LEGACY IN THE SAND

The United States Army Armament, Munitions and Chemical Command in Operations Desert Shield and Desert Storm

DESERT STORM

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This is a broad historical sweep of the role of the U.S. Army Armament, Munitions and Chemical Command in Operation Desert Shield/Storm. This command was responsible for the distribution of all the conventional ammunition used by American forces during the Gulf War. It was also responsible for the management of materiel including Chemical Defensive Equipment for all American troops. The command had the responsibility of shipping materiel and ammunition into the theater of operation and deployment of personnel and repair parts and equipment.

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LEGACY IN THE SAND:

THE UNITED STATES ARMY ARMAMENT, MUNITIONS AND CHEMICAL COMMAND IN OPERATIONS DESERT SHIELD AND DESERT STORM

BY

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United States Army Armament, Munitions and Chemical Command
Rock Island, IL 61299-6000

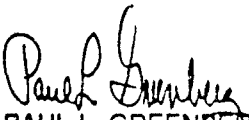
COMMANDING GENERAL'S INTRODUCTION

From 6 August 1990 to 6 March 1991, the 17,000 men and women of AMCCOM, along with countless thousands of other military and civilian personnel from throughout the Department of Defense community, were involved in the largest mobilization of American forces since World War II.

Known as Operations Desert Shield and Desert Storm, the mobilization entailed the movement of over 500,000 fighting men and women 8,000 miles to the deserts of Saudi Arabia. There, final preparations were made for the eventual invasion of occupied Kuwait to expel Saddam Hussein's Iraqi army, which had without provocation invaded the tiny nation and stood menacingly poised upon the border of Saudi Arabia. Under the aegis of the United Nations Charter, the United States and a coalition of some 30 other nations created a most formidable fighting force to challenge, and eventually defeat, Saddam Hussein's troops in just 100 hours of ground warfare.

The men and women of AMCCOM played a most significant role in the success of Operations Desert Shield and Desert Storm. They selflessly worked long, hard hours to ensure the movement of some 500,000 short tons of conventional ammunition; administered over 500,000 materiel requisitions; and accelerated over 300 procurement actions, contracts, and purchase orders. Customer needs were more than met, aided not only by command's direct employees, and its vital, support contractors, but also in large measure by the deployment to Southwest Asia of over 240 AMCCOM military and civilian personnel.

To capture the role of the command in Operations Desert Shield and Desert Storm and to apply it to the military history venue is no easy task. However, the staff of the AMCCOM Historical Office has skillfully used the tools of the trade--papers, photographs, charts, maps, etc.--to assemble an insightful, yet definitive chronicle of the selfless and dedicated contributions made by all the men and women of the AMCCOM family in bringing about the successful conclusion of Operations Desert Shield and Desert Storm. This history is a written testimony to all the men and women of AMCCOM and their role in what to many will be considered "their finest hour."



PAUL L. GREENBERG
Major General, USA
Commanding

FOREWARD

In the Spring of 1991, the AMCCOM Historical Office was tasked by the Department of the Army and the Army Materiel Command to write a history of the command's role in Operations Desert Shield and Desert Storm.

The staff of the historical office decided that a broad historical sweep of the command's activities, contributions, and problem areas should be undertaken with emphasis being placed on significant activities such as deployment, logistical support, movement of conventional ammunition, production and procurement, and personnel. In order to capture the above, the historians engaged in writing the history examined in depth primary sources such as messages, after action reports, memos, and daily briefing reports. A relatively large number of oral interviews were also done with important AMCCOM personnel who affected the command's activities and performance during Operations Desert Shield and Desert Storm. These men and women provided the historical office staff with a most incisive and revealing look at the human and corporate elements which comprised Operations Desert Shield and Desert Storm. Secondary sources such as summaries, Lessons Learned documents, and articles were also freely utilized in writing this ODS history.

Ms. Kimberly K. Porter wrote the majority of the history, and the undersigned wrote the unit detailing the command's deployment of materiel, ammunition, and personnel in support of Operations Desert Shield and Desert Storm. Mr. Thomas J. Slattery made extensive contributions to the portion dealing with Rock Island Arsenal's involvement in ODS. Mrs. Marguerite A. Brown edited the history and provided attendant clerical support.

At this time, appreciation is extended to Ms. Porter for her invaluable contributions to the writing of the history, and for her most lucid, yet definitive style of historical chronicling. Thanks are also extended to Mr. Slattery for taking time from his busy schedule to obtain oral interviews from important Rock Island Arsenal personnel concerning the arsenal's contributions to ODS. He deftly incorporated these interviews into a short, but significant treatise used in the ODS history. Recognition and thanks are extended to Mrs. Marguerite A. Brown for her much appreciated editorial and clerical support. Thanks are also offered to Ms. Linda M. Baeza for her applied editorial skills.

Warm thanks are extended to those people who allowed the undersigned to capture by oral interviews their observations about Operations Desert Shield and Desert Storm. Much was learned and chronicled from these interviews. Finally, in closing, corporate recognition is given to the 17,000 men and women of AMCCOM for their selfless sacrifices and contributions during ODS. What they did will be hopefully indelibly inscribed by this history. It is theirs to remember.

Herbert P. LePore

HERBERT P. LEPORE
Chief, Historical Office

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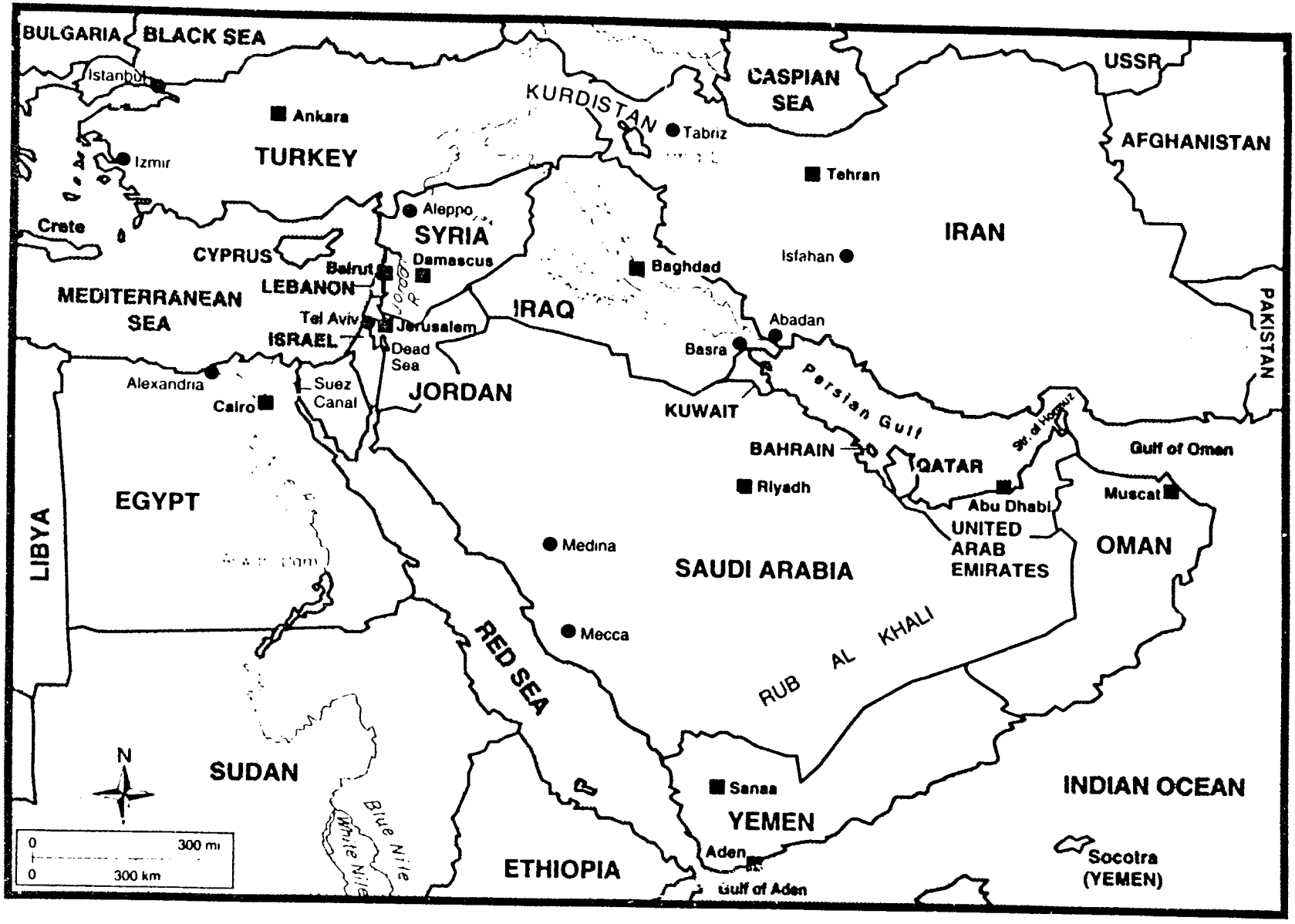
MIDDLE EAST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UNITED ARAB EMIRATES
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Mecca
RED SEA
RUB AL KHALI
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SUDAN
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YEMEN
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Chapter One

Prelude to War

Iraqi President Saddam Hussein's 2 August 1990 invasion of the Emirate of Kuwait did not take the world by storm. Even in the perpetually turbulent Middle East, observers noted his bellicosity towards the tiny nation and wondered both aloud and in print to its end. In late July, with troops poised upon the Iraqi-Kuwaiti border, Hussein specifically charged that Kuwait had violated Iraq's territorial borders by tapping its portion of the Ar Rumaylah (Rumaila) oil field. In compensation for this alleged violation, he demanded $2.6 billion, the relinquishment of Kuwait's claim upon the disputed oil field, and long-term leases on the tiny islands of Bubiya and Warbah. The islands were to provide Hussein with needed seaports in the Persian Gulf.

Hussein also attempted to utilize the 26 July 1990 meeting of OPEC (Oil Producing Exporting Countries) to further his ends. At the meeting, he proposed the OPEC ministers impose more stringent price floors and production ceilings on the member states. His demands rejected, Hussein turned 100,000 of his chemically offensive, war-weary soldiers—of an army estimated at 955,000 and the fourth or fifth largest in the world—against the 20,500 man army of the Emirate. By nightfall of the first day of conflict, the Kuwaiti government fell to Iraq's aggression.

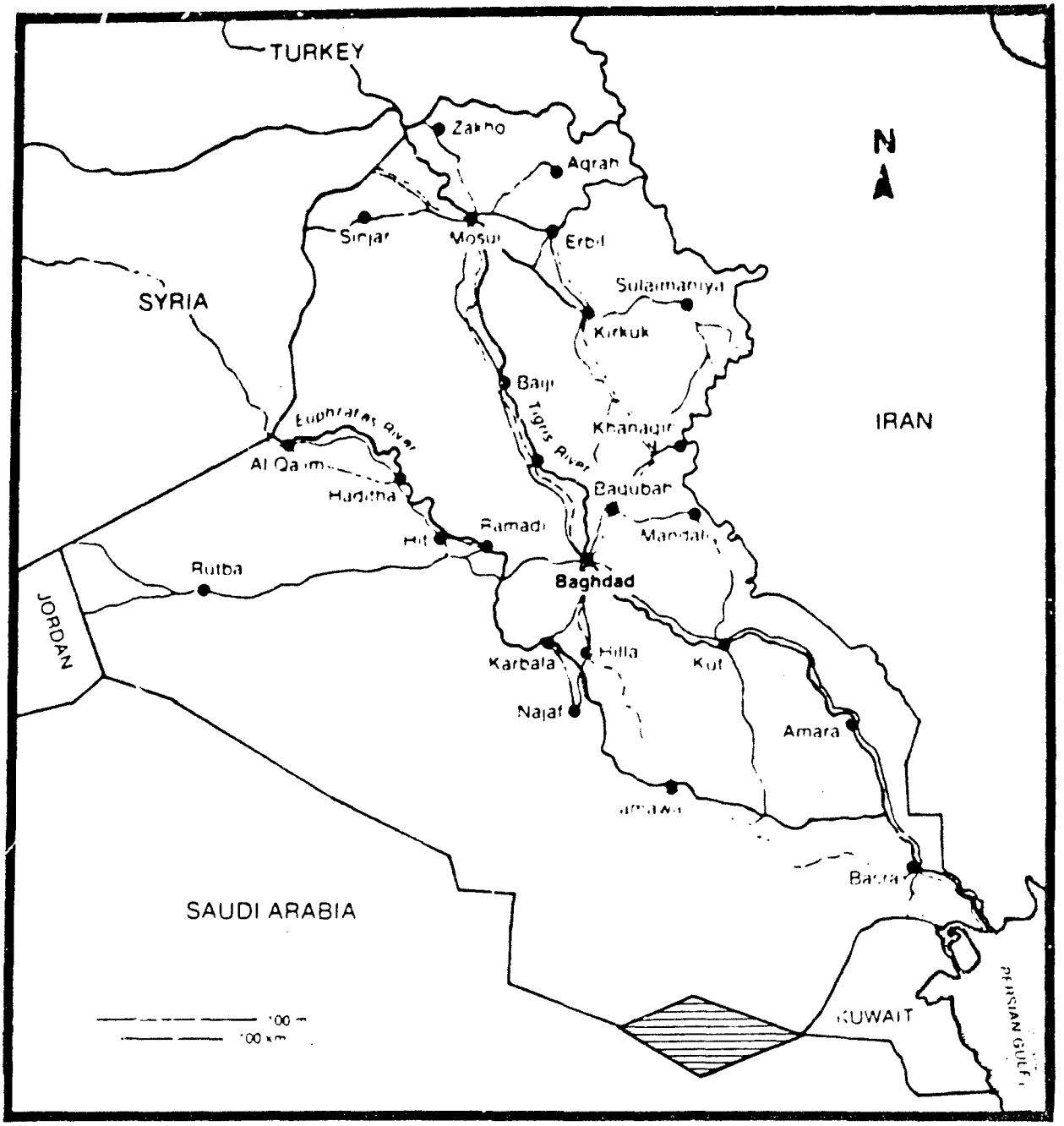
Hussein's motives for the unprovoked attack on the nation of Kuwait do not appear exceedingly complex. In light of his eight-year war with Iran, his thirst for cash was extreme, and by taking control of Kuwait's 97 billion barrel oil reserve and with dreams of further conquests in the region, it could presumably be slaked. Beyond simple economics, however, Hussein's foray into Kuwait has been compared to Benito Mussolini's efforts to claim Ethiopia in the 1930s: territorial aggrandizement thinly veiled by declarations of ethnic unity in the pale light of Baathist ideology. Others have suggested Hussein's motives could be attributed not so much to pan-Arabism, but a distinct anti-Westernism.

If Hussein had presumed that the world would stand back and allow him to simply take Kuwait in the style of Mussolini in Ethiopia, he was mistaken. The Kuwait of 1990 was not the Ethiopia of 1935, and as "JFD" in November 1990's Strategies and Tactics notes, "... Saddam missed a critical bit of information: Ethiopia wasn't in the oil business. Saddam raised a dagger—an economic, political, and military dagger-to the world's petroleum artery." And "he was stupid enough to think he could get away with it."[1]

But Hussein was not destined to "get away with it." On the day of the Iraqi invasion, the United Nations Security Council condemned the attack and demanded that Iraqi forces be immediately and unconditionally withdrawn from Kuwait. It also resolved that Iraq and Kuwait begin negotiations to settle their differences. Hussein chose to defy United Nations Resolution 660, as well as the numerous ones which followed it.

The premeditated invasion of Kuwait, population 2.1 million, by its nine-fold larger, chemically offensive, northern neighbor also attracted the attention of the United States. Upon learning of the invasion, President George Bush immediately ordered additional naval forces to the troubled gulf region. In addition, he issued an embargo of all trade with Iraq and, along with numerous other nations, announced sanctions to both freeze Iraq's assets in the United States and protect Kuwait's financial interests. A tense week followed as the world awaited Hussein's response to not only the United Nations' resolution and the addition of United States naval vessels to the Gulf, but also to the nearly universal outcries against his depredations.

IRAQ



Source: United Nations

Iraqi-Saudi Neutral Zone

Despite the public outcry, Hussein remained determined to continue his efforts. By 6 August 1990, he had arrayed his formidable forces along the Kuwaiti-Saudi Arabian border and appeared poised to continue his Middle Eastern strike. In turn, the United Nations Security Council issued another of its condemnations. With Resolution 661 of 6 August, the U.N. imposed trade and financial sanctions against Iraq and occupied Kuwait. Simultaneously, the United Nations Sanctions Committee came to fruition.

The 6th of August 1990 also bore witness to President Bush's announcement of the deployment of U.S. land, sea, and air forces to the Persian Gulf region in order to deter and defend against an Iraqi invasion of Saudi Arabia. Regardless, just two days following the declaration of deployment issued by President Bush, Hussein escalated world tension by publicly declaring Kuwait to be the 19th province of Iraq.

