. These projects provided the basic infrastructure on which temporary standard prefabricated buildings could be constructed when additional funds were reprogrammed or made available by Congress. MEAPO(SWA) warned that $30 million would not build six base camps because of the inflated cost of construction materials in the theater, particularly plywood.

Representatives from Corps headquarters, South Atlantic Division, MEAPO, Army headquarters, and Forces Command met on 31 August to discuss base camp development. The meeting revealed that too many agencies were developing base camp plans, too many cost estimates were being produced and circulated, multiple definitions were being used to describe the level of base camp development, and no formal process existed to disseminate information and make decisions. As participants discussed the Army Facilities Component System's initial and temporary standards, they found that the initial standard had been pared down by some and enhanced by others based on what each believed to be the customer's guidance or requirements.

MEAPO representatives, acting on advice from MEAPO(SWA), outlined an initial standard more austere and cheaper than what Forces Command had developed. Forces Command added to the confusion by submitting its own DD Form 1391. The command had developed its plans before ARCENT engineers had arrived in the country and had based its plans on information from various sources rather than a specific ARCENT request. MEAPO passed its package to MEAPO(SWA) along with a list of options that Forces Command could select from and remain within the $30 million limit. Participants agreed that Forces Command should review this list of options, incorporate its choices on the DD Form 1391, and send it to MEAPO.[3]

On 12 September 1990, Colonel Miller met privately with General Al-Otaishan to discuss construction of the base camps. The next day the ARCENT engineer briefed General Pagonis and Brigadier General James Monroe, ARCENT's G-4, on the base camp construction program. Meanwhile, the ARCENT engineer, the ARCENT commander, and the XVIII Airborne Corps commander, Lieutenant General Gary E. Luck, met to determine the location, construction type, and facilities requirements for the initial six base camps. General Luck approved the locations and priorities. MEAPO now had enough information to advertise the construction contract for the $30 million base camp. On 14 September Assistant Secretary Susan Livingstone, who oversaw the Corps' military construction, approved the contract up to but not

including the award because Congress preferred that funding came from some third party such as Saudi Arabia or Japan.[4]

MEAPO(SWA) was involved in the difficult process of working with the XVIII Airborne Corps representatives and a Saudi officer to secure host nation approval of the base camp sites. On 15 September 1990 the commander of the Royal Saudi Land Forces' eastern area was briefed, and he deferred the matter to his superiors in Riyadh. On 17 September, Pagonis met with Major General Saleh Bin Al–Mohaya, commander of the Ministry of Defense and Aviation's eastern province, who approved the locations. General Al–Mohaya, in turn, deferred the decision to his superior, General Khalid. General Yeosock appealed directly to him for help in securing approval of the base camp construction plan. Yeosock emphasized the urgency of the matter. General Starling also appealed to the Saudi general for assistance in planning and designing the camps, arranging connections to local utilities, and selecting sites.[5]

Using the authority of the Competition in Contracting Act (Title 10, U.S. Code, Section 2304) for "unusual and compelling urgency," MEAPO acquired a list of all contractors currently working in Saudi Arabia and asked them to submit information about their capabilities.

MEAPO(SWA) established a prequalification board to review data submitted by prospective contractors. Voting members of the board were Lieutenant Colonel Cox and his chief of contracting, chief of construction, chief of engineering, and chief counsel. The board evaluated the firms on their ability to mobilize 200 skilled workers and managers by 25 September 1990, the date MEAPO expected to issue the "notice to proceed," and on their ability to mobilize 800 more workers within 30 days of the notice. Contractors also had to demonstrate that they could administer a heavy construction project the size of a base camp. They had to have successfully completed construction projects worth at least $30 million in the last five years. They had to have enough skilled workers and managers. They also had to have enough equipment available or obtainable in Saudi Arabia, be registered to perform work in Saudi Arabia, and have a joint venture partner or authorized Saudi agent.[6]

MEAPO evaluated 69 firms, and prequalified 14—two American, four Saudi, one Saudi with a U.S. subsidiary, and seven Korean. Because of time constraints, MEAPO excluded contractors who were not in Saudi Arabia, no matter how well qualified. Some of these contractors protested because they believed the Corps was excluding them from what they mistakenly thought was a huge, multimillion dollar contracting effort in Saudi Arabia.[7]

When the Assistant Secretary of the Army for Civil Works, Robert W. Page, who oversaw the Corps' international activities, reviewed the prequalified bidder list, he found it unacceptable because it did not include enough U.S. contractors. On 18 September 1990, he directed MEAPO to cease all actions related to the list. At a meeting with General Ray the next morning, Page agreed to let the Corps proceed with the review and award of the contract using its

standard procedures for overseas construction. But he also directed the Corps to allow three unsolicited proposals from concerned U.S. contractors who claimed they could fulfill the Corps' requirements—Zachary from San Antonio, Texas, Harbert from Birmingham, Alabama, and Turner from New York.[8]

MEAPO had considered these three firms in the formal prequalification procedures, but the board had determined they were unqualified according to the criteria it had established. If it accepted unsolicited proposals from these firms, MEAPO counsel argued, it would be legally obligated to open the competition to all firms that were considered but disqualified.

Colonel Miller personally reviewed the prequalification procedures and concluded that the three firms Page mentioned had received fair and equal consideration along with the other international firms. It would be unethical, he argued, to receive unsolicited proposals from those firms after the fact. Such action would be unfair to other firms that had submitted proposals and would damage the Corps' credibility. Miller warned that if directed to receive the unsolicited proposals from the three firms, he would have to cancel the current solicitation, delaying the contract award past 30 September. The authority to reprogram fiscal year 1990 funds would then be lost.[9]

Based on this response, later that day, Page conceded that MEAPO had done everything possible to solicit U.S. firms, especially the three firms in question. After further reviewing the Corps' contracting procedures, Page concluded that the Corps had used "the best and prudent judgment in moving forward, particularly with the stress placed upon you by the military to bed down our troops as quickly as possible." With time constraint as the driving force behind the initial criteria, he added "you have exercised proper diligence and procedure." In the future, however, Page wanted new criteria for contracting: a firm had to be American or Saudi Arabian; any foreign firm bidding on a contract had to have an American or Saudi joint venture partner; and qualifying factors for all firms would be their experience, general knowledge of the scope of work, and recent experience in that geographical part of the world.[10]

Responding to Page's direction that only U.S. and Saudi firms be considered in the future or that foreign firms had to have a U.S. or Saudi joint venture partner, the MEAPO counsel countered that this would violate the Competition in Contracting Act. Page apparently had a change of heart and in a brief note observed, "You did a good job—The heat seems to be off and in fact may have turned positive."[11]

MEAPO issued the "request for proposal" to the 14 prequalified firms on 19 September, giving each six days to prepare its proposal. MEAPO(SWA) received proposals from 10 of the 14 firms on 25 September. The contract was structured so the base bid included mobilization and demobilization, surveying, and clearing and grubbing. The bid included tent hardstands, latrines, showers, and dining facilities. All other items were identified as contract options.

Including all options, the high offer of $133 million was from J.A. Jones Construction Company of Charlotte, North Carolina. The low offer of $53 million came from Mechanical and Civil Engineering (MACE), Saudi Arabia, LTD., which was affiliated with Globeways Inc. of Tulsa, Oklahoma.

Since all proposals were much higher than the $30 million allowed, MEAPO could not award the project with all the options. With the approval of General Pagonis and General Luck, the project was scaled down. For $30 million, MEAPO could not require the contractor to lay out roads at the camps, as originally planned, but hoped that since the contractor had to travel in the area, he would gradually build the roads. MEAPO could only require the contractor to clear the area, construct a dining room (no kitchens), and provide some bathroom facilities. For $30 million, the contractor had to mobilize at six 260-acre areas located in different parts of the country.[12]

Corps contracting officials had secured a waiver of the 21-day mandatory congressional notification period, but the contract still had to be expedited. Assistant Secretary Livingstone had to approve the contract by 29 September so it could be awarded by 30 September, the end of the fiscal year. On 26 September, Livingstone authorized the Corps to award the base camp contract using the $30 million in reprogrammed military construction funds, provided it included a termination clause in case an alternate source of funding became available.[13]

The Corps awarded the contract on 28 September to MACE for $26,347,014 and set a completion date of 10 January 1991—a 90-day on the ground performance period. The contract called for the construction of six initial standard, temporary base camps for units deployed to Saudi Arabia. Billeting areas would consist of graded and compacted earth suitable for erecting tents. The contract also provided for dining facilities (cement block structures with heating and air conditioning), showers, and latrines. The Corps planned to use engineer troops to upgrade the camps by constructing roads, vehicle parking, helicopter pads, tent pads, warehouses, and sunshades.[14]

Surprisingly, General Schwarzkopf was not informed about the base camps until 2 October. After hearing the proposal, he sternly informed his staff that they did not have the authority to approve the construction of base camps. He demanded that they brief him again before spending a nickel on such construction.

On 6 October CENTCOM and the services laid out a more detailed proposal to complete the six base camps already contracted for and to construct an additional 18 camps. During the briefing, Lieutenant Colonel Cargill explained that the projects would get "the ball rolling to provide facilities to enable our soldiers to survive in the desert." Schwarzkopf strenuously objected to the use of the term "survive." The soldiers, he barked, were "surviving" quite well.

The general insisted that the Army use the term "life support area" rather than "base camp." He observed that U.S. forces did not know where they would be in six months so the services should not spend money they could not justify. The experienced commander also noted that the fire bases the United States built in Vietnam were a mistake that should not be repeated. He did not want the Army to develop the "base camp mentality" that it had in Vietnam. Nor did he want his troops housed in permanent facilities where they would be vulnerable to attack. Camping in the desert, he insisted, would keep the troops sharp, mentally and physically.

Schwarzkopf approved the initial six camps—now called life support areas—so long as they were built primarily for sustainment. These would be secured areas where troops could rest and refit, enjoy a few comforts they did not have in the desert, and then return to the desert for training exercises. He directed his staff to proceed slowly with the remaining camps.[15] General Schwarzkopf also directed that troops in each camp be disbursed for greater security. Each of the six 5,000-troop life support areas would be divided into four smaller modules a kilometer apart, capable of supporting 1,250 soldiers.

The Corps temporarily delayed implementing the contract while its contracting officer negotiated the price of dividing the modules. Spreading the camps out increased the contractor's costs, so other items in the contract had to be cut out. Water wells costing $800,000 were scrapped and a more austere design was adopted for the dining facilities. The Dhahran Area Office also made changes in the latrines that saved $750,000 and helped pay for the dispersal.[16]

Dividing the camps delayed the completion of the contract. The Corps issued an unpriced notice to proceed to the contractor on 15 October for dividing the life support areas. MACE began to bring its construction equipment onsite. The contractor had difficulty getting access to the site for life support area A at King Fahd International Airport because certain approvals were required from airport officials. Work was also delayed at life support area B (Phoenix) because a local landowner complained that the proposed camp was on his farm. The claim of the landowner was resolved, and the farm was relocated. By the end of October, the contractor had completed his survey of life support area F (Pulaski) and begun surveying life support areas C (Bastogne) and E (Abqaiq).

As siting problems continued, MEAPO(SWA) and ARCENT asked Saudi officials to intervene. The Minister of Defense formed a committee in Jeddah to resolve the issue. Meanwhile, MEAPO(SWA) directed the contractor to stop all site work associated with life support area A. By mid-November, the contractor had poured concrete for the dining hall foundations on life support areas C, D, and F. ARCENT directed MEAPO(SWA) to phase the construction to allow troop engineers to work alongside the contractor to upgrade the camps.[17]

On 6 December, as a result of the host nation implementation plan that had been signed a month earlier, the contract for life support area construction was turned over to the Saudi Arabian government. By then, the contractor had completed 84 percent of the work for sites B, C, D, E, and F, but site A was only 45 percent complete. The Saudis turned over the completed life support areas B, C, D, E, and F to U.S. forces in mid-March, weeks after the war had ended. Although the original contract stipulated that the life support areas be completed in mid-January, the contractor did not complete life support area A until the end of April.[13]

Schwarzkopf's objections to spending large sums on life support areas were to some extent vindicated. The ground war ended so quickly and the life support areas took so long to complete that they were never used for the purpose intended. American soldiers never occupied them because by the time the camps were completed, the soldiers had moved into the forward areas.

Although critics complained that the United States received little but leveled-out sand for its $30 million, others disagreed. Corps contract specialist Kay Bauer noted that the Corps did not have the normal 60 to 70 days to work out the arrangements, and the cost of doing business was higher in Saudi Arabia than in the United States. Competition determined price, she explained, and "we got what we reasonably could have expected to get." Mobilizing workers and equipment was expensive, and the contractor had a short performance time of 90 days.

Also, much of the contractor's work was not readily apparent, such as the installation of tanks and sewers. The cement-block dining facilities had air conditioning and reinforced slabs. The contractor had had to establish work camps, air-conditioned supply trailers, and office work space. He had brought

Grader spreads marl at a life support area.

in generators and provided running water. The road construction element had been taken out of the contract, but the contractor had built crude roads to bring in his equipment. The contractor worked on roads for 60 days and used what amounted to a platoon's worth of equipment-four dump trucks, two bulldozers, a bucket loader, a road grader, and compaction equipment-adding considerably to his cost.[19] Given the amount of work that the contractor performed and his expenses, the costs of the life support areas were probably reasonable.

Main Supply Routes

The construction of main supply routes was critical for logistics support and for moving troops. Initially engineers paid little attention to theater planning for main supply routes because the existing highway network in Saudi Arabia gave adequate support during the initial deployment phase. Main supply route Audi, a good multilane road, stretched from Dhahran along the coast to just north of Jubail. Dodge (Tapline Road) ran northwest from Audi to Hafar al Batin and then across Saudi Arabia. Two major southern routes were Toyota and Nash. Toyota was an excellent multilane road that ran between Dhahran and Riyadh, and Nash ran north from Riyadh to Hafar al Batin where it intersected with Dodge. Some roads were in good shape initially, but none could withstand the high volume of military traffic. Few secondary roads existed. Forward logistics

Soldiers from the 20th Engineer Brigade compact the ground for a new road in Southwest Asia.
(U.S. Army photo by SSG Martello, 20th Engineer Brigade, Public Affairs Office)

bases were far from ports and airfields. For example, the distance from Dhahran to King Khalid Military City was 334 miles.[20]

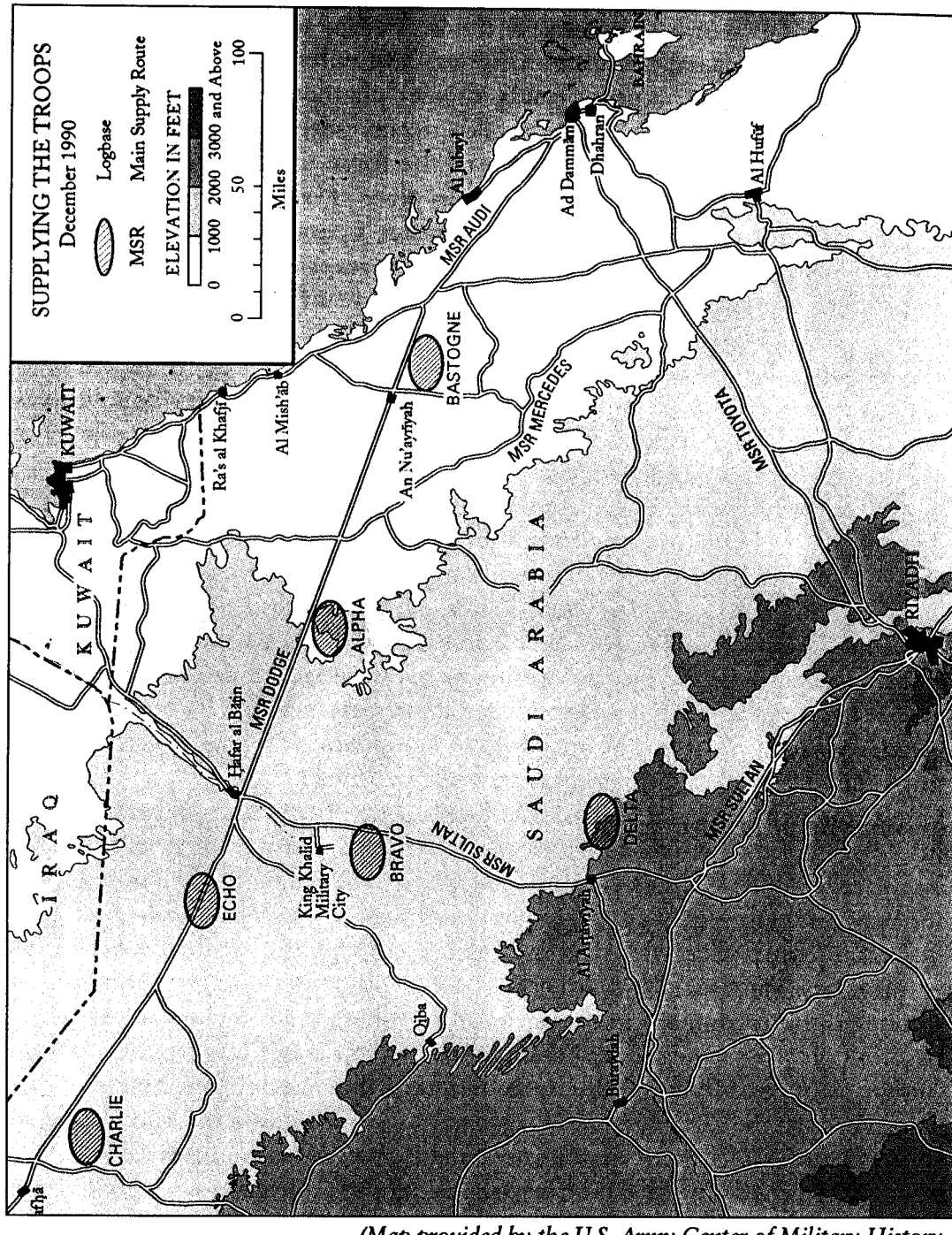
Because of these existing roads, theater planners failed to anticipate the transportation problems that would occur with the second phase of deployments and massive movement of the force to forward positions. As a result, overpasses and bypasses were not in place at critical road junctions. U.S. forces did not control quarries and crusher operations that could reliably delivery construction materials and did not have responsive contract capabilities to produce asphalt or pave roads. CENTCOM was forced to divert the corps' combat engineer battalions from forward support missions and training to road maintenance. Construction, maintenance, and repair of these routes remained a high priority. By mid-January the equivalent of ten engineer battalions was building and improving 3,250 kilometers (1,950 miles) of corps-level and theater-level main supply routes.[21]

Combat heavy battalions were poorly equipped for road maintenance. The battalions' MTOE (modified table of organization and equipment) did not provide for adequate compaction equipment or water and asphalt distribution equipment. Trucks to distribute water or asphalt and vibratory rollers to compact soil were all scarce. Task Force 43 had only two 35-year-old pavers that frequently broke down. Cutting edges for road grader blades were also scarce because the hard desert soil wore them out quickly. The motorized road grader was the most important piece of equipment for road construction and maintenance, and additional graders were procured.[22]

Lieutenant Colonel Gilbert Van Sickle, one of Pagonis' engineers, learned to look at how native contractors constructed roads rather than use U.S. standards and designs—especially when the standard materials were unavailable. During his 21 trips to Southwest Asia, Van Sickle had gained valuable experience with exercise-related construction and in working with contractors. Van Sickle and other engineers with experience in Southwest Asia modeled the Jordanians in using vibratory rollers for compaction. Army units without previous experience in that part of the world tried to use their standard methods of road building, the same methods they used in Europe.

Through the 20th Engineer Brigade, Van Sickle shared his knowledge with units in the XVIII Airborne Corps. By the time those engineers began work, they had learned a great deal from observing the contractors. Upon its arrival, VII Corps moved straight out into the desert, so Van Sickle could not help its engineers. Soldiers with the 265th Engineer Group, a National Guard unit from Marietta, Georgia, and the 92d Engineer Battalion from Fort Stewart, Georgia, had experience constructing roads in desert environments.[23]

Most of the area was sand, 6 to 9 inches deep. Because the sand had a consistent gradation, it did not compact. Engineers had to look for alternative materials and methods of construction. Army doctrine and training specifies that engineers first remove the overburden or organic material (the top surface)



(Map provided by the U.S. Army Center of Military History.)

and build roads from this base. But when they scraped off the surface materials in the desert, they removed the stable base. As a result, the road turned to dust, or mud if it rained, and vehicles were forced to drive off the road. The construction technique eventually adopted was to use a road grader to clear any rubble off the surface of the desert and build up the road above the desert rather than cut into the desert and apply dust palliative.[24]

Soldiers and equipment from the 20th Engineer Brigade work on a new road *bed.* *(U.S.* Army ***photo by SSG Martello, 20th Engineer Brigade, Public Affairs Office)***

Rock was generally not available for the base course for roads. Marl, a clay-type soil rich in calcium carbonate, is quarried in the region and was the most abundant and cost-effective material for road construction. In fact, it was the only widely available material in Saudi Arabia that could be compacted for roads. Marl, a crumbly substance, did not have to be crushed. Its slight moisture content made it easy to compact. Engineers dug the marl out with bulldozers, dumped it on the roads with bucket loaders, wetted it down, and compacted it with graders. Once dried, it had the consistency of concrete. Marl, however, failed after torrential rains and became very dusty after use by vehicles. In areas where it failed, high-priced crushed rock was used.

The application of cold mix asphalt-- sand, gravel, and RC-1 (a rapid cure asphalt)-was another paving process. It was not as good as hot mix asphalt and could not withstand as heavy a load, but hot mix asphalt required batch plants, which no longer exist in active Army units. Engineers using hot asphalt needed a batch plant near the work site because the asphalt hardens over time as it

cools. In some areas paving plants did not appear until late in the operation. By contrast, the cold mix could be hauled long distances.[25]

Troops and contractors sometimes shared the road construction effort. At King Fahd International Airport, for example, roads were a chalky white dust that created health hazards. To reduce the hazard, troop units prepared a base course, and the contractor did the actual paving.[26]

Engineers at echelons above corps constructed 1,133 kilometers of roads, and engineers with the two corps constructed 3,209 kilometers of roads. Yet, the main supply routes the Army built never reached the quality of the existing paved roads. The Army's roads north and west of King Khalid Military City were damaged by rain soon after completion. These roads, Cargill concluded, "were never really able to do what we intended for them to do."[27] The roads served an immediate need but would not hold up in the long term and could not carry the volume of traffic required.

Dust Palliatives

Besides contracts to construct life support areas and main supply routes, the Corps awarded contracts to apply dust palliative. Blowing dust in Saudi Arabia chewed up expensive equipment, created costly maintenance problems, and threatened the safety of helicopter pilots trying to take off or land in the thick clouds of dust. The steady winds blew soil particles across the desert surface

"White-out conditions endangered helicopters trying to land.
(U.S. Army photo, Center of Military History)

wearing them down to an almost microscopic size. Dust on the battlefield obscured vision, coated sighting instruments, and sometimes helped the enemy detect the location of U.S. forces. In its after action report, the U.S. Army Engineer School candidly conceded that the requirement to control dust "far exceeded the engineers' capability to deal with this problem."[28]

Airfield matting, like the M–19 matting brought from Europe, effectively prevented dust but was too expensive to use in all areas. Other methods, such as cutback asphalt, asphalt emulsions, and road tars, were needed to cover the large areas surrounding the matting. They could be applied as a penetration treatment or as admixtures. With admixtures, engineers loosened or broke up the soil and sprayed an asphalt emulsion on it. At approximately $1.80 per square meter, asphalt emulsions were the cheapest form of dust control. Other methods were coarse aggregate, vegetation, resins, brine solutions (which did not work in Saudi Arabia), cement and lime, and crude oil and waste oil. Crude oil did not cure and added no structural strength to the soil. Since the oil remained liquid, it turned the loose soil into a black, oozing mass, coating vehicles, equipment, and personnel. It also polluted the environment.[29]

Soon after the Corps first arrived in Saudi Arabia, Lieutenant Colonel Tomasik directed MEAPO(SWA) to evaluate various methods of dust control such as sand still, magnesium chloride, and peneprime for trafficability, availability, and cost. MEAPO gathered information on cutback asphalt, emulsified asphalt, calcium chloride, magnesium chloride, crude oil, diesel fuel, burnt motor oil, and other dust control substances.

A MEAPO expert, J. R. Ramos, recommended using CSS–1 as a dust palliative. CSS–1 was a cationic emulsified asphalt that provided a nonstick, dust-free surface as durable as the material to which it was applied. This environmentally acceptable material was not as volatile as cutback asphalt and did not have the humidity and reapplication requirements or the corrosive properties of salt emulsions. Moreover, emulsified asphalts were readily available in Saudi Arabia and could be applied by low-pressure spraying equipment, common to paving operations. Ramos recommended using emulsified asphalt in areas with compacted or stabilized soils with heavy foot or vehicle traffic (such as roads) and in loose sand areas with light foot and no vehicle traffic (such as nontrafficked areas adjacent to heliports, airfield aprons, and runway shoulders), but not in loose sand areas with heavy foot or any vehicle traffic.[30]

Army experts recommended using cutback asphalt as prescribed in Army technical manuals, but these materials often had to be worked into the soil to be effective. Combat heavy engineer battalions with the equipment needed to work cutback asphalt into the soil would not start arriving in the theater until late October.

In early October, ARCENT approved the use of waste motor oil and other petroleum products as dust palliatives but, because of the environmental impact,

restricted their use to vehicle and pedestrian traffic areas such as roads, parking lots, and foot paths. Treatment was only effective on compacted areas. Engineers used field expedient methods to distribute the liquid. One method included putting a 53-gallon drum with a 3/8-inch hole in the bottom on the back of a truck. The oil had to be distributed as evenly as possible. Tomasik directed that the oil not be used as dust palliatives outside vehicle and pedestrian traffic areas, especially near water sources, residential areas, agricultural areas, and grazing land for livestock.

MEAPO engineers cautioned that crude oil and diesel fuel should be used only as a last resort. They feared that approval to use oils or fuels would prompt wide, indiscriminate application. The environmental concerns were serious. Also, vehicles and boots tracked the oil all over, making surfaces slick.[31]

As part of the search for appropriate dust control, the U.S. Army Engineer Waterways Experiment Station, a Corps laboratory in Vicksburg, Mississippi, wrote "Dust Control in Desert Environments." No one material could be singled out as the most acceptable for all situations, it reported. Rather, the best method for a particular area depended on such factors as traffic (type, volume, magnitude of wheel loads), soil properties, topography/surface features, climate, availability and cost of materials, and requirements and availability of construction equipment and personnel. In a follow-up paper, laboratory personnel noted that dust control on or near helipads was a major problem. Constructing flexible pavement and using open-graded crushed stone were two methods under consideration. In areas such as refueling, rearming, and maintenance pads with significant foot traffic, flexible pavement might be the better alternative. At least one crushed stone helipad had already been constructed.[32]

On 8 November, representatives from the South Atlantic Division, the Waterways Experiment Station, Corps headquarters, and MEAPO met in Winchester, Virginia, to review MEAPO's proposal for controlling dust and to discuss testing some commercial dust palliatives. At the meeting, Ramos, who had recently returned from a 60-day assignment in Saudi Arabia, reported that contractors were stabilizing the soil effectively with asphalt emulsions.

For nontrafficked areas, contractors sprayed the emulsion on the exposed surface. This controlled the dust effectively but did not hold up under traffic. For trafficked areas, a base section was treated with asphalt emulsion to a depth of 3 inches. The contractor then mixed and compacted the stabilized material. Ramos found that roads stabilized by this method held up well under equipment with rubber tires such as fuel trucks and jeeps but not under tracked vehicles. Asphalt emulsion penetrated better and was more effective than cutback asphalt. In addition, it was available in the country, recyclable, and inexpensive. Surface spray applications cost about $.30 per square meter, while the blended procedure for trafficked areas cost $1.85 per square meter.[33]

Hand application of dust palliative at Al Hasa.

The Dhahran Area Office awarded an open-ended contract for dust palliatives in early October 1990. Delivery order #1 of the contract was to stabilize approximately 330,000 square meters of uncompacted, medium-grain sand with fines at Al Hasa Airport outside Hofuf for the 82d Aviation Brigade. Tamimi Company of Dammam completed the work on 13 November 1990. The area was backgraded by a dozer and graded with two passes of a road grader. CSS-1 asphalt concentrate (0.875 liters per square meter) was mixed with water at a ratio of 6:1 and applied with penetrations up to half an inch. The area held up well. Twenty helicopters operated in the area daily but did not land on these stabilized areas. On the negative side, spreaders had to have balloon tires to operate in some areas, and only two such spreaders were available in the country at the time. Also, areas with sand berms required hand application. It took the contractors 8 days to spray the 3,600-meter long sand berm that surrounded the airfield.

The delivery order also included treatment of roughly 10,000 square meters of road, which had a minimum of 9 inches of compacted marl. The contractor removed the top 3 inches of marl, mixed it with water and roughly 8 liters per square meter of asphalt concentrate, and then spread and compacted the mixture. Operators used the same equipment to process the soil in the trafficked areas that they used in other paving operations.[34]

MEAPO(SWA) received a tasking on 9 October to upgrade 4,000 meters of a road 7 meters wide at King Fahd International Airport by applying 2 inches of asphalt for dust abatement to a subbase constructed by a combat engineer battalion. The contractor was delayed because the engineer troops preparing the base course lacked adequate equipment.

Another tasking was to add dust abatement (a 2-inch surface course of asphalt) to an existing stabilized marl base (more than a million square meters) also at King Fahd International Airport that U.S. forces were using as a temporary parking apron. Many helicopters were housed there before deployment to other locations. MEAPO awarded the indefinite delivery order construction contract on 14 November, and within days the contractor had begun grading and paving operations. By early December two contractors were laying 6,000 to 7,000 tons of asphalt per day using five spreaders. Although the cost of the contract was roughly $4 million, the amount was not excessive considering a single air brigade had already spent $82 million to repair blades and engines damaged by the dust.[35]

In early November MEAPO(SWA) awarded delivery order #2 on the contract with Tamimi Company to apply dust palliative to 26,500 square meters of trafficked area and approximately 290,000 square meters of graded, uncompacted, fine sand. The areas to be stabilized surrounded 80 helipads at Thadj and 20 helipads at Jelady plus two 100-foot-square hot refueling pads-where helicopters refuel without turning off their engines. The contractor was also to provide dust palliative to roughly 20,000 square meters of road leading to the pads.

At Thadj, Tamimi applied a 60 percent water/40 percent asphalt CSS-1 solution at a rate of 7 liters per square meter. Work at Thadj progressed slowly due to limited equipment and water. Two independent laboratories in Saudi Arabia tested the asphalt at Thadj and found the quality to be acceptable. The treated area could take limited foot traffic but not vehicle traffic. The Jelady

Emulsified asphalt was used as a dust palliative at Thadj.

work was planned for December, but the Dhahran Area Office did not award any other delivery orders under this contract because the Saudis took over contracting responsibilities.[36]

General Storat later contended that the most effective method of dust control was crude oil. Diesel fuel was also effective but was a greater environmental hazard. The use of MC–1 and RC–1, he added, was somewhat effective at heliports with no vehicle traffic, but engineers could not keep traffic off the roads long enough for the mixture to cure. Lieutenant Colonel Van Sickle reported that the asphalt emulsion MC–1 was readily available and worked well, but asphalt spreaders were scarce. Ultimately, MC–1 did not cure fast enough or penetrate well enough, causing it to roll back up on vehicle tires. RC–1 evaporated too quickly, without penetrating the soil.

