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.