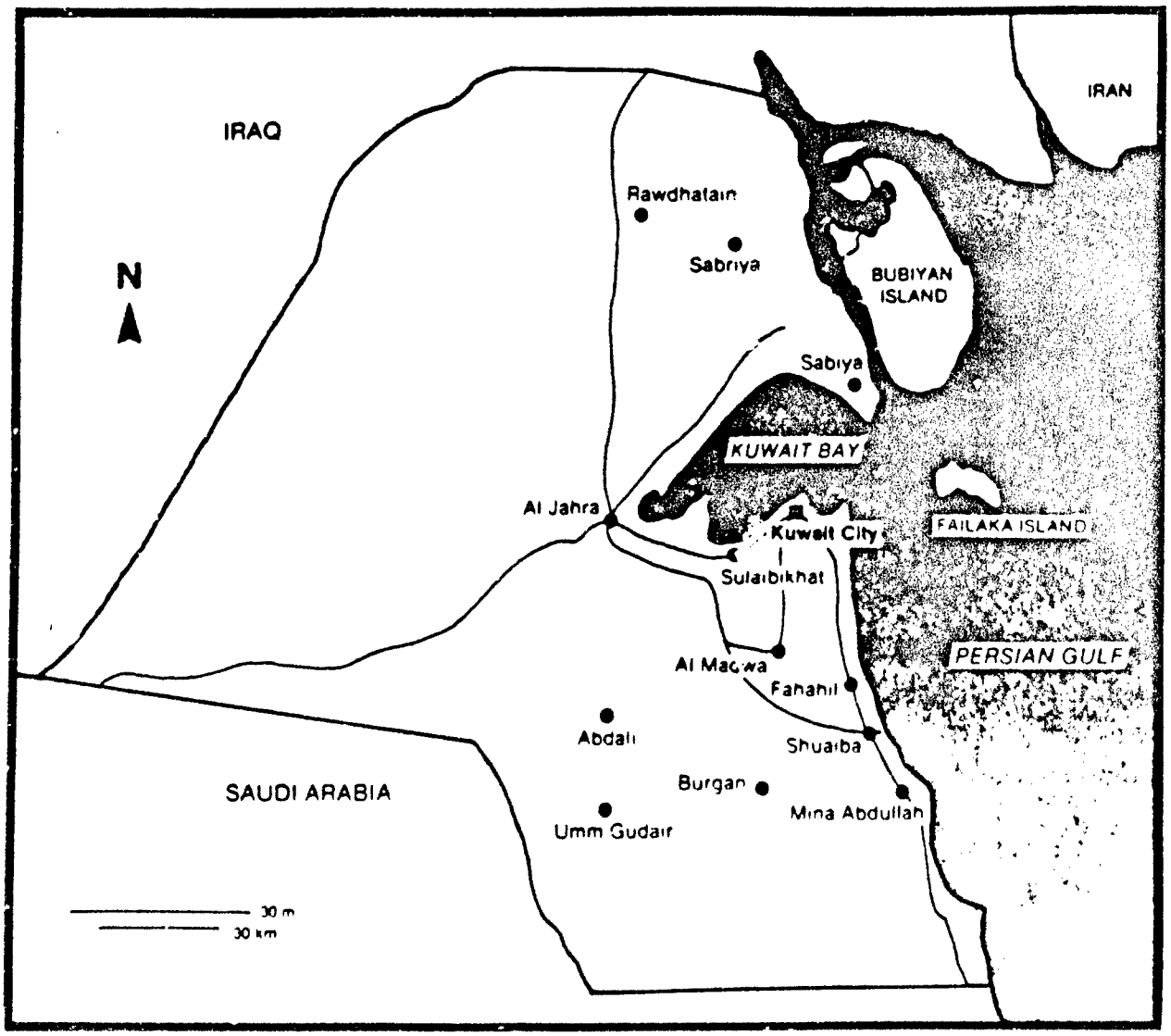
On that same day, President Bush addressed the nation from the floor of the United States House of Representatives to announce the arrival of elements of the 82nd Airborne Division to their defensive positions in Saudi Arabia. Before the nation, President Bush declared that the invasion of Kuwait was much more than "an American problem or a European problem or a Middle Eastern problem." Indeed, he intoned, "it is the world's problem."[2] Noting the world's effort to contain Hussein, President Bush thundered not only that "a puppet regime imposed from the outside" upon Kuwait was unacceptable, but so was "the acquisition of territory by force."[3] Urging that no nation or individual should underestimate the United States determination to confront aggression, President Bush enunciated four simple guiding principles for United States policy. First, the immediate, unconditional, and complete withdrawal of all Iraqi forces from Kuwait must be accomplished. Second, he declared Kuwait's legitimate government must be restored to replace the usurping puppet regime. Third, he repeated this nation's historic commitment, dating from the administration of President Franklin Delano Roosevelt and continuing to his own, to the security and stability of the Persian Gulf. And finally, President Bush noted his determination to protect the lives of American citizens abroad.[4]

In his address to the nation, President Bush continued by noting that such public censure coupled with economic sanctions might not serve to wholly rid Kuwait of Iraq's presence with appropriate dispatch. Indeed, Iraq might continue its efforts at pan-Arabism in the pale of Baathist ideology or, perhaps more correctly, financially motivated territorial aggrandizement into the sovereignty of the Kingdom of Saudi Arabia. The presumption that Iraq's thirst had been slaked and its appetite sated with the taking of Kuwait, President Bush deemed "unwise and unrealistic."[5] Therefore, in response to consultations with Saudi Arabian King Fahd, he had just two days prior deployed United States air and ground forces to the Kingdom. Indeed, the first of these forces arrived in Southwest Asia (SWA) just hours before the president addressed the nation.

The deployment of these troops had not been lightly undertaken. Taken into consideration had been the fact that the sovereign independence of Saudi Arabia was of vital interest to the United States, that the two nations had maintained a lengthy friendship including a security relationship, and that King Fahd had requested a United States presence in the region. Through U.S. commitment coupled with that of the emerging coalition of nations, the preservation of Saudi integrity, as well as the deterrence of further Iraqi aggression, was intended.

President Bush continued that the United States mission in SWA should be considered "wholly defensive."[6] United States forces would "not initiate hostilities, but [would] defend themselves, the Kingdom of Saudi Arabia, and other friends in the Persian Gulf."[7] Seeking to stand by its friends, the United States government also sought a negotiated end to the crisis and consulted with numerous foreign officials, including those of the NATO bloc, the Soviet Union, Turkey, Egypt, and Morocco, among others. Oil producing nations were encouraged to increase production to prevent Iraq's depredations from disrupting

KUWAIT



Source: Embassy of Kuwait

the world's economy unduly. Domestic oil companies were also exhorted not to take advantage of the world's uncertainty by raising prices but rather by illustrating restraint. Furthermore, President Bush urged all Americans to conserve energy.

Concluding his remarks, the president declared:

> Standing up for our principles will not come easy. It may take time and possibly cost a great deal. But we are asking no more of anyone than of the brave young men and women of our armed forces and their families. . .
>
> Standing up for our principles is an American tradition. As it has so many times before it may take time and tremendous effort, but most of all it wil take unity of purpose. As I've witnessed throughout my life in both war and peace, America has never waivered when her purpose is driven by principle. And on this August day, at home and abroad, I know she will do no less.
>
> Thank you, and God bless the United States of America.[8]

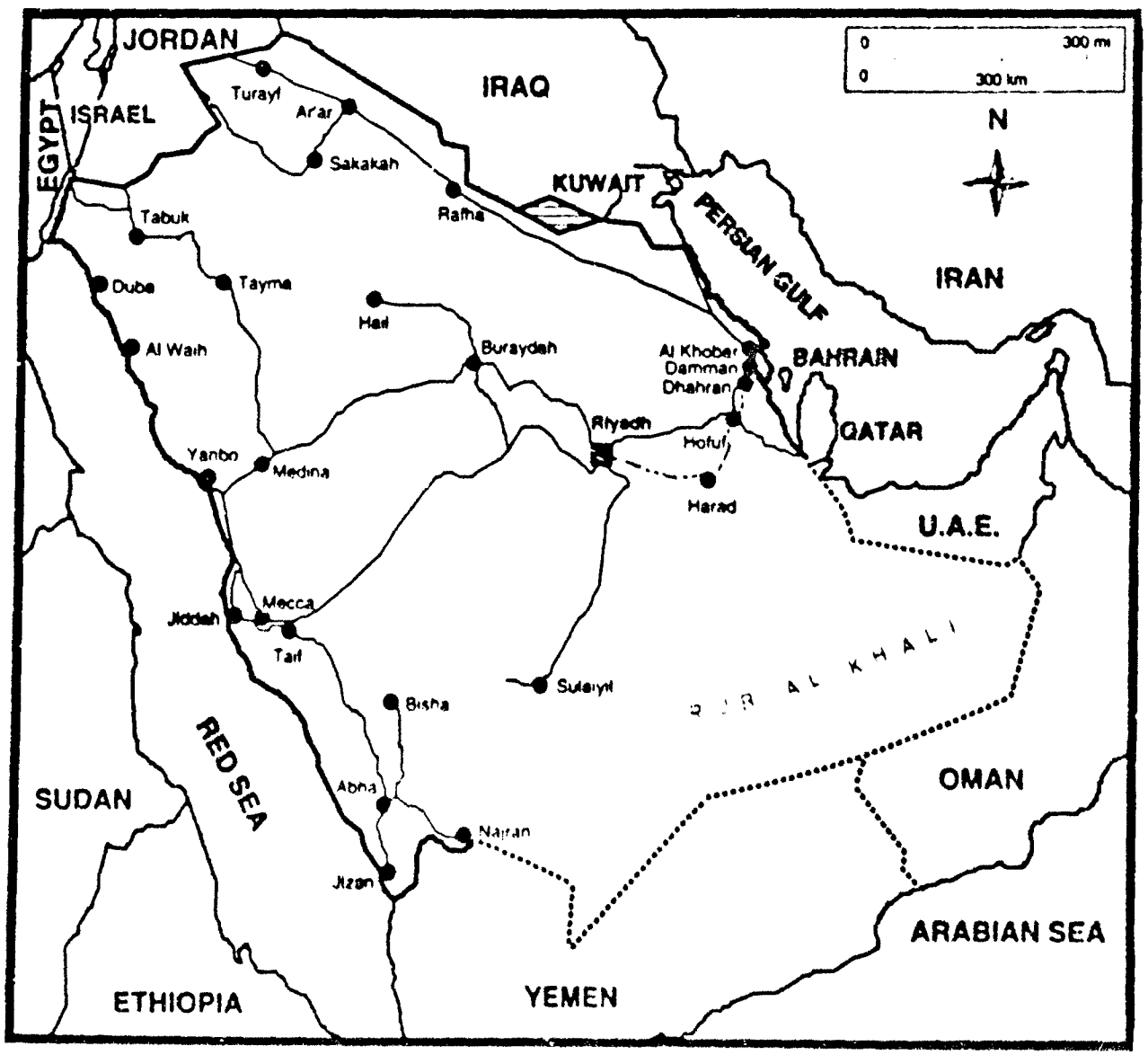
The ensuing efforts by the United States-led, U.N.-authorized coalition force of 37 member nations to unconditionally rid Kuwait of the Iraqi presence by "all necessary means" became known as "Operation Desert Shield," and after the initial day of offensive action, 17 January 1991, as "Operation Desert Storm."[9] Coalition actions were sanctioned by the 11 November 1990 United Nations Security Council Resolution 678 which declared that Iraq must withdraw from Kuwait by 15 January 1991 or face the consequences.

The actual efforts of the United States during these turbulent days have been briefly chronicled by both civilian and military authors. However, the efforts have only, thus far, been broad overviews. What specific commands and individuals contributed to the containment of Saddam Hussein remains to be told. For example, the endeavors of the United States Army Chemical Research, Development and Engineering Center (CRDEC), the United States Army Test and Evaluation Command (TECOM), the United States Army Communication-Electronics Command (CECOM), the United States Army Forces Command (FORSCOM), the Military Traffic Management Command (MTMC), etc., remain to be explicated.

In an effort to shed light on one of the dark corners of America's bright and shining effort in Operations Desert Shield and Desert Storm, this work explores the United States Army Armament, Munitions and Chemical Command. It focuses on not only armaments, munitions, and chemicals, but also on the individuals who endeavored to make such items available to the men and women of the United States armed forces serving in Southwest Asia.

Thus materiel management, communication, transportation, logistics, production, procurement, quality assurance, readiness, personnel, etc., will be examined from an unclassified standpoint.

SAUDI ARABIA



Source: Embassy of Saudi Arabia

Iraqi-Saudi Neutral Zone

NOTES

[1]"JFD", "The 1990 Crisis in the Persian Gulf," Strategies and Tactics, November 1990, p. 6.

[2]Extracted from "President Speaks to Nation: The Deployment of US Armed Forces to Saudi Arabia," Military Review, November 1991, p. 82.

[3]*Ibid.*

[4]*Ibid.*

[5]*Ibid.*

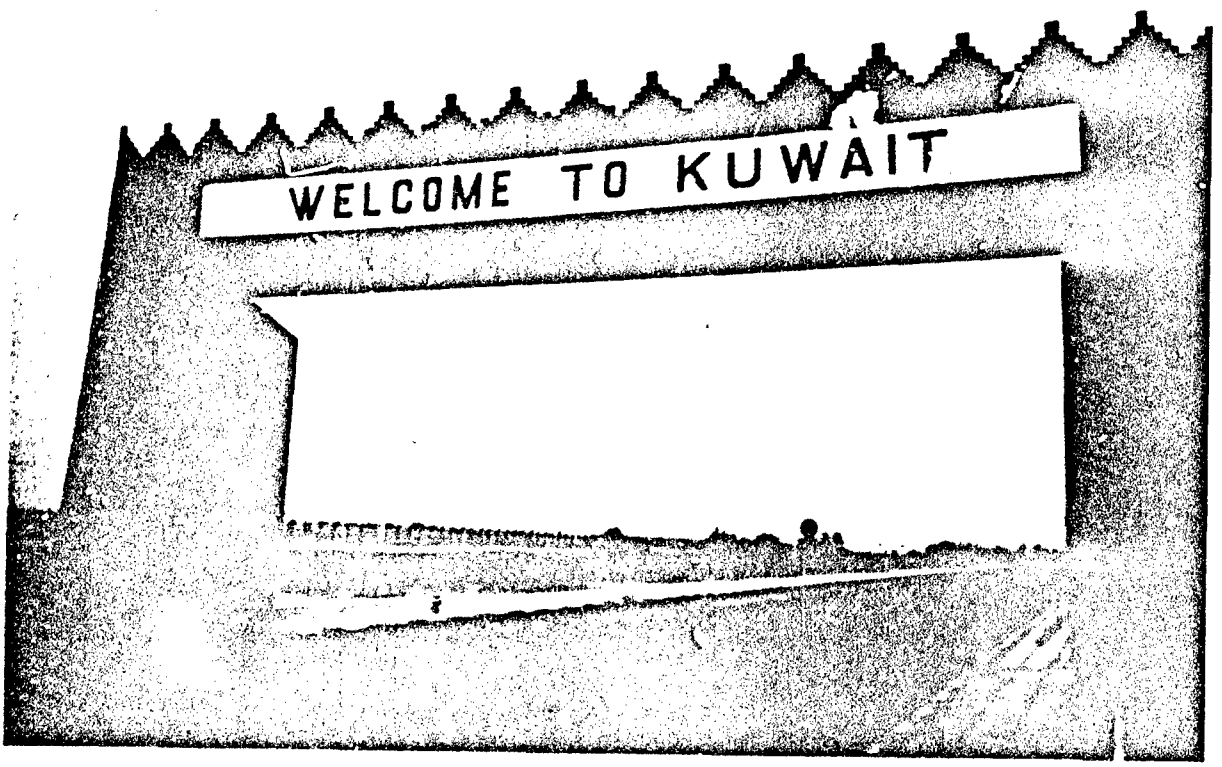
[6]*Ibid.*, 83.

[7]*Ibid.*

[8]*Ibid.*

[9]"UN Resolutions," Military Review, November 1991, p. 79.

Many of AMCCOM's LARs and QASAS passed through this qate, or similar ones, on the Kuwait-Saudi Arabian border eroute to their assignments.



Chapter Two

AMCCOM's Deployment to the Desert

Though the United States and its coalition allies prepared for the air and land phases of the Persian Gulf War for six months, the actual war itself was ephemeral, spanning only a period of seven weeks of military action. However, the AMCCOM role in this war was an expansive one with a myriad of functions endemic to its mission. The command's 17,934 civilian employees and 633 military personnel performed a multiplicity of duties during Operations Desert Shield and Desert Storm, all of which merit comment.