Eventually, crude oil and diesel fuel became the most common dust palliatives used in the theater north of Tapline Road. More than 3 million gallons of crude oil and diesel fuel were spread on main supply routes. Both penetrated well and were easily compacted. No dust palliative held up well in heavily trafficked areas, and vehicle operators tended to drive on any black surface even if it was designated as a nontraffic area.[37]

Helipad/Heliport Construction and Apron Expansion

The sand and grit blowing across the Saudi desert created an urgent need for heliport and helipad construction. Pilots took off and landed in what troops called "white-out" conditions where they had little or no visibility. In October, the commander of the Army's Aviation Systems Command, Major General Donald R. Williamson, reported that the helicopters in Saudi Arabia faced "tremendous logistics and maintenance problems" due to extremely high temperatures and blowing sand and dust. In just a few hours, the sand rapidly eroded layers of protective paint and skin on the rotor blades. Ingested sand ate away at compressor blades in engines at an alarming rate. The aviation command tried painting a protective coating on every rotor blade, but the sand was so abrasive that this coating was only a stopgap until the command could provide blades with a longer-lasting protective tape. It also explored methods of filtering out the sand before it destroyed the engines to buy time while it developed ways to get particle separators into Saudi Arabia. Several commanders grounded their aircraft to save them for possible combat operations.

Williamson complained that commanders could get asphalt pads and short runways for their helicopters but were hamstrung by funding limitations. "In my estimation," he argued, "the savings in resupply and parts alone would pay for these costs in less than 30 days, and improved readiness would be the payoff." The "very serious" situation justified waivers to normal operating procedures.[38]

In response to the problem addressed by Williamson, MEAPO(SWA) awarded some major contracts for helipad and heliport construction. In late September, ARCENT directed the construction of heliports at various locations, and MEAPO issued the solicitation package on 28 September 1990. MEAPO(SWA) personnel began, drafting plans for a 125-helicopter helipad at Thadj on 24 September after learning that the 20th Engineer Brigade was prepared to do the work but lacked a plan of construction. On 3 October, they reviewed the draft plans with the brigade, and a few days later the plan went to the ARCENT engineer for approval. Using M-19 matting, the 20th Engineer Brigade constructed helipads at Thadj and Jelady for approximately 100 helicopters of the 24th Aviation Brigade. MEAPO provided an equipment leasing package to augment the engineer brigade.[39]

In response to the ARCENT commander's directive to move helicopters forward and a Saudi requirement to vacate Dhahran air base's flight line, ARCENT initiated a program in November to construct temporary standard heliports at nine sites, including King Fahd International Airport. Through an agreement with the Saudi Arabian government, construction began on a facility for roughly 100 helicopters from the 18th Aviation Brigade at the Dhahran air base to be completed by 15 November. Space for another 100 helicopters was scheduled for completion by 15 December. The austere facility would include a 6-inch compacted aggregate base, a 2-inch asphalt overlay, helipad markings, and helicopter tiedowns. CENTCOM approved 11 such projects at nine separate sites, totaling roughly $81 million.

Two asphalt paving machines work side by side at the King Fahd International Airport. Five of these machines were used simultaneously to handle the daily requirment of

Workers place concrete at one of the four CH-47 helicopter refueling pads. A mechanical screen saved time, allowing the placement of 2,400 cubic meters of concrete in two weeks.

By mid-December, with support from the 416th Engineer Command, MEAPO(SWA0 had designed 10 of the 13 projected helipads throughout the theater for the Army and had passed those designs to the Saudis for funding and construction. The projects were either under construction or out for bid. When completed, the 13 helipads could accommodate about 1,900 helicopters. The Army tried to balance troop and contractor efforts and use designs that were both safe and effective.[40]

On 24 November, MEAPO(SWA) signed a contract with Al Shuwayer to construct a helicopter apron at King Fahd International Airport. In mid-December, it signed a $10 million contract with Harabi Company to expand a helicopter apron at Riyadh air base and with Al Khereijy to construct two refueling pads at Dhahran. In January, MEAPO(SWA) contracted with Al Turuq Trading Company for a 250-aircraft heliport at Inland Pumping Station #3 and with Gaid Contracting for helicopter ramps at Ras Al Mishab. The next month it signed a contract to expand an apron at Al Qaysumah.

Perhaps the most challenging helipad and apron construction occurred at King Khalid Military City. With the arrival of VII Corps and the movement of troops westward, the need for helipads and heliports at King Khalid Military City became particularly critical. This installation became "the center of gravity" for many multinational combat and logistics units. Pagonis planned to construct the largest logistics base there since Long Binh during the Vietnam War.[41]

In late November, MEAPO(SWA) identified construction requirements at King Khalid Military City. While at a staff meeting in Dhahran on 26

November, Colonel Roger Scearce from the support command headquarters at King Khalid Military City mentioned that the apron there could only support two aircraft, not enough to open an aerial port of departure. After the meeting, Lieutenant Colonel Cox quietly pulled Scearce aside and told him that the Corps had designed and constructed the military city. Cox asked Scearce if he wanted the Corps to explore ways to expand the aircraft capability there. Scearce agreed, indicating that his goal was to park ten C–5 aircraft on the apron at one time.

That night Cox called MEAPO staff in Winchester and asked them to prepare a design package for a 10-aircraft apron at King Khalid Military City. Four days later, on 30 November, he had the design in hand. The Dhahran Area Office quickly reproduced the solicitation package for the apron expansion design and turned it over to the Saudis on 3 December. On 29 December the Saudis hired Ijzala Trading and Construction to pave 171,375 square meters to expand the parking apron at King Khalid Military City for ten C–5 aircraft at a cost of over $10 million.[42]

In addition, Corps contractors constructed a heliport for 200 helicopters. With the increasing workload at King Khalid Military City, Corps officials decided to establish a resident office there. Captain Steve Adams left for the installation on 11 December to coordinate with ARCENT and the SUPCOM and prepare office space. Adams brought a fax machine and computers and obtained telephones, including a phone for secured communications. He relied heavily on a phone answering machine because he was often at heliport projects up to 190 kilometers (a 2-hour and 10-minute drive) away. Adams' missions there included latrine, shower, and washstand distribution; dust palliative for the 1st Cavalry Division; and real estate support. His office grew to eight people, including some from the 308th Engineer Detachment (Real Estate) who helped lease facilities and a civilian resident engineer.[43]

The operations at King Khalid Military City did not run as smoothly as Army officials might have liked. It was one of the wettest winters in recent years. Several rain storms caused delays. At other times, dust storms hampered work. One laborer working on the heliport project was killed when a grader operator accidentally backed over him.

New problems arose as the United Nations' 15 January deadline for an Iraqi withdrawal approached. Just when the need for helipad and apron expansion projects became more urgent, frightened workers began to disappear from the work site. On 17 January, the day the coalition forces launched the air attack against Iraq, one contractor was still bringing up equipment. The contractor had watched five other contractors leave their job sites, but he promised the Corps he would stay. When additional equipment arrived the next morning, however, the crew of nine shrank to three. Some anxious workers rode home on the backs of the flatbed trucks. One worker who complained that work at King Khalid Military City was too dangerous returned to Riyadh, but

after an Iraqi Scud hit within a block of his home, he volunteered to return to work.

Captain Adams invited some of the workers to his residence and offered them protection and help if they would return to work. After some cajoling, workers began returning. Adams issued the workers some German protective masks, and the Corps' construction representative, Ed Miranda, demonstrated how to use them. Many Arab men wear beards, but after Miranda explained that beards might prevent the masks from sealing well, the workers shaved. One worker became so adept at putting on his gas mask that when he was startled by the sound of an aircraft dropping its fuel tank, he put on his mask between the time he jumped off his equipment and the time he hit the ground.[44]

The major contractor at King Khalid Military City agreed to return with a full force on 19 January. Working with the ARCENT engineer, Adams arranged for troop units to help the contractor. The Dhahran Area Office helped the 411th Engineer Brigade acquire leased dump trucks to form a provisional dump truck company. ARCENT detailed Task Force 43 to carry on the construction, and the sight of troops at work reassured the contractor. Contract workers drifted back, and even when a jet crashed 100 yards from the site and the ground war had begun, they stayed on the job. Support from Task Force 43 kept the project on schedule. It provided dump trucks, a bulldozer, some scrapers, and night lights, so work could continue around the clock.

The Corps enlisted the task force to remove material from the site and provide lights and haul capability because its contractor was having difficulty with his aggregate supply. The contractor hauled aggregate from 300 kilometers away, while the engineer troops used heated-bed asphalt trucks to haul asphalt from the contractor's plant 20 kilometers away. In the early construction phases, Task Force 43 provided 10 percent of the contractor's work force and 14 percent of the engineer equipment. By late January, the contractor had mobilized more than 100 people and 50 pieces of equipment, and the task force did less work.[45]

When completed, the apron at the installation was 800 by 250 meters of solid asphalt paving, the equivalent of a paved road 28 kilometers by 9 meters. The first aircraft, three C–130s, used the apron on 16 February, just a month after the original contract was let. The first C–141 used the project a few days later. By the end of February, C–5s, C–141s, and C–130s were landing daily, and the heliport project was nearly complete. Given the siting problems, host nation contracting procedures, and the start of hostilities, Corps officials called the project "a success story."[46]

The apron expansion became one of the most important projects during the war. King Khalid Military City replaced Dhahran as the principal aerial port of debarkation when the ground war began. If the 4-day war had lasted longer, the airfield at King Khalid Military City would have been a major station for resupplying troops and carrying out casualties. Soldiers and contract workers

A contractor and Dave Greenwood, Corps representive, inspect the pavement thickness at the Camp Eagle II paving project. Located near King Fahd International Airport, Camp Eagle II was the base camp for the 101st Airborne Division (Air Assault).

completed the project with remarkable speed and MEAPO staff saved time by making a major design change-cutting the amount of base course required-during construction.[47]

As with the dust palliative contracts, the benefits of helipad, heliport, and apron construction contracts far outweighed the costs. Colonel Cargill observed that $6 million was not unreasonable for a helipad that would hold 100 Apache helicopters, each worth $6 million. The 101st Aviation Brigade spent $82 million between August and November on rotor blades and engines for its helicopters. Comparatively, paving a helipad at King Fahd International Airport cost only $4 million.[48]

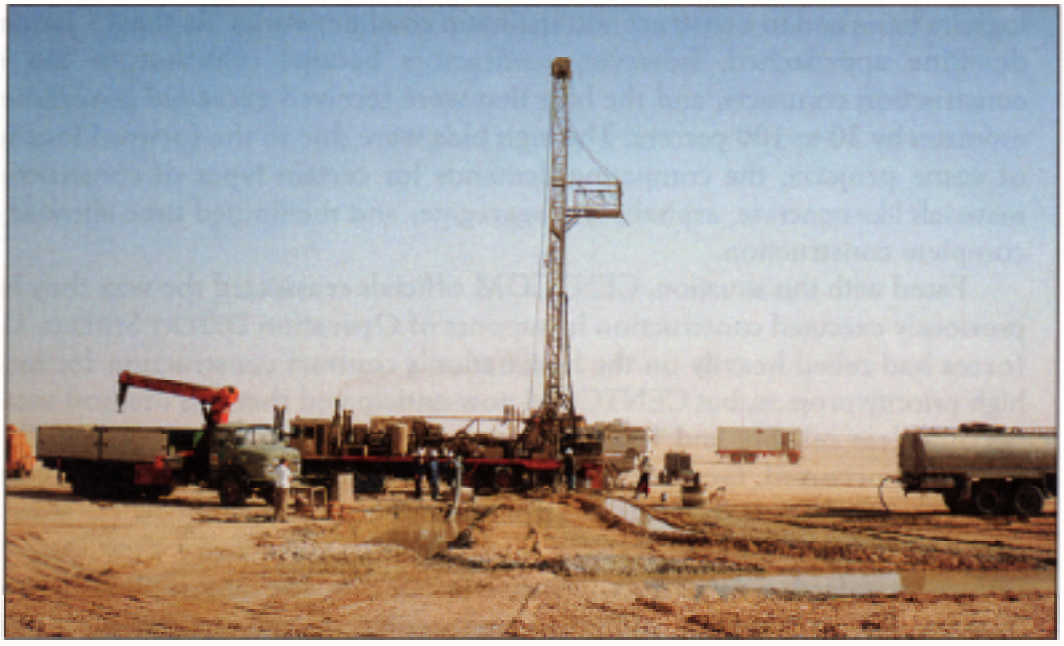
Well Drilling

Contract construction also involved drilling water wells. Initially planners assumed that the Saudi Arabian government would provide enough bottled water, but as they developed plans for offensive operations, they realized that they would have difficulty transporting bottled water to the forward areas. Officials granted permission to drill wells near the Iraqi border.

The Army deployed seven engineer well drilling detachments (including one for command and control) to the theater. Four active component detachments arrived in September, and three reserve detachments followed in January. The three reserve detachments were used initially to support the facilities engineering mission of the 1030th Engineer Battalion at Dhahran and

during the ground war were placed in support of VII Corps. The active component detachments worked under the 20th Engineer Brigade supporting the XVIII Airborne Corps. Three of the four detachments drilled for water at life support area C (Bastogne). When that effort failed, one of reserve units, the 865th Engineer Detachment (Well Drilling), attempted to drill two wells at life support area F (Pulaski). The first attempt failed but the second produced water. The 865th Engineer Detachment drilled the only new well in the theater, but by the time the well was complete, U.S. forces had moved out of the area.[49]

The U.S. Air Force and the Marine Corps were more successful than the Army Army well drilling, oriented as it was toward Europe, worked poorly in the desert. If Saudi Arabia had not already had some wells, the U.S. military would have had difficulty. Lieutenant Colonel Van Sickle observed the Army's well drilling program was "broke." The Army well drilling detachments were neither equipped nor trained to succeed in the desert. Their equipment was new but inadequate, and the units had not been trained in drilling deep wells. Army well drilling rigs were designed to drill 600 feet. This capacity was adequate in Germany, but not in the deserts of Saudi Arabia where the water tables were more than 1,500 feet below ground. The Army had not brought its water well completion kit tools and had to purchase a kit to give the 600-foot rig a 1,500-foot capability. Contractor equipment, which could drill 5,000 feet, Van Sickle observed, made the Army rigs look like "tinker toys." Constructing these deep wells with existing Army equipment took more than 60 days, and soldiers could not wait that long for water.[50]



A contractor drills for water in the Saudi Arabian desert.

To augment the Army's well drilling capability, the Corps awarded well drilling contracts. In September officials determined that two wells were needed at each of the six life support areas. On 29 September the Dhahran Area Office issued an indefinite delivery contract to Hajjan Drilling Establishment to develop up to 12 water wells at various locations. ARCENT canceled the contract on 6 November.[51]

On 10 December the Dhahran Area Office awarded two drilling contracts, one for wells at life support areas A and E and one for the other four life support areas. By early January the contractors had drilled to 722 feet at life support area B, 1,123 feet and 299 feet at life support area C, 1,257 feet at life support area D, 230 feet at life support area E, and 985 feet at life support area F. The contractor had not yet begun drilling at life support area A because of problems with security passes. After the hostilities ended, the Corps signed a $26,667 contract with Al Mobarak to inspect and repair pumps and develop a well at King Khalid Military City. The project was completed on 28 March 1991.[52]

The deficiencies in the Army well drilling program did not significantly affect Army operations because the Army could rely heavily on the huge quantities of bottled water that the Saudis provided.

Contract Support in the Forward Areas

By the end of December CENTCOM had more than 120 approved major construction projects in the theater. Projects that CENTCOM had turned over to the Saudis for contract construction were being expedited to support forward logistics bases and to construct and maintain road networks. As the 15 January deadline approached, however, contractors became reluctant to bid on construction contracts, and the bids that were received exceeded government estimates by 30 to 100 percent. The high bids were due to the forward location of some projects; the competing demands for certain types of construction materials like concrete, asphalt, and aggregate; and the limited time allowed to complete construction.

Faced with this situation, CENTCOM officials reassessed the way they had previously executed construction in support of Operation DESERT SHIELD. U.S. forces had relied heavily on the host nation's contract construction for many high priority projects, but CENTCOM now anticipated that this method would become less reliable and less responsive in the forward areas, especially if hostilities occurred. General Starling recommended that the services reassess their construction requirements and troop construction capabilities. He warned that CENTCOM and the services might need to scale down their projects, reduce standards, develop alternative strategies for accomplishing their missions, and even deploy additional engineer troops and equipment. If Saudi or Japanese government funds were not responsive enough, U.S. funding for emergency construction under Section 2808 could be used.[53]

Contract awards by the Saudi Arabian government had, in fact, slowed for lack of competitive bidders and rapidly escalating prices. To expedite projects, CENTCOM requested that the Saudis award the contracts on a sole source basis. Frightened contract workers walked off two construction sites in northern Saudi Arabia, temporarily halting construction. During the offensive, many workers in the rear and forward areas disappeared for days—or in some cases weeks. One frantic contractor kept his workers on-site only by promising extra pay. With many workers absent, projects took longer to complete or were not completed at all.

CENTCOM reviewed the status of the construction projects to determine which had to be accelerated and which could be delayed. CENTCOM struggled to execute critical projects through revised arrangements with contractors. Some critical projects such as the ramp expansion and helipads at King Khalid Military City and the helicopter ramps at Ras al Mishab were accomplished with troop units using contractor materials. To ensure that construction materials were delivered, CENTCOM provided military escorts for civilian convoys and increased the stockpiles of material in the forward areas. Sometimes troops teamed up with contractor drivers with orders to take over the vehicle and continue driving if necessary. By late January many workers had returned.[54]

CENTCOM refused to supply contractors with chemical defense equipment because this was the contractors' responsibility. Contractors spent days contacting manufacturers of chemical defense equipment, but Defense Department requirements had severely depleted the supplies. Eventually CENTCOM provided some equipment for contract workers. During hostilities, however, workers continued to abandon their job sites, and sometimes the contractors themselves left the area. In one case a major contractor fled to London with a $12 million check, which was later recovered. In other instances, contractors were willing to continue work, but they were barred from construction sites for security reasons.

Colonel Braden later recommended that the services be prepared to provide their contractors with chemical protection gear. He also recommended that contractors be screened for reliability and that engineer troops be brought into the theater and properly allocated to avoid relying heavily on contractors.[55]

Construction to Support Redeployment

The value of the projects under construction in mid-March, several weeks after the ground war ended, was $64,263,152. Of this, $62,494,618 was from host nation support and $1,768,534 from the Gulf Peace Fund. The value of projects completed totaled $107,258,513, most of which came from host nation support. At the time the Gulf War ended, the Corps had projects worth $500 million either awaiting award or under design. Roughly $200 million of these projects were eventually canceled because of the rapid conclusion of the

war.[56] The Corps' emphasis shifted quickly to constructing facilities for redeployment, and construction expenditures dropped dramatically.

The redeployment of equipment and personnel began with the XVIII Airborne Corps, followed rapidly by VII Corps. Redeployment officially began on 10 March. By the end of May, more than 365,000 soldiers from the two corps had left the theater, at an average rate of 5,000 soldiers a day, faster than personnel had entered.[57]

Engineer operations shifted to construction projects for redeployment, especially vehicle washing facilities and hardstands for staging the equipment before and after it was cleaned. The U.S. Department of Agriculture insisted that all equipment be thoroughly cleaned before it was returned home to prevent importing crop-infesting insects. Dust palliative was required at the wash racks because the cleaned equipment and vehicles could not be parked back in the dust while awaiting shipment to the United States or Europe.

Staging areas and wash racks for military vehicles became the dominant construction requirement. Contractors and troops established wash sites at Dammam, Dhahran (where the VII Corps would redeploy), Jubail, and King Khalid Military City (where the XVIII Airborne Corps would redeploy). The plan called for 80 wash points at an estimated cost of $8.6 million, but this was later revised to provide 60 wash points at King Khalid Military City at an estimated cost of $6.6 million.

Soldiers clean vehicles at a wash rack in Saudi Arabia.

U.S. government vehicles at a sterile area near the port of Dammam, Saudi Arabia, await return to the United States. *(U.S. Amy photo by SGT John Bohmer)*

In early March the Corps received requests to install 50 wash racks at Dhahran, King Khalid Military City, King Fahd International Airport, and Dammam. The Dhahran Area Office purchased membrane that the 411th Engineer Brigade installed at the Dhahran temporary wash rack.

On 19 March representatives from the Dhahran Area Office and Bechtel met with the ARCENT SUPCOM engineer to draft a revised plan for wash facilities at Dhahran and King Khalid Military City. The first precast ramps for the temporary wash facility at Dhahran were delivered on 27 March. The Dhahran Area Office awarded the construction subcontract for the permanent wash facility at Dhahran air base on 26 March. The office completed the design for the paved redeployment assembly area in Jubail. Securing approval for these projects was difficult because Saudi officials resisted funding any new projects.[58]

Despite the challenges presented by redeployment, by early May **1991,** the Corps had completed $135,280,121 in construction: **$37,978,398** with U.S. funding, $94,711,723 with Saudi funding, and $2,590,000 with Japanese funding through the Gulf Peace Fund.[59]

Observations

Construction requirements changed continually throughout Operation DESERT SHIELD/DESERT STORM and to a lesser extent during redeployment. The changes posed a particular challenge for MEAPO(SWA) staff. In one instance,

during a visit to King Fahd International Airport the theater commander was alarmed to see roughly 800 helicopters sitting close together on the helipad and ordered that they be dispersed. CENTCOM directed the Dhahran Area Office to design new helipads for dispersing these helicopters. The office awarded a contract for construction of the pads and spent days working with the contractor to adjust the design because adequate material was not available. When the contractor went out to conduct the initial site survey, the general officer responsible for the helicopters directed him to stop work because he did not believe it was necessary to disperse the aircraft. Much valuable office staff time was wasted.[60]

Because of the changing circumstances, MEAPO(SWA) staff found it impossible to anticipate requirements far enough in advance. Requirements for the construction of heliports and airfields were generated at the division and corps level. As tactical plans developed, the locations of proposed aviation facilities changed, so planners could not project requirements far enough into the future to allow time to construct heliports and airfields under contract. Many aviation facilities constructed by contract were never used because units moved to other locations before the projects were completed.[61]

Meeting the expectations of units and dealing with delays in the contracting process made MEAPO(SWA)'s work even more challenging. Captain Adams, who had much direct contact with troop units, aptly observed, "Everybody wanted to be in their facility yesterday." If an engineer troop unit had responsibility for the construction, soldiers could see the engineers start working at the job site right away. By contrast, federal acquisition regulations required that a contract go through a 30-day process before award. During that time, soldiers saw no activity at the site and got the impression that nothing was being done. Most units had little experience working with contractors.[62]

Lieutenant Colonel Cargill conceded there were delays in construction but added, "...we have done most of the construction expeditiously, well within the time that it could be expected to take."[63] Cox observed that the engineering and construction process moved too slowly at times, but generally the Corps did "a very credible" job of moving projects to completion. Contractors often completed projects in 30 to 40 days that normally took 120 days.[64]

Using contractors for construction in an austere theater clearly had both advantages and disadvantages. General Storat, for example, argued that troop construction was more flexible and responsive to a broad range of missions. He recommended that military leaders use contracting to supplement troop construction, not replace it. Lieutenant Colonel Van Sickle expressed satisfaction with the responsiveness of contractors. While some greedy contractors took advantage of the situation and inflated their prices, he conceded, others operated within a 10-percent profit margin. Given their overhead and potential losses, he added, 10 percent was reasonable. Prices could vary widely, for example, laying hot mix asphalt ranged from 25 to 70

riyals per square meter. Three or four contractors consistently received work because they settled for a reasonable profit margin, while contractors demanding a 30-percent profit margin did not get as much work.[65]

The 416th Engineer Command staff observed that contractors supplemented troop capability effectively and were more familiar with local construction techniques and materials. However, contractors were not available in high-risk areas and took longer to mobilize than troops. In addition, the use of contractors required a formal design and contracting process. By contrast, troops were more flexible for contingencies, used expedient construction techniques, and did not require a lengthy approval process. Yet, they did not always have the required equipment (such as distributors or rock crushers) and had to be supplied with materials.[66]

Although military engineers had varied opinions about the value and reliability of contractors during combat, they agreed that contractors contributed significantly to the war effort. They also agreed that contractors should supplement engineer troops, not replace them. The Persian Gulf War experience clearly indicated that the use of engineer troops and the use of contractors each had advantages and disadvantages. Military planners and policymakers must weigh these factors carefully when determining the appropriate role for contractors in future contingencies.

CHAPTER 6
Supply Contracts

Although the Corps' large construction contracts attracted much attention, most of its contracts were small ones for goods or services. The first major supply contract that the Corps let in support of Operation DESERT SHIELD was for latrines followed closely by one for sunshades for helicopters. The searing desert sun made the equipment so hot that mechanics could not perform necessary maintenance and repairs. ARCENT needed sunshades to protect both the workers and the equipment. By mid-September, the Corps had awarded ten supply contracts totaling $6.9 million to include field showers, burnout latrines, washstands, aircraft sunshades, and temporary buildings.[1] The Corps also awarded contracts to rent desperately needed engineer equipment. These supply contracts significantly improved the quality of life for many U.S. soldiers.

Latrines, Showers, and Washstands

One of the first tasks that MEAPO(SWA) received was to provide latrines and showers as quickly as possible for troops camped in the Saudi desert. In late August, the Dhahran Area Office staff contracted with John D. Knerr for 500 latrine units and with Rawan Contracting for 1,000 units.[2] Two Saudi firms, Al Khudair and I.A. Abahsain, became the major latrine, shower, and washstand producers. Companies like John D. Knerr, Al Suaiket, Shinsung Corp., and Nabil performed additional work. The Corps arranged for contractors to supply tens of thousands of latrines, showers, and washstands.

The standard designs for latrines and showers, dating from the Vietnam War era, had to be updated and modified to meet requirements in Saudi Arabia. Corps personnel were never able to locate designs from the U.S. military's more recent experience in Honduras or Grenada. Ceasar Santucci and a captain from the ARCENT SUPCOM sat down with the military's standard design books one evening and within hours had designed the first latrines, showers, and washstands. The Dhahran Area Office staff made some modifications to improve the designs.

Santucci began with an old field manual sketch of a tip barrel shower. He knew that with the very corrosive water in the Middle East, the welded fitting in the design would only last a month, so he looked for an alternative. He worried that some soldier would pull the release string and the barrel containing 300 pounds of water would crash down and kill him. Santucci and the other engineers decided to use 2x4-foot sheets of steel for reinforcement. To prevent corrosion in the water tanks atop the shower units, the Dhahran Area Office directed the contractors to repaint the interior of the shower tanks

already in production with water resistant paint and replace the tanks on the shower units already distributed.[3]

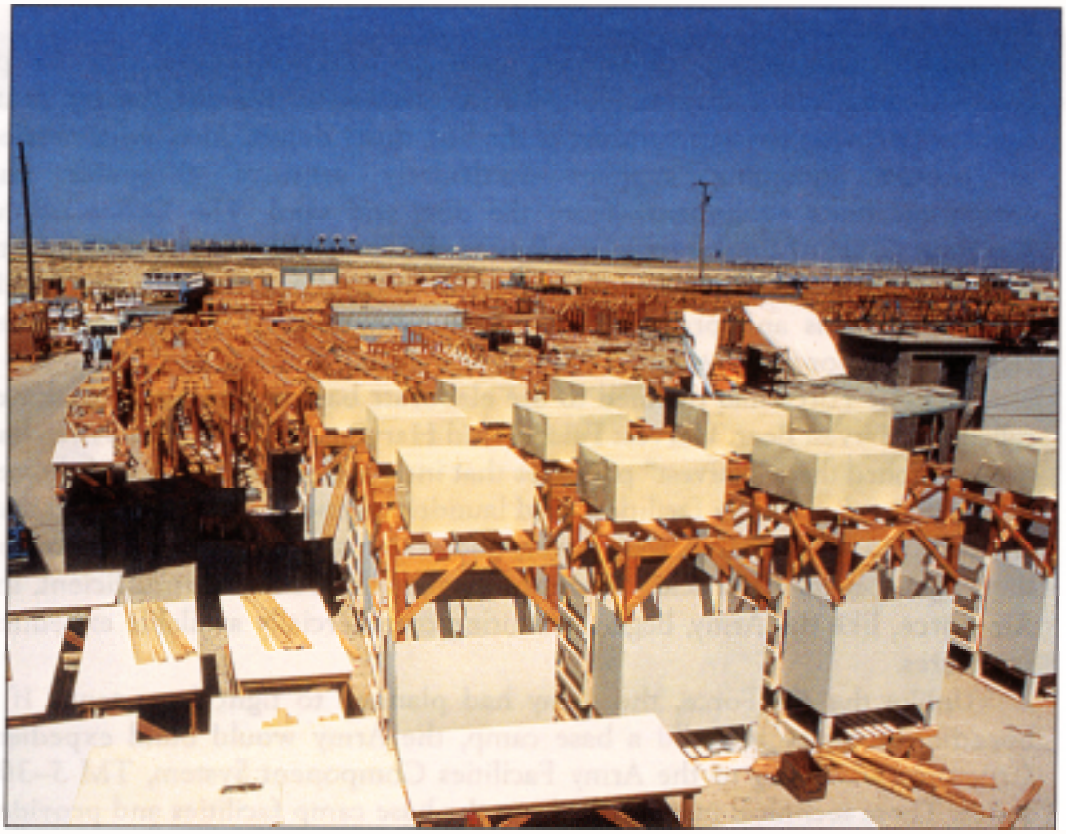
Engineers began with a three-hole wooden latrine with no partitions. Then they added two partitions. The final design was a three hole, three door, individual stall. With each contract award, they modified the design to make the units safer and more durable. For example, they developed more durable, spring hinges for the doors. They began using bolts instead of wood screws because the wood screws started coming off. As the ground war approached, the Dhahran Area Office even held a competition to determine the best design. In mid-February, the Dhahran Area Office issued purchase order contracts to seven contractors to construct portable latrines and showers.

Later that month, the Dhahran office staff held what they called a "build off" to acquire contractors' ideas for assembling collapsible units. The staff could only ship 8 to 12 assembled units on a tractor trailer, and trucks were scarce. Each contractor constructed one latrine unit, one shower unit, and one washstand in the parking lot outside the Dhahran Area Office. The "build off" was a success because the Corps acquired the designs it needed for rapid construction. Although the Dhahran Area Office took great care in designing the units, it never had enough inspectors to ensure that contractors followed the design specifications.

The first contractor for latrines, showers, and washstands did not know how to organize the work effectively. After the Dhahran Area Office personnel helped him move to a new location and establish an assembly line, he began producing units so quickly the office had difficulty modifying the contract fast enough to keep up with him. With so few U.S. troops in Saudi Arabia to counteract the threat of an Iraqi invasion those first weeks, contractors felt a sense of urgency. Later, as the U.S. force grew, the mood shifted to business as usual, and contractors lost some of their zeal. Yet, with some encouragement from the Dhahran Area Office staff, the contractors continued to meet the production goals.[4]

By early November latrine, shower, and washstand contractors had met the demand and were shutting down their operations. Then word came that the VII Corps would be arriving, and the Dhahran Area Office once again mobilized the contractors. With VII Corps' arrival and troop movement to the north, the requirements for these facilities increased dramatically. In early January, ARCENT determined that troops in the northern province of Saudi Arabia required 3,000 latrines, 2,000 showers, and 1,000 washstands. Previously, the supply had kept pace with the demand in the northern province, but stocks in the eastern province had been exhausted.