AMCCOM managed research, development, engineering, product assurance, logistics support, industrial preparedness, procurement, production, security assistance, and materiel readiness for assigned systems. The command was also the Single Manager for Conventional Ammunition for the Department of Defense (DOD) and managed the Production Base Modernization Expansion Program. It also maintained a technical base to accomplish the development, procurement, and life cycle support of conventional and nuclear weapons and ammunition. The above mentioned support included infantry, gun-type air defense, surface and aircraft mounted weapons, and chemical weapons systems. AMCCOM was responsible for the maintenance of the ammunition, chemical, and production base during peacetime and mobilization. This, of course, included the sources of production such as ammunition plants and arsenals.[1]

The deployment of AMCCOM personnel, logistical, and materiel support began on 7 August 1990 with the full-time staffing of the Readiness Directorate's Emergency Operations Center (EOC) on a three shift, around the clock basis. AMCCOM was one of the first major subordinate commands (MSC) to implement around the clock coverage. The EOC was a most significant player in the deployment venue; it combined planning, coordinating, reporting, and directing functions in support of Operations Desert Shield and Desert Storm. Staffed mostly by men and women from the Readiness Directorate (RD), the EOC performed a multitude of important duties such as tracking significant activities, reviewing message traffic, responding to message and telephonic taskers, and providing a secure conference room where daily classified briefings took place. Some significant issues addressed at these briefings included the current status of ammunition, weapons, chemical defensive equipment, spare parts, and the transportation of these items. Personnel deployment to Southwest Asia (SWA) of senior command representatives (SCR), logistics assistance representatives (LARs), and quality assurance specialists-ammunition surveillance (QASAS) from AMCCOM were other items examined at the EOC briefings.

The Emergency Operations Center also contained the Worldwide Military Command and Control System (WWMCCS), a teleconference system for classified discussions used by the Joint Chief of Staff (JCS) to communicate with various commands in the DOD. AMCCOM was a diurnal participant in the WWMCCS teleconferences. The activity in the EOC was generally at a pace so frenetic that it necessitated the utilization of people who could work under pressure. These individuals were normally the ones who put out all types of fires and made sure that everything went smoothly or as smoothly as could be expected. Ironically, when the EOC was activated on 7 August 1990, it was done bereft of a standard operating procedure (SOP) which meant that people working in the confines of the EOC had to learn in a hurry and in many instances through what could be termed as on the job training (OJT). What also took place was the augmentation of an office staff with Individual Mobilization Augmentees (IMA), Individual Ready Reservists (IRR), and civilian personnel from other AMCCOM offices. This caused a great deal of time to be spent by in house EOC employees to train these individuals to perform functions for only a short period of time. Energy no doubt could have been better spent utilizing augmentees and detailed personnel in performing work relative to their mission or retaining these individuals in the Operations Center for a longer period of time. There was also the belief that much time, effort, and emotions were expended in deciding

what directorates/offices could afford to detail personnel to work in the EOC, and that the Readiness Directorate should have established staffing requirements for the Operations Center with directorates and other AMCCOM organizations. This caused some ruffled feelings, however the polemic was relatively short lived and the staffing problem was ameliorated to everyone's satisfaction. AMCCOM was fortunate, however, in that most, if not all, EOC employees deftly used common sense and their wits to get them through the difficult or confusing times. Throughout all facets of ODS, individuals such as MAJ Denton G. (Hank) Snow, the EOC's first Army Operations Officer, Mr. Hygie Reynolds, Ph.D., the first chief of the AMCCOM EOC, COL David O. Lindsay, Director of Readiness Directorate, Mr. Alfred (Al) N. Bradley, Deputy Director of Readiness Directorate, Ms. Chris Schumacher and Ms. Delphia Woods, shift leaders, and Mr. Les Wilcox and Mr. Jerry Isom, also shift leaders, and Mr. Ron Hollimon, subsequent chief of the EOC, along with many others kept the EOC functioning smoothly, no matter what time of day. The Emergency Operations Center staff tendered exemplary, dedicated, and thoroughly professional support throughout the entire desert deployment.[2]

The deployment of AMCCOM personnel and assets for Operations Desert Shield and Desert Storm (ODS) was unique in that such a deployment had never been undertaken, though a number of AMCCOM people and assets had been involved in Operation Just Cause in Panama almost a year earlier. Mobilization exercises (MOBEX) had been implemented numerous times and military equipment had been prepositioned in designated areas around the world for contingency purposes as part of DOD policy. However, there had not been the "tolling of the fire bell" until August 1990. Prior to that time, it was business as usual for AMCCOM and its attendant units, though in house a great deal of perturbation was taking place due to a forthcoming reduction in force (RIF) of AMCCOM personnel at Rock Island Arsenal due to severe fiscal constraints. Saddam Hussein's invasion of Kuwait was enough of a diversion however to attenuate, at least somewhat, the ominous specter of a RIF. Obviously, there were now more pressing matters, one of which was the preparation for an ostensible conflict in the Middle East.

President George Bush's pronouncement of Operation Desert Shield and concomitant call up of American combat and support units along with support personnel served notice that the command and subordinate organizations would have to go on an around the clock staffing. In essence, it would not be business as usual. It was almost immediately after the notification of deployment that AMCCOM directorates such as Logistics, Procurement and Production, and Maintenance and their subordinate units went on a 24-hour a day work day. This entailed approximately 17,000 employees at 36 locations such as army ammunition plants (AAP) to be on a wartime footing. The two research and development centers on the East Coast, Edgewood and Picatinny Arsenals, were also included in the deployment, as were Pine Bluff, Watervliet, and Rock Island Arsenals—all of which made significant contributions. Certainly, this was no easy task, but eventually all the significant organizations and personnel were duly notified. As with any massive deployment, particularly this one for AMCCOM, there was initially a great deal of bewilderment and frustration getting people in place, policies and missions defined, and the deployment implemented. After all, many AMCCOM employees had not ever been involved in a deployment, and had no idea as what was expected from them in such an action. However, it was of a relatively short duration before things began happening. AMCCOM employees began receiving definitive guidance on their mission, and were able to begin working to meet the needs of the customer.[3]

Initially, decision making and prioritization appeared to be in conflict with one another. Questions regarding which AMCCOM employees would be deployed and to where were difficult to initially answer. As with most people, AMCCOM personnel were no less inclined to believe their individual mission and/or job was of the ultimate importance. Every so often, the desire to serve got in the way of realistically assessing and/or performing the mission(s). If nothing else, the ODS deployment illustrated the presence

of human frailties, yet simultaneously, the quantitative and qualitative strengths and forebearance of the AMCCOM men and women during ODS. Everyone from the AMCCOM Commander on down unconsciously and unobtrusively became involved in a crash course in ergonomics—the study of people working in environs or situations somewhat unusual or antithetical to their normal work milieu. It was an interesting revelation. People found they could challenge themselves to go the proverbial extra mile and accomplish significant activities. It must also be remembered however that the United States, since the inception of the Cold War, had militarily and psychologically prepared to fight the Soviet Union and the Warsaw Pact on the plains of Central Europe. The United States had done its homework on how to fight a war in Europe, which it believed would be fought according to the edicts of the Airland Battle Doctrine. Tactically, strategically, and logistically it was prepared to fight a European scenario war. However, it was not prepared to fight what might possibly have been a protracted war in the desert. AMCCOM was going to have to take somewhat of a different approach to providing support for the American and coalition forces.[4]

AMCCOM's preparation for Operation Desert Storm was not as smoothly organized as one might have desired. For one thing, though not readily admitted, it took time to get a feel for what was happening throughout the government, DOD, DA (Department of the Army), and AMC (United States Army Materiel Command). Not to suffer from impetuosity or improper decision making in regard to its deployment role, the AMCCOM management team, comprised of military and civilian leaders, learned to use task organizations. These organizations served to give participants the opportunity to identify means and methodology necessary to make the AMCCOM mission and functions work. The reason for task organizations was that there was not really a viable Operation Plan (OPLAN) for Southwest Asia that could have been taken off the shelf, so to speak, and used. The Department of Defense had implemented an OPLAN for the Middle East during the 1960s and 1970s predicated upon a possible Soviet incursion against Iran, which during that time period had been a close ally of the United States. That Operation Plan however was no longer feasible. The United States had maintained prepositioned stores of military equipment in Southwest Asia, particularly on three ships off of Diego Garcia in the Indian Ocean. The maintenance of these military stores, which included ammunition, had been in effect since 1981. However, on the grounds of appearing to be redundant, it must be remembered that American political, strategic, and tactical interests lay in Europe, and had done so for four decades. This also meant that before August 1990, AMCCOM's support mission had been focused primarily in USAREUR (United States Army, Europe) and on a smaller scale in Korea, while the likelihood of military activity in SWA, if it did happen, was thought to be predicated upon a "brushfire war" scenario employing relatively few troops and a limited amount of equipment. Few AMCCOM personnel had spent much, if any, time in Southwest Asia; so it was readily agreed by the powers to be that deployment of support personnel and mission functions to SWA would not be easy.[5]

AMCCOM, as other major subordinate commands (MSC), received ongoing directives and guidance from higher headquarters on a daily basis throughout ODS. The command, itself, had to promulgate a game plan regarding deployment of personnel, materiel, and ammunition into the theater of operations. Established deployment procedures that could be used were used and expanded upon. However, the ODS deployment would serve to be somewhat different since it was to an area of the world, which though having had exercises such as Bright Star (in Egypt), there had never been the massive deployment of United States military personnel, supporting civilians, materiel, and ammunition. Men and women throughout the AMCCOM community found, if not by choice but by edict, that it was not to be very long before they would know where Iraq, Saudi Arabia, Kuwait, and other Arab nations were along with their principal cities. The deployment made many people within the command who had a parochial view of life and their jobs realize in short order that they and what they did for a living were to have a direct effect upon the success of ODS in more ways than one. As previously mentioned, at the onset of ODS, the command had to deal with a reduction in force (RIF), which to say the least had a debilitating effect on morale. However, though a

number of command employees were to lose their positions, these men and women put aside their own anxieties and bewilderment, and worked with a vigor and determination until now not seen or expected. In late September and early October 1990, the demands brought about by Operation Desert Shield provided a buy back of 132 of the positions identified to be eliminated through the RIF. Besides buying back the above positions, Rock Island Arsenal's Office of Civilian Personnel (CPO) administered the hiring of 1,035 temporary employees for ODS, and the command activated 141 reservists who served in various capacities during the Gulf War. It was not only the AMCCOM men and women at Rock Island Arsenal who acquitted themselves masterfully in providing support to ODS; it was also other individuals who deployed from other AMCCOM units to CONUS (continental United States) areas or to SWA who were significant contributors to the success in the Gulf War.[6]

Over two hundred military and civilian employees within the hegemony of AMCCOM deployed to CONUS facilities and/or Southwest Asia during the period from 7 August 1990 to 1 March 1991. This included 17 individuals from the Rock Island Arsenal element of the command. The composition of AMCCOM personnel deployed to SWA included personnel from Pine Bluff Arsenal, logistics assistance representatives (LARs), some of whom were deployed with their units; other LARs deployed from CONUS, and some from Europe and Korea. Deployed also were quality assurance specialists-ammunition surveillance (QASAS) who served in CONUS, Europe, and in Korea. Additional individuals were deployed from ARDEC (United States Army Armament Research, Development and Engineering Center) and CRDEC (United States Chemical Research, Development and Engineering Center) during the above-mentioned time period.

As with any major deployment, the assigning and movement of personnel was not without its shortfalls and frustrations. The command had done its homework as far as written preparation for such deployment of individuals; however, it had to deal with the fact communication between and among both indigenous AMCCOM units and extraneous DA units was at times obtuse and vacillating, especially at the onset of ODS. One reason for this was the suddenness of the initiation of the deployment. President Bush's response to Saddam Hussein's invasion of Kuwait and subsequent call for mobilization was alacritous, which did not provide much time to prepare for effective deployment of personnel. AMCCOM did however accomplish sending its first senior command representative (SCR) to Southwest Asia in August 1990 as part of AMC Forward. The senior command representative served as the liaison between the command and higher headquarters in the theater, and also had the function as the facilitator for LARs in SWA. Mr. Terry Spurrier, an AMCCOM LAR, was the first SCR, and served in Saudi Arabia from 23 August 1990 until 7 November 1990; he was replaced by MAJ Denton Snow of the AMCCOM Readiness Directorate. MAJ Snow represented the command in SWA from 28 October 1990 until 24 February 1991. COL David O. Lindsay, Chief of Readiness Directorate then became the AMCCOM SCR on 28 February 1991 and was the SCR until his return stateside on 7 June 1991. COL Lindsay had a previous tour of duty in Saudi Arabia having served there from 1980 to 1983, so he knew the region and its people well.[7]

Along with the previously mentioned LARs, a fairly large contingent of QASAS was deployed during ODS. The QASAS were sent to CONUS United States Army Forces Command (FORSCOM) units and ports such as MOTSU (Military Ocean Terminal-Sunny Point), Concord, Houston, Savannah, and Jacksonville to assist with the movement and loading of conventional ammunition destined for Southwest Asia, and to ensure the safety and quality of ammunition being moved. Other QASAS were in USAREUR assisting the 7th Corps with its deployment to Southwest Asia, and, of course, QASAS were sent to SWA to move the ammunition from the ports to ammunition supply points (ASP) in the interior of Saudi Arabia and near the Saudi-Kuwaiti border. QASAS also dealt with problems such as climatological variants affecting ammunition, its movement, and storage. Other AMCCOM employees; such as, gas mask repair personnel from Pine Bluff Arsenal, were sent to the gulf area along with other civilians and military from

ARDEC and CRDEC. A most significant adjunct of the ODS deployment was the command support given to not only the families of AMCCOM personnel who deployed to SWA, but also to the families of military personnel from the area who were sent to Saudi Arabia. The Rock Island Arsenal Commander, COL Richard W. Bregard, and the AMCCOM Chaplain, LTC Robert L. Pearson, along with Mrs. Marva Gaten, an employee of the Army Community Services (ACS), provided the nucleus of what became known as the Waiting Families Support Group. The group provided ongoing support to the friends, families, and loved ones of the men and women deployed to SWA from the Quad Cities and surrounding area on a 24-hour basis, and throughout the duration of ODS, and into the early stages of the retrograde period. The Waiting Families Support Group personified the highest ideals, the greatest compassion and concern, and an unparalleled commitment of service and dedication to the loved ones of those who served in SWA.[8]

Deployment of personnel is never an easy task, particularly moving individuals a distance of 8,000 miles to a country and culture of which little is known. AMCCOM found out only too soon that deployment was no easy endeavor, and was hard pressed to work this issue. Personnel exigencies were an ongoing issue. LARs and QASAS logically should have been in country or on station to provide the logistical and ammunition-related support needed. However, it was not unusual for AMCCOM personnel to be delayed in reaching their assignments, particularly as the mobilization became expanded after the first of November 1990.

It became apparent that the AMC War Plan and the associated Mobilization and Operations Planning and Execution System (MOPES) were not responsive or applicable to ODS. It appeared the industrial base was not fully mobilized to support ODS because AMC tended to maintain a global look as opposed to dealing with a contemporary regional crisis. This meant that AMC had to institute a more definitive MOPES which could and would be disseminated to the MSCs. This was slow to happen. An example, of this was the delay in the movement of essential civilian personnel such as LARs, QASAS, and others which was at times vexatious, though fortunately not having an adverse impact on the final outcome of ODS. An example of a rather irksome delay was when some AMCCOM civilian personnel deploying to SWA had to fly to Washington, D.C., in order to get Saudi visas instead of Saudi officials being at ports or stations of debarkation to process passports or visas. Fortunately this problem was in large measure eventually rectified.[9]

AMCCOM dealt with other personnel deployment problems during ODS, some of which begged clarification or at least satisfactory answers. A cardinal example of this was the nebulous policy known as the emergency essential agreement. Headquarters, Department of the Army stated that all individuals deployed to Saudi Arabia were considered to be emergency essential and had to sign the emergency essential agreement. Conversely, HQ, AMC said that persons deployed to SWA were to be assigned there on a voluntary basis and therefore did not have to sign the above agreement. AMCCOM's policy however was the same as HQDA. What happened subsequently was significant confusion, inconsistency, and consternation regarding whose policy should prevail. The emergency essential agreement ensured that the DA civilian was fully aware of the army's expectations regarding his or her deportment, job performance, or whether or not he or she could be assigned to a work area contiguous to a hostile zone or in a hostile zone itself. The Department of Army ostensibly waivered however because it said in a message that all people deployed to Saudi Arabia, no matter if they had signed an emergency essential agreement or had volunteered or were detailed, were required to do the army's bidding. This meant an army commander could require a deployed individual to perform duties essential to the military mission, no matter where or when. HQDA and AMC were unable to resolve to anyone's satisfaction, the designation of "emergency essential" vis-a-vis "volunteers." Fortunately, this pervasive problem had no discernible impact upon AMCCOM's or AMC's mission requirements.[10]

Though AMCCOM was quite successful in the deployment of personnel to Southwest Asia during ODS, it learned some invaluable lessons. For example, the AMCCOM Emergency Operation Center warranted pre-arranged planning concerning staffing during mobilization. The command also learned that as with other MSCs, it needs definitive guidance from higher headquarters regarding the deployment of individuals to a battle area or theater. In future deployments, the command should maintain more stringent supervision at the home station of its preparation for deployment of its personnel. Medical examinations and issuance of shots, issuance of proper clothing and equipment including chemical defensive equipment, updating of personnel and pay records, and movement of personnel to debarkation points needed closer monitoring during ODS. Another significant lesson learned was that LARs and QASAS required more definitive support in areas of transportation, billeting, and security. Also, guidance concerning the issuance of weapons to civilians warranted clarification. In essence, the LARs and QASAS demanded a support package which included accessibility to military vehicles, weapons, work tools and accessories, and tents and toiletries. This was lacking during Desert Storm.