A Saudi contract with Khudair for latrines, showers, and washstands under host nation support had been pending since late November. In mid-January Colonel Miller asked the Saudis to direct Khudair to increase its production. Khudair could produce more, he explained, and going to other contractors



Contractors assemble latrine, shower, and washstand units for U.S. soldiers.
(U.S. Army photo by the 49th Public Affairs Detachment)

would delay delivery of the units. If the Saudis could not ensure prompt delivery of the units through their own contracts to meet the "critical" need, he warned, he would have to issue a contract using U.S. funds and procedures. Meanwhile, as the United Nations' 15 January deadline approached, contract workers began to abandon their work sites. Khudair shipped more than 200 units a day to Saudi Arabia's northern province, but as workers fled, maintaining those rates was difficult. Determining that the Saudis could not respond quickly enough, Corps staff awarded a U.S. contract to Khudair to supply 3,000 latrines, 2,000 showers, and 1,000 washstands.[5]

By 17 January, the Dhahran Area Office had delivered 10,500 latrine, 8,016 shower, and 5,600 washstand units. The units were not perfect. Troops occasionally complained about rusty water and problem doors, but they appreciated having the facilities. General Pagonis observed that the latrines and showers contributed to the low sick rate among U.S. forces.[6]

Santucci felt a strong sense of pride and accomplishment when, on the eve of the ground war, at the end of a meeting on the logistics scenario for forward deployment, he heard General Pagonis comment, "Well, that's it then. We're going to load up our showers and go."[7]

Expedient Structures

Besides contracting for latrines, showers, and washstands, the Corps contracted for temporary buildings. As soldiers arrived in the theater, tents could not provide enough comfort in the hot, dusty desert. Also, units needed to protect incoming supplies—particularly sensitive computer and communications equipment—from the dust and sand. The Office of the Assistant Chief of Engineers in the Pentagon provided technical assistance to Forces Command and the Army Materiel Command in procuring relocatable building systems and provided overall coordination for validating theater requirements for such systems.[8]

The Air Force had planned to use elaborate base development packages called the Harvest Bear, Harvest Falcon, and Harvest Eagle. The Air Force had pre-positioned these "harvest" packages that included tents, latrine and shower units, kitchen and dining facilities, field laundries, general purpose and aircraft shelters, plus electrical power, sewer, and water systems. Troops assembled these light shelters in the field.[9] When the current stock became insufficient, the Air Force, like the Army, began procuring commercially available expedient structures.

Unlike the Air Force, the Army had planned to fight from tents. If it became necessary to build a base camp, the Army would build expedient structures according to the Army Facilities Component System, TM 5–300 series. These technical manuals laid out the base camp facilities and provided detailed construction plans for individual structures. The Army had not placed the same emphasis on facilities as the Air Force. As a result, it did not have enough tents to meet its needs. Some soldiers slept in their vehicles. It deployed highly complex and costly equipment without providing adequate protection from the harsh climate. The need for facilities quickly became apparent. The Aviation Support Command, for example, hurriedly procured clamshell buildings—prefabricated, aluminum framed, tension structures shaped like clamshells—to support its aviation maintenance activities.[10]

One thorny question was how to pay for these structures. DOD Instruction No. 4165.56, dated 13 April 1988, and HQDA Letter 420–89–1, "Policy Guidance on the Use of Relocatable Buildings," dated 18 December 1989, established the policy and procedures for relocatable buildings acquired for temporary use, to include their use, acquisition, transfer, accountability, and disposition. The 18 December policy letter required that the Assistant Secretary of the Army for Installations, Logistics, and Environment approve all relocatable building purchases for "temporary use as personal property." It also stipulated that, when authorized, these buildings be procured using minor construction or military construction, Army (MCA) appropriations. The Army's Engineering and Housing Support Center issued further guidance on 24 August 1990.

Clamshell buildings, manufactured in Santa Barbara, California, were used for aviation maintenance. Here, two AH-64 helicopters await maintenance outside a clamshell structure at King Fahd International Airport. Sand has eroded the blades from the Apache in the foreground costing $180,000 *in repairs.*

Despite the guidance, military officials found that they needed further clarification of the policies and procedures for purchasing relocatable buildings to support the operations in the Middle East. Since MEAPO(SWA) procured the relocatable buildings to meet an overseas requirement and the need for the buildings would continue indefinitely, a MEAPO attorney concluded that the buildings should be classified as real property, rather than personal property, and should be paid for from military construction or operation and maintenance funds, not from the OPA (other procurement, Army) funds.[11]

Arguing that the approval process was too lengthy and cumbersome, Pagonis asked Assistant Secretary Susan Livingstone to waive the approval requirement in the 18 December policy letter and give him authority to purchase relocatable buildings. He also asked her to seek authority for ARCENT to use operation and maintenance funds to purchase relocatable buildings until it had enough other procurement funds or military construction money available.

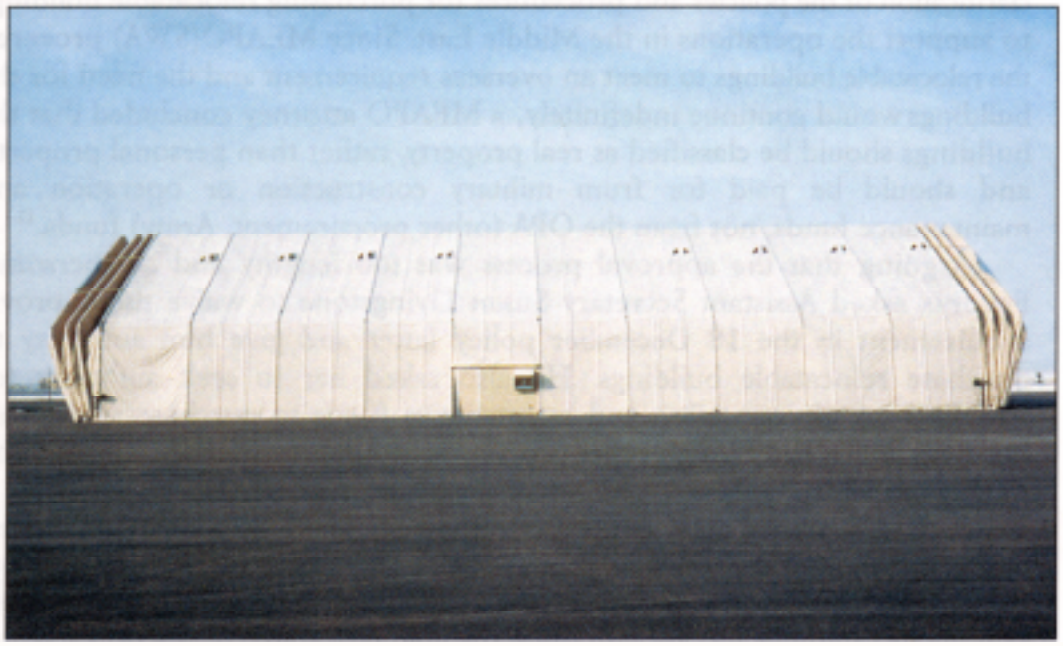
ARCENT needed many temporary, relocatable buildings to provide shelter, latrine and shower, maintenance, recreational, and medical facilities throughout the theater, he emphasized, but it was "almost impossible" to purchase relocatable buildings fast enough using the guidance stated in the policy letter. Leasing these units would be too expensive. ARCENT was competing with

other organizations to purchase these assets, and if the Army did not expedite the procurement process, it would lose the facilities to a competing buyer. Yet, Pagonis failed to note any instance where the existing procurement system had failed during the operation.

Livingstone found it impossible to waive the existing procedures. The Army general counsel had already determined that operation and maintenance funds could be used for military construction projects in support of Operation **DESERT SHIELD,** provided individual projects cost no more than $200,000. All other construction was to be charged to military construction funds. Thus, relocatable buildings were included in funded costs in construction projects, and military construction funds had to be used for projects exceeding $200,000. Livingstone determined that ARCENT had to fund all relocatable building procurement with these funds.[12]

U.S. forces used various expedient shelter systems for troop billeting and operations in the theater, including festival tents, clamshell buildings, sprung structures, and K-Span. Festival tents, purchased from Germany where they were used on holidays for temporary beer halls, were sometimes difficult to erect in the desert. The lightweight, compact clamshell buildings were assembled rapidly on site. They could be erected in four days by an untrained platoon. The sprung structures, in which a tension fabric skin covered a metal frame, required scaffolding and a crane to erect.

K-Span structures, made of thin sheets of galvanized steel, were cut to size and shaped on site by an automatic building machine. One machine formed



Side view of a clamshell building at King Fahd International Airport. The ends of the clamshell are opened and closed by either a band-cranked or a generator-driven winch.

enough steel for 15,000 square feet per day. One type of K–Span machine generated structures up to 72 feet wide at the base, while the "Super K–Span" generated structures up to 117 feet wide at the base. There was no limit to length. The average K–Span structures were 60 feet wide, 160 feet long, and 22 feet high. Typically, a crew of ten trained engineers could assemble a structure in three to five days. Soldiers from the 411th Engineer Brigade constructed 47 K–Span structures during the operation.[13]

At the time of the invasion, Forces Command had three K–Span machines in Jordan, where they had been used during a Joint Staff exercise. The command agreed to loan ARCENT these machines through 30 November 1990. In early October, four C–130 aircraft transported a K–Span machine and associated rolls of steel to Saudi Arabia. In addition, at CENTCOM's request, the Japanese government purchased ten K–Span machines with enough material to construct 80 insulated structures. The K–Span material began arriving in Saudi Arabia in early November. CENTCOM planned to use the initial shipments to construct helicopter maintenance facilities at Jubail and at Sheik Isa air base in Bahrain.

Although material for 70 more K–Span structures was expected to arrive from the United States in early January, the supply did not meet the project requirements. CENTCOM worked with the Saudi Arabian and Japanese governments to locate additional K–Span materials and obtain them through indefinite delivery contracts.[14] Congress eventually gave the Army $10 million in other procurement money for automatic building machines and "associated materials," but by that time, the Japanese government had procured all the machines that were needed.[15]

MEAPO(SWA) provided trailers as another form of expedient shelter. In September the Dhahran Area Office staff signed a contract with Al Khudair to supply several large trailers and signed a $3 million contract with the Abdullah Fauhad Company to supply 360 mobile housing units. In October, ARCENT directed the Dhahran office to procure, transport, and install roughly 400 temporary buildings to establish a billeting compound for the support command staff at the Dhahran air base. In another instance, the Dhahran Area Office procured 50 temporary buildings for tactical units and others to use as needed.[16]

No one type of expedient structure met all requirements. Many systems were suitable depending on the requirements. Colonel Braden observed that clamshell buildings seemed best suited for the desert environment followed by sprung structures. Most troops preferred clamshell buildings because they were the easiest to erect. Assembly required no engineer skills or equipment and could be completed in one or two days. The K–Span structures were also easy to construct and versatile. Braden later recommended that this system be adopted as a joint service engineer building system. The problems encountered with K–Spans were sand in the equipment, heat buildup, and their immobility

once constructed. Ultimately, other nations provided 143 sprung structures, 220 K–Spans, and 20 K–Span automatic building machines.[17]

Equipment Rental

Engineer troops arrived in the theater with little or no equipment, particularly compaction, water distribution, and heavy transport equipment. Air transport space went to critical weapons systems and much needed supplies rather than heavy construction equipment. Army engineers and planners believed they could lease enough construction equipment in the theater. At the beginning of the operation, construction equipment was, in fact, widely available in Saudi Arabia because the country was in the midst of a construction slump. Operators, however, quickly discovered that the existing equipment was poorly maintained and unreliable.[18]

The shortage of engineer equipment significantly affected ARCENT's ability to support operational requirements. The 307th Engineer Battalion (Airborne) from Fort Bragg, which supported the 82d Airborne Division, and the 326th Engineer Battalion from Fort Campbell, which supported the 101st Airborne Division, brought little of their own equipment. Some soldiers from the 20th Engineer Brigade were in the theater for 20 days without equipment.[19] In late December, the 307th's commander, Lieutenant Colonel Carl A. Strock, reported, "This lack of equipment would haunt us and hinder our effectiveness for the first two months of the operation and to some extent continues to do so."[20]

Meanwhile, the Army found that the equipment it had brought was quickly damaged by the desert environment. Sand filtered into the most minute areas of any piece of equipment. To minimize this, soldiers replaced filters and wiper blades more often than usual and wiped lubricants from outer surfaces to keep sand from sticking there.[21]

With military construction equipment at a premium, officials launched a "massive effort" to lease and purchase dump trucks, dozers, graders, bucket loaders, water distributors, back hoes, and other equipment for engineer units whose own equipment had not yet arrived in the theater. The Army leased local contractor equipment, and used heavy transportation equipment from the Japanese, Germans, Italians, and Czechs. The Dhahran Area Office staff leased construction equipment from the Bosmain Commercial Establishment for the 20th Engineer Brigade and the 608th Ordnance Company on 30 September. The 608th received equipment on 7 October, but the contractor had difficulty providing equipment and maintenance for the 20th Engineer Brigade. The South Atlantic Division reported in October, "Obtaining timely and reliable contractor provided maintenance continues as a problem."[22]

Faced with a shortage of engineer assets at echelons above corps, work requirements that were predominantly horizontal, and a shortage of organic compaction equipment and water and asphalt distribution equipment, the 411th

Engineer Brigade began leasing commercial construction equipment and using Japanese funds to purchase that equipment. With both corps requesting equipment, well-maintained host nation equipment became even scarcer. In a three-week period, the brigade requested and inspected roughly $10 million in engineer equipment. Although personnel inspected the equipment before accepting it from the contractor and procurement packages provided for maintenance, the quality of the commercial equipment, particularly the leased equipment, was often poor.[23]

The 411th Engineer Brigade faced a continual shortage of compaction and water distribution equipment and primary haul assets. Although the brigade purchased and leased compaction and water distribution equipment in the theater, it never had enough to meet all requirements. For example, it never had enough capability to produce and spread hot mix asphalt at King Khalid Military City or enough organic haul capability to respond to shifting priorities in the theater. "It wasn't that you didn't have it [the equipment]," General Storat explained. "It was the difficulty in getting the right equipment at the right place and the right time to do the job."

The brigade had to spend much time servicing the equipment it acquired to keep it running. Equipment owners did not supply instruction manuals, and the equipment operators they provided were inadequately trained. Some equipment worked well; some did not. Some contractors were excellent, and they successfully got water and compaction equipment out to the job sites to keep projects going. But there were also many problems associated with rental equipment. Leasing, Storat concluded, was "not an effective long term remedy for having the right mix of equipment in the combat heavy battalions."[24]

The most severe shortage was in heavy transport equipment. Long haul trucks, flatbeds, and dump trucks became critical because they were low on the Army's priority list for transport into the theater. Before the force deployed, logistics planners assumed there would be enough trucks in the theater, without bringing in Army and Marine construction support (truck) companies. They planned to contract with the host nation for trucks, but good trucks were scarce on the Arabian peninsula.

Prices escalated sharply as various services competed with one another to lease trucks, particularly in November and December as the U.S. military moved tanks and other equipment to the front lines. When the Saudis began negotiating contracts for trucks as part of host nation support, they competed with U.S. units and drove prices up even higher. Initially, the Dhahran Area Office could rent a truck for 400 riyals a day, but at one point the price rose to 1,500 riyals a day, and at times no trucks could be found at any price.[25]

Current modified tables of organization and equipment authorizations for combat heavy engineer battalions and combat support equipment companies provided only a third of the haul assets that the engineers needed to move their equipment over long distances. VII Corps, for example, had difficulty

transporting its only heavy battalion—the 249th Engineer Battalion (Combat Heavy) out of Knielingen, Germany—from the port to the northern and western regions where the corps was located.[26]

During the Gulf operations, Task Force 43 made two moves, each covering nearly 350 miles. The lack of trucks forced the task force to rely extensively on nonorganic sources, but changing priorities and availability of transportation vehicles made these sources unreliable. Nearly six weeks passed before the task force had all its organic equipment in place. Meanwhile, it had missions vital to the mobility of the entire VII Corps.

Task Force 43 used equipment purchased with Japanese government funds. Much of this equipment needed repair. The equipment's 90-day maintenance warranty did not include repair parts. The task force had to obtain its own repair parts, and since the rental equipment rarely matched the equipment in the Army inventory, repair parts were not readily available. The only source of repair parts was in Riyadh, an hour's drive from the task force's base camp. The equipment came without manuals, making maintenance even more difficult. Terminating a useless contract could take months. The task force simply parked broken equipment in the motor pool until it had to be turned in. When equipment arrived with operators who provided maintenance, the equipment was more productive. When the contractor provided no operator, the equipment often arrived in "a very deplorable state of maintenance" and had to have major repairs before it could be operated. Purchasing large quantities of used construction equipment did not help the task force much and created a maintenance nightmare.[27]

After the Persian Gulf War, Lieutenant Colonel Van Sickle warned that engineers should not expect to enter a foreign country and rent new equipment. Understandably contractors were reluctant to rent their newest and best equipment when they knew the renter would pay as much for the old equipment. Moreover, contractors knew that renters would not care for the rental equipment as well as they would care for their own. If a contractor rented his best equipment, he would have to charge an extremely high fee to make a profit, so he loaned out equipment that he could throw away if the renter broke it.

Shipping equipment from the United States was very expensive for the contractors, and getting replacement parts could take up to four months. Replacing a dozer, for example, could cost $30,000 to $50,000. Also, equipment owners worried that U.S. troops might take the rental equipment into Kuwait and Iraq. Their concerns were justified. Although the Dhahran Area Office contracts required that the rental equipment remain in Saudi Arabia, troops drove the equipment into Kuwait and Iraq during Operation DESERT STORM and abandoned it there after the war.[28]

Observations

The contracts for latrines, showers, and washstands plus sunshades, expedient structures, and rental equipment filled a critical need in the first months. These contracts helped U.S. forces execute their missions more effectively.

The U.S. Army Corps of Engineers and its contractors provided 10,000 washstand, 16,000 field shower, and 23,000 latrine units. By 1 March, the Corps had spent more than $29 million on latrine, shower, and washstand contracts, more than $6 million on equipment rental, and more than $5 million on expedient structures.[29] With the implementation of host nation support, the Saudi Arabian government assumed some responsibility for these supply contracts.

Yet, even with increased support from the host nation and later the Japanese government, the need for the Corps' basic supply contracts continued throughout the offensive and redeployment phases. Supply contracts proved to be a reasonably responsive and cost-effective method of meeting the immediate needs of troops, but as noted, the reliance on contractors also posed problems.

CHAPTER 7
Leasing Real Estate

Another major mission of the U.S. Army Corps of Engineers was to provide real estate services for American troops in the theater. This was particularly important in Operation DESERT SHIELD/DESERT STORM because American forces relied so heavily on support from the host nation. Leased facilities were necessary to provide beds and sanitation facilities for the incoming troops. The United States had no authority to take property through eminent domain, so Corps real estate specialists had to negotiate leases with property owners. Besides processing leases, real estate personnel often prepared "intent to lease" letters, allowing the military to occupy a tract of land or facility before the formal lease had been signed. Through its real estate activity, the Corps successfully provided a wide range of facilities critical to the effective operation of U.S. forces.

Initial Deployment

The use of civilian real estate specialists in contingencies was not new for the U.S. military. The Army had used them in the Dominican Republic, Lebanon, and Grenada and in Panama during Operation JUST CAUSE. When Operation DESERT SHIELD began, the Corps' top real estate official, Barry Frankel, knew instantly that real estate would be a problem. He was concerned that the role of the two Army Reserve real estate detachments was unclear. No doctrine existed concerning real estate activities that defined the role of civilians and determined when the military took over. Without such doctrine, training the real estate detachments proved difficult.[1]

In 1987 when MEAPO began contingency planning with Third Army, Corps officials recognized the potential need for a real estate capability. Since MEAPO had no real estate expertise, the South Atlantic Division assigned the real estate mission in the Middle East and Africa to the Savannah District. The district signed a memorandum of understanding with MEAPO, agreeing to provide the full range of real estate services. It had preexisting authorities to lease housing, warehouse space, and other facilities and to pay damage claims. Savannah officials quickly consulted with real estate specialists who had previously worked in the Middle East. They also formed a team of six real estate specialists and appraisers who could deploy to the Middle East on short notice and instructed them on local customs and leasing procedures.

When the Iraqi invasion occurred, however, the Savannah District had not yet tested its plans. The district found that it did not have a good package containing forms and authorities to give deploying personnel, so South Atlantic

Division's chief of real estate, Al Posner, asked Mobile District real estate specialists to develop a package of important information based on their experience in Operation JUST CAUSE. Savannah District placed two real estate specialists on alert ready to deploy to Saudi Arabia as soon as MEAPO issued the order.[2]

The first to deploy, John R. "Rick" Thomas from Savannah District, accompanied Lieutenant Colonel Cox to Saudi Arabia on 17 August to lease billeting for as many troops as possible. As the only real estate specialist in the theater, Thomas worked long hours. Savannah District's chief of real estate, Jim Ellis, followed five days later. Before departing, he requested that the rest of the district's real estate team deploy. By late August, the team of six was operating out of the Dhahran Area Office.[3]

The first lease was for a warehouse in Dhahran for an Army medical unit. Another early requirement came from the Marines when General Boomer asked the Corps to lease housing for some of his troops. The Marines wanted their own designated real estate specialists to represent them. A small group of Corps real estate specialists traveled to the forward area on 31 August to help the Marines. By early September, the Corps was receiving requests for real estate support from all the services.[4]

In the first months, real estate specialists in the Dhahran Area Office worked 12 to 16 hours a day, seven days a week, under great pressure to lease facilities quickly. Initially, Saudi property owners or their agents took real estate specialists who were unfamiliar with the city to inspect properties. Most of these Saudis spoke English, which improved communication. Lease documents were printed with English and Arabic text side by side. The Dhahran Area Office personnel leased a variety of facilities for billeting, equipment storage, and maintenance. For example, they leased the Saudi Automotive Service Company facility, where the Army Material Command's support group rebuilt transmissions, engines, and major assemblies on expensive, high-tech military vehicles.[5]

By late August, the Army had 15 real estate leases—primarily for warehouses, compounds, and other facilities—at a cost of $1.5 million. With the rapid deployment, there were not enough Saudi facilities to meet the requirements. Pagonis noted that billeting remained a top priority directly affecting the soldiers' health, welfare, and morale. He and his staff anticipated that real estate requirements would increase with the influx of nondivisional troops. With Saudi resources already "severely strained," he observed, the United States would have to obtain real estate and facilities through civilian leases. By the first week of September, Pagonis reported 10,000 to 12,000 soldiers were being housed in leased facilities; 8,000 to 10,000 more were at the air base in Dhahran. Many were in large complexes that had been build in the 1970s and 1980s to house foreign laborers.[6]

In mid-September, Pagonis' support command reported that real estate leasing was the dominant engineer activity. The United States had leased 90 percent of the immediately occupied compounds. Compounds still being negotiated would not be livable for weeks. The support command found housing for 2,000 troops a week—four leases per week each averaging 500 persons—but 7,000 to 14,000 soldiers arrived each week, creating a tremendous backlog. Throughout September host nation assets remained strained and the backlog increased. By 4 October MEAPO(SWA) had completed 44 leases representing nearly 32,000 billets at a cost of more than $45 million.[7] By mid-October the real estate staff included 18 Corps members and three clerks hired locally.[8]

Leasing Authorities

Corps real estate specialists had a delegated authority from the Deputy Assistant Secretary of the Army for Installations and Housing. Title 10, U.S. Code, Section 2675, provided leasing authority. In April 1987 the Army established a policy requiring the Assistant Secretary of the Army for Installations and Logistics (now Installations, Logistics, and Environment) to approve all foreign leases with an estimated annual rental of more than $50,000 and a firm term of more than a year. Delegation of leasing authority for the Persian Gulf operations went from the Assistant Secretary to the Chief of Engineers and his director of real estate, and then to the commander of the South Atlantic Division and his chief of real estate. From there, authority went to the Savannah District engineer and his chief of real estate who could redelegate that authority to whomever he chose, except to military personnel because they lacked the training and expertise.

By mid-August, Corps officials realized that their real estate specialists in the theater had not been delegated enough authority. The South Atlantic Division requested authority to execute leases without the approval of the Deputy Assistant for Installations and Housing, Paul W. Johnson, and to let the Savannah District's chief of real estate redelegate his authority to sign leases to an authorized representative. This enabled Corps officials in the theater to sign the leases and respond effectively to mission requirements.

Initially contracting officers could only sign leases up to $50,000 annual rental. That authority proved to be inadequate. As the situation became more urgent, Johnson delegated to the Chief of Engineers, the South Atlantic Division commander, the Savannah District engineer, and their respective real estate chiefs the authority to execute leases in foreign countries up to $250,000 annual rental and up to five years firm term. Corps personnel had to forward a report on such leases to the real estate directorate in Corps headquarters and to Johnson's office within 90 days of execution.[9]

Lieutenant Colonel Cox quickly responded that Johnson's delegation of authority was "totally unacceptable" to General Pagonis and did not "stand the

test of common sense." At Pagonis' request, Cox urged the Corps to seek relief from this $250,000 cap. Troops arrived daily with no operating areas or housing available, he explained, and the Saudi Arabian government had its own substantial requirements for facilities. The Corps' Dhahran office had to lease warehouse space and billeting and maintenance facilities for echelons above corps and corps logistics units as an alternative. It was currently working on 15 leases, all critical, Cox reported, and only three of these would fit under the $250,000 cap. A year's rent for just one compound could equal $2 million.

"We are attempting (as much as one man can do) to analyze the market, negotiate firmly, and get the best possible deal," he explained. "But the bottom line is we are in a sellers' market." MEAPO officials warned that Corps personnel in Saudi Arabia urgently needed authority to execute leases of more than $250,000. "Absence of this authority," they observed, "is seriously degrading MEAPO credibility with ASG [Area Support Group] commander, Major General Pagonis."[10]

At the Corps' request, on 21 August, Johnson delegated to the Chief of Engineers, the South Atlantic Division engineer, the Savannah District's engineer, and their respective real estate chiefs the authority to execute leases in foreign countries up to $2 million annual rental and up to one year firm term. For any lease longer than one year, ARCENT had to determine that it was necessary in support of Operation DESERT SHIELD, and Johnson had to approve it. Cox responded that even the $2 million limit was inadequate and pleaded for a minimum authority of $4 million to $5 million.[11]

Despite Pagonis' and the Corps' pleas, Johnson retained approval authority for leases costing more than $2 million. In response, the South Atlantic Division set up procedures to expedite the approval process. For leases costing more than $2 million, the Dhahran Area Office staff faxed the request to their counterparts in Winchester, Virginia, who in turn faxed it to the real estate office at Corps headquarters in Washington, D.C. An individual from headquarters hand carried the request to Johnson's office in the Pentagon for approval. The approval process usually took only six or seven hours. The Assistant Secretary's staff members were very cooperative. They even gave the Corps real estate personnel their home phone numbers in case approval was needed after business hours. Johnson granted authority on 11 occasions, each within a 24-hour turn around.[12]

Processing Requirements

The system for processing real estate requirements was less centralized than the system for processing construction requirements. Army troop units generated the real estate requirements, and the field commander sent them to the terrain manager in the area support group that was responsible for validating the requirements and establishing priorities. All requests had to be approved by Colonel Stephen Koons and his staff, who sat at a table in the

center of the large auditorium where Pagonis' support command staff operated at the Dhahran air base.

After Koons' approval, the requirement went to the host nation support desk (located in the same auditorium) manned by a Saudi colonel, Khalaf M. Al-Shammari, and Colonel Roger Scearce who determined whether a Saudi military facility was available to fill the requirement. If not, the requirement went to the support command's engineer desk that tasked the Dhahran Area Office to locate and lease the necessary real estate. If an Army unit submitted a lease requirement directly to the Corps without the approval of the area support group, the Corps returned the requirement for formal approval before initiating leasing procedures.[13]

Initially the support command engineers worked with Pagonis and the user to determine priorities. Priorities changed daily, sometimes even hourly. Pagonis had tremendous real estate requirements—most of them in Dhahran—which he spelled out in his daily briefing. The support command gobbled up 95 percent of the Corps' real estate resources.

At a meeting with Colonel Miller on 19 September, Pagonis indicated that he wanted to validate each requirement personally and assign its priority. After lease negotiations were completed, he wanted to approve the funding. Responding to this guidance, the ARCENT engineer and MEAPO(SWA) representatives met with terrain managers for the Army's major commands to discuss procedures for setting priorities, managing leased facilities, and processing leasing requests. The Dhahran Area Office staff did not set priorities or validate requirements. They simply kept Pagonis informed on the status of real estate actions, and he rearranged or confirmed those priorities.[14]

When the requirements climbed from 2 or 3 to 50, officials looked for a better process to sort out the priorities. They developed a detailed priority list. The list grew to 80 items at one point, and so many entities became involved—such as the XVIII Airborne Corps, 593d Area Support Group, Dhahran Area Support Group—that they established a weekly meeting.

Each Thursday terrain managers for all the major commands, Pagonis' engineer staff, and Corps real estate specialists sat down at a large conference table where they reviewed the list and recommended priorities. The next day the list went to Pagonis for approval, and once approved, it became the priority list for the week. The following Thursday, the group met again to modify the list and integrate new requirements that they added to the bottom of the list unless Pagonis directed differently. Through their terrain managers, every major command could vote on the list.[15]

The Dhahran Area Office presented the proposed lease to Pagonis before the lessor signed it. Pagonis then determined if the priorities had changed. In one instance, office personnel negotiated a lease for a cold storage plant with an operating crew of 20. By the time they presented the lease to the general, he

had other more pressing requirements, so he directed them to put the cold storage lease on hold.

After determining priorities, Pagonis' engineers gave MEAPO(SWA) a directive with a fund source. After the ARCENT SUPCOM directed the Dhahran Area Office to lease a facility, its real estate specialists had authority to contact the units directly to determine their needs and execute a lease. At first, there were not enough Corps real estate specialists to identify potential rental properties and keep up with the paperwork, so they relied on troop units to identify places that they believed would meet their requirements.[16]

Although Corps real estate specialists leased properties primarily for the Army, they also supported the Navy and Marine Corps. The Air Force handled its own real estate requirements. At the direction of Colonel Miller, the Dhahran Area Office responded to Marine requirements immediately, so they never had to be raised to the CENTCOM level. Colonel Miller assigned Terry McGivern as his liaison with the Marines. Real estate specialist Bob Dragonette later traveled to Jubail to support the Marines and Navy. He also helped a Marine air wing in Bahrain lease housing and warehouse space. In addition, the Corps assigned one real estate specialist to support the Navy in the United Arab Emirates and another to handle Navy real estate actions in Bahrain. At the request of the Navy, the Corps leased two plots of land at the Port of Fujairah in the United Arab Emirates. The Navy and Marines provided their own funding and did not compete with the Army for scarce real estate funds.[17]

Lease Negotiations

Corps personnel negotiated real estate prices with property owners in strenuous sessions that could last up to five hours. Specially trained appraisers prepared a government estimate of the property. The appraised value was the guidepost. If the negotiated cost was more than 20 percent over the appraised value, the unit requesting the property and the Dhahran Area Office had to justify the cost to Pagonis.

Over time, real estate specialists based their appraisals both on the nature and size of the actual facility and, some contend, on the number of soldiers who could live there. Saudi Arabia had many vacant facilities designed to house hundreds of laborers. The Saudis had experienced a construction boom in the 1970s and early 1980s, but the boom ended and the work force disappeared. Soldiers occupied space differently than previous tenants had; 2,000 soldiers could possibly live in space that normally housed 500 tenants.