Though AMCCOM had to deal with what may have seemed to have been an inordinate number of problems in regard to deployment of its personnel to SWA, there were noteworthy accomplishments. First, in spite of the previously mentioned problems and/or concerns, AMCCOM successfully deployed over 200 people bereft of any opportunity to rehearse or plan in depth for the movement of personnel. Second, the command and its subordinate units strove in a most determined fashion to work through or around problems. This did not necessarily mean everything was resolved; but what was not resolved or ameliorated, was at least duly noted from observations. Third, AMCCOM personnel in spite of dealing with problems associated with a first time tactical deployment, still performed magnificently in theater throughout Operations Desert Shield and Desert Storm.

As with all wars, this war entailed the providing of materiel and ammunition to combatants, in this instance, this being the American fighting men and women involved in Operations Desert Shield and Desert Storm. AMCCOM had not ever undertaken such a deployment of ammunition and materiel as seen during ODS. It would go down in the annals of contemporary military history as one of the truly great logistical endeavors. The command's logistical role and support in ODS was most significant just in the fact AMCCOM moved much equipment and ammunition to SWA, which will be covered later in this unit. The organization responsible for the deployment of materiel and ammunition was the Deputy for Logistics Readiness under the most capable leadership of Mr. Perry C. Stewart.

To be brought out in another part of the manuscript is the fact the AMCCOM Transportation and Traffic Management Directorate was tasked to be the DOD single manager for munitions movement, planning, and execution, and was assisted by the Defense Ammunition Directorate. This meant AMCCOM had the responsibility for providing logistical munitions support to all branches of the armed forces. This tasking also included the loading, assembling, and packing (LAP) at the army ammunition plants (AAPs) of all conventional munitions, including bombs, and the Cruise and Tomahawk missiles. The Materiel Management Directorate also had a most important mission in Operations Desert Shield and Desert Storm which will subsequently be discussed.

From the onset of ODS, the men and women of the Materiel Management Directorate became responsible for supplying Class II (individual equipment), Class VII (major items), and Class IX (repair parts) along with other materiel to its customers in SWA. The deployment of ammunition and materiel was one that involved the men and women of these directorates working 24-hours a day, 7 days a week to meet the needs of the military involved in ODS.[11]

First to be discussed will be the role of the Materiel Management Directorate and its involvement in the deployment of materiel goods and services to its customers in Southwest Asia. The first action taken by the directorate upon notification of U.S. troop deployment was to provide for 24-hour staffing, in order to quickly respond to any exigency. Endemic to this activity was the establishment of an ongoing communication system replete with telephones and Datafax service to handle customer requisitions. The Management Directorate also managed 2,000 major items, and during ODS, had the dubious task of handling 20,000 pieces of correspondence concerning the deployment of much needed items to Southwest Asia. By the time hostilities on the ground had ended in Kuwait and Iraq on 28 February 1991, the directorate had successfully processed over 508,000 requisitions.

It also was responsible for the fielding of over 317,000 M17 gas masks and over 25,000 M25A1 tank gas masks to the soldiers in ODS. No commercial mail order house likely had to deal with as much materiel and correspondence as did AMCCOM between the middle of August 1990 and the first of March 1991. Combat Support Services (CSS) were also provided to SWA as part of the logistical deployment to Saudi Arabia, because most logisticians believed that such support should be in country or in theater with the arrival of the first troops or shortly thereafter. Realistically, such units often did not get into theatre until several months had gone by since the presidential call up.[12]

Mr. Deane L. Warnecke, ably assisted by Mr. Roger Reinitz, directed the activities of the Materiel Management Directorate during Operations Desert Shield and Desert Storm. With over thirty years of professional experience as a logistician and manager, Mr. Warnecke parlayed successfully the talents and enthusiasm of the over 600 men and women in his organization to go the extra mile under circumstances in which few of them had worked. These men and women, who worked ever unobtrusively, as did their cohorts in the Transportation Directorate, during ODS were going to have to overcome adversity; be subject to frustration and failure; and to use their corporate and individual skills to meet the needs of American warfighters in SWA.

One of the initial activities undertaken by the Materiel Management Directorate was to establish a prioritization of customer requirements. This certainly was not easy because units tended to presuppose what they perceived to be exigencies were of paramount importance and thusly should be met post haste. It seemed everybody needed something, be it an individual item, a major item, or a repair part. The command learned tactical units in SWA believed basic loads—be it ammunition or materiel—were not sufficient and expected that war stockage distributed to them should be bountiful, if not perpetual. This mindset caused a myriad of problems for the command and the Materiel Management Directorate. The directorate, using guidance both from the command and higher headquarters, and coupled with its visceral reaction to customer needs created a systemic method of prioritizing customer requirements. Hence, some unsatisfied customers became ever apparent. Some of the earliest units to deploy to SWA did so without their total TO&E (Table of Organization and Equipment) support. Conversely, other units deployed believing they had all of their materiel needs accounted for, only to find out once in country, such was not the case. Units would have to submit requisitions for equipment and parts as soon as possible. These two problems were to be be somewhat portentous of what was going to happen to the command's efforts to fill requisitions. Significant issues were the identification of those deploying units, timeframe of deployment, and organizational relationships. The primary source to accomplish this was the Time-Phased Force Deployment Data (TPFDD). Only one person in AMCCOM was familiar with this system, so access to it was certainly limited., In addition, the TPFDD had to be extracted from the Worldwide Military Command and Control System (WWMCCS), which also was predicated upon limited accessibility. The TPFDD was programmed to normally examine the sequencing of units into a theater or country to support an operation. By the second day of ODS, it became apparent that the existing OPLAN was not feasible and would have to be replaced. Yet, units being deployed had to be identified, along with, their materiel needs. What

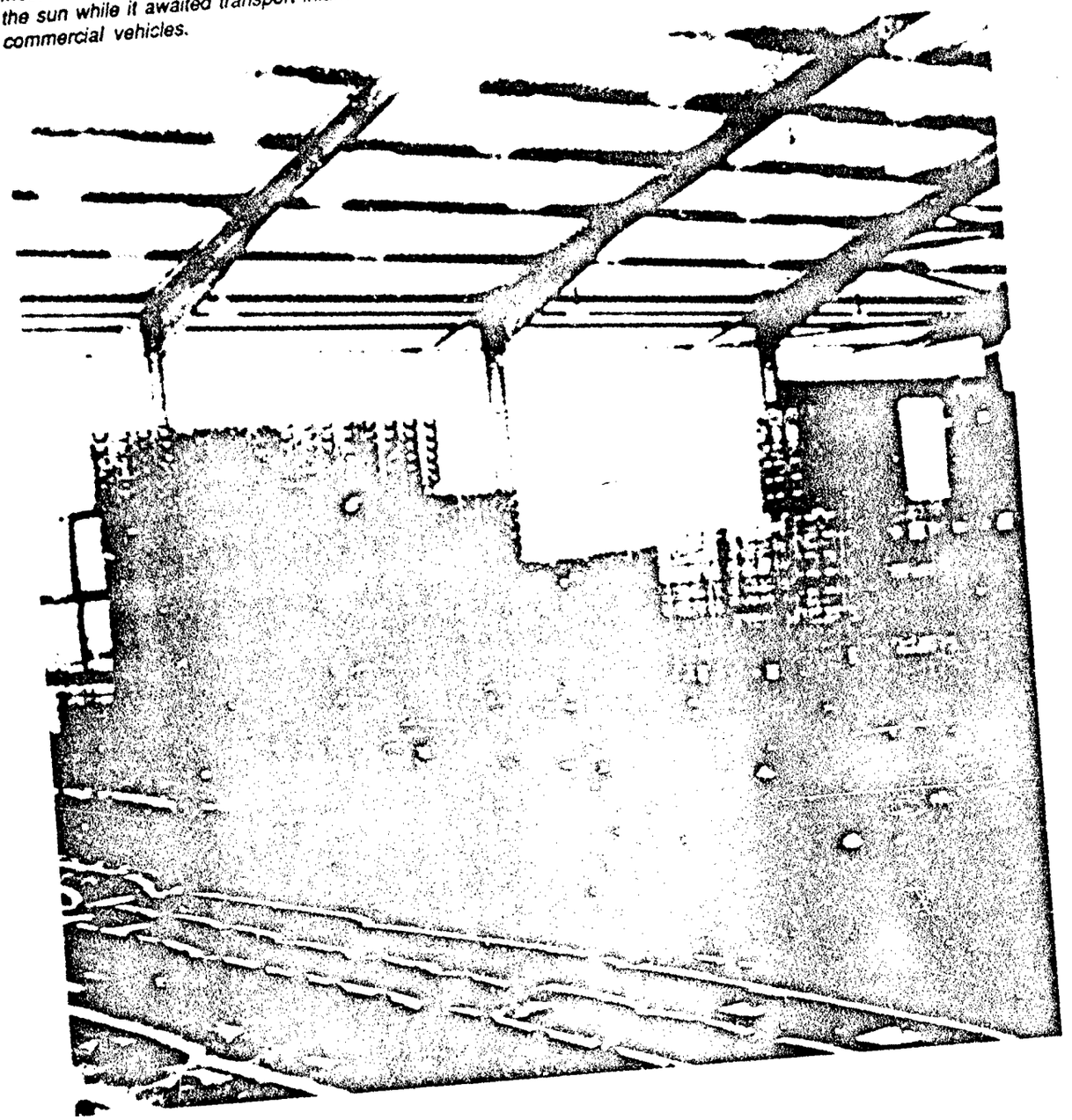
AMCCOM finally did to rectify this problem was to better staff the TPFFD system so that deploying units could be identified more rapidly.[13]

The American military buildup and preparation for Operations Desert Shield and Desert Storm was one which defied description. It incorporated the best of high technology in weapons and weapons delivery systems, the best trained military fighting force in the world, and the best military logistical system ever seen. The American military establishment decided in no small measure to guarantee that when and if hostilities took place in Southwest Asia [Kuwait and Iraq], America and its coalition allies would be totally prepared for war. For seven months, United States forces and coalition units trained relentlessly to prepare for war with Saddam Hussein's purportedly invincible military forces. This meant that in the materiel support arena, the Department of Defense would ensure an never-ending supply pipeline into Saudi Arabia. No American tactical unit was to go into battle unprepared and unsupplied. AMCCOM was tasked to make sure it did its role to guarantee that materiel such as Class II, VII, and IX items would get to the warfighting units prior to and during any hostile engagement with the minions of Saddam Hussein.

Central to the providing of materiel to units and organizations in SWA by AMCCOM Materiel Management Directorate employees was the presence and/or establishment of a viable requisitioning system. At the onset of ODS, AMCCOM believed its existing requisitioning system was mission capable, and would in all likelihood be able to meet most, if not all, demands placed upon it. However, during the early stages of ODS, the existing retail supply system, the Standard Army Intermediate Level Supply (SAILS) system was being replaced by the Standard Army Retail Supply System (SARSS). Normally, this transitioning or upgrading would have caused few if any problems. The transition period of the systems, however, was not fortuitous. There was not sufficient time to correct deficiencies or problems relative to the SARSS. As a result, accountability and visibility of assets received in theater was almost nonexistent; therefore, materiel was taken by units on a first come basis. What this meant was that the supply system, including the requisitioning capability, was inundated because of the difficulty by the command to govern the actions of requesting units. Some initially deployed units issued multiple requisitions for materiel because they either did not receive their original order, as the result of not having gone through the proper channels, or simply ordered more than they needed. The demands of mobilization brought about unusual actions and reactions by both the Materiel Management Directorate and the user. In most instances, required and/or requested materiel was available, from depots on up through the system. However, the imprecision of the requisitioning system, served to challenge AMCCOM as it had not been challenged before. For example, customers in SWA bypassed their supply support activities and went directly to the National Inventory Control Point (NICP) by datafax or telephone to order excessive amounts of materiel. [The NICP was the supply management function for all weapons and chemical defensive equipment for the army and other branches of the service]. AMCCOM attempted to get the customers to use the requisitioning system, but often to little avail. Fictitious non-mission capable supply (NMCS) requisitions with 02 priority codes [the highest priority within the supply and transportation system] were sometimes sent to the NICP thus diverting assets from valid NMCS requirements and flooding the distribution and transportation systems. Because of the materiel demands placed upon the requisitioning system, AMCCOM was hard pressed to enforce strict supply discipline.[14]

The Gulf War brought about other problems concerning the deployment of materiel to Southwest Asia. Materiel often became lost upon arrival in Saudi Arabia, either at the port or at an airport. Materiel misplaced or missing purportedly got lost in what became known as the "black hole." This was the alleged never-never land of misplaced equipment. It was the apocryphal bottomless pit or abyss where all lost and/or unclaimed materiel ended, hence, thought never to be retrieved. In actuality, what often happen was that requisitioned materiel arrived at its destination unbeknownst to the receiving unit; and when not claimed, was moved to another area for storage or simply taken by another unit. Much of the impediment of supplies

Most ammunition at the port was temporarily stored in covered, transient shelters to protect it from the effects of the sun while it awaited transport inland. Port congestion occasionally resulted from the shortage of available commercial vehicles.



and equipment to SWA was as the result of the absence of a definitive supply infrastructure in place to receive and process materiel. What this did was to cause supply personnel in country difficulty in identifying and locating materiel which had arrived at either the seaports or airports. In some instances, materiel was diverted to customers who had not requisitioned it; and who upon opening the packing, and seeing it was not what they ordered, would simply keep it because it was easier to do this than to repack and return it. Also, customers who knew their orders were somewhere in country, in lieu of looking for their lost stocks, would summarily submit new requisitions for the same equipment because it was more expedient than attempting to find the original shipment. This quandary subsequently inflated the demand data and deprived customers of timely support. As an example, command representatives would often go to where they believed their AMCCOM-requisitioned materiel was only to find it was not there, and realize the likelihood was that someone else had it. Another iteration of the "black hole" scenario was when shipments were sent to SWA prior to the establishment of an operational receiving activity. The 321st Materiel Management Center (MMC), a reserve unit from the southeastern part of the United States, and under the hegemony of the XVIII Airborne Corps, arrived in Saudi Arabia in October 1990, several months after tons of unaccounted equipment had already arrived. The 321st began its automated bookkeeping system and attempted to eliminate the backlog of materiel accountability already accrued as the result of the buildup. Unfortunately, this was never accomplished, and AMCCOM kept filling requisitions for its customers while possibly not being apprised of the lack of combat supply services support in SWA. The 800th MMC, which represented the VII Corps, encountered many of the same problems which beset the 321st, though somewhat to a lesser degree because it did not need to requisition as much materiel. This was because the VII Corps was able to draw down a large amount of its prepositioned materiel in USAEUR and bring it to SWA. Meanwhile, shipments moved not only by ship, but also by air, which of course was a faster means of transportation. Because of the under-utilized bookkeeping process in SWA, materiel then underwent a fate similar to that of losing luggage as the result of traveling on an airliner. The passenger arrives at one destination; the luggage at another. This is similar to what took place in SWA. Units arrived at one place, the requisitioned equipment arrived at the same place earlier by air and was moved, or arrived at a different destination. AMCCOM also found that tracing shipments moved by air was difficult. Once the equipment was in air force transportation channels, visibility was lost, coupled with the fact that there was an obvious unmanageable backlog of supplies and equipment at Dover Air Force Base, DE, awaiting shipment. The air force, in order to mitigate the effects of the backlog, fragmented army shipments to conform to space available/air pallet configuration. This further reduced any audit trail of goods moving by air. Another problem relating to this dilemma was the air force numbering shipments by pallets as opposed to the army's use of a different tracking system known as the DOD Activity Address Code (DODAC).[15]

The Materiel Management Directorate strove assiduously to meet all of its customers' needs during ODS as it was normally able to do in a peace time milieu. This however was not to be the case as the frenetic military activities along with the diplomatic perturbations seemingly precluded orderly, consistent logistical support. As previously mentioned, customers in SWA, for whatever reason, attempted to bypass the requisitioning system in order to obtain what stockage they believed they warranted or needed. Written or verbal justification for additional materiel by the customer seemingly was out of the question. There were two categories of multiple requisitions addressed by the Materiel Management Directorate. In the first category were attempts to bypass maximum quantity checks and/or justify stockage by meeting a number of demands per timeframe criteria. This was often apparent because of the sequential document numbers. The second category was less obvious and more inadvertent than the first. The retail supply system contained checks that forwarded and subsequently canceled customers' requisitions if they did not have a requirement loaded into the system. What happened was that AMCCOM received and processed a requisition on one day and received a cancellation the next day. Upon receipt of the AMCCOM cancellation, customers summarily thought the MSC was cancelling so they simply resubmitted their

requisitions. Duplication of orders became commonplace, total confusion and frustration sometimes reigned along with a breakdown in both the requisition and delivery systems. AMCCOM became aware of the problem, and in order to rectify what seemed to be an interminable situation, agreed to accept and process all requisitions. A number of customers continued to resubmit requisitions with inflated demands. All of this lent itself to the situation of requisitioned materiel being delivered to Saudi Arabian seaports or airports while customers who requested the supplies and equipment were still sending requisitions to AMCCOM for the materiel they were already receiving. As one AMCCOM employee who spent time in SWA during ODS said rather wryly concerning the plethora of requisitions submitted and equipment in country, "No one went to war broke." The change in the force structure in November 1990 by the inclusion of the VII Corps from USAREUR into SWA caused the command to implement a materiel bypass system to expedite orders for major parts items which did reduce the above-mentioned backlog.[16]

What happened as described in the above paragraph indicated that the requisitioning system was not totally on track during Operations Desert Shield and Desert Storm. The culpability concerning the problems attendant with the above system lay with no one. What apparently happened was that this system became overworked and over extended because of the demands placed upon it. The requirements the customer placed on the NICP were predicated in large measure by the belief that the unpredictability of events in Southwest Asia dictated being totally prepared for any tactical or strategic contingency, ergo, the proclivity to overreact and thus ask for more equipment than actually needed.

The Materiel Management Directorate and the customer in SWA were having to deal with the fact that ongoing communications between CONUS and Southwest Asia often left much to be desired. This meant rectification of problems concerning the submission of requisitions and the receiving of materiel was often difficult, frustrating, and taxed the patience of everybody concerned. It often took too much time to use the pipeline or system the way it should have been used. Units then out of frustration tried to take matters into their own hands to meet their needs. This did nothing but set the system back and cause redundancy of effort and misunderstanding. Though the requisition issue caused exacerbation, AMCCOM was able to fill 95 percent of all the requests issued because its Management Directorate employees were working around the clock to meet the customers' needs. The directorate had people staffing telephones at all hours of the day to receive telephonic requisitions from SWA, and other employees in turn issued Materiel Release Orders (MROs) to the depots to have the materiel sent to the customer in SWA. AMCCOM even went so far as to get materiel from USAREUR and Korea to send to the Gulf; and when necessary, even cannibalized equipment for parts for the customer. It was discerned that AMCCOM provided their customers with between 180 to 250 percent of their materiel requirements by the time the ground war began on 24 February 1991.[17]

During the period of Operations Desert Shield and Desert Storm, authorization was given to issue war reserve assets to meet the demands of deploying units, especially in the chemical defensive equipment arena because of the possible chemical threat from Iraq. As the SWA buildup occurred, it became apparent that chemical defensive items were in short supply. This entailed the usage of war reserve assets which became depleted well before production deliveries were able to support the level of demands being experienced. AMCCOM had the responsibility of issuing chemical defensive equipment for the men and women in theater. Some units, prior to leaving CONUS or USAREUR for SWA, had exchanged worn out or irreparable equipment for new equipment. Others had not accomplished this prior to deployment, so upon arrival in theater, these units had to have new M17 gas masks issued to them. However, a number of problems surfaced concerning the acquisition of these masks. One of the most apparent problems dealt with the need to produce more chemical defensive equipment. Some production lines of this equipment had been laid away or reduced as far as production. Manufacturers then had to restart production lines, which certainly was no easy matter. AMCCOM at the same time drew stores from reserve and National

Guard units to fill inventory stores. By the beginning of the ground war in Southwest Asia on 24 February 1991, the Materiel Management Directorate had sent over 317,000 M17 gas masks, 25,000 M25A1 tank gas masks, 4,000 M24 aviation masks, and 600 M43 masks for Apache helicopter crewmen. The likelihood of tactical operations in Kuwait heightened the DOD's determination to get its fighting men and women the masks they needed. To meet the needs for chemical defensive equipment, AMCCOM deployed a repair unit from Pine Bluff Arsenal whose function it was to test, repair, refurbish, and replace gas masks and other chemical defensive equipment such as filters, detection devices, and protective equipment in the field rather than waiting for orders of new masks to arrive in country. By the beginning of the ground war, just about all, if not all, gas masks had been tested and, as necessary, replaced.[18]

Finally, one area that had to be addressed throughout the deployment of materiel to Southwest Asia was that of priority of shipments. Class II, VII, and IX items were sent by both sea and airlift. During the initial phase of Operation Desert Shield, the command had a treasure trove of ideas as far as how and when to send big package items such as howitzer recoil mechanisms, M1A1 turret rings, vehicles, etc. However, it was sometimes difficult to get other organizations such as the air force and the Military Traffic Management Command (MTMC), which was the primary allocator of sealift resources, to respond as rapidly or as thoroughly to AMCCOM's materiel deployment needs. This was ironic because the command had attempted to meet the needs of its customers in SWA by prioritizing requisitions in order to facilitate the fulfillment of customer requirements; expedite the shipment of critical materiel; and safeguard the arrival of equipment to its assigned destination. However, as the frenzy of activity was expanded both in CONUS and OCONUS, getting critical items from depots to organizations in SWA became anything but easy. The DOD instituted an airlift program known as Desert Express. Its primary mission was the movement of critical repair parts and medical items to Saudi Arabia in order to mitigate the backlog of materiel at aerial ports of embarkation (APOEs). These items were to be "highest priority non-mission capable" supply items (NMCS). AMCCOM had to make sure that its critical materiel be at either Dover or Charleston AFB when scheduled or the flight would leave without it. The Transportation and Materiel Management Directorates worked in concert whenever possible to bring about the movement of priority parts and items. It was not an easy task. Initially, there was only one flight a day from either Dover AFB or Charleston AFB. After the air war commenced in SWA on 16 January 1991, the Desert Express flights were increased to two per day. The army was allocated 15,000 pounds of equipment or five pallet positions or 2,500 square feet for each daily flight predicated on what was being shipped. Every branch of service deluged Military Airlift Command (MAC) with its own list of critical items that had to be moved to SWA. This meant that sometimes the air force had to decide whose narrative about materiel needs was most cogent among the service representatives, and then would decide whose requirements warranted priority shipping to SWA. The Materiel Management Directorate dealt with a Desert Express shipping restriction which caused some concern, that being the exclusion of essential Class II items such as binoculars and chemical defensive equipment. These items were excluded because they were not repair parts. However, the criticality of these items was apparent. Fortunately, the above mentioned Class II items were finally sent to SWA by other aircraft in time to meet mission requirements.[19]

The Materiel Management Directorate learned some significant lessons concerning the deployment of materiel in Operations Desert Shield and Desert Storm. One of the most important observations was that the requisition system needed to be reexamined, and in all likelihood revised. Though meeting the needs of its customers, the command learned it was inundated with the inordinate number of requisitions which taxed the response capabilities of AMCCOM. Better supply discipline and coordination between the customer and NICP was necessary. AMCCOM also learned the requisition and supply system lacked the flexibility necessary to make it more effective during ODS because it had been geographically narrow in scope, dealing primarily with the use of war reserve stockage, and prepositioned materiel in USAEUR and Korea. The system had to become more global in its focus, yet be able to meet materiel demands

in any part of the world. Still another observation was that of the need for better means of accountability of materiel once it left CONUS and arrived in country. This meant that both the sender and the customer had to become more involved in the policing of the supply system. Too many items were lost, misplaced, stolen, or sent to the wrong units because the wholesaler and retailer did not follow up on equipment once it left CONUS. An apparent awareness was that if the customer did not receive his order, in lieu of looking for it, he would summarily issue more requisitions for the same materiel. The customer had to be better tracked as far as what happened to his materiel. Wholesale and retail automated systems had to be improved upon and tied into a single net to reduce redundancy and ineffective logistical support and accountability. This could best be accomplished by a single DOD automated logistical system, as opposed to each service having its own system which lacked conformity. Finally, determination of priority shipping of critical items or equipment was not well defined, thus causing some problems between the air force and other branches of the armed forces concerning what items were sent on Desert Express. This problem could have been resolved by better coordination between the respective branches and the air force regarding what items should have priority.

The 600 men and women of the Materiel Management Directorate worked 7-days a week, and 24 hours a day to meet the inordinate number of materiel needs requests by the customer in Southwest Asia during Operations Desert Shield and Desert Storm. The directorate filled over 500,000 requisitions including sending approximately 300,000 M17 gas masks; 25,000 M42A1 tank gas masks; 4,000 M24 Helicopter gas masks; and 600 M43 Apache helicopter crew gas masks. AMCCOM also fielded a chemical defensive equipment repair facility to SWA staffed by personnel from Pine Bluff Arsenal. The Materiel Management Directorate overcame a number of logistical and administrative problems [already mentioned] to accomplish its broad-based mission. The directorate in fact met between 180 to 250 percent of the customers' needs in SWA, and played a most significant role in the successful military accomplishments of ODS.

Ammunition was no doubt the most crucial commodity fielded by AMCCOM to the American and allied fighting forces in the Gulf War. It drew the most attention concerning its deployment to SWA from depots, prepositioned stores, from army ammunition plants (AAPs) or wherever it was drawn. And the role of the AMCCOM Transportation Directorate in the fielding of conventional ammunition was and will be much heralded in the annals of military history and tactical logistical support.

Approximately 500,000 short tons of conventional ammunition were sent by sealift to SWA during ODS. Forty-five ships were used to move the majority of the ammunition. Of the above figure, 5,361 short tons of conventional ammunition, weapons, and chemical defensive equipment were airlifted to Saudi Arabia. The total tonnage moved to SWA was the equivalent of 23,000 semi-truck loads. Responsible for this most auspicious endeavor were the men and women of the Defense Ammunition Directorate and the Transportation Directorate. COL Scott W. Hull was the Director of the Defense Ammunition Directorate and Mr. Gary L. Anderson served as the Director of the Transportation and Traffic Management Directorate--hereafter to simply be referred to as the Transportation Directorate. The importance of their respective missions was apparent from day one of Operations Desert Shield and Desert Storm, and the fact they were able to use what resources they had, to accomplish the herculean feat of moving the much needed conventional ammunition to Southwest Asia was certainly unequaled. President George Bush's first utterances about the American and allied support for Operation Desert Shield were hardly completed when the United States Transportation Command (TRANSCOM) tasked the Transportation Directorate to be the single manager for the planning of movement and transportation of conventional ammunition for all branches of the armed forces. As with other AMCCOM directorates and staffs, both the Defense Ammunition and Transportation Directorates were on a 7-day a week, 24 hour a day footing. Deployment of ammunition was to be no less arduous, frustrating, or exciting for these two organizations than the

activities of other AMCCOM organizations during ODS. The logistical elements surrounding the supplying of conventional ammunition to the warfighters in SWA was of paramount interest and concern from the highest headquarters down to the user.[20]

As with other AMCCOM organizations, the Transportation and Defense Ammunition Directorates were to find that preparation of ammunition for deployment and its subsequent deployment took a great deal time, energy, and even at times emotion. As mentioned previously, the United States had for four decades primarily prepared to fight a major war with what once was known as the Soviet Union and the Warsaw Pact in Central Europe. Its prepositioning of ammunition stocks throughout Europe far exceeded any endeavors of conventional ammunition prepositioning in the Persian Gulf or contiguous areas. The Marine Corps had three prepositioned supply ships in the Indian Ocean at the onset of ODS. However, the amount of ammunition these ships had was minuscule as opposed to ammunition stockage in Europe. This meant that COL Hull's and Mr. Anderson's directorates were going to have to think and prepare for their missions within a relatively new venue, that of possible military activity in the Persian Gulf. It could be safely said that many people throughout AMCCOM were probably not very knowledgeable about the geography and politics of the Persian Gulf region on 7 August 1991 when President Bush issued the clarion call for mobilization. It was not long however until all of the men and women of the two directorates were keenly aware that they were going to be very much involved in what took place in that part of the world in the ensuing months.[21]

The basic question or questions that were apparent to AMCCOM was how much ammunition was there to ship and how much was needed? Where was the ammunition to come from, and how was it going to get to SWA were also other questions that had to be answered. Also, what about units that took their unit basic load (UBL) of ammunition with them to the theater? Did they actually have enough? The answer was apparently no. Some units which deployed early did not have their full complement of ammunition which meant that once they arrived in Saudi Arabia, commanders had to make sure they were able to obtain their proper stockage. The first units to deploy, the 82d Airborne, 101st Airborne, and the 24th Mechanized Divisions, took most of their basic loads with them. However, some ammunition stockage had to be sent from the wholesale base to the unit. These stocks were identified and shipped either to the unit or to the port, depending on the disposition the particular unit wanted made. If they were shipped to the port, the stocks were marked for pick up at that port by the requesting unit. Subsequent deploying tactical units, in many instances, deployed rapidly, and were not able to take all of their UBL with them, or simply planned to have the ammunition shipped to them. The initial phase of Desert Shield began with the offloading of the previously mentioned three Near Term Prepositioned Fleet (NTPF) ships in country with approximately 60,000 short tons of Class V ammunition. All of the ships had been restocked with new ammunition, thereby placing new ammunition in country at the time of the first troop arrivals. The quick response of these logistical assets corroborated the efficacy of the NTPF program.[22]

Fortunately for the United States and its coalition allies, they not only had time to train ground, air, and naval forces prior to Desert Storm, but AMCCOM also had time to load, assemble, and pack (LAP) its conventional ammunition requirements, and then move the ammunition to ports or airfields for further transfer to SWA. Sudden surges concerning requests for ammunition were an ongoing problem for the command. As done by the Materiel Management Directorate, the Defense Ammunition Directorate upon receipt of requisitions from SWA or CONUS, issued Materiel Release Orders (MROs) to the United States Army Depot System Command (DESCOM) and AMCCOM depots for whatever ammunition was needed and then had those facilities send it to the customer. This capability was most important because the need for ammunition became established even in the initial period of the deployment, thereby necessitating quick response to demands by commanders in the field. The Defense Ammunition and Transportation Directorates met quite often to coordinate efforts, discuss problems, and resolve issues in order to facilitate

the expeditious movement of ammunition to the theater of operations. The directorates made a concerted effort to meet the total requirements for ammunition movement as outlined by the Military Traffic Management Command (MTMC). This meant scheduling the right number of trucks and trains required at each location, and this was not easy because of the somewhat greater reliance on truck transportation than had been planned. There was also a shortage of trucks in the western United States, which necessitated issuing some over-the-road waivers in regard to the number of drivers and how long vehicles could be driven during a certain period of time. The two AMCCOM directorates also found they had to monitor the movement of ammunition to ports such as Concord on the West Coast, Houston and New Orleans on the Gulf of Mexico and Military Ocean Terminal-Sunny Point (MOTSU), Earle, Savannah, and Jacksonville, all on the East Coast.[23]

To move 500,000 short tons of ammunition was certainly no pedestrian undertaking; in fact, in some ways it was mindboggling! The command and the 13 ammunition plants involved in the manufacturing and shipping of much of the ammunition certainly did not work within the "business as usual" mindset during ODS. The requirements were pressing, personnel needs at the plants were apparent and somewhat difficult to fill, and addressing the problems associated with the deployment of conventional ammunition to SWA was challenging. Though computer technology was used in regard to the logistics of moving 500,000 tons of ammunition a distance of 8,000 miles, it was human logic, perseverance, and eclecticism that really brought about the above accomplishment. No required delivery date (RDD) was missed, and ammunition got to where it was supposed to be—be it tactical units or ammunition supply points (ASPs). However, if problems ever existed for the command during ODS, it was in the area of deployment of ammunition. The problems to be subsequently discussed will illustrate that they were not the result of ineptness, lack of vision, or logistical skills; but that they happened because of the plethora of demands placed on meeting the needs of the customer in Southwest Asia.

In order to fight a conventional war, a nation or coalition of nations usually has some opportunity to develop, refine, and enhance fighting and tactical skills preparatory to armed conflict. ODS was no exception; however as in Vietnam, a major problem was that of distance. One could no longer think of the relative contiguity of the Central European forests and plains as spelled out in the NATO/Warsaw Pact tactical scenario. Thirty-two hundred miles to a well-known, well-reconnoitered Europe was easier to provide logistical support than the relatively unknown expanses of the Persian Gulf, 8,000 miles away from the continental United States. The first problem was dealing intellectually with the fact that the command, as the nation, and its coalition allies, would be fighting in a part of the world not fought in by western nations since World War II. The French had fought in Algeria for a brief stint during the early 1960s; however no large scale operations by European nations and the United States had taken place there since 1943. Iran and Iraq, however, militarily knew the region, having fought an inconclusive eight-year war of attrition, which literally and figuratively bloodied the sands of the Persian Gulf. As referred to earlier, movement and delivery of materiel to SWA had meant a new mindset for everyone involved, and this was to be no less true for conventional ammunition.