As a basis for evaluating a lease before final approval, Pagonis sometimes wanted to know the cost per person. Property owners also wanted to base their negotiations on the capacity of the facility. Although Corps real estate officials claimed that they emphasized the quality and location of the facility in evaluating the cost and never allowed capacity to be the determining factor, at Pagonis' request they occasionally determined the cost per person per day. They

developed an acceptable range of value—$2.00 to $15.00 per day per person. Leases averaged about $5.00 per day per person. Property owners eventually became aware of the cost-per-person factor and began asking how many people the United States planned to house in the facility. They multiplied this figure by $10.00 to $15.00 per day and used this figure as their starting price.

As Operation DESERT SHIELD dragged on, Corps real estate specialists found it increasingly difficult to lower excessively high prices through negotiations. Occasionally, Pagonis personally intervened in lease negotiations when he believed the price was too high and the facility was large and important. The general had his attorney present who reminded him that he could not threaten to take property through eminent domain, but he managed to at least leave the impression that he could and would do so.

Even with the implied threat, Pagonis did not always succeed in lowering the price. Sometimes in frustration he appealed directly to Brigadier General (Prince) Turki Bin Nasser Bin Abdul Aziz, the commander in Saudi Arabia's eastern province, to help lower the prices. He provided information about leasing problems at regularly scheduled meetings with Prince Turki and his staff, and after the meeting the prince's staff called the property owner. Not long after, the owner would inform the Dhahran office staff that he had decided to lower his price.

Pressuring property owners worked well initially, but after late October, the threat of an Iraqi invasion of Saudi Arabia had diminished. Pagonis could no longer use the implied threat that war was imminent and he would take the property through eminent domain.[18]

General Pagonis approached negotiations with his characteristic shrewdness and energy. The general observed that as property owners negotiated with him in his office, they fingered strings of "worry beads." He decided to acquire his own worry beads, and as the next round of negotiations began, he pulled them out. As soon as he did this, the tension in his office eased and stalled negotiations began to move forward. In Saudi culture, being an effective negotiator was a valued skill, and Pagonis maintained that the worry beads helped him negotiate a lower price.[19]

The law of supply and demand drove costs up, and cultural factors made leasing difficult. The Saudis who had been bartering for thousands of years were astute negotiators. Colonel Braden compared the leasing process to telling an automobile dealer that you were going to buy a certain car before discussing the price. Corps real estate specialists were not able to shop around for the best deal. Braden suggested that the United States create a multiple listing service to better match military units with available facilities.[20]

Negotiating leases was further complicated because no one knew how long U.S. troops would need the facilities. The Joint Chiefs of Staff established an interim policy limiting to 60 days the term of contracts in support of Operation DESERT SHIELD. Yet most Saudi property owners refused to lease their property

for less than a year. Real estate officials recommended that leases be exempt from any 60-day restriction. The delegation of authority to execute leases in support of Operation DESERT SHIELD specifically authorized leasing up to one year in support of the operation. In most of the previously negotiated leases, the United States had agreed to pay one year in advance, with rental reimbursement if the lease was terminated early.

Real estate officials struggled to reduce the amount of rent that the United States had to pay up front because they believed that money would be difficult to recover. They tried to include a provision in leases requiring an irrevocable bank letter payable to the United States if the lease was canceled. Real estate officials noted that the administrative costs of renegotiating leases every 60 days would be significant. They also warned that if U.S. military requirements extended beyond 60 days, they might not be able to lease the facilities at any price because of the increasing competition for available property.

Barry Frankel complained that the restriction would "tie our hands as far as ability to be responsive." The restriction would also make it impossible to do planned construction unless the host nation provided the land because the United States did not want to invest large sums of money in renovating property that it could only use for 60 days. He added that the costs of leases increased dramatically as the lease terms decreased. The usual practice in Saudi Arabia was payment of one year's rent up front with the promise of reimbursement if the lease was terminated sooner. Real estate specialists tried to negotiate six-month cancellation clauses whenever possible.[21]

Pagonis made leasing a top priority and strongly supported the Corps' efforts. In an October meeting he indicated that because of the increased buildup, the Corps had to acquire 30 to 40 properties within the next 20 days to handle the flood of incoming troops. Corps real estate specialists successfully met Pagonis' challenge negotiating 40 leases in 17 days—3 days before the deadline. MEAPO(SWA)'s goal was to complete one lease a day. The peak activity occurred from 17 October to 1 November when real estate specialists averaged 2.8 leases a day.[22]

308th Engineer Detachment (Real Estate)

Despite their best efforts in those early months, Corps personnel could not keep up with the mounting real estate requirements. They enlisted the support of the 416th Engineer Command and the three real estate units attached to it. On 20 September, Barry Frankel and his staff met in Washington with Claudette Tucker, Savannah District's real estate liaison to MEAPO, and Major Salvatore "Mike" Cremona of the 416th to discuss real estate support to Operation DESERT SHIELD and other contingencies.

Frankel candidly observed that the three real estate detachments might not be trained adequately for Saudi Arabia and might unwittingly violate prescribed procedures. Frankel added that the Army reserve component held a potentially

invaluable source of real estate support, and that Corps headquarters and the 416th Engineer Command should work together to develop a viable program. Frankel and the other participants concluded that the current structure of real estate detachments did not meet the requirements of the theater and lacked training and expertise in real estate and acquisition.[23]

In early October, the 308th Engineer Detachment (Real Estate), an Army Reserve unit headquartered in Bismarck, North Dakota, received the mission to provide theater real estate support for CENTCOM units in the Persian Gulf. Real estate officials from Corps headquarters trained the detachment before it deployed. A three-person team including Jim Ellis who had just returned from Saudi Arabia; Denise Titus, the chief of Savannah District's real estate acquisition branch; and Jerry Leiss, Frankel's chief of realty services, visited the 308th's headquarters and provided a concentrated two-day training course.

The real estate detachment was at full strength, but many of its members had only recently enlisted. Only four or five had received the basic real estate mobilization course. The 308th helped the Dhahran Area Office organize its real estate records. Some of the officers were trained to help with lease negotiations.[24]

A 16-member detachment from the 308th—5 officers, 3 noncommissioned officers, and 8 enlisted personnel—under the command of Major Thomas M. Senger, was called into active service on 11 October and deployed to Saudi Arabia on 30 October. The commander of the 416th Engineer Command's forward element, Colonel Alan J. Berg, put the detachment to work acquiring and disposing of real estate; managing contracts and agreements; investigating, processing, and settling real estate claims; and supporting forward deployed troops as required. Berg indicated that the engineer detachment would be under MEAPO(SWA)'s operational control and that it had the authority to coordinate directly with other Army units to accomplish its tasks.

Since the detachment had no leasing experience or delegated leasing authority, Colonel Cox searched for a way to use the unit and integrate it into the Corps' operations. He wanted the 308th to have a unit mission rather than just fill in as needed. Cox had the soldiers conduct real estate surveys. This involved going back to all the leased properties and documenting their condition with video cameras, still photographs, and written reports so the Corps had a complete record of the original condition when it turned the facilities back to their owners. Normally such surveys were done before a unit moved into the facility, but the Dhahran Area Office staff had not had the time.

Cox also gave the real estate detachment the task of mediating problems with leased facilities—such as sinks that would not drain. The soldiers established a customer service center to perform that mission. The 308th also developed a detailed computerized inventory of all properties, host nation provided and leased facilities, within Saudi Arabia, which the Directorate of Engineering and Housing personnel were using. The data base was particularly

valuable later when the Dhahran Area Office closed out the leasing operations. Cox also ensured that officers from the 308th worked alongside his staff to gain some experience negotiating leases.

With the beginning of Operation DESERT STORM, a major real estate mission developed at King Khalid Military City. Cox sent three soldiers from the real estate detachment to work with Captain Adams and handle leasing actions in that remote northern area. The soldiers spent two months working on water well issues and helping the Army's host nation support element deal with the local emir.[25]

In sum, the 308th Engineer Detachment effectively supported the Dhahran Area Office by managing contracts and agreements, investigating claims, maintaining records, and preparing reports, thus freeing the office's real estate specialists to concentrate on negotiating and awarding contracts. The unit remained in Saudi Arabia until 4 April 1991. This was the first time that a real estate detachment and civilian real estate specialists had worked together on a mission. Bob Dragonette, who served as the Dhahran Area Office's chief of real estate from March to May 1991, characterized the association between the 308th and the Dhahran Area Office as "a very good marriage."[26]

Host Nation Leasing Support

The implementation plan for host nation support stipulated that the government of Saudi Arabia would provide facilities for U.S. troops, but at the time the agreement was signed, the Saudi Arabian government was ill prepared to take over the real estate leasing mission. The Saudi military had no experience or organization ready to lease real estate. Saudi troops were in the field preparing for war, and few could be dedicated to real estate work. The Saudi Arabian government devoted only three officials to this full time—an air defense officer, a helicopter pilot/engineer, and a medical service corps officer—none of whom had any experience leasing real estate.

On the day the Saudis signed the host nation support agreement, no procedures were in place for how the system would work. The Dhahran Area Office staff, who had worked feverishly 20 hours a day to meet General Pagonis' challenge to lease 40 properties in 17 days, became discouraged when the Saudis took over after 11 November and real estate work came to a standstill. Saudi officials, for their part, questioned why U.S. troops did not simply camp in the desert. They also wanted to know why the troops needed facilities in the built-up areas, even though Cox explained that troops lost efficiency in the desert. Moreover, the Saudis believed the United States had been paying too much for rental properties.[27]

As might be expected, Saudi officials insisted on being directly involved in acquiring leases since they would be paying the rent. On 2 November, the Dhahran Area Office referred three lease actions that had been negotiated to an acceptable price and approved by the ARCENT SUPCOM to a Ministry of

Defense and Aviation representative, Captain Ossaimy. The office asked for quick approval. At the ministry's request, the office provided government estimates, location maps, renovation requirements, services and facilities provided by the lessor, and payment terms. The next afternoon Ossaimy indicated that he and two officers wanted to visit the sites of the three leases. In addition, he wanted a Saudi representative to participate in all the Corps' future real estate negotiations.

After visiting the sites, the Saudi representatives announced that they planned to reopen negotiations. Tommy R. Hill, the Dhahran Area Office's chief of real estate, arranged the renegotiation appointments. Ossaimy and two other officers attended these meetings, along with a Corps real estate specialist. Despite Hill's insistence that all negotiations be conducted in English, the Saudis conducted these meetings in Arabic. The lessors later reported that the Saudi officers had asked them to lower their rentals based on duty to their country, not on real estate values. One owner claimed they asked him to submit a signed contract with the amount left blank to be filled in later at the Ministry of Defense and Aviation's headquarters in Riyadh.

Saudi officers insisted that the Dhahran Area Office's real estate specialists use similar methods to get lessors down to the lowest rate possible and then turn the negotiations over to them. Hill, however, argued that only one party should negotiate with the lessors. "If we continue with these procedures," he warned, "the real estate leasing program will come to a virtual standstill." Hill recommended limiting Saudi involvement to reviewing and concurring with the government estimate. The Saudis and the Dhahran Area Office staff should agree on a set percentage that they would negotiate to on all leases before approving. Once a price was negotiated within this percentage, the Saudis should automatically approve the price and a lease would follow.[28]

As the Ministry of Defense and Aviation assumed responsibility for negotiating leases, the Corps redefined its own role. The Dhahran Area Office's real estate branch now acted as the theater's single point of contact between the ministry and U.S. troop units that needed facilities and provided all technical data needed to negotiate the leases. It tried to ensure that the property was acquired quickly and met the troop unit's requirements. After the lease was executed, the Corps continued to serve as the point of contact for the units to resolve leasing problems.[29]

The Corps developed new procedures to meet leasing requirements. The Dhahran Area Office staff prepared the lease package with the facility requirement and the appraisal (the government estimate) and then handed the package over to Saudi officials who conducted the negotiations. The Dhahran office helped them prepare a lease agreement, and local representatives from the Ministry of Defense and Aviation referred these leases to their superiors in Riyadh for approval and execution.

In instances where the Corps and the lessor had already agreed upon a price, Saudi officials often renegotiated to lower that price. Unfortunately, in their eagerness to lower prices, they sometimes negotiated away a key part of the facility or access to the facility that the troop unit needed. Saudi negotiators excluded Corps personnel by sending them out of the room during negotiations or by conducting the negotiations in Arabic. The Saudis also objected to the leasing forms that the Dhahran Area Office had been using with English on one side and Arabic on the other. The Ministry of Defense and Aviation did not use the Corps' lease agreements but simply attached them to the Arabic contracts that they had the lessors sign.[30]

By mid-November CENTCOM's real estate priority list contained 71 unfulfilled requirements and was growing rapidly. Although billeting made up most of the list, the warehouses, operation areas, and maintenance facilities got priority. Worried unit commanders complained that the backlog jeopardized their mission. Although the Saudis continued to conduct the negotiations, Corps personnel again became heavily involved in leasing activity. They identified requirements, located properties, estimated real estate values, secured price proposals from property owners, and prepared documentation.

Record keeping, lease and utility payments, and lease administration became increasingly difficult for the Ministry of Defense and Aviation. It increased its real estate office from three to five, but this small staff could not keep up with the mushrooming requirements. MEAPO(SWA) assigned a real estate specialist to each Saudi officer to improve coordination and communications.[31]

The ministry's own practices caused additional delays. Its approach was first to locate available properties and then identify individual troop units that could occupy those properties. This approach ignored the units' own efforts to locate facilities and required units to revalidate the requirements for the ministry's personnel and evaluate as many as five alternatives before finding suitable facilities.

Army operations came under increasing strain as the backlog of real estate actions mounted. General Pagonis warned the ARCENT deputy commander that the situation would worsen as troops from VII Corps deployed. He recommended that the Ministry of Defense and Aviation increase its local staff and first negotiate for the property that units had identified before moving to alternatives. If these changes did not occur, Pagonis persisted, he would have to enlist MEAPO(SWA) to acquire the property and use U.S. funds, seeking reimbursement from the Saudis later.[32]

The situation became so critical that on 25 November 1990, the commander of the Navy forces in the Gulf directed the use of U.S. funds for Navy leases. At the same time, General Pagonis approved, case by case, the use of U.S. funds to lease critical facilities. He directed MEAPO(SWA) to resume

negotiations to reduce or eliminate the backlog that had accumulated since 1 November.

MEAPO(SWA) representatives discussed the problem with Saudi officials and offered to continue helping them gather unit requirements, government estimates, and written proposals, as it had done for the previous three weeks, but also to negotiate the lease for them. MEAPO(SWA) would then present the "final" negotiated lease to the Ministry of Defense and Aviation's local representative.

If he approved the lease proposal, he would forward it to Riyadh for the Ministry of Defense and Aviation to approve and lease. If the proposal was rejected, MEAPO(SWA) would use U.S. funds, write a U.S. lease, and later seek reimbursement from the Saudi government. Although the ministry's local representatives insisted they would not approve any of these negotiations, MEAPO(SWA) was determined to resume a rapid leasing program until directed to go back to ministry leases or until U.S. funds ran out.[33]

For a brief period the Corps used U.S. funding for some critical real estate and sought reimbursement from the Saudis, but when Pagonis realized how expensive this would be, he went back to Saudi funding. On 29 November, just as MEAPO(SWA) personnel were ready to present two high-priority leases for U.S. funding, Pagonis directed them to hold off leasing for 48 hours.

The services remained frustrated by the "lack of action" on their lease requirements. Between mid-August and 1 November, when the Saudis assumed responsibility for real estate leasing, the Corps had completed more than 90 leases. By the end of November the Saudis had completed only 9 leases. In Saudi Arabian culture, haggling with property owners was a way of life, and price was more important than meeting the requirement. Finally, the Saudi government had the power to negate negotiated leases if it did not like the terms. By early December, unfilled lease requirements were having "a negative impact on mission efficiencies."[34]

Lease Assignment

The host nation support agreement also raised the difficult issue of lease assignment—transferring existing lease agreements from the U.S. government to the Saudi Arabian government. A proposed lease assignment agreement went to CENTCOM on 5 December for final review and presentation to the Ministry of Defense and Aviation. Under the host nation support implementation plan, the United States needed to assign 84 existing leases to the Saudis. Some leases could not be assigned because the original lease specifically prohibited this.

On 12 December, CENTCOM's staff judge advocate reviewed the draft assignment form and made several changes. A few days later, General Pat Stevens transmitted the form to the Saudi ministry. Saudi officials objected to the paragraph that stated:

The Kingdom of Saudi Arabia does hereby remise, release, and forever discharge the U.S. government, its officers, agents, and employees from restoration, damage, and waste, and from all manner of actions, liability, or claims against the U.S. government, its officers, agents, and employees arising out of said lease and the occupation by the U.S. government of the leased property.

On 5 January, Stevens resubmitted the form with this paragraph excised, but Saudi officials remained dissatisfied. They then objected to the clause stating that the Saudi government agreed to perform all duties and covenants contained in the lease.[35]

General Stevens resubmitted the revised form to the Ministry of Defense and Aviation on 26 January, and this time the ministry accepted it. Saudi officials agreed to comply with the terms of the existing leases to include payment of rental costs, water and electricity, and maintenance of the leased areas. Yet, they reserved the right to renegotiate the terms of the lease in accordance with Saudi laws, provided that renegotiation did not require any American military unit to vacate the leased premises. No lease would be canceled before it expired unless the leased premises had been vacated and the U.S. government agreed to the cancellation.

But the issue did not die. A few weeks later Brigadier General Addul Aziz Al-Hussein, director of the Ministry of Defense and Aviation's Joint Forces Support Unit, reiterated that the transfer agreement must contain the clause, "that the government of the KSA [Kingdom of Saudi Arabia] reserves the right to alter/change the contracts or cancel them, and/or negotiate their prices without jeopardizing the availability of real estate based on regulations adopted by the KSA." General Stevens had previously rejected this provision.[36]

The lease assignments process continued to falter. By the end of the ground war in late February, the Ministry of Defense and Aviation had not signed any of the 21 lease assignments that CENTCOM had transmitted. In the first half of March, it accepted 27 lease assignments. It did not accept any lease with rent due, though it had not officially indicated that the status of rental payment was a criterion for acceptance.

Faced with the ministry's failure to accept lease assignments where rent was due, Cox and Miller took a firm stance. They decided that the United States would not pay any further rent. Savannah District officials objected, arguing that this decision could jeopardize the use of leased facilities by U.S. troops. Rather, they suggested, the United States should continue to pay the rent until the Saudis accepted the assignments. Failure to make the payments, the real estate specialists warned, would do nothing to encourage the Ministry of Defense and Aviation to accept the lease assignments but would put the United States "in bad standing" with the lessors.

On 13 March 1991, the United States forwarded 59 lease assignment agreements to the ministry for acceptance. The rest of the 82 leases requiring assignment contained language restricting assignment without the lessor's approval. The Dhahran Area Office's real estate specialists were negotiating assignment approval with these lessors.[37]

Another thorny problem was the Ministry of Defense and Aviation's failure to pay utility and service bills for leased sites. The original rental agreements required the U.S. government either to pay the bills directly or to reimburse the lessor. Under the host nation support agreement, the ministry was obligated to pay for these utilities and services when such payments were stipulated in the lease. The Dhahran Area Office forwarded the bills to the ministry's representative in Dhahran, but the ministry did not pay them. By 20 February, 39 utility bills, totaling roughly $290,000, were outstanding. Complaints mounted. If the Ministry of Defense and Aviation did not pay the utility bills, the lessor's only option was to discontinue service.[38]

There were other signs that relations with the Saudis were becoming strained. Colonel Khalaf M. Al-Shammari, director of the Joint Forces Support Unit's eastern province branch, indicated that any contracts signed after 1 November 1990, without prior approval of his branch, fell outside the host nation support agreement, and the Saudi government would not reimburse the United States for them. In effect, the Ministry of Defense and Aviation denied responsibility for leases for which a letter of intent was signed before 1 November 1990 but the actual lease agreement was not executed until after that date. The ministry continued to refuse to accept the lease assignments and make payments on the assigned leases. It also refused to terminate leases on properties that U.S. forces vacated and attend termination inspections.

Meanwhile, as Miller and Cox had directed, the Dhahran Area Office personnel refused to make further payments on leases transferred to the Ministry of Defense and Aviation for assignment. Lessors increasingly pressured the office to make these payments. Rather than deal with the angry lessors, the ministry had simply referred them to the Dhahran Area Office, which led the officials to conclude, "The intent of the host nation agreement is being defeated by middle managers in the system."

Several lessors took legal action against Tommy Hill who had served as the Corps' top real estate official in Saudi Arabia. Attorneys representing the owner of the Saudi Catering Compound warned that unless someone paid $128,000 in delinquent rent by 8 June 1991, they would take legal action. The property owner argued that any attempt by the United States to assign the lease obligations was invalid because there was no privity of contract between himself and the government of Saudi Arabia.

On 3 June 1991, a representative of Redec-Daelim Company delivered a summons to the Dhahran Area Office for Tommy Hill—who by then had returned to the United States—to appear in court on 8 June 1991. The

company had been due a second rental payment of $80,000 on 4 May. Since the Ministry of Defense and Aviation had accepted the lease on 8 April, the Dhahran Area Office refused to make the payment.

On 6 June 1991, ministry officials returned 18 leases that they had previously accepted to the Dhahran Area Office, with a letter from Colonel Al-Shammari indicating that the ministry would not accept such leases until the United States paid all the rent due on them. The MEAPO deputy commander, the Dhahran Area Office commander, and their legal and real estate specialists agreed to present a proposal to General Pagonis that the Dhahran office would resume paying rent, arbitrate all leases to which it was a contractual part, and try to terminate leases no longer required. When the Corps briefed Pagonis on 8 June, he remained firm. The Saudis agreed to pay for facilities under the host nation support agreement, he insisted, and they should comply.

In May 1991 it was determined that if the Saudis did not make the delinquent lease payments, the U.S. government was responsible for those payments due to privity of contract with the lessors. The U.S. government paid the outstanding rent to the Saudi property owners in June 1991.[39]

An added complication in implementing host nation support was the rapid turnover in the Corps real estate personnel who deployed on a 90-day tour of duty. Between August 1990 and February 1991 three different people—Jim Ellis, Tommy Hill, and Lon Larson—served as the Dhahran Area Office's chief of real estate. Under the host nation support program, Corps real estate specialists worked with Saudi officials on a daily basis in all phases of lease acquisition and management. For that effort to succeed, Tommy Hill warned, Corps and Saudi personnel had to develop a level of professional trust that was hard to achieve in a short time. Working relationships suffered because the Saudis knew the Corps representative would only be there a short time. To complicate matters, Saudi and Corps personnel rarely communicated in writing about pending lease actions. Rather, communication was verbal.

Hill stressed that personnel had to be committed to the program longer than 90 days to maintain an effective business relationship. The Dhahran Area Office's commander eventually requested some permanent change of station positions in real estate and other areas, but he never received them. From March 1991 to March 1992, the Corps had five real estate chiefs—Bob Dragonette, Bruce Bringman, Jim Simpson, Denise Titus, and Tony Sousa.[40]

Leasing During Redeployment

With the outbreak of hostilities in mid-January, the real estate program encountered new difficulties and the number of leasing actions declined. The Dhahran Area Office personnel had increasing problems contacting lessors and prospective lessors. Work came to a standstill on one "build to lease" compound. The lessor had left the area and refused to tell the Dhahran office how to contact him. The maintenance contractor at another compound told the

office he could no longer honor his contract because his workers were fleeing. Soldiers from the unit leasing the compound met with the contractor and convinced the workers to stay by offering them chemical protection suits.

The demand for leased facilities declined as troops moved into the desert. As units moved out of their rental facilities toward the front lines, however, they sometimes neglected to notify the lessor or anyone else. They left large compounds open and abandoned. No director of engineering and housing organization managed these properties. When troops vacated a leased facility, Corps real estate specialists inspected the facility with the owner to determine any damages. If they found damages, the owner could file a claim against the U.S. government. After negotiations were concluded, they drafted a final document that released the U.S. government from its obligations and returned the facility to its owner.[41]

By the end of January, with the air attack on Iraq well underway, the Army made plans to dispose of some of its rental property. Terminating existing leases proved difficult. Only 20 percent of the leases had viable termination clauses, and these usually required advance notice of 30 to 60 days. When the Saudi Arabian government granted use of the huge Al Khobar Towers housing complex in the Dhahran area, the Army had more property available for redeployment than for deployment, especially for billeting troops. In fact, outside the Dhahran area, there was a "gross excess" of property available for redeployment activities.[42]

Corps real estate specialists remained in Saudi Arabia until March 1992, long after most U.S. troop units had departed. In the first months after the ground war ended, they were occupied with assignment activities. Then in May 1991 their focus shifted to terminating leases and settling claims. Tommy Hill observed that Corps real estate specialists put as much effort into termination and claims settlements as they had put into the initial lease negotiations.[43]

Observations

Perhaps the greatest real estate lesson that the Army could learn from the Persian Gulf War was the need to deploy real estate specialists early and to maintain enough specialists to handle any requirements that developed. The extremely large influx of troops during the early days of deployment created a huge backlog of real estate requirements. At that time, no one from CENTCOM or the Corps could accurately forecast the scope of the real estate mission. Lease actions were time consuming, and there were never enough real estate specialists to do the work. Logistics units at echelons above corps required a disproportionately large number of leased facilities.[44] "Deployment planning," warned Colonel Pylant, "must provide for early deployment of sufficient Corps of Engineers real estate professionals and/or mobilized reservists to support the needs of the force."[45]

CENTCOM's initial reluctance to deploy Corps real estate specialists created problems. Contracting officers of all kinds attempted to negotiate and sign real estate leases, which was illegal. This resulted in inconsistent prices and terms. After Corps real estate specialists arrived, leasing costs and terms quickly stabilized. Colonel Miller warned, "We must recognize the need for early deployment of USACE [U.S. Army Corps of Engineers] real estate leasing capability into a contingency theater."[46]

After the Gulf War, the Corps established predesignated real estate teams—contingency real estate support teams—that participate in military training exercises at Fort Leonard Wood, Missouri, and are prepared to deploy overseas on short notice.

The operation also highlighted the need for military doctrine to define clearly the real estate mission, especially when no status of forces agreement exists with the host nation. Corps officials also recommended incorporating real estate support into the operations plans. This presumably would help commanders better anticipate the need for real estate resources. Since the Gulf War, the Army has rewritten the doctrine governing its real estate activities.

U.S. forces were fortunate that Saudi Arabia had many facilities available for lease and that the Saudi Arabian government was willing to bear most of the cost of renting them. Tommy Hill observed that having the Saudi Arabian government take over responsibility for leasing facilities was "the best thing that ever happened." The American taxpayer was spared a great expense. Hill estimated that at the rate the Corps was leasing property, it would have spent another $100 million to $150 million.[47]

The reluctance of Saudi officials to pay for some expensive leases is perhaps understandable. Under pressure from the United States, the Saudis leased facilities for the VII Corps, but the troops never occupied all these facilities. However, as indicated, the transfer of leasing responsibilities to the Saudi Arabian government created problems and at times had a negative impact on the mission of U.S. forces.

Despite the problems, Jim Ellis called the operation "real estate's finest hour" and commended the districts and divisions for their support. "You have sent the very best," he wrote. "This is evident from the attitude, hard work, long hours, and final work product your employees have turned out." According to Bob Dragonette, "...we got what we were trying to accomplish. We were trying to get our troops out of the sun, out of the sand, and into some air conditioning...we have done something that we can be proud of." Most troop units were satisfied with the real estate support they received.[48]

By mid-March 1991, after hostilities had ended, the United States had completed 109 lease and modification actions at a cost of nearly $94 million, and Saudi officials had completed 41 actions. The United States had leased more than 48,000 billets at an average cost of $5.85 per billet per day. Leases executed by the Corps and through the Ministry of Defense and Aviation real

estate officers totaled $135 million in annual rental fees. At peak, 18 real estate specialists and 16 members of the 308th Engineer Detachment worked out of the Dhahran Area Office with four liaison officers from the ministry.[49]

Some leased facilities proved to be as important as the facilities the Army constructed. Through its real estate activity, the Corps improved the quality of life for thousands of U.S. troops who might have otherwise had to camp in the desert and provided facilities that contributed directly to the success of Operation DESERT SHIELD/DESERT STORM.

CHAPTER 8
Support from Corps Laboratories

American soldiers—many unfamiliar with a desert environment—arrived in Saudi Arabia with numerous questions. Can we drive on the surface in the area of operations? Will driving produce dust? What is the best way to control dust? How can we maintain our equipment in the extreme desert heat? Where is the best location to find ground water? What obstacles will we encounter?

The Army canvassed its technology base for new or enhanced capabilities to help these soldiers operate effectively in the desert. All 42 Army laboratories and centers reviewed their programs to generate ideas and products. Research, development, and engineer institutions offered new technology and capabilities, while ARCENT and CENTCOM requested solutions to unique problems they faced in the theater.

Four U.S. Army Corps of Engineers research and development facilities made significant contributions. The U.S. Army Engineer Waterways Experiment Station in Vicksburg, Mississippi; the U.S. Army Construction Engineering Research Laboratory in Champaign, Illinois; the U.S. Army Cold Regions Research and Engineering Laboratory in Hanover, New Hampshire; and the U.S. Army Engineer Topographic Laboratories (now the U.S. Army Topographic Engineering Center) in Alexandria, Virginia, provided invaluable help in topographic support and terrain analysis, water detection, construction and construction management, dust control, and mobility.[1]

Topographic Support and Terrain Analysis

Commanders need a clear picture of the battlefield. In General Schwarzkopf's 27 February 1991 briefing, he emphasized that technology had enabled him to "see" the entire battlefield while Saddam Hussein could not. Corps laboratories provided much of the technology that let U.S. forces view the entire battlefield, which covered 2,100 square miles. Within two weeks of the Iraqi invasion of Kuwait, military units and agencies had depleted existing stocks of maps of the Persian Gulf. Existing topographic maps only covered 50 percent of the area of operations, mostly with outdated or inaccurate information, and no digital terrain analysis existed.

The Defense Mapping Agency was responsible for providing all military services with standard mapping, charting, and geodesy products in digital and hard-copy formats. The Army topographic engineers in the theater customized those products to meet the changing requirements of the battlefield commanders. When the first U.S. soldiers deployed, the Defense Mapping Agency began shipping its standard products, recognizing that some would be

obsolete and incomplete. Meanwhile, topographic engineer units in the theater updated and customized these products.

The agency produced 13.5 million maps, most on the 1:50,000 scale that CENTCOM planners had requested, rather than the 1:100,000 scale that the VII Corps requested. Getting the maps into the theater and to the forward deployed units proved difficult because the distribution system was jammed. Faced with distribution problems and a lack of maps at 1:100,000 scale, both corps used their organic topographic units to create maps at 1:100,000 scale from the existing 1:50,000 versions.[2]

Another challenge was converting the Defense Mapping Agency's mapping, charting, and geodesy products from a standard format into the specialized formats required by the terrain analysis systems supporting the theater of operations. No Army tactical system in Operation DESERT SHIELD used LANDSAT, a civilian, multispectral imagery satellite, or the Defense Mapping Agency's digital topographic data directly from the agency's standard 9-track tape. Rather, the tactical systems required different types of media.