AMCCOM took the initiative to improve planning for efficient and effective use of strategic use of sealift assets in conjunction with TRANSCOM and MTMC in support of the CINC (commander in chief), service components, shippers, and ammunition ports. The Transportation Directorate began the Desert Shield phase by focusing on supporting XVIII Airborne Corps with its unit basic load (UBL) and ammunition basic load (ABL) followed by shipments of supply, otherwise known as initial sustainment. This meant of course that UBL and ABL had to be met by the movement of ammunition from depots and ammunition plants to the deploying units. Trucks had to be located to move the required ammunition, which amounted to approximately 40,000 tons. There tended to be a shortage of trucks or sometimes, just the opposite, that being a plethora of over-the-road vehicles inundating installations. What happened was that prioritization

became a much sought after commodity, especially in light of the proclivity for units to attempt to get their UBLs and ABLs delivered to the home station and then forwarded to the port of embarkation before other units. Upon receipt of ammunition from depots and AAPs, units would offload the carriers of this ammunition and have to reload it on the same vehicles or on to other trucks for further movement to ports. This took a great deal of time, and much to the surprise of deploying units, they found in many instances that they had more ammunition than could be carried by their organic equipment. DOD intransit security rules and rising fuel prices also affected the availability and movement of trucks to transport ammunition. DOD regulations requiring two drivers per truck, and on occasion an escort vehicle, had to be somewhat amended due to the shortage of trucks and drivers. AMCCOM asked MTMC for the opportunity to hire additional carriers; MTMC acquiesced to this request. Fuel prices also were adjusted to compensate the carriers for having to deadhead many miles to pick up a loads of ammunition. National Guard and Reserve support, whenever possible, supplemented commercial carriers.[24]

Relative to the UBL and ABL was the tendency for nascent units deploying to fail to properly load or restrain ammunition on combat vehicles. QASAS who worked at either the ports of embarkation, ports of debarkation, or at the installations complained that tactical units often did not adhere to proper loading and blocking/bracing standards. This meant that ammunition had to either be repackaged, reloaded, or restrained before it could either be shipped to the port of debarkation or placed aboard ship, which in turn affected the loading schedule. Some combat units arrived in SWA with unpackaged and unrestrained ammunition. This became less of a problem as ODS became further implemented thanks in large measure to the protest by port operating personnel and the assignment of QASAS personnel to installations to provide much needed technical assistance to units. Due in large measure to the support rendered by QASAS personnel, the 1st Infantry Division from Fort Riley, KS, left for Southwest Asia with its UBL and ABL requirements and uploaded unit vehicles properly prepared. However, what was apparent was the obvious lack of overall training of military personnel in the areas of loading, blocking, and bracing of ammunition aboard vehicles.[25]

An area of serious concern which arose at ports in both CONUS and OCONUS dealt with the shortage of properly trained stevedores and ship crews to handle the loading of ammunition. At times, ammunition was not properly tied down, palletized, or loaded in the proper holds of the ships. This meant that QASAS detailed to the ports, had to spend time correcting the situation or in some instances, do some of the loading of the ammunition in order to guarantee proper storage. QASAS related the fact that in one port in Germany, a number of crew members of foreign vessels refused to work with the loading of ammunition outbound from the VII Corps, and demanded to be given an airline ticket to their home, which, in accordance with maritime law, they were. Comments were also made to the fact that at a number of ports, both in CONUS and in OCONUS, there was a shortage of forklifts capable of lifting and moving ammunition in ships holds. Most forklifts were able only to handle 4,000 pounds of ammunition while most individual loads in the hold exceeded 7,000 pounds. What was done to alleviate this problem was to make the forklift loads lighter in order to facilitate ease of loading. In spite of taking longer to load ships, most of these ships were loaded on time and made their scheduled departure time.[26]

The Transportation Directorate also dealt with port reception capability and congestion, particularly during the early stages of ODS. A significant example of this concerned MOTSU which encountered an almost gridlock type of congestion due in large measure to the large number of ammunition shipments sent to the port by truck. During the first three weeks of ODS, MOTSU received 1,100 truck shipments of ammunition. The port had limited storage facilities, thus necessitating the offloading of ammunition from trucks onto rail cars for temporary storage. This materiel then had to be subsequently located and loaded aboard ship which strained required delivery dates (RDD). However, when the emphasis switched to rail shipments, there was a noticeable easing of congestion and ammunition moved from the AAP, depot, and/

or station to the ports, then aboard ship, and subsequently to SWA. Transportation control and movement documentation (TCMD) of ammunition from shipping installations to the ports was also a problem in the beginning stages of ODS, due primarily to the initial in-port delivery requirements to the respective ports by MTMC. This confused sending units on how shipments should be coded for delivery, and akin to this was the variance in shipment sizes and identification which precluded discernible movement control and documentation. In essence, there was little if any conformity concerning TCMDs, especially in ligt t of the fact that overseas ports were often not identified at the time of early shipments. The Transportation Directorate finally resolved this issue by requiring TCMDs by shippers for all shipments being transported to ports for further transfer. In fact, the movement of ammunition eventually became unfettered once ships left port, and many units arrived in theater to find that their initial ammunition shipment had already arrived and was waiting for them. [27]

The exigencies of ODS certainly put a strain on AMCCOM subordinate installations, particularly army ammunition plants (AAPs) and depots. In turn, HQ, AMCCOM managers found it extremely difficult to correctly gauge installation capabilities such as the ability to load and transport ammunition. The inability to accurately assess requirements and capabilities was due in no small measure to the inconsistencies of what constituted outload capabilities as defined by the master mobilization plan (MMP) and the plant contract. The lack of conformity between the MMP and the plant contract regarding requirements and capabilities prevented AMCCOM planners from distributing the ammunition shipping workload in an efficient manner. Hawthorne AAP served as a cardinal example of the above problem. It found that it had, or was able to get, the required number of warehousemen and truck drivers. Conversely, however, Hawthorne AAP was unable to obtain experienced supervisors and blockers from the civilian sector. Outloading capabilities were thus unable to be expanded which meant that loading dock activity often came to a standstill as loaded railcars awaited blocking and bracing from what experienced personnel the AAP had. The contractor was forced into longer work shifts which brought about worker fatigue and numerous minor injuries. A number of AAPs experienced such problems and found it difficult to overcome them during ODS.[28]

An area of great concern regarding the deployment or movement of ammunition dealt with depot outload capability. The massive ammunition requirements of ODS caused depots to adopt extraordinary measures. The work force at a number of depots had been reduced in October 1990. This meant that outloading capabilities were adversely affected for a while due to the reduced personnel staffing. Matters became further complicated as the result of certain ammunition items being stored at only a few depots. This brought about great pressure to quickly load and ship ammunition to meet tight port dates. CONUS ports requested rail shipments in order to expedite the movement of ammunition and to avoid depot and dockside congestion. However, rail capability at a number of depots was limited with certain storage igloos and magazines accessible only by truck. This resulted in double handling of ammunition at the rail transfer facility thereby impeding the loading of ammunition. To correct this problem, AMCCOM directed work force shifts in order to keep pace with outloading requirements, which entailed the shifting of workers, occasionally between depots. Fortunately, the ammunition surges were met as the result of distribution of workload between depots and the ports, and the flow of ammunition to support vessel loading operations was unimpeded. For some unexplained reason, GOGO (government-owned, government-operated) depots seemed able to accommodate the double loading and surges better than the GOCOs (government-owned, contractor-operated).[29]

Possibly the most significant issue or problem besetting AMCCOM in regard to the deployment of ammunition to SWA was the need to maintain ongoing coordination between all of the AMCCOM elements, higher headquarters, and supporting organizations, such as the MTMC and commercial carriers. AMCCOM implemented the Movement Control Center (MCC) to supervise the coordination between

depots and ports, distribute the ammunition workload, adjust the port windows, and ensure the uninterrupted flow of ammunition to support vessel loading operations. However, this was easier said than done. As earlier mentioned, massive requirements overwhelmed depot outload, port reception, and transportation asset capabilities. This was coupled with the fact that initial port dates often did not account for depot capability and means of transportation of the ammunition from the depots to the ports. Port reception and capability were issues constantly being addressed by the MCC, and shipping schedules frequently had to be revised to get the ammunition to the port on time for its scheduled loading and transport to SWA. Truck and rail analysis were implemented for each ship planning increment which was no easy task. Constant telephonic coordination between the MCC, depots, MTMC, and carriers was undertaken to address issues such as port dates, workload analysis, the prevention of depot and port congestion, and shipping schedules, all of which seemed to be frequently insurmountable, but fortunately were not. Though effective, the MCC suffered from the fact that it had to transmit its action in the manual mode which took a great amount of time. The command would have been able to expedite its actions if an automated assist program was available. During Desert Shield and Desert Storm, AMCCOM was without such a system to prioritize and control transportation assets between competing MTMC area commands. Consequently, area commands competed for the same trucks and railcars, thereby facilitating unwarranted redundancy, some delays, and frustration.[30]

Because of the massive amount of ammunition being shipped to SWA during Operations Desert Shield and Desert Storm, it was imperative that the command have an effective plan for scheduling the departure of ammunition vessels from ammunition ports of debarkation. Incremental to this planning was the scheduling of ammunition items or components to be placed on the same ship to ensure that all end items or components would arrive as one package in theater. However, this desired action often did not get implemented because the individuals handling vessel scheduling ignored or forgot AMCCOM ship planning actions, especially when a replacement ship was used. This often caused the loss of identity of the ammunition components by the command, especially prior to receipt of the ship's manifest. This impacted negatively on intransit visibility and upon the ammunition end items arriving intact at their destination.[31]

The Transportation Directorate and the Defense Ammunition Directorate functioned extremely well during ODS in spite of the apparent problems besetting them. They learned some invaluable lessons. Both directorates learned the need for closer and more extensive coordination between the customer and AMCCOM, not only during mobilization, but also during peacetime. They both learned that the customer also has the responsibility of working closely with the command in all facets of logistical support given to the movement of conventional ammunition from knowing how to load, block, and brace ammunition to knowing how to move it safely to the ports. In essence, AMCCOM cannot, and should not be expected to do all of the preparation for shipment of unit basic loads (UBL) for the customer. AMCCOM learned that its ammunition mobilization plans must undergo constant scrutiny and revision, and that all contingencies must be addressed. The Military Traffic Management Command and the two directorates should undergo constant coordination and review of logistical doctrine. Training of personnel who handle ammunition, be they military or civilian, must be ongoing, especially in the areas of ammunition movement, storage, and loading. Also, AMCCOM and other government agencies dealing with the handling and movement of conventional ammunition should have an integrated computerized networking system by which to enhance efficient logistical support to the customer. Another significant lesson the command learned is the need to have prearranged ammunition ports of debarkation and the right mix of vehicles to move the ammunition from the plants and depots to the ports. The Movement Control Center (MCC) should be implemented at the onset of any contingency to maximize effective depot and port workload and operations. The DOD, TRANSCOM, and MTMC must be able to prioritize and implement viable plans and policies concerning the movement of ammunition by both commercial carriers and the military. AMCCOM civilian and military personnel who deal with conventional ammunition should undergo periodic training and

exercises during peacetime to hone their required skills for any contingency. And finally, AMCCOM learned it was able to do the job given to it by the Department of Defense concerning the deployment of ammunition to a combat zone, and do it well. The command also learned it could not and must not rest on its laurels but continue to be ever more effective in providing the customer the very best conventional ammunition support—both in peacetime and in war.

The Transportation and Defense Ammunition directorates performed in a most exemplary manner during ODS. They met the needs of the customer without any significant delays, and exceeded the required conventional ammunition requirements. The men and women of these two directorates worked assiduously to move more than 500,000 short tons of ammunition to SWA in a record time. This meant working often long and arduous hours, but with a corresponding sense of elan. AMCCOM more than met the challenge in regard to the movement of large quantities of conventional ammunition. It overcame a myriad of excruciating problems, and provided the very best of service and support to the fighting men and women who relied so very much on the timely deployment of ammunition to SWA. It could be said of these directorates, "To so few, so much was owed."

NOTES

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[4]Lindsay Intvw, 27 June 1991; HQ, AMCCOM, Commander's Assessment, 1 June 1991; Intvw, H.P. LePore, AMSMC-HO with T. Lighthiser, SMAC-AV, 7 November 1991; After Action Report, HQ, AMCCOM, Historical Analysis, 1 June 1991, iv-1-3; Stewart Intvw, 23 April 1991; Morgan Intvw, 14 March 1991; Warnecke Intvw, 19 March 1991.

[5]Lighthiser Intvw, 7 November 1991; Greenberg Intvw, 31 July 1991; Stewart Intvw, 23 April 1991; Morgan Intvw, 14 March 1991.

[6]Greenberg Intvw, 31 July 1991; Warnecke Intvw, 19 March 1991; After Action Report. HQ, AMCCOM, Commander's Assessment, 1 June 1991; White Intvw, 22 July 1991; Stewart Intv, 23 April 1991; Lighthiser Intvw, 7 November 1991; Information Paper, AMSMC-PTE, Subj:Operation Desert Shield, 17 August 1990.

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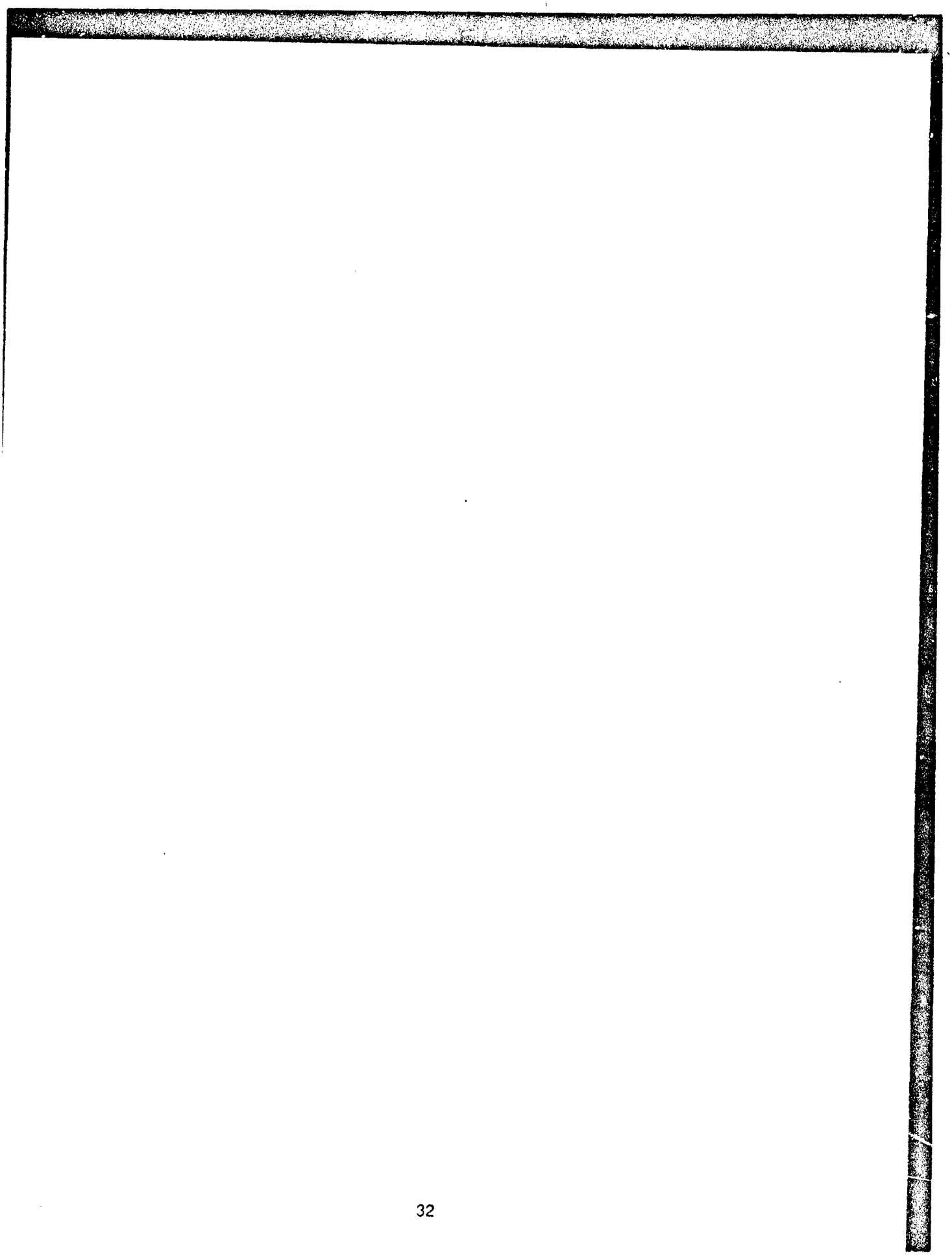


Chapter Three

Production and Procurement

"The Gulf War wasn't won by aircraft. It wasn't won by tanks or missiles or bombs," observed an anonymous author in the December 1991 AMC News. Indeed, the "miracle in the desert" could be traced to one source: people. "War and Pieces: The Logistics Story of Desert Storm" further noted that these people were a varied lot; they were not just the soldiers who had served so valiantly in the sands of Southwest Asia (SWA). They were the shipping clerks, office workers, mechanics, scientists, and engineers. They worked on the docks, in the factories, as well as in the laboratories, and in the warehouses. Furthermore, the people behind the success of Operation Desert Storm were fathers, mothers, sisters, wives, brothers, husbands, children, and simply concerned citizens who waited patiently and courageously, toiling all the time in their own ways, to return their loved ones and fellow countrymen and women to safety.[1]

From the beginning days in August 1990, the products of AMCCOM's laboratories, arsenals, depots, maintenance shops, proving grounds, and contractors began to flow into Saudi Arabia. "What started as a trickle ended as a flood," the author of the AMC News piece noted, "as thousands of tons of supplies, ammunition, weapons—big things, small things—arrived incountry." And as the journalist continued, "Nothing has ever happened quite like this before. A logistical nightmare became a miracle in the desert." The journalist's reflections took into consideration the innovations devised by a nation preparing for war: the fast freight and overnight express deliveries, the prioritization and super-prioritization of shipments that allowed units preparing for deployment to requisition supplies one day and have them the next, sitting on their loading docks awaiting further instructions.[2]

The Persian Gulf campaign resulted in victory because the people behind, as well as in front of, the scenes cared enough to prepare for any exigency which might befall their nation. And ultimately because such organizations as the United States Army Armament, Munitions and Chemical Command (AMCCOM) were in place, with the appropriate skills and foresight, flexibility and responsiveness, to guide the good-willed citizenry of the United States, the successful attainment of the nation's goals was possible. Because of such prepositioning, AMCCOM was able to fulfill its mission of "providing the firepower" as well.

As noted, the requisite structure did not simply spring forth in full bloom with the 2 August 1990 Iraqi invasion of tiny Kuwait, nor with its subsequent threats upon the territorial integrity of Saudi Arabia. Indeed, it had existed in a variety of permutations for decades. And accordingly, due to its presence, many of the parts and supplies needed for Operations Desert Shield and Desert Storm (ODS) were already on hand. Yet not all the implements of war that kept the soldiers of the United States armed services, as well as a significant number of their allies, fed, clothed, armed, transported, reasonably safe from chemical attack, and offensively prepared were on hand, or even in existence. And in order to properly attend to the perceived needs of the soldiers in the sand, AMCCOM had to rapidly initiate production and procurement efforts.

During ODS, the AMCCOM Procurement Directorate accelerated 149 actions, 53 contracts, 96 purchase orders, and awarded 503 contracts in support of America's efforts. Consequently, the directorate administered a total of 1,434 procurement requirements during the war at a dollar value of $895,169,286. Many of these actions were executed with little or no additional cost to the government, or accordingly, the taxpayer, as they represented accelerations, not unbudgeted purchases. Such efforts contributed mightily to the iron mountain of materiel shipped to SWA by AMCCOM. Indeed throughout the conflict, AMCCOM, aided in part by its predecessor's 1977 designation as the Single Manager for Conventional Ammunition operations, as well as its own endorsement by the Military Traffic Management Command

(MTMC) and Transportation Command (TRANSCOM) as the single focal point for ammunition ship planning, deployed a myriad of supplies to SWA. By the war's conclusion, AMCCOM had shipped $97 million worth of Class II supplies (individual equipment), $356 million worth of Class IX supplies (repair parts), and a total of $4 billion worth of Class V supplies (ammunition), constituting 620,000 short tons.[3]

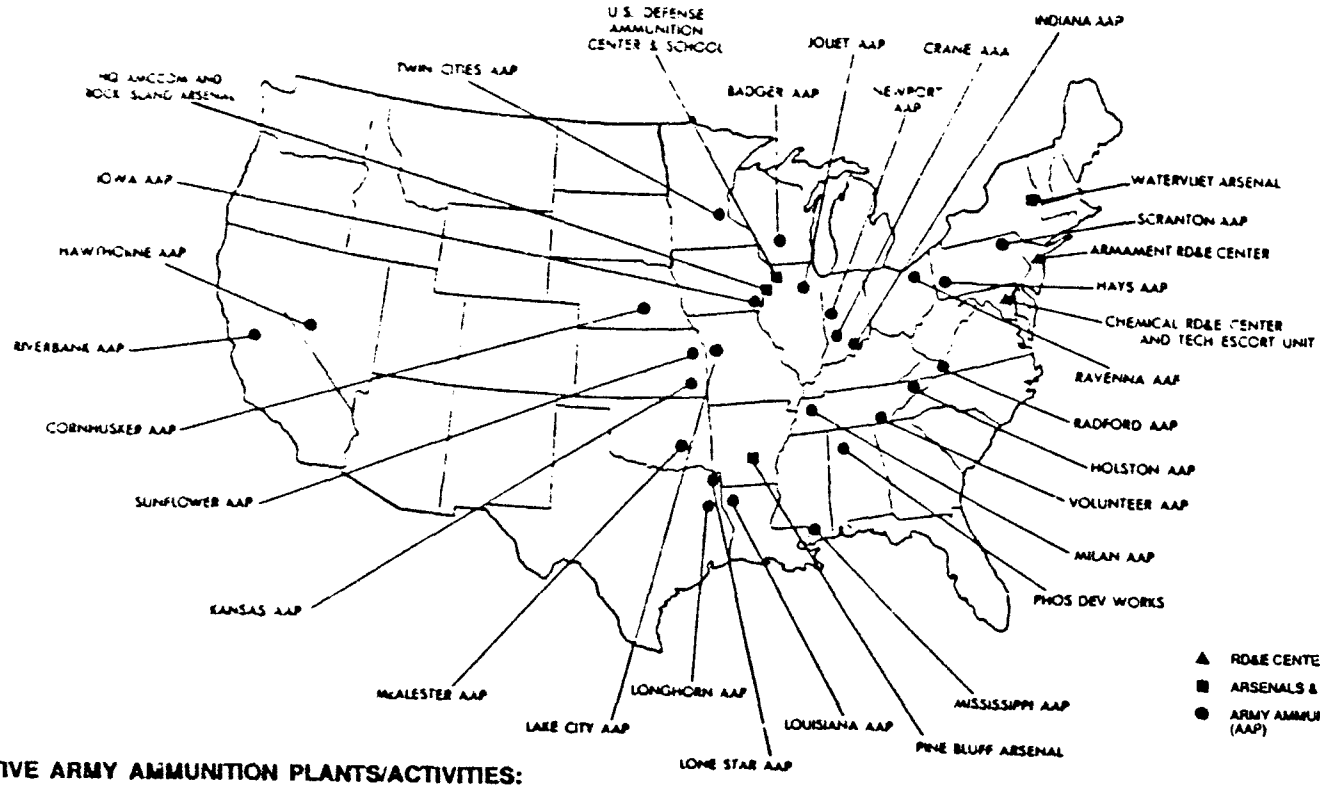
Included in the categories of items shipped in support of ODS by AMCCOM were 314,585 M17 protective masks, 27,500 M25A1 tank crewman protective masks, 4,529 chemical agent alarms, 3,962 M24 aviation gas masks, and 680 M43 chemical protective masks for Apache helicopters. Other major items shipped in support of the American effort in the Persian Gulf War by AMCCOM included 45,896 M16A1 rifles, 10,770 M9-9mm pistols, 600 M17 lightweight decontaminating apparatuses, 282 M12A1 decontaminating units, 9,420 M16A2 rifles, 1,183 M203 grenade launchers, 1,792 M240 machine guns, and 1,076 of the M60 variety. Nearly 1,500 smoke grenade launchers (M239/M250/M243/M257/M259) were also shipped to SWA under the direction of AMCCOM.[4]

AMCCOM supervised the shipment of smaller quantities of nonetheless essential items to Saudi Arabia as well. For example, AMCCOM arranged for the transport of eleven M24A1 4.2inch mortars, six M29A1 81mm mortars, and seven M224 60mm mortars to SWA. Additionally, 34 mine clearing line charge (MICLIC) launchers and trailers were shipped under the guidance of AMCCOM, as were 500 Canadian chemical agent monitors, 18 engineer air assault tool kits, 19 lathe engines, 109 steam cleaners, 39 telescopes, and 10 M578 recovery vehicles. AMCCOM also oversaw the transport of 274,000 short tons of bombs, 245,000 short tons of artillery munitions, 34,000 short tons of small arms ammunition, 36,000 short tons of mortar, tank, and navy gun shells, and 31,000 short tons of other assorted ammunition.[5]

Much of what AMCCOM shipped to SWA had been produced prior to the invasion of Kuwait by Saddam Hussein and his army—reputedly the fourth largest in the world. Yet not all the called for materiel had been produced or procured prior to the onset of deployment, and emergency operations were undertaken at the command's numerous subordinate facilities to fill the voids ascertained. Assisting AMCCOM in what became a success story were its supporting research centers, arsenals, and assorted facilities: the United States Army Armament Research, Development and Engineering Center (ARDEC), Picatinny Arsenal, NJ; the United States Army Chemical Research, Development and Engineering Center (CRDEC), Aberdeen Proving Ground, MD; Rock Island Arsenal, Rock Island, IL; Watervliet Arsenal, Watervliet, NY; Pine Bluff Arsenal, Pine Bluff, AR; Crane Army Ammunition Activity, Crane, IN; the United States Army Defense Ammunition Center and School (USADACS), Savanna, IL; McAlester Army Ammunition Plant, McAlester, OK; Hawthorne Army Ammunition Plant, Hawthorne, NV; Holston Army Ammunition Plant, Kingsport, TN; Indiana Army Ammunition Plant, Charlestown, IN; Iowa Army Ammunition Plant, Middletown, IA; Kansas Army Ammunition Plant, Parsons, KS; Lake City Army Ammunition Plant, Independence, MO; Lone Star Army Ammunition Plant, Texarkana, TX; Longhorn Army Ammunition Plant, Marshall, TX; Louisiana Army Ammunition Plant, Shreveport, LA; Milan Army Ammunition Plant, Milan, TN; Radford Army Ammunition Plant, Radford, VA; Scranton Army Ammunition Plant, Scranton, PA; and Sunflower Army Ammunition Plant, DeSoto, KS.[6]

Behind the primarily government-owned, contractor-operated ammunition plants—the McAlester and Crane plants are governmentowned and operated—and assorted support facilities were a total of 17,934 civilian employees and 633 military personnel, albeit augmented during Operations Desert Shield and Desert Storm by approximately 700 temporary employees. Working together, frequently on lengthened shifts, these employees were responsible for the loading, assembling, packing, shipping, delivery, etc., of all conventional ammunition utilized in ODS by the U.S. Army, U.S. Navy, U.S. Marine Corps, and the U.S. Air Force, as well as much of that needed by coalition allies. A total of 1,619,552 civilian, government employee hours were extended in support of AMCCOM's mission in SWA with a concomitant expenditure of $52 million.[7]

AMCCOM INSTALLATIONS AND ACTIVITIES



ACTIVE ARMY AMMUNITION PLANTS/ACTIVITIES:

Load, Assemble and Pack

Crane	Lone Star
Hawthorne	Longhorn
★ Indiana	★ Louisiana
Iowa	★ McAlester
★ Kansas	Milan

Propellant and Explosive

Holston	Radford
★ Indiana	Sunflower
★ Kansas	

Arsenals

Rock Island Arsenal
Watervliet
Pine Bluff

RD&E

Armament RD&E Center

Chemical RD&E Center
And Tech Escort Unit

★ **Dual Capabilities**

Metal Parts

★ Louisiana
Scranton

Small Arms

Lake City
★ McAlester

INACTIVE PLANTS:

Badger	Ravenna
Cornhusker	Riverbank
Hays	Twin Cities
Joliet	Volunteer
Mississippi	Phosphate
Newport	Development Works

As noted earlier, AMCCOM's mission did not end with simply supplying the needed ammunition to the field. According to its mission statement, the command's charge included the duty to:

> exercise total Life Cycle Management over research, development, engineering, product assurance, logistics, support, industrial preparedness, procurement, production, security assistance, and material readiness, for assigned systems; Single Manager for Conventional Ammunition for DOD; manage Production Base Modernization Expansion Program; maintain a technical base to accomplish development, procurement; production and Life Cycle support of conventional and nuclear weapons and ammunition (artillery, infantry, gun-type air defense, surface vehicle mounted and aircraft mounted); certain weapons systems/ subsystems and chemical systems/materiel; related components and conventional ammunitiion as assigned; peculiar equipment, test, measurement, and diagnostic equipment; and tools maintenance equipment, command and control assigned centers, activities, and installations. Maintain the Ammunition Chemical and Armament Production base which includes initial production facilities programs, modernization, expansion projects, facilitization to satisfy peacetime surge and mobilization.[8]

To fulfill this mission in the environment termed Operations Desert Shield and Desert Storm required AMCCOM not simply to locate, package, load, and ship materiel, but also, on occasion to produce, or otherwise procure it.

Perhaps the best known, and arguably the most vital of AMCCOM's production efforts during the war came from eastern New York's Watervliet Arsenal. The primary mission of the facility is to perform procurement, fabrication, industrial engineering, and product assurance of assigned materiel; and to provide administrative and logistical support services to tenant activities. In the case of Watervliet Arsenal, the assigned materiel is mortars, recoilless rifles, cannons for tanks, towed and self-propelled artillery, components for these end items, and special tool sets, training devices and simulators relating to assigned materiel. Slightly over 2,000 civilian employees and eight military personnel comprised the arsenal's workforce during the war in the Persian Gulf.[9]

During ODS, Watervliet, founded in 1813 and now the nation's oldest government-operated arsenal, was called upon to provide a bomb the likes of which had never been seen before, and which would be capable of penetrating the Iraqi command cadre's bunker, encased in concrete and buried to a depth of 100 feet. Despite the U.S. military's use of huge 2,000-pound bombs designed to slice through 6-foot-thick bunker walls, the military bunker complex at Al Taji Air Base, to the north of Baghdad at Abu Ghurab, remained secure. Secure, that is until on the evening of 27 February 1991, when, a mere four days into the ground offensive against Iraq, two U.S. Air Force F-111F fighter-bombers streaked north across the Saudi desert bound for Al Taji. Guided by lasers, two long, cylinder-like devices fell from the jets' wings. Then from far below on the desert floor, a small puff of black smoke suddenly shot from the entrance to Taji Bunker No. 1; one bomb had hit its target. (The second bomb, misdirected by the weapon systems officer aboard the jet, hit an un-targeted bunker instead, destroying it.) A few moments later, a huge secondary explosion ripped through the targeted command post, reducing the bunker, according to air force personnel, to a jumble of broken steel and concrete.[10]

The mission marked the spectacular battlefield debut of the GBU (glide bomb unit)-28, called the "bunker buster", which had been developed, tested, and fielded with unprecedented speed by the combined effort of the air force, Texas Instruments, Inc., Lockheed Missiles and Space Company, Wright Laboratories, Cameron Forge, and last, but certainly not least, Watervliet Arsenal. It also marked the denouement of the Persian Gulf War. For although the actual psychological impact of the GBU-28 on Iraqi President Saddam Hussein and his military commanders ensconced within bunkers similar to the one destroyed may

never been known, less than twelve hours after the destruction of the Al Taji command post, the nation's leadership indicated their readiness for a cease-fire. The success of the super-penetrating bombs may also be inferred from the relatively low rank of Iraqi military officers who attended the capitulation meeting with GEN H. Norman Schwarzkopf marking the end of the war.[11]

Watervliet Arsenal's involvement in the creation of the nowfamous bunker-busting GBU-28 began shortly after the commencement of the air war against the forces of Saddam Hussein. Although United States military strategists were concerned throughout the build-up to war with Iraq, the passing of the United Nations Security Council Resolution 678 deadline for the unconditional withdrawal of all Iraqi forces from Kuwait brought the dogmatic threat to "use all necessary means" to achieve the end into sharper focus. And when the air bombardment of Iraq began on 17 January 1991, the worst fears of the United States military commanders were realized. Air force reconnaissance photographs showed that a number of Iraqi bunker complexes had withstood direct hits by bombs that could destroy typical concrete bunkers. The Iraqi command posts, presumed to be frequented by Hussein and his fellow military strategists, apparently were either too deep or too well-protected by reinforced concrete to be penetrated by existing means, primarily BLU (bomb, live unit)-109. BLU-109 had made direct contact with bunkers, but as it was designed to penetrate between six and twelve feet of reinforced concrete, had inflicted only minimal damage. Obviously, "all necessary means" would need to be produced or procured, not simply drawn from existing stores if the underground lair of Hussein and his commanding generals was to be penetrated.[12]