The Engineer Topographic Laboratories quickly acquired and transformed thousands of digital products (digital terrain elevation data) from 9-track tapes into floppy disks and digital audio tapes. By January, the laboratory had transformed and dubbed more than 16,000 floppy disks of digital terrain elevation data covering the area of operations and distributed them to various Army units and organizations. It also converted 33 LANDSAT scenes from 9-track tapes to floppy disks or 4-millimeter digital audio tapes.[3]

The Engineer Topographic Laboratories also provided topographic units with prototypes of systems that were currently being developed—including three Digital Topographic Support System prototypes (DTSS–P). This system gives field commanders quick terrain graphics and a better tactical knowledge of the battlefield. It replaces the slow, manual methods currently used to store, process, and analyze terrain information. Faced with the chaos of battle, commanders with this system have access to more current and intelligible terrain products.

The DTSS, including the prototype, automates many terrain analysis processes. It uses standard digital topographic data from the Defense Mapping Agency and updates and disseminates that data in map form to the field. The system, however, relies primarily on specific tactical terrain data that was not yet available from the agency. The Defense Mapping Agency had produced an alternative—interim terrain data—for the U.S. Army in Europe and in the Pacific. CENTCOM, however, had not submitted any requirement for this interim data, so the 30th Engineer Battalion (Topographic) had no experience using the DTSS–P.

Soon after the invasion, the Army began pressuring the Defense Mapping Agency to produce interim terrain data for the Kuwaiti theater of operations. Once the topographic battalion realized that the agency would produce this

data, it asked for a prototype. The Engineer Topographic Laboratories shipped one to the 30th's headquarters at Fort Bragg and quickly trained key operators on the prototype before they deployed. But there was not enough time for the operators to become proficient.

Once in the theater, the topographic battalion had difficulty operating the prototype. The battalion's commander, Lieutenant Colonel Paul Ray, later reported that his unit found the prototype to be "useless" because it required a data base built by the Defense Mapping Agency and none existed for Saudi Arabia or Iraq. Six months after the beginning of Operation DESERT SHIELD, there was still no tactical terrain analysis data base or its digital equivalent, interim terrain data. By contrast, VII Corps and the 1st Cavalry Division—the only other units with the DTSS–P in the theater—successfully used their prototypes.[4]

The Engineer Topographic Laboratories also provided CENTCOM units with several established systems. For example, the laboratory rushed three Earth Resources Data Analysis Systems to deploying units. The laboratory's staff helped develop procedures to produce images from LANDSAT and national imagery to substitute for standard Defense Mapping Agency maps that were not available. Topographic units did not previously have the capability to produce image-based map substitutes.

The Engineer Topographic Laboratories also expedited the updating of the TerraBase terrain analysis software and released the updated version on 1 October 1990 to 400 Army and Marine Corps TerraBase users. Finally, with funding from Forces Command, the laboratory loaded some of its own prototype terrain analysis software into 10 Forces Command Automated Intelligence Support Systems (FAISS). It sent those systems to every topographic unit in Saudi Arabia and trained the units to use them. Lieutenant Colonel Ray found the systems to be "versatile and powerful."[5]

To further enhance terrain analysis, the Engineer Topographic Laboratories provided a quick response multicolor printer prototype. The prototype was a commercial system that provided color copies of large-format mapping, charting, and geodesy products. It combined current color photocopying techniques with laser technology in a dry copying process. The major advantage was the ability to produce small quantities of full-color maps quickly while giving the field commander a high-resolution terrain product. It was now practical to run off maps or graphics that would have been prohibitive and time consuming using the old technology.

In early December 1990, the Engineer Topographic Laboratories purchased three Canon Bubble-Jet A1 color copiers with quick response capabilities and shipped one of these large-format, full-color copiers to the 30th Engineer Battalion (Topographic) in Saudi Arabia. The copier was operational by mid-January. It worked so effectively that the battalion later recommended obtaining similar copiers for each topographic company.[6]

The Engineer Topographic Laboratories provided extensive support to Army headquarters and to Army and Marine Corps units in the theater with the Global Positioning System (GPS). This satellite navigation, timing, and ranging system developed by the Defense Department accurately measures position. In Saudi Arabia the distances were so great and existing control points so few that new methods of surveying based on the GPS were used for the first time to support the Army and other services.

Artillery and aviation units needed precise reference points to initiate their inertial positioning systems. Previously, maps, charts, and geodetic products required time-consuming validation or verification. The GPS revolutionized the way the military worked. It quickly provided the data required to help units use a complex mixture of available mapping, charting, and geodesy products. The Engineer Topographic Laboratories provided seven GPS receivers and trained topographic units to use these receivers to establish hundreds of accurate survey control points.[7]

The 30th Engineer Battalion (Topographic) asked to borrow GPS receivers from the Engineer Topographic Laboratories. The battalion had 11 receivers but needed more to equip an additional survey team. In early October, the XVIII Airborne Corps commander asked the laboratory to deploy a two- or three-person survey team with the receivers to support the 30th. The laboratory arranged for the 30th to obtain four single-channel GPS receivers and a laptop computer and trained the battalion's surveyors.

Information derived through the GPS helped commanders plan their strategy and showed troops where they were, where they were going, and where their friends were located. It also helped units detect mapping and charting deficiencies.

One test conducted during the Gulf War illustrated the value and effectiveness of the system. Four units consisting of several vehicles were each tasked to rendezvous at a particular site at a designated time. The units started from four different locations. The two units with GPS receivers arrived at the designated spot within 15 minutes of each other. The third group using a conventional topographic map and compass arrived several hours later. A search team had to locate the fourth unit.[8]

In response to the military's need for better information about the battlefield, Engineer Topographic Laboratories also developed Project "Flying Carpet," a digital mapping system, with funding and direction from the Defense Advanced Research Projects Agency. Using the Army's simulation network and terrain visualization technology, Flying Carpet gave commanders and their staffs a three-dimensional view of the area of operation. It let them view the terrain as if they were flying and looking down on enemy positions. No other Army system had this capability. Evaluators at Fort Knox studied the system to determine if it was ready for use in a war zone.[9]

As part of its support mission, the Engineer Topographic Laboratories maintained volumes of historical information on climate and geography, which it provided to all the services. When Iraq invaded Kuwait, the laboratory's Terrain Analysis Center was completing the military geography portion of the "Army country profiles" of the region. It accelerated production of the profiles of Iraq, Saudi Arabia, and Jordan. A profile served as a strategic planning document, which gave trainers and planners of battlefield maneuvers a detailed analysis of a country's terrain, hydrologic features, and infrastructure.

These profiles helped commanders identify elements that affected troop cover, concealment, observation, cross-country movement, and avenues of approach; availability of construction materials; and drop zones, high ground, and landing beaches for troops and equipment. The military geography portion included information about the country's climate, natural terrain, transportation, telecommunications, military considerations, strategic areas, industrial facilities, energy and construction resources, and maps. Within these categories, analysts provided the most current information on soils, groundwater, surface water, vegetation, and other features such as bridges, highways, and airfields.[10]

Dr. Jack Rinker, one of the Engineer Topographic Laboratories' most renowned terrain analysts, wanted to develop a document that would help terrain teams get, on their own, the information they needed from the imagery. So, in conjunction with the U.S. Geological Survey and after visiting as many deserts in the world as possible, he and others from the laboratory produced the *Remote Sensing Field Guide, Desert.*

The guide contained images and descriptions that let anyone working in the desert predict various characteristics of the terrain. Is the surface hard or soft? Can tanks and wheeled vehicles drive on it? Can people travel over it on foot? Where are the possible sites for ambush? Where are the good observation points?

Shortly after Operation DESERT SHIELD began, Marine Corps officials reviewed a draft of the guide. The Marine Corps commandant directed that the *Remote Sensing Field Guide, Desert* be reproduced as a Marine Corps manual and issued to all the company commanders. The Marine Corps initially produced 4,000 copies and gave 500 to the Engineer Topographic Laboratories to distribute to Army terrain teams. The Marines ultimately printed 20,000 copies of the guide. With help from the Marine Corps, the Engineer Topographic Laboratories also published 1,000 copies of *The Environment and its Effects on Materiel, Personnel, and Operations with Special Emphasis on the Middle East.*[11]

In mid-August, Dr. Rinker and hydrologist Robert Knowles traveled to Fort Bragg to brief the 30th Engineer Battalion (Topographic) on the remote sensing field guide. Drafts had been distributed through Army channels, but few copies

had reached the terrain analysts. Knowles had shown soldiers from the 30th a copy of the guide during an earlier visit, and they had requested a briefing.

During the two-day briefing, Lieutenant Colonel Ray became convinced that the data base and guide were "essential" to supporting U.S. forces. "It is imperative," he wrote the Engineer Topographic Laboratories commander, "that you continue this program to meet both the immediate and long term needs of the Army." Ray needed all the information that Dr. Rinker could provide because no other sources were available. "Dr. Rinker's guidance," he concluded, "has significantly influenced how we, as topographic engineers, look at arid terrain."[12]

The Waterways Experiment Station, the Engineer Topographic Laboratories, and the U.S. Military Academy jointly prepared an updated version of the Condensed Army Mobility Modeling System (CAMMS) to install on FAISS. In late November 1990, the Waterways Experiment Station trained soldiers from the 30th Engineer Battalion (Topographic) and personnel from the Defense Mapping School on the use of these systems. The topographic unit later deployed with ten CAMMS-equipped FAISS. The 649th Engineer Battalion (Topographic) also received CAMMS.[13]

At the end of January, ARCENT staff logisticians asked the Engineer Topographic Laboratories for three terrain analysts experienced in interpreting images in desert areas to help the 30th Engineer Battalion prepare and refine terrain information from imagery. Michael G. Barwick traveled to Saudi Arabia on 23 February 1991 with Dr. Rinker. They arrived in Riyadh on the evening of 26 February in a driving thunderstorm to discover that their mission to help the 30th produce terrain products was no longer feasible because of the progress of the ground war. After discussions with Lieutenant Colonel Ray and his staff, they decided to conduct a reconnaissance of selected areas within the theater of operations and hold a class on remote sensing applications in desert environments highlighting equipment and methods.

It was important for Rinker and Barwick to verify the predictions that analysts had made about terrain characteristics for CAMMS and collect air and ground photographs for the *Remote Sensing Field Guide, Desert.* The topographic battalion secured a Chinook helicopter to support the effort. Using an operational navigation chart and thematic mapper imagery, Rinker and Barwick laid out a flight path that covered various image patterns. They also selected areas where the helicopter would land so they could take photographs and gather rock and sand samples. The three-day field trip, which began at King Khalid Military City, successfully provided material that the team could use to verify its previous analysis.

Back in Riyadh the team prepared a course on remote sensing applications in desert environments. The two-week course and field trip—which relied on available material from LANDSAT and other sources—drew students from the 30th Engineer Battalion (Topographic), the 513th Military Intelligence Brigade,

Dr. Jack Rinker and Michael G. Barwick traveled by helicopter to take photographs and collect rock and soil samples.

the 416th Engineer Command, VII Corps, and the British 14th Topographic Battalion. Rinker and Barwick integrated into their lectures hands-on experience analyzing terrain features using LANDSAT imagery. Many participants reported they had learned more about remote sensing and terrain analysis during those two weeks than they had during their previous five months of deployment. For some students who had been conducting terrain analysis from inside their offices, the field trip provided their first opportunity to see the desert.

Rinker returned to the United States on 15 March, having taken numerous rock and sand samples and acquired photographs of the border and other areas. He did not have time to collect samples from as many areas as he wanted, so Knowles, who had another month before redeployment, filled 17 boxes with soil and geologic samples from the Rub al Khali desert and the Asir Mountains. Information gleaned from these samples was incorporated in the data base.[14]

Water Detection

Laboratory support extended beyond terrain analysis to other areas such as water detection. In the dry, hot Middle East, where potable water was scarce, information about the location and quality of water was critical.

From 8 to 13 August, Knowles and two colleagues, Jim Staley and Tom Webster, briefed 20th Engineer Brigade officials at Fort Bragg on water resources in Saudi Arabia. The Engineer Topographic Laboratories answered questions from Army and Marine Corps units and other agencies about the availability of water, groundwater depths, and the production capacities of existing desalinization plants. The Waterways Experiment Station also worked to improve the capability of the Army's reverse osmosis water purification to handle the local sea water.

Hydrologists from the Engineer Topographic Laboratories gave soldiers copies of water resource overlays for the theater. Its Terrain Analysis Center briefed the services about water-related issues, including water quality and availability for military drilling. It assisted the Navy Seabees, the Air Force RED HORSE unit drillers, and Army drillers.

The Engineer Topographic Laboratories had been preparing for contingencies of this type by creating an automated water resources data base. It consisted of map overlays that gave graphic representations of water resources and an automated textual data base with additional detailed information on water features. This was the first large-scale, real-life test of the data base.[15]

A water detection response team, created in 1985, helped Department of Defense water drilling teams find suitable sites for wells. No water detection response team members deployed to Saudi Arabia, but when Knowles deployed as a member of the 416th Engineer Command, he performed a water detection mission. He had trained in Jordan, the Honduras, and Bolivia, and when he deployed he carried current water resource overlays from the Engineer Topographic Laboratories. With information from the water resources data base, host nation sources, and much field reconnaissance, the Army identified and developed enough water resources so its operations never suffered.[16]

Construction and Construction Management

Corps laboratories also provided support in the areas of construction and construction management. In October 1990, personnel from the Waterways Experiment Station instructed the 43d Engineer Battalion at Fort Benning on horizontal construction techniques applicable to Operation DESERT SHIELD. They also developed and tested a rapid repair kit. The kit included a reinforced polyester grid that could be expanded to form an 8-inch thick honeycomb and be filled with sand to form a road base. They investigated the use of roller compacted concrete—including materials selection, mixture proportions, thickness, design procedures, construction methods, and long-term durability.

Another Corps laboratory, the Construction Engineering Research Laboratory, had been developing the Theater Construction Management System. After Iraq's invasion of Kuwait, the laboratory accelerated the development of a test version of the system. Many combat engineer units asked

for the system. The Construction Engineering Research Laboratory provided 10 units of the system and commanders used it to plan and execute missions at echelons above corps. Because the system was still in the early development stage, no formal support or training mechanisms existed. As a result, the laboratory trained and supported the 416th Engineer Command and its subordinate units. It also responded to urgent requests to enhance the Theater Construction Management System, provided maintenance support, and converted Army Facilities Component System drawings into compatible formats.[17]

The Construction Engineering Research Laboratory also had completed several studies on commercially available, lightweight, relocatable structures during the 1980s and gave MEAPO information about them. It developed a computer data base with information on suppliers of expedient construction systems and provided that information on floppy disks.[18]

Dust Control

The Waterways Experiment Station continued its research on dust palliatives in a desert environment and developed a manual for selecting proper materials and methods to control dust. It also prepared a guide for military construction called "Dust Control and Soil Stabilization in Dry Marginal Soils (Saudi Arabia)," and an engineer technical letter, "Engineering and Design Dust Control and Soil Stabilization in Dry Marginal Soils (Saudi Arabia)." The Waterways Experiment Station helped MEAPO develop specifications for dust control measures and provided the Navy, Air Force, and Forces Command with information on dust control.[19]

Mobility

Besides addressing problems with terrain analysis and dust control, the Army needed to improve its mobility in the desert. Early in the operation, the Army had problems with wheeled vehicle mobility and with tires—insufficient traction, improper tire pressure, and poor tire performance. Problems reported included excessive tire failures, poor cross-country mobility, poor fuel performance, and air-cleaner and filter problems from dust ingestion.

The Waterways Experiment Station used its Army mobility model to determine the effects of tire pressure and vehicle configuration on mobility in the desert. It provided guidance on proper tire inflation pressures and suggested retrofit and replacement tires for vehicles, which improved overall ground mobility. The Waterways Experiment Station conducted mobility tests of selected tactical vehicles at the Yuma Proving Grounds for a variety of sand conditions and reported the results to the U.S. Army Transportation School.

In mid-November, a Waterways Experiment Station representative traveled to Saudi Arabia as part of a Tank–Automotive Command team to analyze tire damage, endurance, trafficability, composition, wear, and soil interaction on

various vehicles. The Corps' Cold Regions Research and Engineering Laboratory used its experience from work on the trans-Alaska pipeline to provide information to the Army Engineer School on how best to cross the large pipelines encountered in Kuwait and Iraq.[20]

Other Laboratory Support

The Corps laboratory support also extended to mine detection. Early reports confirmed the likelihood of widespread use of mines by Iraqi troops. The Waterways Experiment Station worked on a remote minefield detection system. The Army tested the overall mine detection program at Fort Hunter Liggett, California, during September and October 1990.

Meanwhile, personnel from the Engineer Topographic Laboratories recognized the possibility that minefields in dry soils could be detected by various sensors. To test this, in September 1990 they began an effort to build and scan a mock minefield using radar. First they had to find a secure site in the United States with very dry soil, comparable to that in the Middle East. After reviewing soil samples, the Engineer Topographic Laboratories selected the Marine facility at Twentynine Palms, California. There they replicated an Iraqi minefield and flew planes with various radars over the site.

Marines place inert mines at Twentynine Palms, California, to test how well remote sensing techniques detect buried and surface mines.

Personnel from the Waterways Experiment Station; the U.S. Marine Corps' Combat Division Center in Quantico, Virginia; the Naval Air Development Center in Warminster, Pennsylvania; and the Environmental Research Institute of Michigan in Ann Arbor were also involved. The tests revealed that the radar could readily detect freshly disturbed soil and easily distinguish patterns of soil resulting from mine emplacement. Concertina wire bordering minefields provided yet another indicator. However, the disturbed earth also made it more difficult to identify the buried mines.[21]

In another instance, a Waterways Experiment Station camouflage, concealment, and deception team helped the 24th Infantry Division (Mechanized), the 3d Armored Division, and the Air Force procure camouflage materials and trained the soldiers to use them.[22]

When Iraqi troops blew up pipelines in Kuwait and crude oil began pouring into the Persian Gulf, the Cold Regions Research and Engineering Laboratory used its satellite imagery and remote sensing capability to provide information on the location and movement of the oil spill.

Observations

Corps laboratories responded to requests from CENTCOM; Forces Command; Army, Marine, and Air Force units; MEAPO; the Army Materiel Command; the U. S. Army Engineer School; the Defense Intelligence Agency; and the U. S. Air Force Logistics Command. They often provided expertise and support to these agencies that engineers in the theater could not. General Hatch encouraged this support, emphasizing the need to transfer the technology to the customer rapidly as units and individuals rotated into the theater.[23]

At the end of Operation DESERT STORM, Lieutenant Colonel Ray sent a letter to General Hatch praising Colonel David F. Maune, commander of the Engineer Topographic Laboratories, and his staff. "From the start they have been the best friends we have had in the engineer community," Ray wrote. "They helped us solve equipment, training, and technology problems, sometimes before we even recognized we had them....As the topographer of the Army," Ray added, "you have a right to be proud of your deployed topographic engineers and those who gave us such great support from CONUS."[24] Primarily as a result of its outstanding support for Operation DESERT SHIELD/DESERT STORM, Army leaders named the Engineer Topographic Laboratories the 1991 Army Research and Development Organization of the Year.

The Corps laboratories enhanced the technological advantage that U.S. forces had on the battlefield. Their contributions to terrain analysis, water detection, dust control, mobility, and other areas contributed significantly to the success of the operations in the Gulf. The technological advances introduced during Operation DESERT SHIELD will no doubt have a great impact on future contingencies.

Powering the Theater

The U.S. Army's prime power program maintains an inventory of power generation, transmission, and distribution equipment to support the military during contingencies. Prime power assets include land-based 750kw to 1,500kw generators, 1,500kw to 4,500kw power plants, and distribution systems. The Chief of Engineers, who is responsible for executing the Army's prime power program, has delegated this program to the U.S. Army Center for Public Works in Alexandria, Virginia. (At the time of the Gulf War it was called the U.S. Army Engineering and Housing Support Center.)

Prime power teams, stationed at Army bases in the continental United States, Hawaii, Korea, and Germany, provide electrical expertise for facilities engineers. Their electrical equipment augments the electrical generators organic to Army units in the field. Their primary mission is to install, operate, and maintain power plants and up to 3.6 kilovolt amperes of medium-voltage distribution equipment. Their secondary mission is to provide expertise and technical advice on a wide range of electrical power systems. Prime power teams performed both missions in Saudi Arabia and Kuwait during the Gulf War and its aftermath and contributed significantly to the success of U.S. military operations.

During the first months of Operation DESERT SHIELD, the rapid development of the theater created extraordinary power requirements. Initially, the Army used contractors to perform some of the needed electrical work, but qualified contractors were scarce and expensive. Contractors were reluctant to work in the forward areas under the threat of hostilities. Moreover, contracting procedures were complex and time consuming. As a result, war planners needed soldiers with the technical expertise and equipment to expand the commercial power grid and operate the power plants.[1]

On 10 August, Forces Command asked the Army staff to direct the 535th Engineer Detachment (Prime Power), headquartered at Fort Monmouth, New Jersey, to provide prime power teams in support of ARCENT headquarters. The next day, Army officials approved Forces Command's request, and the Engineering and Housing Support Center activated a prime power team of 16 soldiers at Fort Bragg, consisting of elements of the 535th Engineer Detachment from Fort Bragg, Fort Monmouth, and Fort Campbell.

The detachment's commander, Major Dale A. Knieriemen, deployed with this team and a three-person headquarters element on 5 September. At Forces Command's direction, the team left without its large power generation equipment. Since the team could not accomplish its major prime power mission without this equipment, the ARCENT SUPCOM used the team members to perform electrical assessments and hookups. For example, they hooked up a 750kw generator to the 85th Medical Evacuation Hospital, freeing up thirteen 100kw generators for use elsewhere.[2]

Since the Army had no doctrine that defined the control and use of prime power teams, Major Knieriemen had to educate other engineers on the mission and capabilities

of his unit. He and the theater engineer decided to retain the prime power units as theater assets.

Forces Command directed that the prime power team work under the ARCENT SUPCOM engineer staff to help plan and develop requirements. Initially the team worked for the ARCENT engineer, Lieutenant Colonel Tomasik, in Dhahran. After Tomasik returned to Riyadh, the ARCENT SUPCOM engineer staff continued to task the prime power team. In late November the 416th Engineer Command arrived and assumed control of the 535th Engineer Detachment.[3]

Soon after its arrival, the team convinced Tomasik that he needed the generator package left behind at Fort Bragg. ARCENT SUPCOM asked Forces Command to deploy the 535th's power generation assets by sea. Specifically it requested nine 750kw generators for base operations at echelons above corps in and around Dammam and Dhahran and for the proposed life support areas. (The XVIII Airborne Corps located two of the life support areas 30 kilometers from a commercial power source, so the Saudi government could not provide them power.) ARCENT asked Forces Command to obtain and ship additional generators and deploy another prime power team.

At Forces Command's request, the Army staff directed the Engineering and Housing Support Center to provide sixteen 750kw generators. These were sent by ship from Charleston, South Carolina, to Bayonne, New Jersey, on 27 October. The generators were shipped from Bayonne on 2 November and arrived in Saudi Arabia on 24 November. A second team deployed from Fort Benning on 21 November and arrived in Saudi Arabia two days later.[4]

In December, as power requirements continued to mount, ARCENT asked for two more prime power teams. In January, Major Knieriemen echoed this request. He explained that the two teams in the theater were providing power at two geographically separated areas—Riyadh and Dhahran—and providing technical assistance and advice to all Army units in the theater. Neither team had adequate resources to perform all these missions. The first team had already received 142 projects, Knieriemen warned, and as the backlog grew, the unit would become less effective. If two more teams with organic equipment deployed, he observed, the 535th could operate three more power plants, perform all the foreseeable secondary missions, and maintain all power generation equipment. If not, the 535th could not deploy any more power plants or provide any further technical assistance and advice to units in the theater.[5]

Recognizing the shortfall, the Engineering and Housing Support Center created Task Force Bravo, comprised of prime power detachments at Fort Bliss, Texas; Fort Lewis, Washington; Fort Bragg, North Carolina; Fort Leonard Wood, Missouri; and Germany. The task force, commanded by Major Kenneth E. Cockerham, consisted of two prime power teams and a small command and control headquarters. Although Task Force Bravo did not arrive in the theater until 1 March, after coalition forces had liberated Kuwait, it provided needed power for Patriot air defense batteries, evacuation hospitals, and command and control headquarters. Elements of the 535th, reinforced now by Task Force Bravo, helped conduct damage assessments and restore emergency power in Kuwait.

When the detachment redeployed to the United States on 1 and 2 April, Task Force Bravo took over the theater's prime power operations. In June, as most U.S. Army forces withdrew from the theater, the task force prepared a plan to replace Army-installed prime power plants with commercially leased and contractor operated generator equipment.

Task Force Bravo's projects included a power plant for the west heliport and redeployment wash racks in Dhahran, plus another power plant at King Khalid Military City. Two soldiers continued to operate and maintain one of the generators in Kuwait City. As task force members redeployed to the United States and Germany on 19 August, a prime power team from Fort Leonard Wood assumed the mission. This team remained in the theater until 3 December 1991.[6]

Prime power teams remained in the theater longer than any other engineer unit and performed more than 300 power-related missions. No other unit had the technical expertise to perform these missions. The 535th's electrical technicians performed power surveys, designed and redesigned electrical systems, prepared construction plans for electrical systems, installed and operated auxiliary power, designed and constructed secondary distribution systems, and inspected electrical work performed by contractors. Though based in Dhahran, the teams traveled all over the theater in teams of two or four to support troop units. Teams provided power for ARCENT's main operations and intelligence center, prisoner-of-war camps, hospitals, clinics, airports, food distribution centers, telecommunications facilities, and various Kuwaiti government buildings.

They powered many key facilities: the theater headquarters' operations center that transmitted Schwarzkopf's televised newscasts, the Patriot air defense batteries in Dhahran that knocked Scud missiles out of the sky, the 85th Medical Evacuation Hospital's operating room where doctors treated victims of the Scud attack on a barracks in a suburb of Dhahran, and the conference site in southern Iraq where Schwarzkopf discussed cease-fire conditions with Iraqi generals. They set up generators for the base camps and were among the first to enter Kuwait. Using their organic equipment, they produced more than 10-million kilowatt hours of reliable, commercial-grade electricity.[7]

Despite initial difficulties because of shortages of electrical equipment and adequate materials-handling equipment, the prime power detachments and teams proved their value during the operation. Although the prime power mission to support the Army in the field was not recognized in doctrine and there were no TOE (tables of organization and equipment) units, the engineers crafted ad hoc organizations to accomplish the mission.

On 24 July 1991, the Chief of Engineers granted the prime power directorate of the Engineering and Housing Support Center the authority to reorganize into a provisional engineer battalion, the first step toward creating a TOE prime power engineer battalion. The 249th Engineer Battalion (Prime Power), headquartered at Fort Belvoir, activated in November 1994, becoming the core of the Army's prime power capability.

Conclusion

Operation DESERT STORM ended on 28 February after Iraqi troops pulled out of Kuwait. Cease-fire talks began at Safwan, Iraq, on 3 March, and shortly after that the first Army troops began redeploying. In the months following the cease-fire, as it completed its missions in support of redeployment, the Corps began phasing out its operations in Dhahran. As he left Dhahran, Colonel Cox had high praise for his staff and for the hundreds of Corps members back in the United States who had provided support. "The success of Desert Shield and Desert Storm," he wrote, "resulted from a total team effort, the best I've ever seen."[1]

The Corps ultimately performed $298.7 million worth of construction of base camps, sanitation facilities, airfield pavements, roads, bridges, warehouses, wash racks, hardstands, sunshades, other troop support facilities, and equipment leasing. Of the $298.7 million, $8.7 million was paid with military construction funds, $33.4 million with Army operation and maintenance funds, $37 million from the Gulf Peace Fund, and $219.6 million with Saudi funds.[2]

Engineer Deployment

Operation DESERT SHIELD/DESERT STORM highlighted the need to deploy engineer planners early in contingencies. Military leaders in the United States found that they could not "push" engineers into the theater. Rather, they had to wait for the maneuver commanders to request engineers. In the first weeks of the operation, there were no engineer planners in Saudi Arabia who could determine valid engineer requirements and make them known to the maneuver commanders or identify needed engineer resources and initiate requirements for Class IV construction materials.

Engineers need to be brought into the theater early, General Storat concluded, to aggressively affect theater-level planning. Because of the delays in deploying engineers, Storat's command had to plan and design projects as they constructed them, which caused some confusion. The planning was backwards in the sense that Storat's unit had to first find out what real estate and materials were available before they could begin design work.[3]

Combat engineers were also late in deploying although there was an immediate need to prepare the area for the maneuver force—particularly building roads and grading tent sites. Engineer leaders repeatedly complained that there were not enough engineers in the theater to bed down and sustain the maneuver force.

Colonel Braden recommended that in future contingencies in austere theaters, the Army deploy engineers for tasks at echelons above corps concurrently with maneuver forces. He suggested that the Army identify an

early-deploying "package" at echelons above corps to provide facilities for the soldiers. The Joint Staff's engineer, Air Force Colonel James E. Jenkins, agreed. The Air Force, he noted, had organic Prime BEEF teams for its forces and the Navy provided organic Seabee battalions to support the Marine Expeditionary Force. But the Army had no troop construction capability in the theater during the initial phase. As a result, combat engineer battalions were diverted from operational and training missions. Jenkins recommended that the Army have a combat support element organic to the deploying engineer force. The Army needed to identify organic construction assets in its engineer force for deliberate support of the contingency.[4]

Although military leaders agreed on the need to deploy engineers early and pre-position engineer equipment, they were also pragmatic. Combat engineers, they conceded, would probably never receive priority for deployment because of other pressing needs. "Tanks," Pagonis explained, "will always be put on the ships first."[5] A theater commander will always have to balance the various requirements in a theater of operations—keeping in mind the limitations of available transportation.

Mobility

The war not only highlighted the need to deploy combat engineers early, it also demonstrated that combat engineers needed greater mobility. The 43d Engineer Battalion had difficulty moving to King Khalid Military City, a distance of more than 250 miles. It took nearly a month to get all the equipment from the battalion and its supporting companies out to their job sites. General Storat argued that combat heavy battalions need to become more mobile so they can keep up with fast-paced construction activities, even at echelons above corps. Army commanders also found that combat heavy battalions did not have enough horizontal construction capability.[6]

Use of Contractors

Faced with a shortage of engineer troops and equipment, military leaders turned to contractors. Pagonis and other commanders quickly discovered that contracting was a "logistics force multiplier." Yet, contracting brought its own problems. Commanders found they could not always rely on contractors when hostilities began, and the contracting system lacked flexibility. "Contracting support can provide long-term requirements," Colonel Carroll observed, "but is very difficult in responding to immediate requirements, short-term requirements—and does not respond to a changing situation." For example, ARCENT contracted for six life support areas and for helipads and heliports when units were concentrated along Saudi Arabia's eastern corridor. Then when VII Corps arrived, ARCENT repositioned the forces for an offensive action. Contractors who had just begun work could not respond to the change. They finished facilities that were unused or abandoned. Senior engineers agreed

that contractors were a valuable and sometimes essential means of supplementing troop construction, but they should and could not replace troops.[7]

Funding

The Persian Gulf War also revealed that U.S. contracting and funding regulations could create serious problems during contingencies. Pagonis called some of the funding authorization levels "ludicrous." Corps personnel found that the existing federal acquisition regulations were too restrictive, hampering their ability to award contracts. Colonel Cox recommended having waivers in place or at least a list of needed waivers before the contingency occurred.[8]

Funding mechanisms for new construction projects were too restrictive, Braden argued, and limited the theater commander's options. Construction projects that cost more than $200,000 could not be easily funded. If the Saudis and Japanese had not paid for most large projects, the United States would have had to reprogram more than $600 million in military construction funds under Title 10, U.S. Code, Section 2808. Both Braden and Jenkins recommended that Congress amend Section 2805 to allow for unlimited use of operation and maintenance funds for new construction during contingencies and amend Section 2808 to give the theater commander approval authority up to some agreed upon limit.

Jenkins recommended that the Secretary of Defense's staff address the issue of contingency construction so the theater commander, services, Joint Staff, and Secretary of Defense would not have to reinvent the procedures during each contingency. If the Defense Department did not get authority to construct facilities using operation and maintenance funds, Jenkins observed, it would need to establish procedures that would work in all contingencies and push for limited approval authority for the unified commanders.[9]

Support from Other Nations

The shortage of engineer troops and the funding restrictions made support from the governments of Saudi Arabia and Japan critical. After the war, General Schwarzkopf wrote, "had it not been for the Japanese, DESERT SHIELD would have gone broke in August."[10]

Without host nation support and the Gulf Peace Fund, the Defense Department's ability to support its troops would have been significantly impaired. Yet, host nation contracting and funding procedures were cumbersome. Although host nation support saved the United States money, it sometimes delayed projects. "By and large, the use of Saudi funds to acquire Class IV and other materials, while saving us money, in fact cost us time," General Storat observed, "and in a theater that moved as rapidly as we did...you can make a case that time was more valuable than the money in many instances."

The Gulf Peace Fund procedures were often more responsive than host nation support. "In the absence of engineer troops, or to conserve engineer effort for forward area battlefield tasks, the hiring of a major international contractor on a cost-plus-fixed-fee basis provides an extraordinary benefit," Colonel Braden concluded. "Using Bechtel for assistance in kind construction provided responsive and professional support to the forces beyond what could have been conceivably provided by U.S. troop engineers."[11]

The Saudis, who tended to be careful and methodical in their dealings, understandably felt overwhelmed by the scope and urgency of the U.S. requirements. The U.S. military "pounded" Saudi officials with requirements, Colonel Miller observed, and they proved to be generous hosts. They opened all of their facilities to U.S. forces—the Port of Jeddah, the airfield at Dhahran, and King Fahd International Airport. U.S. forces extensively used King Khalid Military City, which the Corps had built in the 1970s and 1980s. The Saudis tolerated a tremendous cultural impact and depletion of their financial resources. They sometimes felt that the United States was placing unnecessary requirements on them. The United States asked them to build facilities that were never used because the war ended so quickly. Despite the occasional strains between the two nations, the bond of mutual trust was maintained and even strengthened.[12]

Civilian Deployment

Besides demonstrating the importance of engineers and the value of host nation support, the Gulf War highlighted the key role of civilians in contingencies. The Defense Department relied heavily on its civilians during Operation DESERT SHIELD/DESERT STORM, and they performed well. "They came over and lived in conditions under a very stressful situation that is entirely different from deploying on an emergency of a hurricane or something like that," Captain Adams explained. "They actually came to war with us. And they came...to do the work, to share the hours that a lot of tactical-type people did."[13]

Corps civilians voluntarily left their families to work long hours in a potentially dangerous environment. And without exception, they chose to remain in the theater when hostilities broke out. General Ray observed that uniformed service members received "abundant and well deserved plaudits for their brilliant performance," culminating in a national victory celebration in Washington and ticker tape parade in New York. "The civilian members of our team," he argued, "deserve no less appreciation because their support was vital to the success of the operation."[14]

Operation DESERT SHIELD/DESERT STORM did much to validate the Total Army concept, including its civilians. The Army goes to great lengths, Colonel Cox observed, to build cohesiveness in its units so when they deploy, they function as a team, but Cox deployed with five civilians whom he had known

for less than 30 days. He formed an organization with Corps employees from many different districts and divisions. His organization was effective because the civilians were professional and dedicated. Referring to his staff, Cox noted, "there's no doubt in my mind that what I got was very high quality...we got the best they had to offer. We could not have done what we did in DESERT STORM and DESERT SHIELD without the civilian component," he added.[15]

Working together, the U.S. Army Corps of Engineers civilians and soldiers demonstrated their unique ability to respond to contingencies. Operation DESERT SHIELD/DESERT STORM, Colonel Braden noted, had "conclusively demonstrated the flexibility and responsiveness of the U.S. Army Corps of Engineers to contingency construction requirements." If the Corps had not had forward elements on the ground at the outbreak of hostilities, he added, "there would have been no responsive construction capability." He recommended that in the future military leaders deploy the Defense Department's contract construction agent (either the Corps of Engineers or the Navy) as early as possible.[16]

If the Corps had not been in Saudi Arabia early, Colonel Jenkins reiterated, there would not have been a responsive construction capability. He agreed with Braden that the Department of Defense must assure that the Corps and the Navy can deploy people as early as possible. "We should not be lulled to sleep in future force structure and contingency planning by the wealth of facilities we found in Saudi Arabia," Jenkins cautioned. "We need to be able to project force around the world, regardless of the infrastructure we find in the AOR [area of operations]. Without host-nation provided ports, airfields, etc., we could not project force in the time we were able to during DESERT SHIELD/DESERT STORM."[17]

Although Corps civilians volunteered in large numbers and those who deployed performed with courage and dedication, General Hatch warned that in an area where conditions might be rougher or more dangerous than Saudi Arabia, the volunteer response might not be as great. He raised a key question: "To what extent should we allow our increasing reliance on civilians in a combat zone put us at risk?" He suggested that some functions be performed by soldiers if they must be performed in a combat environment. He suggested that the Army minimize the number of civilians who deploy to a war zone and send only those who are essential.[18]

The need for civilian skills, particularly in the areas of contracting and real estate, however, will undoubtedly continue, and the deploying civilians must be provided with adequate support and protection. U.S. Army Corps of Engineers civilian and military personnel significantly improved the quality of life for tens of thousands of soldiers and made it possible for them to perform their missions more effectively.

Notes

Introduction

[1]The CENTCOM commander in chief had five service components (MARCENT, ARCENT, NAVCENT, SOCCENT, and CENTAF). He had responsibility for 18 countries in the Middle East and Africa, all in an area about the size of the United States. They varied from countries on the Horn of Africa (Somalia, Sudan, Ethiopia, Kenya) to those on the Arabian Peninsula. The operational chain of command for U.S. forces extended from the President to the Secretary of Defense through the Chairman of the Joint Chiefs of Staff to the unified commander in chief (in this case the CENTCOM commander) and down to the service commander.

[2]Frank N. Schubert and Theresa L. Krause, ed., *The Whirlwind War: The United States Army Operations in Desert Shield and Desert Storm*, [draft], p. 92; Department of Defense, *Conduct of the Persian Gulf War: Pursuant to Title V of the Persian Gulf Conflict Supplemental Authorization and Personnel Benefits Act of 1991*, Apr 1992, p. 33 (hereafter cited as Title V Report); Michael R. Gordon and Gen. Bernard E. Trainor, *The Generals' War: The Inside Story of the Conflict in the Gulf* (Boston: Little, Brown and Company, 1995), pp. 41–43.

[3]Brig. Gen. Robert H. Scales, Jr., et al., *Certain Victory: The U.S. Army in the Gulf War* (Washington: Office of the Chief of Staff, U.S. Army, 1993), pp. 43–46, 48; Schubert and Krause, *Whirlwind War*, [draft], pp. 93–94; Gordon and Trainor, *The Generals' War*, pp. 44–45.

[4]"The Persian Gulf—Excerpts from President Bush's press conference, 30 Nov 1990," Misc Msg #5: OACE Reference Files; Schubert and Krause, *Whirlwind War*, [draft], p. 96; Gordon and Trainor, *The Generals' War*, pp. 51–52.

[5]Powell Statement, 3 Dec 1990; Headquarters, U.S. Army Forces Command (FORSCOM) public affairs pamphlet, "Commander Praises Mobilization Efforts," 14 Mar 1991, p. 2, FORSCOM Engineer Files; Association of the U.S. Army, "Special Report: Operations Desert Shield and Desert Storm: The Logistics Perspective," Sep 1991, pp. 3–4; Title V Report, p. 20.

[6]Interv, author with John Braden, Riyadh, Saudi Arabia, 30 Mar 1991, pp. 6–8.

[7]Gordon and Trainor, *The Generals' War*, p. 56.

All records are at the U.S. Army Corps of Engineers, Office of History, unless otherwise indicated.

[8]Lt. Col. F. Marion Cain, III, "Force Projection: Building Desert Storm Force Structure," *Military Review*, Jul 1993, p. 22; Braden interv, p. 10; Scales, *Certain Victory*, p. 50; Schubert and Krause, *Whirlwind War*, [draft], pp. 101–103; Gordon and Trainor, *The Generals' War*, pp. 54–55.

[9]Braden interv, p. 14; Lt. Gen. John J. Yeosock, "Army Operations in the Gulf Theater," *Military Review*, Sep 1991, pp. 3–4, 7; interv, Lt. Gen. William G. Pagonis by Lt. Col. Wesley V. Manning and Maj. Glen R. Hawkins, Dhahran, Saudi Arabia, 17 Feb 1991 (U.S. Army Center of Military History), pp. 20, 23. See also, *Whirlwind War*, [draft], pp. 105–108; 22d SUPCOM Command Report, n.d., DSDS Files: 22d SUPCOM; Lt. Gen. William G. Pagonis and Maj. Harold E. Raugh, Jr., "Good Logistics is Combat Power," *Military Review*, Sep 1991, pp. 29–30; Gordon and Trainor, *The Generals' War*, p. 56. On 19 December the ARCENT SUPCOM (Provisional) became the 22d SUPCOM.

[10]Interv, author with Lt. Col. James Walter, Riyadh, Saudi Arabia, 1 Apr 1991, p. 1.

Chapter 1. Shaping the Engineer Force

[1]See Thomas A. Keaney and Eliot A. Cohen, *Gulf War Air Power Survey Summary Report*, (Washington, D.C.: Government Printing Office, 1993) for a discussion of the air war.

[2]John R. Brinkerhoff, "Engineer Support at Echelons Above Corps: The 416th Engineer Command," [draft], Mar 1992, pp. 7–8 (hereafter cited as The 416th Engineer Command); Braden interv, p. 43; Title V Report, pp. 442–43.

[3]Interv, author with Col. Philip Carroll, Fort McPherson, Georgia, 5 Dec 1990, pp. 5–7.

[4]Brinkerhoff, "The 416th Engineer Command," pp. 3–6; Headquarters, Department of the Army, FM 5–100, *Engineer Combat Operations*, Nov 1988, pp. 12–19.

[5]Maj. Gen. Terrence D. Mulcahy, "Engineer Support in the COMMZ," *Military Review*, Mar 1992, p. 14.

[6]Col. Richard M. Swain, "'Lucky War' Third Army in Desert Storm," [draft], 29 Mar 1993, pp. 53–55.

[7]Cain, "Building Desert Storm Force Structure," pp. 23–24.

[8]Swain, "Lucky War," pp. 56–59.

[9]Cain, "Building Desert Storm Force Structure," p. 23; Swain, "Lucky War," p. 53; interv, author with Jim Johnston, Fort McPherson, Georgia, 5 Dec 1990.

[10]Carroll interv, 5 Dec 1990, p. 5; Brinkerhoff, "The 416th Engineer Command," p. 8; "Lucky War," pp. 58, 60; Braden interv, pp. 16–19; AFKE-CG-EN-FE (416th ENCOM), Memorandum for Record, [draft], subj: "Desert Shield/Storm Engineer 'Hot Wash,'" 7 Apr 1991, DSDS: Engineer School Materials; U.S. Army Engineer School,

"Engineer After Action Report: [final draft], Operations Desert Shield and Desert Storm," May 1993, p. 48; ibid.

[11]Brinkerhoff, "The 416th Engineer Command," pp. 8–9; msg, Cdr, Forces Command to ARCENT engineer (Forward), 1 Sept 1990.

[12]Braden interv, pp. 21–24.

[13]Carroll interv, 5 Dec 1990, pp. 8, 11; Braden interv, pp. 54–57, 60.

[14]Carroll interv, 5 Dec 1990, pp. 12–14; Braden interv, p. 40.

[15]Memo, Lt. Col. Donald M. Tomasik for Chief of Staff, TUSA, 20 Aug 1990, TAD Incoming Message File #2. *

[16]Col. Robert Flowers, 20th EN BDE Briefing, DSDS: Flowers Briefing; interv, Col. Robert Flowers by Lt. Col. Reardon, Fort Bragg, North Carolina, 3 Jun 1991.

[17]Flowers interv, pp. 5–7.

[18]Interv, author with Lt. Col. Kenneth Cargill, Dhahran, Saudi Arabia, 25 Mar 1991, pp. 60, 68–69; interv, author with Lt. Gen. William G. Pagonis, Dhahran, Saudi Arabia, 27 Mar 1991, pp. 3, 11.

[19]"Operation Desert Shield/Storm Recap," *U.S. CENTCOM Engineer Newsletter*, v. 2, no. 1, Jul 1991, p. 5.

[20]CENTCOM Engineer Summary (ENSUM), 16 Aug 1990, TAD Incoming Message File #4; Frank C. Carlucci, Deputy Secretary of Defense, DOD Directive #4270.5, subj: "Military Construction Responsibilities," 2 Mar 1982, DSDS: 1982 DOD Directive.

[21]Braden interv, pp. 65–67; interv, author with Maj. Gen. Terrence Mulcahy, Riyadh, Saudi Arabia, 1 Apr 1990, p. 4; memo, Jim Johnston to Charles Thomas, 12 Sep 1990, SAD/Forces Command Liaison Book #2.

[22]Memo, Mulcahy for Gen. Edwin H. Burba, Jr., 9 Sep 1990, Misc Msg #2: OACE Reference Files.

[23]Mulcahy, "Engineer Support in the COMMZ," p. 14; memo, Col. Alan J. Berg for ARCENT SUPCOM (Provisional) G–3, 12 Nov 1993, TAD Incoming Message File #24.

[24]Braden interv, p. 67; Flowers interv, p. 16.

[25]CINCFOR Sitrep #29, 5 Sep 1990; ARCENT SUPCOM (Provisional) Logsitrep #32, 6 Sep 1990; ibid., #36, 10 Sep 1990; ibid., #41, 15 Sep 1990; CINCFOR Sitrep #28, 4 Sep 1990.

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*Copies of all TAD incoming and outgoing message files are at the U.S. Army Corps of Engineers, Office of History.

[26]Record of phone conversation, FORSCOM Engineer with Lt. Col. Tomasik, 17 Sep 1990, FORSCOM Engineer Files; record of phone conversation, FORSCOM Engineer with Lt. Col. Cargill, 14 Sep 1990, FORSCOM Engineer Files.

[27]U.S. Army Engineer School Briefing, Apr 1991, DSDS: Engineer School Materials.

[28]ARCENT SUPCOM (Provisional), Logsitrep #77, 21 Oct 1990; CINCCENT Sitrep, 24 Oct 1990; U.S. Army Engineer School Briefing, April 1991.

[29]Cain, "Building Desert Storm Force Structure," pp. 24–25.

[30]CINCCENT Sitrep, 15 Nov 1990; COMUSARCENT Main SITREP, 26 Nov 1990.

[31]Carroll interv, 5 Dec 1990, pp. 1–2.

[32]CINCCENT Sitrep, 20 Nov 1990.

[33]Swain, "Lucky War," pp. 119–121; Association of the U.S. Army, "Special Report," p. 12; Lt. Gen. William G. Pagonis and Col. Michael D. Krause, "Observations on Gulf War Logistics," *Army Logistician*, Sept–Oct 1992, pp. 7, 8.

[34]Mulcahy interv, p. 6; record of phone conversation, Mulcahy with Lt. Gen. John Yeosock, FORSCOM Engineer Files.

[35]Memo, Lt. Col. Patrick Barry, 13 Nov 1990, TAD Incoming Message File #24.

[36]Interv, author with Cpt. Steve Adams, Riyadh, Saudi Arabia, 31 Mar 1991, pp. 43, 45; Mulcahy, "Engineer Support in the COMMZ," p. 17.

[37]"Operation Desert Shield/Storm Recap," pp. 5–6.

[38]Mulcahy interv, pp. 15–16; Mulcahy, "Engineer Support in the COMMZ," pp. 17–18.

[39]Interv, author with Brig. Gen. Richard E. Storat, Dhahran, Saudi Arabia, 22 Mar 1991, pp. 2–6; Col. Anthony R. Kropp, "Engineers Build For Victory In Operation Desert Storm," p. 6, DSDS: 411th EN BDE.

[40]Storat interv, pp. 5–6, 8, 10.

[41]Memo, Storat to Commander ARCENT, subj: Command Report, Operation Desert Shield Activities, 26 Feb 1991, DSDS: 22d SUPCOM.

[42]Mulcahy, "Engineer Support in the COMMZ," p. 20; Title V Report, p. 444.

[43]U. S. Army Engineer School Briefing, April 1991; ARCENT Main Logstat Report #144, 27 Jan 1991.

[44]CINCCENT Sitrep, 28 Jan 1991; interv, author with Col. Philip Carroll, Riyadh, Saudi Arabia, 1 Apr 1991, p.11; interv, author with Lt. Col. Gilbert Van Sickle, Dhahran, Saudi Arabia, 26 Mar 1991, p. 42.

[45]U.S. Army Engineer School, Engineer After Action Report, p. 139, DSDS: Engineer School Materials.

[46]Title V Report, p. 444; Braden interv, pp. 61, 90; Mulcahy, "Engineer Support at Echelons Above Corps," p. 21; AFKE-GC-EN-FE (416th ENCOM), Memorandum for Record, subj: "Desert Shield/Storm Engineer 'Hotwash,'" 7 Apr 1991, [draft], DSDS: Engineer School Materials.

[47]Storat interv, p. 27.

Chapter 2. The Corps of Engineers Responds

[1]Middle East/Africa Projects Office, Public Affairs Office, "Corps Facts," v. 1, no. 9, 24 Sep 1990, DSDS: Articles on Saudi Construction; see also John Greenwood, "Diplomacy Through Construction: The U.S. Army Corps of Engineers in Saudi Arabia," USACE Office of History, pp. 1–6, ibid.; Joan F. Kibler, *The Military Engineer*, no. 527, Mar/Apr 1989, pp. 81–84.

[2]Transatlantic Division, "Briefing to House Appropriations Committee," n.d.; Lt. Gen. Henry J. Hatch and Janet A. McDonnell, "Corps of Engineers: Laying the Groundwork for Theater Operations," *Military Review*, Mar 1992, pp. 3–4.

[3]Interv, author with Lt. Gen. Henry J. Hatch, Washington, D.C., 10 Feb 1992, p. 6; The White House, *National Security Strategy of the United States* (Washington: Government Printing Office, August 1991), p. 2.

[4]Interv, author with Ceasar Santucci, Kuwait City, Kuwait, 5 Apr 1991, pp. 2–7; *Engineer Update*, v. 15, no. 2, Feb 1991, pp. 4–5.

[5]*Transatlantic News*, Mar 1993, p. 13; interv, author with Chito Gomez, Dhahran, Saudi Arabia, 28 Mar 1991, pp. 3–7, 16–17, 21–25, 27–28.

[6]"Memorandum of Agreement between Third United States Army and the U.S. Army Corps of Engineers," 29 Sep 1986, DSDS: TUSA–MOA with Corps; interv, author with Col. William Miller, Atlanta, Georgia, 21 Nov 1991, pp. 2–3.

[7]Interv, author with Lt. Col. Charles S. Cox, Winchester, Virginia, 21 May 1991, pp. 2–4; msg, SAD to CECW-OE, 091130Z Aug 1990, DSDS: Deployment; msg, SAD CDR to CINCCENT, MacDill/CC J4/7, 161330Z Aug 1990, ibid.; Cox interv, 21 May 1991, pp. 6–9; interv, author with Ben Wood, Kuwait City, Kuwait, 6 Apr 1991.

[8]William Miller interv, pp. 4–6; Wood interv.

[9]In a 14 August letter indicating that the MEAPO team was ready for deployment, Col. Emory Pylant told the CENTCOM J–8, "It would be irresponsible to not take advantage of the expertise and emergency contracting capabilities of the MEAPO team." (memo, Col. Julian E. Pylant for CENTCOM J–8, 14 Aug 1990, SAD/FORSCOM Liaison Files); Cargill interv, pp. 8–11; Wood interv; William Miller interv, p. 7.

[10]Msg, Cdr, FORSCOM to Cdr, USACE/CECW-OE-EOC, 111922Z Aug 1990; Sitrep #2, 15 Aug 1990, SAD/FORSCOM Liaison Files; Pagonis interv, 27 Mar 1991, p. 15; Braden interv, p. 46; record of phone conversation, FORSCOM Engineer with Lt. Col. Elrick, 24 Sep 1990, FORSCOM Engineer Files; record of phone conversation, Maj. Treadway with Lt. Col. Elrick, 25 Sep 1990, ibid. Since TUSA/ARCENT resisted

funding MEAPO operations, Hatch decided to fund the deployment of 30 people until 30 September. The Corps ended up funding its own operations in the theater. MEAPO normally operated with minimum Operations and Maintenance, Army (OMA) funds. Most of its funding came from supervision and administration (S&A) reimbursement from the military construction (MILCON) projects it managed for the U.S. government and from the foreign military sales cases with nations in the region.

[11]Interv, author with Col. Brent Laurence and Lt. Col. Anthony Jayjock, Riyadh, Saudi Arabia, 2 Apr 1991, pp. 14, 16, 26–27; Cox interv, 21 May 1991, p. 14; msg, MEAPO Emergency Operations Center (EOC) to SAD and HQUSACE EOCs, 15 Aug 1990, DSDS: Personnel.

[12]Cox interv, 21 May 1991, pp. 10, 15–16; Cargill interv, p. 11.

[13]Cox interv, 21 May 1991, p, 16; Santucci interv, pp. 10, 12; Cargill interv, p. 13; South Atlantic Division (SAD) Sitrep #15, 21 Aug 1990.

[14]Walter interv, pp. 4, 7; Wood interv; Cargill interv, p. 28; Cox interv, 21 May 1991, pp. 16–22; SAD Sitrep #14, 20 Aug 1990; msg, CINCFOR to CDR MEAPO, 202213Z Aug 1990, DSDS: Deployment; SAD Sitrep #17, 23 Aug 1990; Miller interv, p. 8.

[15]Santucci interv, p. 10; Cox interv, 21 May 1991, pp. 32–36.

[16]Santucci interv, pp. 12–13, 29–30. Eventually the tasking system became more formal. Corps personnel developed a computer data base listing the assignments that the Dhahran Area Office was working on, along with the command's priorities. The office coordinated closely with the ARCENT SUPCOM.

[17]William Miller interv, pp. 9–10; Notebook, Col. William Miller Files; interv, author with Maj. Gen. John Sobke, Atlanta, Georgia, 3 Dec, 1990, pp. 1, 3.

[18]William Miller interv, pp. 10–11; Miller, Periodic Report #1, 3 Sep 1990.

[19]Miller, Periodic Report #3, 7 Sep 1990; "The DAO News," 12 Sep 1990, TAD Incoming Message File #8.

[20]Miller interv, pp. 14–15; fax, Cox to Miller, 4 Sep 1990, OPD: Miller Files #4; Cox interv, 21 May 1991, pp. 26–27; C.C. Miller interv, p. 7.

[21]Miller, Periodic Report #4, 10 Sep 1990; Miller interv, 14–17.

[22]"Operation Desert Shield/Storm Recap," p. 6.

[23]Msg, COMUSARCENT Main/EN to DAEN-CG, 311700Z Oct 1990, TAD Incoming Message File #22.

[24]Miller, Periodic Report, #14, 2 Nov 1990.

[25]Memo, Cecil E. Hutchinson for Ron Rhodes, 1 Sep 1990, TAD Outgoing Message File #6; MEAPO(F) Sitrep #2, 24 Aug 1990, TAD Incoming Message File; Adams interv, pp. 33, 36; interv, author with Lt. Col. Charles S. Cox, Winchester, Virginia, 24 Aug 1991, pp. 44–46.

[26]Miller, Periodic Report #6, 16 Sep 1990; Cox interv, 21 May 1991, p. 56; interv, author with Maj. James Brooks, Dhahran, Saudi Arabia, 26 May 1991, pp. 39–40; Wood interv; fax, Miller to Roger Thomas, 8 Dec 1990, TAD Incoming Message File #30.

[27]SAD, "Civilian Personnel Plan," 1 Sep 1990, DSDS: Personnel.

[28]SAD Sitrep #109, 19 Dec 1990; interv, author with Ron Magnuson and Hal Faulkner, Atlanta, Georgia, 3 Dec 1990, pp. 5, 9, 29–31, 53, 47.

[29]Magnusen and Faulkner interv, pp. 22, 43–45; memo, Miller for Distribution, 31 Aug 1990, "Policy for Temporary Duty Assignments for Operation Desert Shield," DSDS: Personnel; memo, Ralph Loschialpo for Hatch, 29 Nov 1990, ibid.; msg, ARCENT MAIN G–3 to AIG 11743, 080900Z Nov 1990, ibid.; fax, Miller for Lt. Col. Brown, 1 Dec 1990, ibid; SAD Sitrep #102, 3 Dec 1990.

[30]Msg, Headquarters PERSCOM to AIG 7406, 11 Oct 1990, DSDS: Personnel; msg, Deputy Chief of Staff for Operations and Plans (DAMO/TAPC/DAPE) to AIG 9150, ibid; memo, Stephen Arnold for Director of Human Resources, subj: Desert Shield/Desert Storm, 18 Feb 1993, ibid; Schubert and Krause, *Whirlwind War,* [draft], p. 373.

[31]Interv, author with Bruce Garwood, Winchester, Virginia, 12 Oct 1990, pp. 11–12; memo, Leo R. Lavinka for Chief of Staff, USACE, 12 Sep 1990, DSDS: POR; memo, Lavinka for CECW-OE, 13 Sep 1990, ibid.

[32]Memo, Ralph Loschialpo for Human Resource Director, SAD, [draft], n.d., ibid.

[33]Memo, Col. Andrew L. Austin, U.S. Total Army Personnel Command, for See Distribution, 6 Dec 1990, DSDS: Personnel; msg, DAPE-ZA, 211800Z Dec 1990, TAD Incoming Message File #33.

[34]Memo, Maj. Gen. C. Ernest Edgar for PERSCOM Director of Mobilization Operations, 10 Dec 1990, DSDS: Personnel; fax, Cox to Lt. Col. Brown, 8 Dec 1990, TAD Incoming Message File #30.

[35]AMC chose to continue processing its civilians at the Aberdeen Proving Ground. Memo, Stephen E. Arnold for Col. Herndon, 15 Jan 1991, DSDS: Personnel; memo, Arnold for Hatch, 25 Jan 1991, ibid.

[36]Memo, Edward C. Massimo for Crisis Management Team, 17 Jan 1991, DSDS: POR; memo, Massimo for CECS, 19 Feb 1991, ibid.

[37]Miller, Periodic Report #8, 23 Sep 1990; Magnuson and Faulkner interv, pp. 36–37; Miller interv, pp. 38–41; Notes from Crisis Management Team Briefing, 11 Jan 1991, DSDS: Author's Notes.

[38]Msg, DAPE/DAMO to AIG 9150, subj: Desert Shield Personnel Policy Message no. 38, 4 Jan 1991, DSDS: Personnel; William Miller interv, pp. 38–41; Cox interv, 24 Aug 1991, pp. 53–55.

[39]Stephen E. Arnold, Fact Sheet, subj: Emergency-Essential Civilians, 21 Aug 1990, DSDS: Personnel; msg, Cdr USACE to AIG 9181, 152249Z Jan 1991, ibid; msg, DAPE/DAMO to AIG 9150, 4 Jan 1991, ibid.

[40]William Miller interv, pp. 43–46; Cox interv, 24 Aug 1991, p. 61; Brooks interv, p. 51.

Ordnance Program Division

[1]Laurence and Jayjock interv, pp. 1–3, 6,10–12, 25.

[2]OPD Commander Update #37, 27 Aug 1990, TAD Incoming Message File #4; "A Look Back: Operation Desert Storm/Kuwait Recovery," *Transatlantic News,* v. 6, no. 7, Aug–Sep 1991, p. 7.

[3]Lt. Col. Jayjock, Fact Sheet, 26 Feb 1991; OPD Weekly Update, 18 Feb 1991, OPD: Miller Files #26.

[4]Jayjock, Fact Sheet, 26 Dec 1990, TAD Incoming Message File #34; Lawrence and Jayjock interv, pp. 28, 37.

[5]Jayjock, Fact Sheet, 26 Dec 1990; OPD Weekly Update, 11 Feb 1991, OPD: Miller Files #26.

[6]OPD, "OPD's Accomplishments in Support of the Gulf War," n.d.

[7]Laurence and Jayjock interv, pp. 49–50.

Individual Mobilization Augmentees

[1]Memo, John F. Wallace for Chief of Staff, 21 Feb 1991, DSDS: IMA; msg, ARPERCEN to AIG 12417, 140905Z Aug 1990, ibid.; memo, Col. Michael V. Marengo, 28 Jan 1991, ibid.; msg, DAMO-ODM-AOC to CDR AMC, 261425Z Aug 1990, ibid.; memo, MG Glynn C. Mallory for CDR USACE, 30 Jan 1991, ibid; interv, author with Maj. Gen. Gary Stemley, Washington, D.C., 21 Dec 1990, p. 1.

Funding the Corps

[1]"Memorandum of Agreement between Third U.S. Army and the U.S. Army Corps of Engineers," 7 Oct 86, Resource Management (RM) Files; William Miller interv, pp. 3–6.

[2]Memorandum for Record, Bronel Jerrell, 12 Aug 1991, RM Files; interv, author with Larry Graham, Winchester, Virginia, 16 Oct 1990, pp. 4–7; Miller interv, p. 8; Cox interv, 21 May 1991, p. 12; DSDS: Author's Notes, 27 Aug 1990.

[3]Msg, CECW-OE-P to CENTCOM (MacDill AFB) AFRD-EN, Funding: OACE Reference Files; CINCFOR Sitrep #27, 030400Z Sep 1990.

[4]Memo, Lt. Gen. Ellis D. Parker for Principal Officials of HQDA, Headquarters, Department of the Army (HQDA), Guidance/Instructions: RM Files.

[5]Memo, Maj. Gen. C.E. Edgar for Col. D. Berg, 20 Aug 1990, RM Files; memo, Gen. Gordon R. Sullivan for HQDA officials, 18 Sep 1990, RM Files.

[6]Graham interv, pp. 6, 18–19, 25; interv, author with William Richardson, Atlanta, Georgia, 6 Dec 1990, pp. 2–4.

[7]U.S. Cong., House Committee on Armed Services, House Report to Accompany H.R. 1175, "National Defense Supplemental Authorization Act for Fiscal Year 1991," 7 Mar 1991, pp. 2–3; U.S. Congress, House, Committee on the Budget, Hearing, "Cost of the War in the Gulf," 27 Feb 1991, 102d Cong., 1st sess., p. 69; memo, John Wallace to Hatch, 11 Dec 1990, DSDS: Workload/Saudi Funding: RM Files; memo, Col. Thomas J. Sheehy for Assistant Chief of Engineers, 19 Dec 1990, DSDS: Funding, OACE Reference Files; House Committee on Armed Services, "Persian Gulf Conflict Supplemental Authorization and Personnel Benefits Act of 1991," 102 Cong., 1st sess., 21 Mar 1991, p. 51.

[8]House, Committee on the Budget, Hearing, 27 Feb 1991, pp. 1–3; "National Defense Supplemental Authorization Act for Fiscal Year 1991, to Accompany H.R. 1175," pp. 2–3; msg, SAFM-ZB to et. al., 152200Z Jan 1991, HQDA Guidance/Instructions: RM Files; memo, Joseph Hemphill to MACOMs, 15 Jan 1991, DSDS: Funding; "Persian Gulf Conflict Supplemental Authorization and Personnel Benefits Act of 1991," p. 51; Information Paper, John Jones, 11 Jan 1991, DSDS: Funding.

Chapter 3. Saudi Arabian and Japanese Support

[1]Title V Report, pp. 401, 635; CINCCENT Sitrep 151745Z Aug 1990; Gen. H. Norman Schwarzkopf, *The Autobiography: It Doesn't Take A Hero,* (London: Bantam Books, 1992), p. 364. MEAPO officials had anticipated that for host nation support they would be dealing with the General Directorate of Military Works, the people they had been dealing with for the past 20 years in its Saudi construction program. They looked forward to this because they had established good personal relationships with the directorate's officials and the directorate had some organizational similarities with the Corps. But the Saudi government decided that the Saudi Air Defense Corps' Directorate of Engineering and Housing would provide the support. The command had less experience at this type of contract construction and tended to be slow. (Cox interv, 24 Aug 1991, pp. 27–30); Adams interv, pp. 53–54; Richard J. Kaplan, "Saudi Arabian Host Nation Support For Operation Desert Shield/Storm," [draft], Aug 1991, pp. 3–7, DSDS: HNS—Rand Corporation Report (hereafter cited as HNS Report).

[2]Memo, Lt. Gen. William G. Pagonis for ARCENT Commander, subj: "Command Report, Operation Desert Shield, 22d SUPCOM," 23 Mar 1991, DSDS: 22d SUPCOM After Action Documents; Schubert and Krause, *Whirlwind War,* [draft], pp. 113–115; interv, Lt. Col. Donald L. Trautner by Lt. Col. Wesley Manning and Maj. Glen Hawkins, Dhahran, Saudi Arabia, 10 Feb 1991, CMH; Lt. Col. Norman F. Hubler,

USAR, "Civil Affairs and Wartime Host Nation Support," *Military Review*, July 1992, pp. 73, 75. Scearce was followed by Lt. Col. Donald L. Trautner, from early October to early January, and finally by Col. Robert H. Sholly.

[3]Memo (unsigned), Frederick C. Smith for Deputy Sec Def, n.d., Foreign Gifts: RM Files; Kaplan, HNS Report, pp. 7–9.

[4]Kaplan, HNS Report, p. 16; interv, author with Maj. Gen. James W. Ray, Washington, D.C., 28 Nov 1990, pp. 1–2.

[5]Memo, Lt. Gen. Henry J. Hatch for ASA/FM, 14 Sep 1990, Lt. Col. Michael Fisher Files.

[6]Ray interv, p. 3; SAD Sitrep #71, 16 Oct 1991.

[7]Kaplan, HNS Report, pp. 16–17; memo, Lt. Gen. Michael P. C. Carns to Maj. Gen. Ray, n.d., DSDS: HNS.

[8]Ray interv, p. 4. Because no bank in Riyadh could accept a check for that amount, an officer was put on a plane to Paris so he could catch the Concord and get to the Federal Reserve Bank in New York to deposit the check on the same day. The cost of the trip would be recovered in the interest ($250,000 per day) on the money. Memorandum for Record, Col. Robert Herndon, 31 Oct 1990, DSDS: HNS; Kaplan, HNS Report, pp. 18–20.

[9]Kaplan, HNS Report, p. 24; "Implementation Plan for Logistics Support of U.S. Forces in Defense of the Kingdom of Saudi Arabia," 5 Nov 1990, DSDS: HNS.

[10]Memorandum for Record, Col. Stewart H. Bornhoft, 26 Oct 1990, DSDS: HNS; msg, CINCCENT J4/7 to Director/Joint Chiefs of Staff, 051400Z, 9 Nov 1990, Foreign Gifts: RM Files; msg, D/JS to DAMO-ZA, 192050Z Nov 1990, ibid.

[11]SAD Sitrep #89, 5 Nov 1990; ibid, #91, 7 Nov 1990; CENTCOM Regulation 415–1, Appendix G, "Procedures for Construction in the Kingdom of Saudi Arabia," 6 Nov 1990, DSDS File: CENTCOM Regulation 415–1.

[12]Msg, CINCCENT J4/7 to CENTAF et al., 020500Z Nov 1990, HNS Agreement: Miller Files #18; Braden interv, pp. 75–76, 88–89.

[13]Memorandum for Record, AFRD-EN, 17 Nov 1990, Misc Info: Lt. Col. Kenneth Cargill Files #39; SAD Sitrep #100, 26 Nov 1990; Miller, Periodic Report #15, 27 Nov 1990; interv, author with Brig. Gen. Pat Stevens IV Riyadh, Saudi Arabia, 1 Apr 1991, p. 15.

[14]Cox interv, 24 Aug 1991, pp. 20, 23–24; Adams interv, p. 56; Walter interv, pp. 26–27.

[15]Memo, Col. John M. Downey, "Minutes of Meeting at the Ministry of Defense and Aviation, 27 October 90," 30 Oct 1990, DSDS: HNS.

[16]Memo, George M. Kingsley to CESAI-OC, 29 Oct 1990, TAD Incoming Message File, #21; memo, Kingsley and Allan M. Tyrrell for CDR DAO, 6 Nov 1990, Contract Turnover: Miller Files #19.

[17]Memo, Col. Raymond C. Ruppert, CENTCOM Staff Judge Advocate, for Col. John M. Downey, 1 Nov 1990, TAD Incoming Message File #24.

[18]Memo, Col. Miller to Matt Thomason, 1 Dec 1990, Contract Turnover: Miller Files #19.

[19]CINCCENT Sitrep 032115Z Dec 1990; memo, Cox for Col. Pryor, n.d., JFSU Actions: Miller Files #19A; Actions; memo, Ali Saad Zehefa to William R. Brewer, 1 Jan 1991, ibid.; Brewer to Zehefa, 1 Jan 1991, ibid.; Cox interv, 24 Aug 1991, pp. 24–26; William Brewer comments, June 1995.

[20]Fax, Miller to Cox, 6 Jan 1991, JFSU Actions: Miller Files #19A; fax, Miller to Cox, 7 Jan 1991, ibid.

[21]Fax, Miller to Cox, 9 Jan 1991, ibid.; fax, Miller to Roger Thomas, 24 Jan 1991, TAD Incoming Message File #41.

[22]"Memorandum of Agreement between JFSU and MEAPO for construction quality assurance, technical oversight and contract administration," 29 Jan 1991, DSDS: HNS.

[23]Fax, Maj. Gen. Starling to MEAPO [draft], 11 Dec 1990, DSDS: GOJ-GPF; MEAPO Point Paper, 11 Jan 1991, ibid.

[24]Title V Report, p. 635; msg, COMUSJapan to USCINCCENT J4/7, 070404Z Sep 1990, DSDS: GOJ-GPF. On 1 September, the commander of the U.S. Pacific Command (CINCPAC) authorized COMUSJapan to coordinate directly with CINCCENT for the Japanese government's offers of assistance. Navy Commander Steve Johnson served as liaison. (Msg, JCS J4 to USCINCCENT J4/7, 082334Z Nov 1990, DSDS: GOJ-GPF; msg, CINCCENT J4/7 to COMUSARCENT Main et al., 121200Z Sep 1990, TAD Incoming Message File #8; CINCCENT Sitrep, 122115Z Sep 1990; ibid., 142115Z Sep 1990.

[25]Msg, Joint Staff (J–4) to USCINCCENT J4/7, 272229Z Sep 1990, Foreign Gifts: RM Files; msg, USCINCCENT J4/7 to COMUS Japan Command Center, Yokota Air Base, 170830Z Sep 1990, ibid.; CCJ4/7–E, "Fact Paper," 17 Nov 1990, Misc: Miller Files; Title V Report, p. 637.

[26]Cox interv, 24 Aug 1991, pp. 1–3; SAD Sitrep #67, 12 Oct 1990.

[27]CCJ4/7–E "Fact Paper," 17 Nov 1990; memo, Maj. Christopher S. Prinslow for ARCENT Main EN, 10 Nov 1990, Cargill Files #39; fax, Miller to Lt. Col. Ashhurst, 8 Jan 1991, TAD Incoming Message File #36.

[28]Cox interv, 24 Aug 1991, p. 5; Miller interv, p. 56; Braden interv, pp. 78–80, 95; memo, Cox to Braden, 11 Nov 1990, DSDS: GOJ-GPF; memo, Matthew D. Thomason, III, for Cox, 9 Nov 1990, DSDS: GOJ-GPF.

[29]Miller interv, pp. 57–58; memo, Cox for Dick Wiles/M. Thomason, 8 Nov 1990, TAD Incoming Message File #24; fax, Miller for Wiles, 11 Dec 1990, TAD Incoming Message File #50.

[30]Msg, USCINCCENT J4/7 to CESAI-DE, 181130Z Dec 1990, TAD Incoming Message File #32.

[31]Memorandum for Record, Faye M. Steffes, 7 Jan 1991, DSDS: GOJ-GPF; memo, Cecil Hutchinson for Col. Miller, 2 Dec 1990, ibid.; SAD Sitrep #115, 7 Jan 1991.

[32]Fax, Miller to Huchinson, 13 Jan 1991, TAD Incoming Message File #37; memo, Miller for Braden, 18 Jan 1991, ibid, #39; fax, R.D. Bryan to Ox Van Hoften, 18 Jan 1991, DSDS: GOJ-GPF.

[33]Memo, Miller to Bechtel International Systems, Inc., 23 Jan 1991, TAD Incoming Message File #41; Miller, Periodic Report #21, 25 Jan 1991 Periodic Reports; CINCCENT Sitrep, 222115Z Jan 1991; fax, Miller to Roger Thomas, 24 Jan 1991, TAD Incoming Message File #41.

[34]Fax, Miller to MEAPO Emergency Operations Center, 8 Feb 1991, TAD Incoming Message File #45; Cox interv, 24 Aug 1991, pp. 9–11; msg, CESAI-CD to CENTCOM J4/7, 101500Z Jan 1991, DSDS: GOJ-GPF; memo, Miller for Braden, 12 Jan 1991, TAD Incoming Message File #37; memo, Maj. Gen. James W. Ray for Maj. Gen. John Sobke, 19 Feb 1991, ibid, #48.

[35]"Gulf Peace Fund Work Nears Completion," *Transatlantic News*, v. 6, no. 8, Oct 1991, p. 3; Information Paper, "Gulf Peace Fund Contract" n.d., DSDS: GOJ-GPF.

[36]"Operation Desert Shield/Storm Recap," p. 2; letter, Lt. Gen. Calvin Waller to Lt. Gen. Khalid Bin Sultan Bin Abdul Aziz, 8 Mar 1991, Misc: Miller Files.

[37]Cox interv, 24 Aug 1991, pp. 12–13; "Gulf Peace Fund Work Nears Completion," p. 3; memo, Cpt. Carey S. Hill to D/Cdr DAO, 18 Mar 1991, TAD Incoming Message File #55.

[38]Memo, Col. Gaines B. Hall for DAO, 3 Apr 1991, ibid., #59.

[39]Cox interv, 24 Aug 1991, pp. 15–18; Miller interv, pp. 59–60; Braden interv, pp. 93, 95. The abrupt end to the war meant that the demand for construction and services was less than anticipated. The cap on the Gulf Peace Fund was lowered from $100 million to $50 million, which CENTCOM put into the U.S. Treasury.

[40]Memorandum for Record, Col Lee Pryor, 416th ENCOM, 7 Apr 1991, p. 7; memo, Col. Charles D. Bartlett for Hdq, 22d SUPCOM, 22 Apr 1991; Col. Charles D. Bartlett, Jr, interviewed by Lt. Col. Wesley Manning and Maj. Glen Hawkins, Dhahran, Saudi Arabia, 10 Feb 1991, pp. 12–14, 19–21.

[41]Title V Report, p. 444.

[42]Ibid, pp. 402, 634; "Gulf Peace Fund Work Near Completion," p. 3; Scales, *Certain Victory*, p. 65.

Chapter 4. Engineer Construction

[1]Headquarters, Department of the Army, FM 5–116, *Engineer Operations: Echelons Above Corps*, Mar 1989, pp. 6–7; msg, CINCCENT J4/7, 11 Nov 1990, TAD Incoming Message File #25.

[2]South Atlantic Division (SAD), "Engineer Support, Echelons Above Corps, Southwest Asia," [draft], 28 Sep 1990, DSDS: Command and Control; FM 5–116, pp, 6, 22; Army Regulation 415–1, "Military Construction/Engineering in the U.S. CENTCOM Area," [draft], n.d., DSDS: CENTCOM Regulation 415–1.

[3]Memo, CENTCOM J4/7–E, "Macro Lessons Learned for Operation Desert Shield/Storm," p. 3, 25 Mar 1991, TAD Incoming Message File #57 (hereafter cited as "Macro Lessons Learned"); SAD "White Paper: Engineer Support, Echelons Above Corps, Southwest Asia," 1 Oct 1990, DSDS: Command and Control; Braden interv, pp. 34, 76. The regional contingency construction management cell eventually included four representatives from the 416th Engineer Command—Majors Prinzlow, Ryezek, and Yarzumbeck, and Captain Alexander.

[4]CENTCOM ENGRSUM, 28 Aug 1990, DSDS: CENTCOM ENGRSUM; ibid., 31 Aug 1990; "Operation Desert Shield/Storm Recap," pp. 1–2; SAD Sitrep #23, 29 Aug 1990; AFKE-GC-EN-FE, Memorandum for Record, 7 Apr 1991.

[5]See FM 5–116, p. 54; DAEN-ZCM, Information Paper, 23 Aug 1990, DSDS: Construction Management; CENTCOM ENGRSUM, 28 Aug 1990; "Operation Desert Shield/Storm Recap," p. 1.

[6]Mulcahy interv, p. 8.

[7]Brinkerhoff, "The 416th Engineer Command," pp. 23–24; Braden, "Macro Lessons Learned."

[8]Cox interv, 21 May 1991, p. 32; Cargill interv, p. 68; Adams interv, p. 36; msg, Paul Des Roches to Col. Braden, 25 Oct 1990, Desert Storm Information #2/3 FORSCOM Engineer Files,; William Miller interv, p. 22.

[9]Adams interv, pp. 37, 40; MEAPO(F) Sitrep #39, 17 Oct 1991.

[10]Brooks interv, pp. 24–27; Cox interv, 21 May 1991, pp. 29–30, 41; interv, author with Cpt. Lee Stabb, Dhahran, Saudi Arabia, 27 Mar 1991, p. 5; William Miller interv, pp. 19–21.

[11]Stevens interv, p. 25.

[12]Brinkerhoff, "The 416th Engineer Command," p. 26; memo, Col. Lee Pryor, 3 Jan 1991, DSDS: Construction Management.

[13]MEAPO, Point Paper, subj: Kingdom of Saudi Arabia Support to Operation Desert Shield/Storm, Feb 1991; William Miller interv, p. 24; C.C. Miller interv, p. 2.

[14]Braden interv, p. 86; Stevens interv, pp. 25–26; memo, Col. Braden for ARCENT EN and MEAPO(SWA), 20 Feb 1990, TAD Incoming Message File #48.

[15]Miller interv, pp. 24–26; Miller, Periodic Report #15, 27 Nov 1990.

[16]Cox interv, 21 May 1991, p. 29; Miller interv, pp. 21, 26–28.

[17]MEAPO, Point Paper, "Kingdom of Saudi Arabia Support."

[18]U.S. Army Engineer School, "Engineer After Action Report," p. 81, DSDS: Engineer School Materials.

[19]Msg, CINCFOR to ARCENT EN, 1 Sep 1990; CENTCOM ENGRSUM, 2 Sep 1990; Joint Chiefs of Staff Publication #3, Appendix to Section 3, Chapter 6, "Suggested Construction Standard for Military Construction and Civil Engineering Support of Joint Contingency Operations," DSDS: Construction; msg, CINCCENT J4/7 to COMUSARCENT Main, 6 Sep 1990, TAD Incoming Message File #6; FM 5–116, p. 52.

[20]CENTCOM ENGRSUM, 12 Sep 1992.

[21]Record of phone conversation with Lt. Col. James Walters, ARCENT(F), 1 Sep 1990, DSDS: FORSCOM Engineer Files; Title V Report, p. 442.

[22]Msg, USCINCCENT J4/7 to COMUSARCENT Main, 16 Sep 1990, DSDS: Construction Management; Lt. Col. Gordon Quesenberry, Information Paper, 26 Sep 1990, DSDS: Misc Msg, OACE Reference Files #3.

[23]CINCCENT Sitrep, 14 Dec 1990; msg, CINCCENT J4/7 to COMUSARCENT Main, 11 Dec 1990, DSDS: Construction Management.

[24]Brooks interv, p. 63; Van Sickle interv, pp. 57, 60; AFKE-GC-FE (Brig. Gen. Storat), Memorandum for Record, 7 Apr 1991, p. 4; Wood interv.

[25]Ben F. Wood, Fact Sheet, 2 Dec 1990, TAD Incoming Message File #28.

[26]FM 5–116, p. 51; memo, Col. T. J. Sheehy for DALO-AV, 10 Nov 1990, DSDS: Base Development, OACE Reference Files; U. S. Army Engineer School, "Engineer After Action Report," p. 80, Engineer School Materials.

[27] Braden, "Macro Lessons Learned."

[28]Santucci interv, pp. 20–21; Wood interv.

[29]Santucci interv, p. 15.

[30]Ibid, p. 19; Brooks interv, pp. 60–61; Cox interv, 21 May 1991, pp. 47–48; memo, Maj. Gen. John Sobke for CECW, subj: "Lessons Learned in Operation Desert Shield/Desert Storm," 3 June 1991, DSDS: After Action Report—SAD.

[31]Interv, author with Adam "Ollie" Werner, Winchester, Virginia, 10 Oct 1990, p. 34; memo, CESAI-ED-MC, 15 Sep 1990, TAD Outgoing Message File #16.

[32]MEAPO, "Operation Desert Shield Design Support," 29 Nov 1990, DSDS: Funding.

[33]SADvR 1110–3–1 and Engineer Regulation 1110–345–100; memo, K.R. Akers for CESAI-ED, 10 Oct 1990, TAD Incoming Message File #19.

[34]Stabb interv, pp. 4–6; Braden interv, p. 47; interv, author with Cpt. Paul R. Cudney, Dhahran, Saudi Arabia, 28 Mar 1991, p. 25.

[35]Memo, Sobke for CECW, 13 June 1991.

[36]Van Sickle interv, pp. 8, 11–12; Cox interv, 21 May 1991, p. 46; Santucci interv, pp. 20–21; Stabb interv, pp. 4, 7–8.

[37]Stabb interv, p. 14; Brinkerhoff, "The 416th Engineer Command," p. 27; U. S. Army Engineer School, "Engineer After Action Report," p. 65.

[38]SAD Sitrep #15, 21 Aug 1990; CENTCOM ENGRSUM, 22 Aug 1990; Braden, "Macro Lessons Learned;" "Operation Desert Shield/Storm Recap," p. 3; AFKE-GC-EN-FE (416th ENCOM), Memorandum for Record, subj: "Desert Shield/Storm Engineer 'Hotwash,'" 7 Apr 1991, [draft], DSDS: Engineer School Materials.

[39]411th EN BDE, S–1 Section Report for Command Report, DSDS: 22d SUPCOM.

[40]U. S. Army Engineer School, "Engineer After Action Report," pp. 65–66; Brinkerhoff, "The 416th Engineer Command," p. 42.

[41]Task Force 43 After Action Report, DSDS: Engineer School Materials.

[42]Mulcahy, "Engineer Support in the COMMZ," p. 19.

[43]"Operation Desert Shield/Storm Recap," p. 2.

[44]Braden interv, pp. 70–71; Van Sickle interv, pp. 9, 21–22, 68–69.

[45]U.S. Army Engineer School Briefing.

[46]Storat interv, p. 12.

[47]Van Sickle interv, pp. 80, 31–32.

[48]"Title 10, United States Code, Armed Forces (As Amended Through December 31, 1988)" Committee Print, 101st Cong., 1st sess., no. 2, Feb 1989, DSDS: Construction Funding.

[49]Memo, Maj. Gen. Peter J. Offringa for Comptroller of the Dept of Defense, 23 Aug 1990, DSDS: Funding, OACE Reference Files. The Corps also deferred two projects (Fort Ord, California, and Fort Riley, Kansas) to fund planning and design. DAEN-ZCR (Mr. Landahl), Information Paper, subj: "MILCON Requirements in Support of Desert Storm," 7 Feb 1991, ibid.

[50]Memo, Sean O'Keefe to Sen. Jim Sasser, 24 Aug 1990, TAD Incoming Message File #28; memo, Sasser to O'Keefe, 27 Aug 1990, DSDS File: Funding–Reprogramming.

[51]ARCENT SUPCOM (Provisional) Sitrep #65, 092300C Oct 1990.

[52]Memo, Offringa for D/ASA(I&H), 31 Oct 1990, DSDS: Funding, OACE Reference Files.

[53]"Water Wells," n.d., Construction Funding: Cargill Files #2; SAD Sitrep #52, 27 Sep 1990; memo, Maj. Gen. William G. Pagonis for Lt. Gen. John Yeosock, 29 Sep 1990, TAD Incoming Message File #14; msg, Commander FORSCOM to Commander USACE, 071632Z Oct 1990, Construction Funding: Cargill Files #2.

[54]ARCENT SUPCOM (Provisional) Sitrep #63, 7 Oct 1990; CINCFOR Sitrep, 23 Oct 1990.

[55]Msg, CINCCENT J4/7 to Joint Staff, 090945Z Oct 1990, Desert Shield Funding: Miller Files #17; msg, CINCCENT to Chairman, JCS, n.d., ibid.

[56]Msg, JCS/J4 to CINCCENT J4/7, 170017Z Oct 1990; Miller, Periodic Report #12, 21 Oct 1990.

[57]Memo, Maj. Gen. John Sobke for Commander MEAPO, 5 Oct 1990, TAD Incoming Message File #15.

[58]Memo, Lester Edelman for Acting Director, Military Programs, 21 Aug 1991, DSDS: Funding.

[59]Memo, Lt. Col. William Hagan for ARCENT Staff Judge Advocate, 1 Oct 1990, DSDS: Construction Funding, Cargill Files #2.

[60]Memo, Col. Tonu Toomepuu for ARCENT Chief of Staff, 3 Oct 1990, ibid.

[61]Memo, Lt. Col. William David Brown for Director, Military Programs, 12 Oct 1990, DSDS: Funding; memo, Cox to MEAPO Cdr, 12 Oct 1990, ibid.

[62]Memo, Sobke to Director, Military Programs, 12 Oct 1990, DSDS: Funding; memo, Maj. Gen. James W. Ray for Commander SAD, 12 Oct 1990, ibid.

[63]Memo, Sobke to Ray, 23 Nov 1990, Desert Shield Funding: Miller Files #17.

[64]Memo, CECC–J for Director, Military Programs, 7 Dec 1990, DSDS: Funding.

[65]Memo, Matt Reres to Office of the Chief of Engineers, 17 Dec 1990, subj: Legislative Proposal for Funding Support of Construction Performed by the Kingdom of Saudi Arabia for Operation Desert Shield, DSDS: Funding; memo, Maj. Gen. Ray for Commander, USACE, 10 Jan 1991, ibid.; memo, Lt. Gen. J. Hatch for ASA(ILE) 10 Jan 1991, ibid.

[66]Memo, Ray for Commander SAD, 29 Mar 1991, TAD Incoming Message File #57; Transatlantic Division Briefing Slide, 1 Mar 1991, "Operation Desert Storm: Transatlantic Division Expenditures," DSDS: Briefing Slides.

[67]Memo, Col. William Miller for SAT-DE, "Lessons Learned," 16 Mar 1991, TAD Incoming Message File #53.

[68]Memo, Col. Miller for SAT-DE, "Lessons Learned," 16 Mar 1991, TAD Incoming Message File #53; Point Paper, Julian E. Pylant, 22 Mar 1991, SAD Emergency Operations Center, Desert Storm, Message Reading File, Book #6.

[69]Pagonis and Krause, "Observations on Gulf War Logistics," p. 8.

[70]U. S. Army Engineer School, "Engineer After Action Report," p. 84; Title V Report, p. 444.

[71]Procedures changed somewhat after the Gulf War ended and the regional contingency construction management cell departed. With redeployment underway, CENTCOM and the services engineer offices could coordinate the few remaining construction requirements. ARCENT assumed responsibility for theater construction management for the remaining requirements. Each service would continue to manage the remaining CENTCOM-approved projects with existing Japanese government

contracts or with Saudi-funded construction or material contracts. New redeployment projects requiring host nation or Japanese contract support would be submitted through DD Form 1391 to ARCENT for review and approval in accordance with the redeployment construction guidance contained in a 23 March 1991 CENTCOM message. ARCENT would coordinate host nation funding and reimbursement for approved redeployment construction requirements. Msg, CINCCENT J4/7 to ARCENT MAIN/EN, 3 Apr 1991, Misc: Miller Files; "Operation Desert Shield/Storm Recap," p. 5; Braden, "Macro Lessons Learned;" Title V Report, p. 444.

Chapter 5. Construction Contracts

[1]Van Sickle interv, pp. 35, 27, 60; Dhahran Area Office (DAO) Sitrep #87, 21 Jan 1991; memo, Lt. Col. Philip M. Jones, Jr., for COMUSARCENT, subj: After Action Report, 43d Engr Bn (Cbt Hvy), 22 Apr 1991, DSDS: Engineer School Materials.

[2]Memo, Col. James Frederick for Commander ARCENT(F), 29 Aug 1990, DSDS: Life Support Area #5, Cargill Files.

[3]Author's DSDS notes, 6 Apr 1991; Bill Brasse, Memorandum for Record, 31 Aug 1990, DSDS: Construction Management; memo, Maj. Jay Treadway for Forces Command Engineer, 1 Sep 1990, in SAD/FORSCOM Liaison Sitreps.

[4]Miller, Periodic Report #5, 13 Sep 1990; msg, Commander, Forces Command to CJCS, subj: FORSCOM Sitrep #39, 15 Sep 1990; memo, Maj. Gen. Peter Offringa for Director of Military Programs, HQUSACE, 14 Sep 1990, DSDS: Fiscal Year 1990 Reprogramming and Base Camps, Fisher Files.

[5]Miller, Periodic Report #8, 23 Sep 1990, TAD Incoming Message File #11; Roger L. Thomas, Memorandum for Record, 25 Sep 1990, TAD Outgoing Message File #15; memo, Maj. Gen. William Pagonis to Maj. Gen. Saleh Bin Ali Al-Mohaya, 17 Sep 1990, DSDS: Life Support Area #5, Cargill Files; memo, Lt. Gen. John J. Yeosock to Lt. Gen. Khalid Bin Sultan, n.d. (unsigned), ibid.; memo, Maj. Gen. Dane Starling to Lt. Gen. Khalid Bin Sultan Bin Abdul Aziz, n.d., Base Camp: Miller Files.

[6]Memo, Julius E. Bounds for MEAPO Commander, 12 Sep 1990, TAD Incoming Message File #10; memo, Col. William Miller to Lt. Col. Brown, 18 September 1990, TAD Incoming Message File #9.

[7]Fax, Ben Wood to Maj. Gen. James W. Ray, 18 Sep 1990, TAD Incoming Message File #9; memo, Lt. Col. Gordon S. Quesenberry for Maj. Gen. Gary Stemley, 17 Sep 1990, DSDS: Contract Construction; Santucci interv, p. 46.

[8]Memo, Robert W. Page to MEAPO, 18 Sep 1990, DSDS: Maj. Gen. Ernest Edgar File; memo, Page for Director of Military Programs, HQUSACE, 19 Sep 1990, TAD Outgoing Message File #13.

[9]George M. Kingsley, Memorandum for Record, 20 Sep 1990, DSDS: Contracting; Col. Miller, Memorandum for Record, 20 Sep 1990, TAD Incoming Message File #10.

[10]Page memo, 19 Sep 1990.

[11]Kingsley memo, 20 Sep 1990; note from ASA(CW), 21 Sep 1990, DSDS: Edgar File.

[12]Memo, K.R. Akers for Commander, USACE, 27 Sep 1990; Wood interv.

[13]Akers memo, 27 Sep 1990; memo, Susan Livingstone for Director of Military Programs, HQUSACE, 26 Sep 1990, DSDS: Life Support Area.

[14]SAD Sitrep #87, 1 Nov 1990.

[15]Cargill interv, pp. 52–54; Miller, Periodic Report #10, 10 Oct 1991; Norman Schwarzkopf, *It Doesn't Take a Hero*, pp. 355–56

[16]Memo, Darrell Crawford to Col. Emory Pylant, n.d., SAD/FORSCOM Liaison Sitreps; Werner interv, pp 13–17; interv, author with Kay Bauer, Atlanta, Georgia, 4 Dec 1990, p. 17; interv, author with Bennie Stephens, Atlanta, Georgia, 3 Dec 1990, pp. 26, 22.

[17]SAD Sitrep #72, 17 Oct 1990; ibid., #73, 18 Oct 1990; ibid., #84, 29 Oct 1990; ibid., #86, 31 Oct 1990; ibid., #91, 7 Nov 1990; ibid., #94, 13 Nov 1990.

[18]SAD Sitrep #115, 7 Jan 1991; memo, Dwight Burns to Maj. Mohammad Shonaify, 13 Mar 1991, Base Camp: Miller Files; Burns to Shonaify, 18 March 1991, ibid.; Larry Ems to Shonaify, 1 May 1991, Contract Turnover: Miller Files #19.

[19]Stephens interv, p. 22; Bauer interv, p. 18; Cudney interv, p. 20.

[20]Scales, *Certain Victory*, pp. 76–77.

[21]Braden, "Macro Lessons Learned;" CINCCENT Sitrep, 12 January 1991.

[22]John R. Brinkerhoff, "The 416th Engineer Command," p. 36; 411th Engineer Brigade, Command Report, Brig. Gen. Richard E. Storat to Commander, ARCENT, 25 Feb 1991, DSDS: 411th EN BN.

[23]Van Sickle interv, pp. 2–3, 6–7.

[24]Carroll interv, p. 10.

[25]U. S. Army Engineer School, "Engineer After Action Report," p. 65; Van Sickle interv, pp. 13–17.

[26]Cox interv, 21 May 1991, p. 59.

[27]U.S. Army Engineer School Briefing, April 1991; Cargill interv, p. 46.

[28]U. S. Army Engineer School, "Engineer After Action Report," p. 65.

[29]Maj. Michael F. Hullihan, "Dust Control in Saudi Arabia," *Engineer*, Jan 1991, pp. 10–12.

[30]Memo, Lt. Col. Donald Tomasik for MEAPO(SWA), 7 Sep 1990, TAD Incoming Message File #6; CESAI-ED-F, Memorandum for Record, 17 Sep 1990, TAD Outgoing Message File #12; fax, "Dust Control," J. R. Ramos to Gary Kula, 4 Oct 1990, TAD Incoming Message File #15.

[31]Msg, FORSCOM/FCCS to COMUSARCENT Main, 29 Oct 1990, DSDS Reading File, SAD Emergency Operations Center; Tomasik, memo for See Distribution, 9 Oct 1990, TAD Incoming Message File #20; MEAPO Emergency Operations Center Tasker #419, 2 Oct 1990, TAD Outgoing Message File #17.

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[33]Memo, Lt. Col Kenneth R. Ashhurst for Col. Miller, 6 Nov 1990, Reading File, SAD EOC; Roger A. Brown, Memorandum for Record, 9 Nov 1990.

[34]Cudney interv, p. 1; Roger A. Brown, Memorandum for Record, subj: Dust Palliative Experiences in Operation Desert Shield, 7 Dec 1990; DSDS: Dust Control.

[35]SAD Sitrep #78, 23 Oct 1990; Brown, Memorandum for Record, 7 Dec 1990; DAO Sitrep #7, 10 Dec 1990; SAD Sitrep #109, 19 Dec 1990.

[36]Roger A. Brown, Memorandum for Record, 12 Dec 1990; DAO Sitrep #71, 10 Dec 1990; SAD Sitrep #100, 26 Nov 1990.

[37]Storat interv, p. 22; Van Sickle interv, p. 57; U. S. Army Engineer School, "Engineer After Action Report," p. 65.

[38]Msg. Maj. Gen. Donald R. Williamson for Maj. Gen. Peter J. Offringa, 26 Oct 1990, DSDS: Facility Requirements, OACE Reference Files.

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[41]Cargill interv, pp. 33, 36; Miller, Periodic Report, #19, 8 Jan 1991; Walter interv, p. 12.

[42]Cox interv, 21 May 1991, pp. 61–62; fax, Cox to Roger Thomas, 3 Dec 1990, TAD Incoming Message File #29.

[43]Adams interv, pp. 59, 66, 70, 72.

[44]DAO Sitrep #120, 8 Apr 1991; Cargill interv, pp. 39–42; Adams interv, pp. 59–60, 62.

[45]DAO Sitrep #86, 18 Jan 1991; ibid., #97, 13 Feb 1991; Cargill interv, pp. 42–44; Adams interv, pp. 63–64.

[46]Adams interv, p. 66; SAD Sitrep #132, 20 Feb 1991; DAO Sitrep #100, 20 Feb 1991; ibid., #103, 27 Feb 1991.

[47]Cargill interv, p. 39; Cox interv, 21 May 1991, pp. 63–64.

[48]Cargill interv, p. 18.

[49]Brinkerhoff, "The 416th Engineer Command,"p. 44; Van Sickle interv, pp. 53, 45.

[50]U. S. Army Engineer School, "Engineer After Action Report," p. 73; Van Sickle interv, pp. 53, 54, 55; Brinkerhoff, "The 416th Engineer Command," p. 46.

[51]Memo, Richard Bennett for SAI-ED-ME, 14 Sep 1990, TAD Outgoing Message File #11; SAD Sitrep #71, 16 Oct 1990; ibid., #88, 2 Nov 1990; ibid., 26 Nov 1990.

[52]DAO Sitrep #84, 14 Jan 1991; SAD Sitrep #107, 12 Dec 1991; ibid., #117, 9 Jan 1991; TAD Briefing, "Operation Desert Storm, Kuwait Emergency Recovery, and Operation Provide Comfort Update," 12 Jul 1991.

[53]CINCCENT Sitrep, 24 Dec 1990; ibid., 31 Dec 1990; msg, CINCCENT J4/7 to ARCENT Main/AFRD-EN et al., 9 Jan 1991, DSDS: Contracting.

[54]CINCCENT Sitrep, 14 Jan 1991; Van Sickle interv, p. 23; CINCCENT Sitrep, 17 Jan 1991; ibid., 21 Jan 1991; ibid., 28 Jan 1991; Brinkerhoff, "The 416th Engineer Command," p. 29.

[55]Msg, FORSCOM EN to SAD EOC, n.d., SAD/FORSCOM Liaison Book #11; Braden, "Macro Lessons Learned."

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[57]Pagonis and Krause, "Theater Logistics in the Gulf War," p. 6.

[58]Memo, Col. Miller to J4/7–E, 11 Mar 1991, TAD Incoming Message File #52; memo, Braden to MEAPO(SWA), ibid.; DAO Sitrep #112, 20 Mar 1991; ibid., #115, 27 Mar 1991; msg, COMUSARCENT Main, subj: G–4 Log Stat Report #200, 24 Mar 1991.

[59]TAD, "Operation Desert Storm, Kuwait Emergency Recovery, and Operation Provide Comfort Update," 8 May 1991, TAD DS/KR Briefing, 8 May 1991.

[60]Wood interv.

[61]Memo, Col. Miller for SAT-DE, subj: "Lessons Learned," 16 Mar 1991, TAD Incoming Message File #53.

[62]Adams interv, p. 38.

[63]Cargill interv, p. 36.

[64]Cox interv, 21 May 1991, p. 43; AFKE-GC-EN-FE (416th ENCOM), Memorandum for Record, subj: "Desert Shield/Storm Engineer 'Hotwash,'" 7 Apr 1991, [draft], DSDS: Engineer School Materials.

[65]AFKE-GC-EN, Memorandum for Record, 7 Apr 1991, p. 4; Task Force 43 After Action Report; Van Sickle interv, pp. 34, 46.

[66]416th ENCOM, "DSDS Lessons Learned," DSDS: 416th ENCOM, OACE Reference Files.

Chapter 6. Supply Contracts

[1]*Engineer Update*, v. 14, no. 10, Oct 1990, p. 1.

[2]SAD Sitrep #31, 6 Sep 1990.

[3]Adams interv, pp. 11–12; Santucci interv, p. 34; MEAPO(F) Sitrep #39, 17 Oct 1990.

[4]Brooks interv, pp. 20–21; DAO Sitrep #100, 20 Feb 1991; Santucci interv, pp. 34–38.

[5]Brooks interv, p. 22; memo, Col. William Miller for Maj. Shonaify, 13 Jan 1991, JFSU Actions: Miller Files #19A; DAO Sitrep #85, 16 Jan 1991; ibid., #86, 18 Jan 1991.

[6]SAD Sitrep #120, 18 Jan 1991; Pagonis interv, 27 Mar 1991, p. 1.

[7]Santucci interv, p. 38.

[8]Fact Sheet, Michael Shama, 10 Oct 1990, subj: OPA Procurement of Commercial Building Systems, DSDS: Expedient Structures.

[9]Barbara Bryant, "City in the Sand: Building Support for Desert Shield/Storm," *The Military Engineer*, v. 13, no. 546, Nov–Dec 1991, p. 11.

[10]Memo, Robert B. Oswald for Lt. Gen. Henry J. Hatch, 17 Oct 1990, DSDS: Expedient Structures; Information Paper, Michael Shama, subj: Expedient Construction and Relocatable Structures, 25 Oct 1990, ibid.

[11]Memo, Richard Russo for Forces Command Engineer, 24 Aug 1990, DSDS: Expedient Structures; HQDA Letter 420-89-1, Milton H. Hamilton, Admin. Assistant to the Secretary of the Army, 18 Dec 89, ibid.; memo, Michael Rea for Matt Thomason, 13 Sep 1991, TAD Outgoing Message File #10.

[12]Memo, Maj. Gen. Pagonis to ASA(ILE), 10 Oct 1990, TAD Incoming Message File #15; memo, [draft], Paul W. Johnson for ARCENT, n.d., DSDS: Expedient Structures.

[13]Brinkerhoff, "The 416th Engineer Command," pp. 37–38; memo, William Rushing for Emergency Operations Center, HQUSACE, 17 Aug 1990, DSDS: Expedient Structures; Information Paper, Shama, 9 Nov 1990, subj: Automatic Building Machines, ibid.

[14]Memo, William Rushing, 17 Aug 1990; CINCFOR Sitrep #27, 13 Sep 1990; CINCFOR Sitrep #61, 7 Oct 1990; Fact Paper, CCJ4/7–E Lt. Col. Trelease, subj: "K–Span Machines and Materials," 17 Nov 1990, DSDS: CENTCOM Engineer, OACE Reference Files; CINCFOR Sitrep, 14 Nov 1990; CINCCENT Sitrep, 26 Nov 1990.

[15]Msg, FORSCOM Engineer to ARCENT Main/Engineer, 20 Dec 1990, DSDS: Expedient Structures. The K–Span machines were considered equipment and could be funded with OPA (Other Procurement, Army). The structures built with the machines, however, had to be funded with MILCON because they usually required a concrete foundation. Clamshell structures could be procured with OPA funds if they were for

unit use and not tied to an installation as real property (Msg, Assistant Chief of Engineers to FORSCOM, 16 Nov 1990).

[16]SAD Sitrep #71, 16 Oct 1990.

[17]Braden, "Macro Lessons Learned;" Memorandum for Record, AFKE-GC-EN-FE, 7 Apr 1991, p. 10; Rushing memo, 17 Aug 1990; "Operation Desert Shield/Storm Recap," p. 3.

[18]Santucci interv, p. 23; Carroll interv, p. 6; letter, Lt. Col. Carl A. Strock, 27 Dec 1990, DSDS: Engineer Letters.

[19]ARCENT SUPCOM (Provisional) Logsitrep #43, 17 Sep 1990; Braden interv, p. 72; record of phone conversation with Maj. Grebling, 28 Sep 1990, FORSCOM Engineer Files.

[20]Strock letter, 27 Dec 1990.

[21]411th EN BDE, Command Report, Operation Desert Shield/Storm, 22d SUPCOM, DSDS: 411th EN BDE.

[22]Carroll interv, 1 Apr 1991, p. 7; SAD Sitrep #57, 2 Oct 1990; SAD Sitrep #84, 29 Oct 1990.

[23]Memo, Brig. Gen. Richard Storat to Cdr, ARCENT, 25 Feb 1991, Command Report, Operation Desert Shield/Storm, 22d SUPCOM, DSDS: 411th EN BDE.

[24]Memorandum for Record, AFKE-GC-FE, 7 Apr 1991, p. 4; Storat interv, pp. 13, 15–17.

[25]Stevens interv, p. 15; Santucci interv, p. 23.

[26]Carroll interv, 1 Apr 1991, p. 8.

[27]Task Force 43 After Action Report, 22 Apr 1991, DSDS: Engineer School Materials.

[28]Van Sickle interv, pp. 71–75.

[29]"A Look Back: Operation Desert Storm/Kuwait Recovery," p. 9; "DAO Command Briefing," n.d., Desert Storm: DAO Command Briefing, TAD Incoming Message File.

Chapter 7. Leasing Real Estate

[1]Interv, author with Barry Frankel, Washington, D.C., 17 Jun 1991, pp. 7–8.

[2]Interv, author with Al Posner, Atlanta, Georgia, 4 Dec 1990, pp. 1, 4; CERE-ZA (Wilemer), Information Paper, 10 Aug 1990, DSDS: Real Estate, OACE Reference Files.

[3]Santucci interv, p. 14; memo, M. Fountain for SAD-CO-E, 16 Oct 1991, DSDS: CONUS Support.

[4]Frankel interv, pp. 10, 14; SAD Sitrep #26, 1 Sep 1990.

[5]*Engineer Update*, vol. 14, no. 11, Nov 1990, p. 1; "Gulf Peace Fund Work Nears Completion," p. 4.

[6]CINCFOR Sitrep, 25 Aug 1990; ARCENT SUPCOM (Provisional) Log Sitrep #26, 31 Aug 1990; CINCFOR Sitrep #30, 6 Sep 1990.

[7]Miller, Periodic Report #6, 16 Sep 1993; ARCENT SUPCOM (Provisional) Log Sitrep #38, 12 Sep 1990; msg, COMUSARCENT Main/AFRD to CINCCENT Main J3/4/7, 20 Sep 1990; SAD Sitrep #59, 4 Oct 1990.

[8]Brinkerhoff, "The 416th Engineer Command," p. 27.

[9]Posner interv, p. 6; memo, A.C. Posner for CERE-A, 16 Aug 1990, TAD Incoming Message File #3; memo, Paul W. Johnson, "Delegation of Authority to Execute Leases in Support of Operation Desert Shield," 20 Aug 1990, TAD Outgoing Message File #3.

[10]Memo, Lt. Col. Charles Cox for Col. William Miller, 21 Aug 1990, TAD Outgoing Message File #3; Flash Sitrep #2, MEAPO EOC to SAD EOC and HQUSACE EOC, 21 Aug 1990, DSDS: Real Estate.

[11]Memo, Paul W. Johnson, 21 Aug 1990, DSDS: Real Estate; fax, Cox to Miller, 21 Aug 1990, TAD Outgoing Message File #3.

[12]Posner interv, p. 7; Frankel interv, pp. 21, 23; memo, M. Fountain for SAD-CO-E, 16 Oct 1991, DSDS: CONUS Support.

[13]William Miller interv, p. 32; Walter interv, p. 20; Cox interv, 21 May 1991, pp. 37–39; memo, Maj. Matchinski to Harry Painton, 26 Aug 1990, TAD Outgoing Message File #4.

[14]William Miller interv, p. 33; SAD Sitrep #49, 24 Sep 1990; Adams interv, p. 24; Walter interv, p. 22.

[15]Cox interv, 21 May 1991, pp. 39–40.

[16]Adams interv, pp. 23–24, 35.

[17]Miller interv, p. 34; interv, author with Robert Dragonette, Dhahran, Saudi Arabia, 25 Mar 1991, pp. 12, 17; memo, James M. Ellis for all Real Estate Divisions and Districts, 18 Dec 1990, TAD Incoming Message File #32; DAO Sitrep #84, 14 Jan 1991; SAD Sitrep #109, 19 Dec 1990.

[18]Adams interv, pp. 21–22, 26–28; Dragonette interv, pp. 6, 22–23, 29–30.

[19]Pagonis interv, 27 Mar 1991, pp. 16–17; Lt. Gen. William G. Pagonis, *Moving Mountains: Lessons in Leadership and Logistics from the Gulf War* (Boston: Harvard Business School Press, 1992), p. 109.

[20]Dragonette interv, pp. 18–21; Braden interv, pp. 50–52.

[21]Memo, Herbert Fahy for Col. Scholl, 31 Aug 1990, DSDS: Real Estate; memo, Barry Frankel for Col. Scholl, 31 Aug 1990, DSDS: Real Estate.

[22]Memo, M. Fountain for SAD-CO-E, 16 Oct 1991, DSDS: CONUS Support.

[23]Maj. Salvatore Cremona, Memorandum for Record, 22 Sep 1990, TAD Incoming Message File #14.

[24]Jerome Liess, Memorandum for Record, 24 Oct 1990, DSDS: Real Estate; Frankel interv, p. 27.

[25]Cox interv, 24 Aug 1991, pp. 38–42.

[26]Fountain memo, 16 Oct 1991; Dragonette interv, p. 34.

[27]Cox interv, 24 Aug 1991, pp. 32, 35.

[28]SAD Sitrep #89, 5 Nov 1990; memo, Tommy R. Hill for Commander MEAPO(F), 4 Nov 1990, Real Estate: Miller Files #9.

[29]Adams interv, p. 48; Fountain memo, 16 Oct 1991.

[30]SAD Sitrep #94, 13 Nov 1990; Dragonette interv, pp. 24, 28; Adams interv, p. 52.

[31]SAD Sitrep #95, 14 Nov 1990; ibid., #97, 19 Nov 1990; ibid., #99, 21 Nov 1990.

[32]Memo, Maj. Gen. William G. Pagonis for Brig. Gen. Frix, 21 Oct 1990, TAD Incoming Message File #27.

[33]SAD Sitrep #100, 26 Nov 1990.

[34]Miller interv, pp. 36–37; SAD Sitrep #101, 30 Nov 1990; OACE Paper, "Key Real Estate Issues," n.d., Misc Msg #5: OACE Reference Files; SAD Sitrep #103, 5 Dec 1990.

[35]SAD Sitrep #105, 7 Dec 1990; Frankel interv, pp. 40–43; memo, Brig. Gen. Pat Stevens to Brig. Gen. Al-Hussein, 18 Dec 1990, Real Estate: Miller Files #9; memo, Stevens to Al-Hussein, 5 Jan 1991, ibid.; memo, Jim Simpson for Tommy Hill, 13 Jan 1991, ibid.; SAD Sitrep #118, 14 Jan 1991.

[36]Memo, Stevens to Al-Hussein, 26 Jan 1991, Real Estate: Miller Files #9; memo, Al-Hussein to Stevens, 1 Feb 1991, ibid.; memo, Stevens to Al-Hussein, 4 Feb 1991, ibid.; memo, Al-Hussein to Col. K. Al-Shammari, 22 Feb 1991, ibid.

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[38]Memo, Tommy Hill for CCJ4/7 (Lt. Col. Walter), 27 Feb 1991, Real Estate: Miller Files #9; DAO Sitrep #100, 20 Feb 1991.

[39]DAO Sitrep #140, 24 May 1991; ibid., #141, 27 May 1991; ibid., #144, 3 Jun 1991; ibid., #145, 5 June 91; ibid., #146, 7 Jun 1991; ibid., #147 10 Jun 1991; fax, Tommy R. Hill to Janet McDonnell, 27 Sep 1995, DSDS: Real Estate.

[40]Memo, Tommy R. Hill for SAS-RE, 8 Feb 1991, Organization and Mission: Miller Files #4.

[41]DAO Sitrep #86, 18 Jan 1991; ibid., #89, 25 Jan 1991; ibid., #90, 28 Jan 1991; *Transatlantic News,* vol. 6, no. 8, Oct 1991, p. 4.

[42]Information Paper, Capt. Christopher J. Schopfer, 416th ENCOM, 29 Jan 1991, Real Estate: Miller Files #9.

[43]Hill fax, 27 Sep 1995.

[44]Memo, Col. William Miller for SAT-DE, subj: "Lessons Learned," 16 Mar 1991, TAD Incoming Message File #53.

[45]Point Paper, Col. Julian E. Pylant, 22 Mar 1991, SAD EOC, Misc Reading File, Book #6.

[46]Miller comments on a Joint Staff memo dated 1 Apr 1991, 3 Apr 1991, Policy Guidance: Miller Files.

[47]Phone conversation, author with Tommy R. Hill, 1 Aug 1995.

[48]Memo, James M. Ellis for all Real Estate Divisions and Districts, 18 Dec 1990, TAD Incoming Message File #32; Dragonette interv, p. 18; Frankel interv, pp. 49–50.

[49]TAD Briefing, 15 March 1991; *Transatlantic News*, Oct 1991, p. 4. Roughly 40 people from the Corps' Savannah, Norfolk, Vicksburg, Huntington, Mobile, Omaha, Portland, Seattle, Fort Worth, Little Rock, Albuquerque, Nashville, and Pittsburgh districts, and from the Missouri River and New England divisions supported real estate operations in the theater at one time or another. Brinkerhoff, "The 416th Engineer Command," p. 27.

Chapter 8. Laboratory Support

[1]David E. Koegel, Information Paper, 25 Jan 1991, SARDA: OACE Reference Files.

[2]Defense Mapping Agency Brief, "DMA Support to Desert Storm," Comparative Land Area for Recent U.S. Operations," n.d., Deputy Cdr and Director: ETL Files; Brinkerhoff, "The 416th Engineer Command," p. 59; Scales., *Certain Victory*, p. 134.

[3]Much topographic information today is compiled and maintained in digital format so complete maps can be transmitted in the form of computer diskettes for modification and printing. "U.S. Army Corps of Engineers' Laboratory Support to Operations Desert Shield and Desert Storm and to the Kuwait Recovery Operations," [draft], pp. 1–3, DSDS: ETL Files; memo, Robert Oswald, 14 Nov 1990, DSDS: R&D.

[4]Memo, Col. David F. Maune for Cdr, USACE, 12 Apr 1991, subj: Letter from Lt. Col. Paul Ray, Deputy Cdr and Director: ETL Files; letter, Ray to Lt. Gen. Henry J. Hatch, 6 Mar 1991, ibid.; memo, Ray for CG, 416th ENCOM, 7 Mar 1991, subj: Topographic Engineer Issues, ibid.; "U.S. Army Corps of Engineers' Laboratory Support," pp.1–3.

[5]Memo, Donald J. Levernez for George Singley, 1 Mar 1991, SARDA: R&D Files; letter, Ray to Hatch, 6 Mar 1991.

[6]30th EN BN (Topographic), Lessons Learned, JULLs #31436-96600 (00010), Maj. Wright, 13 Mar 1991; Robert Hellman, "A History Update of the U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Virginia, 1984–1988," Aug 1994, pp. 35–36.

[7]"U.S. Army Corps of Engineers Lab Support to Operation Desert Shield and Desert Storm," p. 3; Mark K. Ross, "ETL Provides Desert Shield Support," *Engineer Update*, v. 15, no. 1, Jan 1991, p. 3.

[8]Memo, Col. David F. Maune for Headquarters, USACE Emergency Operations Center, 25 Feb 1991, DSDS: ETL Files; msg, CDR XVIII ABN Corps to CDR ETL, 111000Z Oct 1990, ibid.; Muneendra Kumar, and Bryn A. Fosburgh, "The Global Positioning System and Operation Desert Shield and Desert Storm," *Abstract*, 29 Aug 1991, Topographic Development Lab: ETL Files.

[9]Memo, Col. Jerome G. Edwards for Maj. Gen. Silvasy, 23 Jan 1991, Deputy Cdr and Director: ETL Files.

[10]Jackie L. Bryant, "ACPs Supply Timely Middle East Data," *Tech–Tran*, v. 16, no. 2, spring 1991, p. 3.

[11]Ibid., p. 4; USACE, "Terrain," *Army Environmental Sciences*, v. 9, no. 2, winter 1991, p.3; memo, Col. Maune for Chief of Engineers, subj: Commander's Periodic Report, 22 Aug 1990, ETL Files; *Lab Lines*, v. 11, no. 5, p. 2.

[12]Memo, Lt. Col. Ray for Cdr., ETL, 16 Aug 1990, Deputy Cdr and Director: ETL Files.

[13]"Operation Desert Shield/Storm After Action Report, USA Engineer Waterways Experiment Station," May 1991, DSDS: WES After Action Report; memo, Robert B. Oswald for Air Force Engineering Support Command and Commander, U.S. Naval Facilities Engineering Command, DSDS: R&D.

[14]Msg, ARCENT Main/G4 to DAMO-AOC, 311235Z Jan 1991, Deputy Cdr and Director: ETL Files; Michael G. Barwick, Trip Report, 11 Apr 1991, ibid; memo, Robert Knowles for Jackie Bryant, 7 Aug 1995, DSDS: TEC Review Comments.

[15]"Countless Terrain Products," *Tech–Tran*, v. 16, no. 1, winter 1991, pp. 3–4; CEETL, "Operation Desert Shield provides real-life test of Water Resources Data Base," *Digital Data Digest*, v. 1, no. 2, fall 1990, p. 6; Knowles memo, 7 Aug 1995.

[16]Memo, Robert B. Oswald, 14 Nov 1990, DSDS: R&D; *Lab Lines*, vol. 11, no. 5, p. 2; Hellman, "A History Update," p. 59; Knowles memo, 7 Aug 1995.

[17]WES After Action Report; "U.S. Army Corps of Engineers' Laboratory Support," p. 9; memo, John M. Deponai for Resource Management Officer, 12 Dec 1990, Resource Management Directorate Files.

[18]Memo, Robert Oswald, 14 Nov 1990, DSDS: R&D.

[19]"U.S. Army Corps of Engineers' Laboratory Support," p. 7; WES After Action Report.

[20]"U.S. Army Corps of Engineers' Laboratory Support," pp. 6, 10; WES After Action Report.

[21]Oswald memo, 14 Nov 1990; USACE, "Soil," *Army Battlefield Environment*, v. 9, no. 3, summer 1991, p. 1; John Hansen, "Location of Subsurface Ordnance and Structures," ETL Lessons Learned, 11 Apr 1991, Deputy Cdr and Director: ETL Files.

[22]"U.S. Army Corps of Engineers' Laboratory Support," p. 7.

[23]Memorandum for Record, CERD-ZA, 17 Sep 1990, Fisher Files.

[24]*Lab Lines*, v. 12, no. 2, Mar–Apr 1991, p. 2; Lt. Col. Paul L. Ray to Lt. Gen. Hatch, 6 Mar 1991, Deputy Cdr and Director: ETL Files.

Powering the Theater

[1]The Army prime power program comes under Army Regulation 700–128; Maj. Kenneth E. Cockerham, "Prime Power on the Battlefield," *Engineer*, Apr 1992, pp. 30–31.

[2]Msg, CINCFOR to DAMO-AOC/DAEN-ZCM, 101230Z Aug 1990, Prime Power: OACE Reference Files; EHSC Briefing, "Chronological History," 9 Nov 1990, DSDS: Prime Power; msg, DAEN-ZCM to CEEC-EOC, 112200Z Aug 1990, ibid; msg, FORSCOM to Dir USAEHSC, 070130Z Sep 1990, Prime Power: OACE Reference Files; Brinkerhoff, "The 416th Engineer Command," p. 29; Van Sickle interv, pp. 62–63.

[3]Cockerham, "Prime Power on the Battlefield," p. 31; msg, FORSCOM to Dir USAEHSC, 070130Z Sep 1990, Prime Power: OACE Reference Files; Van Sickle interv, p. 64; Brinkerhoff, "The 416th Engineer Command," p. 30.

[4]ARCENT SUPCOM (Provisional) Logsitrep 37, 112300C Sep 1990, Misc Msg #3: OACE Reference Files; msg, COMUSARCENT Main/AFRD, 202359Z Sep 1990, ibid; msg, CINCFOR/J–3, 021930Z Oct 1990, Prime Power: OACE Reference Files; EHSC Sitrep #86, 20 Dec 1990.

[5]Memo, Maj. Dale A. Knieriemen for Cdr, 416th ENCOM, 22 Jan 1991, Prime Power: OACE Reference Files.

[6] Cockerham, "Prime Power on the Battlefield," pp. 32–33; EHSC Sitrep 102, 5 Apr 1991; EHSC Sitrep 111, 7 Jun 1991; Brinkerhoff, "The 416th Engineer Command," p. 30; MSG Pryor, Information Paper, 23 Sep 1991, DSDS: Prime Power.

[7]Pryor, Information Paper, 23 Sep 1991; "52–Echos Zap Back Kuwait," *Engineer Update*, v. 15 no. 7, Jul 1991, p. 4; Penelope Schmitt, "Prime Power Soldiers Electrify Saudi Scene," *DEH Digest*, v. 3, no. 4, Jul 1991, pp. 8–9; Cockerham, "Prime Power on the Battlefield," p. 33.

Conclusion

[1]DAO Sitrep #113, 22 Mar 1991.

[2]TAD Briefing to U.S. House of Representatives, n.d., DSDS;

[3]Storat interv, p. 18.

[4]Braden, "Macro Lessons Learned;" Col. Jenkins, "Desert Shield/Storm Joint Engineer History and Lessons Learned," n.d., DSDS: Lessons Learned.

[5]Pagonis interv, 27 Mar 1991, p. 3.

[6]Storat interv, p. 14; AFKE-GE-EN-FE, Memorandum for Record, 7 Apr 1991.

[7]Bartlett interv, p. 39; Carroll interv, pp. 25–27.

[8]Pagonis interv, 27 Mar 1991, p. 8; Adams interv, p. 39; Cox interv, 21 May 1991, pp. 64, 71.

[9]Braden, "Macro Lessons Learned;" Jenkins, "Desert Shield/Storm Joint Engineer History and Lessons Learned."

[10]Schwarzkopf, *It Doesn't Take a Hero,* p. 364.

[11]AFKE-GC-EN-FE (416th ENCOM), Memorandum for Record, subj: "Desert Shield/Storm Engineer 'Hotwash,'" 7 Apr 1991, [draft], DSDS: Engineer School Materials; Storat interv, pp. 18, 21; Braden, "Macro Lessons Learned;"

[12]Col. William Miller interv, pp. 49–54.

[13]Adams interv, p. 74.

[14] Memo, James W. Ray for the Chief of Staff of the Army, 24 Jun 1991, DSDS.

[15]Cox interv, 24 Aug 1991, pp. 51–53, 63. The Total Army concept, which evolved in the 1970s, called for the blending of Active, Reserve, and Army National Guard capabilities.

[16]Braden, "Macro Lessons Learned."

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[18]Hatch handwritten notes, "Desert Storm Special Study Project," General Officer Steering Committee Desert Storm Special Study Book.

Acronyms

AFB	Air Force Base
AIG	Address indicating group
AMC	U.S. Army Materiel Command
AR	Army Regulation
ARCENT	Army component of U.S. Central Command
ARPERCEN	U.S. Army Personnel Center
CAMMS	Condensed Army Mobility Modeling System
CECS	Corps of Engineers Chief of Staff
CECW	Corps of Engineers Directorate of Civil Works
CENTAF	Air Force component of U.S. Central Command
CENTCOM	U.S. Central Command
CINCCENT	Commander in Chief, U.S. Central Command
CINCFOR	Commander in Chief, Forces Command
CINCPAC	Commander in Chief, U.S. Pacific Command
CJCS	Chairman, Joint Chiefs of Staff
CMH	Center of Military History
COMMZ	Communications Zone
COMUSARCENT	Commander, U.S. Army Central Command
CONUS	Continental United States
DAO	Dhahran Area Office
DMA	Defense Mapping Agency
DOD	Department of Defense
DSDS	Desert Shield/Desert Storm
DTSS-P	Digital Topographic Support System Prototype
EHSC	Engineering and Housing Support Center
ENCOM	Engineer Command
EN BDE	Engineer Brigade
ENSUM	Engineer Summary
EOC	Emergency Operations Center
ETL	Engineer Topographic Laboratories
FAISS	Forces Command Automated Intelligence Support Systems
FIDIC	Federation Internationale Des Ingenieurs-Conseils
FM	Field Manual
FORSCOM	Forces Command

GDMW	General Directorate of Military Works
GPS	Global Positioning System
HQDA	Headquarters, Department of the Army
HQUSACE	Headquarters, U.S. Army Corps of Engineers
IMA	Individual Mobilization Augmentee
JFSU	Joint Forces Support Unit
LSA	Life Support Area
MACE	Mechanical and Civil Engineering Saudi Arabia, Ltd.
MACOM	Major Command
MCA	Military Construction, Army
MEAPO	Middle East/Africa Projects Office
MEAPO(SWA)	Middle East/Africa Projects Office–Southwest Asia
MILCON	Military Construction
MARCENT	Marine component of U.S. Central Command
MOA	Memorandum of Agreement
MOBTDA	Mobilization Tables of Distribution and Allowances
MTOE	Modified Tables of Organization and Equipment
NAVCENT	Navy component of U.S. Central Command
OACE	Office of the Assistant Chief of Engineers
OMA	Operation and Maintenance, Army
OPA	Other Procurement, Army
OPD	Ordnance Program Division
OPLAN	Operations Plan
PERSCOM	U.S. Total Army Personnel Command
POR	Preparation for Overseas Replacement
Prime BEEF	Prime Base Emergency Engineer Force
Prime RIBS	Prime Readiness in Base Services
R&D	Research and Development
RED HORSE	Rapid Engineer Deployable, Heavy Operations Repair Squadron, Engineer

RCCM	Regional Contingency Construction Management
RM	Resource Management
S&A	Supervision and Administration
SAD	South Atlantic Division
SARDA	Assistant Secretary of the Army (Research, Development, and Acquisition)
SITREP	Situation Report
SOCCENT	Special Operations component of U.S. Central Command
SUPCOM	Support Command
TAD	Transatlantic Division
TOE	Tables of Organization and Equipment
TUSA	Third U.S. Army
USAES	U.S. Army Engineer School
USAR	U.S. Army Reserve
WES	Waterways Experiment Station

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