Around 21 January 1991, air force officials contacted aerospace companies around the nation asking for ideas on how to destroy the deep, reinforced targets. One call went to Texas Instruments Defense Systems and Electronics Group, Dallas, TX, in consideration of its previous engineering of laser-guided bombs capable of delivering—with pinpoint accuracy—a 2,000-pound bomb that could punch through six feet of concrete. Simultaneously, Mr. Al Weimorts, an engineer at the Air-to-Surface Guided Weapons Systems Program Office at Eglin Air Force Base in Florida, began sketching designs for a longer, heavier bomb. Yet his efforts quickly hit a snag.[13]

It was this snag that ultimately led to Watervliet's involvement in the production of the bunker buster. A key element in Mr. Weimorts's plan was to use off-the-shelf air force materials to construct the bomb; manufacturing components from scratch would consume months of precious time that the current situation did not luxurously provide. The primary problem facing Mr. Weimorts involved the need for a steel tube long and strong enough to serve as the bomb's body. While pondering the issue, Mr. Weimorts shared his problem with a retired army veteran at the Lockheed Missiles and Space Company, Sunnyvale, CA. (Lockheed had been tapped by the air force to produce the GBU-28's warhead.) The veteran recalled that the army stockpiled old gun barrels that might serve the purpose Mr. Weimorts required. The barrels just happened to consist of the same hardened steel needed for the bomb body. A few minutes work located the gun barrels at Letterkenney Arsenal in eastern Pennsylvania.[14]

Without waiting for Pentagon approval, the Eglin weapons lab asked Letterkenney Arsenal to ship several of the 8-inch M201 howitzer barrels to Watervliet Arsenal. On 1 February 1991, just days after the realization that the existing bomb units, BLU-109, were incapable of penetrating the bunkers of Hussein and his generals, Watervliet personnel started shaping the first bomb bodies from the gun barrels. Transforming gun tubes into bomb bodies involved removing the hoops and rails, shortening the barrel from 17 feet to the required length of 12 feet, 7 inches, and removing the chrome plating from the bore. As the work progressed, additional gun tubes arrived at Watervliet from Ingersol Rand located in Texas.[15]

Despite having overcome one obstacle in the creating of a super-penetrating bomb, several others remained. Texas Instruments was called upon to reassemble the engineering team that had previously

designed and built the Paveway laser-guided weapons system. Time was critical, and Texas Instruments was asked to compact the normal 18 months to two year development process, involving wind-tunnel and simulation tests, into a single week. Simultaneously, engineers sought to discover how different speeds and altitudes would affect the bomb they had not yet created. In Lewisville, TX, a Texas Instruments' defense plant team of 18 engineers labored in absolute secret, 20-hour marathons to find the solutions to the mind-numbing challenges which had been set before them. On Saturday, 16 February 1991, less than a month after their first contact with air force officials concerning the possible construction of a bunkerbusting super-penetrator, wind-tunnel testing began under the close eye of engineers. Texas Instruments, however, did not face the only problems in the construction of the bunker buster.[16]

Lockheed engineers, along with Watervliet Arsenal personnel, faced the problem of assembling the nose of the body. The traditional method of performing this operation on hard target penetrators was to utilize the inertia welding process which would not be possible in the case of the GBU-28 due to its increased bore size—ten inches compared to the original gun-tube of eight inches. Eventually, Lockheed and Watervliet staffers explored a multitude of attachment processes: thread, pin, shrink, weld, and various combinations among them. An error in this decision would seriously affect the ability of the program to meet its required deadline. Ultimately, the decision was made to proceed with a combination shrink and weld process. After examining test pieces of the so-joined material, the results were declared to be even better than expected. Watervliet staffers became proficient at the process of joining the nose and body portions of the penetrator. Although the union initially absorbed twelve hours from the shrink process to initially join the implements to the preheating with special torches, and the final welding, innovation and skill reduced the procedures to eight hours. Time was always a factor in the production of the bunker buster, and all involved knew that every minute could be the critical one. Indeed, the machining operation conducted at Watervliet to create all of the threaded holes for the multiple aircraft stabilizing wing configurations was reduced by one half, from fourteen to seven hours, as all sought to hasten the process.[17]

On 17 February 1991, Watervliet Arsenal and Lockheed personnel put the finishing touches on the first two penetrators. The penetrators were completed at 0600 and by 0700, still wet with paint, they were enroute via New York Air National Guard C130 transport to Eglin Air Force Base, FL. On 21 February, a pair of bomb guidance units engineered at the Dallas laboratories of Texas Instruments arrived there via T1 Lear jet. At Eglin, the vital components were united, and explosive was added.[18]

The process of loading the GBU-28 with explosives also challenged the men and women of the United States defense community. Of primary concern to the men and women of the United States Air Force Munitions Systems Division at Eglin were the units' dimensions. Previous to the arrival of GBU-28, the largest unit handled was but half its size. Accordingly, the technicians could not pour explosives straight from the melting kettle into the warhead inside their facility as was the usual case. Thus a makeshift, outside facility was created, allowing the units to be loaded in the upright position by a "bucket brigade" of technicians. From the usual melting facility inside the division, TNT flakes were carefully melted in a 30-pound kettle. The molten Tritonal thus created was then poured into buckets for transfer to the penetrator. Two varieties of molten material were needed to fill each penetrator. A special load was used that contained two different explosives. The first explosive poured was insensitive Tritonal so that the bomb could survive the impact without detonating. The second pouring was regular Tritonal. Once filled with its cargo of explosives of over 600 pounds, the penetrator was capped and prepared for curing.[19]

The curing process was also made more difficult by the penetrator's size. As it was far too large for any of the facility's ovens, the loading crew wrapped it in copper tubing and surrounded it with felt insulation. A hot water circulator kept the unit warm. Mr. Art Spencer, chief of the High Explosive Research and

Development (HERD) Processing Laboratory at Eglin, noted in retrospect that the curing process was so critical that he had individuals watching the process around the clock to assure that the unit retained its heat. Just two days from the initial delivery of the penetrators, the facility had loaded its first penetrators; they would not be the last.[20]

Before the units were fully cool, they had been loaded for shipment to Nevada's Nellis Air Force Base. There they were fitted with improved laser guidance units. On 24 February 1991, the weapon's only operational flight test occurred at the Tonopah Test Range, NV. Testing demonstrated at the F-111 aircraft could fly in a stable fashion with the super-penetrator in place under one wing and balanced by a 2,000-pound MK-84 unguided bomb under the other. After being released from the aircraft, the penetrator buried itself so deeply in the ground that it appears uneconomical to even attempt to recover it. MAJ Dick Wright, Air-to-Surface Guided Weapons Systems Program Office, declared after the testing that, "As it turned out, our bomb worked so well, it went even beyond their [Tonopah Test Range's] ability to recover it and remains more than a hundred feet underground."[21]

While the flight testing proved that the adaptive laser guidance devices did indeed work, it took the use of a sled test to prove that the GBU-28 could penetrate several feet of reinforced concrete with little damage to its bomb case. On 26 February, the second penetrator was subjected to just such a rigorous challenge at Holloman Air Force Base, NM. After being placed on a sled track and attached to a "pusher", the device shot down the track towards a target. Designated as the target was 22 feet of concrete in several slabs of varying grades. After piercing the steel-reinforced concrete, the bomb skipped once and continued down range for approximately another half mile before coming to a rest. The casing remained intact.[22]

After successfully testing the first and second iterations of the GBU-28, the third and fourth received final preparations for shipment to SWA at Eglin Air Force Base. They were each loaded with approximately 670 pounds of Tritonal, and fitted with laser guidance units and tail assemblies which brought their total weight to nearly 5,000 pounds. They began their flight to SWA still warm from loading processes and still secret. At least one machinist, however, correctly guessed the primary target of the bomb he had labored upon. On one he wrote: "The Saddamizer."[23]

Mr. Gerald L. Yarter, Chief of the Production and Planning and Control Division at Watervliet Arsenal, stood justifiably proud of that facility's efforts at the close of the war. Because the arsenal was in place with its varied capabilities and capacities, he noted, it could be responsive with its manufacturing expertise and could accordingly provide American troops with quality products and confidence on the battlefield.[24]

Also providing soldiers in the field with quality products and concomitant confidence was Pine Bluff Arsenal, Pine Bluff, AR. Throughout the Persian Gulf War, the Arkansas facility sent a plethora of protective devices to SWA. While Pine Bluff Arsenal was not responsible for the entire effort of outfitting America's fighting men and women and their supporting staff of civilians and military personnel with chemical protective devices, it did field a considerable proportion of them. This was in accordance with the facility's primary mission to operate and maintain production facilities for the manufacture of assigned materiel; store, survey and ship supplies and equipment; manufacture chemical systems/materiel; operate a calibration laboratory; perform demilitarization of chemical munitions; and produce binary munitions. The primary materiel responsibility of Pine Bluff Arsenal is chemicals, smoke, incendiary agents, and other pyrotechnic mixes, as well as defensive chemical materiel. A staff of 1,151 civilians and 62 military personnel aided in the fulfillment of Pine Bluff Arsenal's mission during ODS.[25]

The special abilities of Pine Bluff Arsenal would have been called upon in any conflict facing the United States in the summer of 1990. However, given an understanding of Saddam Hussein's use of chemical

warfare in his recently concluded foray against Iran, it played a somewhat larger role than it might otherwise have been expected to do.

Hussein's familiarity with the agents of chemical warfare was rather extensive. During the early 1980s, Iraq's State Enterprise for Pesticide Production purchased several million of dollars worth of modern Western chemical production equipment from international brokers. Installed at the chemical production plant at Samarra, to the north of Baghdad, the equipment utilized legitimately obtained thiodiglycol and phosphorous trichloride to churn forth mustard gas and nerve agents. In their more legitimate iterations the chemicals can be used to print textiles, develop photographs, and create ink for ball-point pens. In their less legitimate, lethal forms the chemicals were initially tested on camels and sheep, as a prelude to humans, in the desert.[26]

Despite the fact that Iran first reported to the United Nations Security Council in November 1983 the use of chemical warfare agents by Iraq, experts believe their first use occurred in early 1984. Earlier reports have been relegated to history's dust bin as propaganda on the part of Iran to elicit world sympathy. Yet in the early months of 1984, the use of chemical warfare was documented by Iran's dispatch of 30 chemical casualties to hospitals in Tokyo, Vienna, Stockholm, and London. The medical evidence gathered at the hospitals supported Iran's claims, resulting in a United Nations investigation. The investigative team, escorted to the battlefront by Iranian authorities, quickly concluded, based upon an examination of the casualties, soil samples and even samples of mustard agent from an unexploded 250-kilogram bomb, that the nation had not cried "wolf". While the report stopped just short of flatly stating that Iraq had used chemical agents, and did not acquit Iran of wrong-doing, it left little doubt as to who had broken the 1925 Geneva Convention outlawing chemical weapons which both nations, as well as a host of others, had signed. Following the report, the United States, France, Britain, Japan, and, a few months later, Australia banned the export—to both Iraq and Iran—of chemicals which could be utilized to make nerve or mustard agent.[27]

This lack of a true international response to the Iraqi use of chemical weapons did nothing but encourage their further use as the desperate nation grasped at its deadly arsenal in an attempt to secure victory. And the incidence of chemical casualties incurred by Iran rose. In 1981, when few if any believed that Iraq had begun to utilize the weapons, Iran reported eleven casualties due to them. The number reported rose to 29 in 1982, and precipitiously to 564 in 1983. By 1984, Iran reported 2,237 chemical casualties, and by 1985 3,267. In 1986, Iran blamed Iraq's chemical agents for the deaths of 11,141 of its soldiers, and for 13,496 in 1987. Obviously, Iraq gained a degree of boldness over time regarding the use of chemical agents in light of world non-reaction. Where chemical weapons had once been used only as a last resort technique to forestall routs of its forces against the human-wave assaults of Iran's Revolutionary Guards and offered with the most experimental of tactics, Iraq began to gain a degree of finesse. Rather than simply dumping mustard agent from helicopters and cargo planes as it had done in the early portion of the 1980s, Iraq's chemical arsenal included aerial bombs, artillery and 122mm rockets launched from the Soviet-made BM-21. Uniquely Iraqi was the 90mm helicopter-launched air-to-surface rocket.[28]

As Mr. Lee Waters, a threat analyst at the United States Army Chemical School, Fort McClellan, AL, noted in "Chemical Weapons in the Iran/Iraq War," Iraq's attack on the oil-rich Majnoon Islands may have been typical of the threat faced by American and allied troops.

> The artillery preparation began at 0300. Chemical rounds were mixed with high explosives. Front-line Iranian defensive positions were attacked with a mix of cyanide, nerve agent, and high explosives. The bombardment lasted two hours. Iranian defenders were killed and injured, but the contamination dissipated by the time advancing

> Iraqi forces reached the positions. Iran reported 2,000 chemical casualties in the main battle area. Then, Iraqi helicopters and fighter aircraft joined the attack, dropping mustard and nerve gas in the Iranian rear—on command and control centers, logistic sites and reserves to break up counterattacks.[29]

Iran lost control of its defense, and when the smoke cleared, Iraq had retaken its territory, lost since 1984. Such was the foe the United States and its allies faced when the need arose to defend the territorial integrity of the Kingdom of Saudi Arabia with Iraq's refusal to remove itself from Kuwait by 15 January 1991 as per United Nations Security Council Resolution 678.[30]

But American troops did not enter the fray without an understanding of chemical warfare. Despite not having fought on a chemically-oriented battle field since the close of World War I, the nation's military leaders thoroughly understood the dangers inherent in the challenge. This understanding came in part from observations gathered during the Iran-Iraq war of the 1980s. They came to realize that light forces, of the variety frequently used in adverse terrain, were particularly susceptible to the perils of chemical attack. They could carry little in the form of protection, and were inviting targets to chemical strike planners. Furthermore, the fox hole, the perennial friend of the foot soldier as protector against shrapnel and artillery rounds, could become his deadliest foe in chemical warfare scenarios. Chemical agents, heavier than air, frequently collected in the holes, suffocating or otherwise incapacitating those taking shelter in them.[31]

Additionally from the Iran-Iraq War, certain United States observations were reaffirmed. It was recognized that the Iranian Revolutionary Guard had no professional chemical force training. They, therefore, despite the availability of resources, frequently did not promptly don their chemical defense equipment nor did they always keep it in place until the threat had subsided. Additionally, the facial hair of the Guardsmen did not allow for a proper mask fit.[32]

From observations concerning the failures of Iran to properly prepare for the known chemical threat, as well as the successes of the Iraqi military machine in mounting the threat and defending itself from inadvertent self-contamination, the United States forces gained valuable lessons. From the Iraqis, the United States learned that trained chemical specialists to administer the army's chemical defense system were invaluable; this was simply an affirmation of its own theories. Further, the analysts of the United States noted the capability of the Iraqis to use collective protection systems to exploit the effects of their chemical strikes against the Iranians. The Soviet-made armor and infantry fighting vehicles used by the Iraqis had the systems, but it was unknown whether or not they were used.[33]

Mr. Waters concluded his examination of the use of chemicals in the Iran-Iraq War with a brief comment on the capacity of the United States to wage just such a war. He observed that the United States, in both its light and heavy forces, had concentrated on individual protection and had invested in the creation of an air-permeable NBC (nuclear, biological, chemical) overgarment, as well as chemical agent detectors. This, according to Mr. Waters, denoted a key philosophical variance between United States forces and those of probable threat nations. Protective overgarments and chemical warfare agent detectors focused on the survivability of the individual, whereas chemical reconnaissance and collective protection, whether in vehicles or on shelters, concentrated on the survivability of the force. Mr. Waters did not offer an opinion on the observation, but did note that chemical warfare agents and delivery systems, including short-range ballistic missiles, had proliferated throughout the Third World where "balances of power, as understood in a European scenario, do not exist." And, "as new missions point our light and contingency forces toward the world's trouble spots, our current capabilities to fight on a chemical battlefield appear increasingly at risk."[34]

The United States military had understood the risk of chemical warfare for quite some time, however, for the age of chemical warfare had begun on 22 April 1915 with the German release of chlorine gas at Ypres, Belgium. With the release of the cloud of chlorine came the rapid effort to deploy soldiers with some form of protection against the insidious fumes. Assorted masks were fielded by Allied as well as Central Power forces during the war in an attempt to protect soldiers from not only chlorine gas, but mustard gas, phosgene, and tearing agents. Indeed, under the auspices of the United States Army Medical Department, over 1.5 million British-designed Small Box Respirator (SBR) masks, utilizing activated coconut charcoal as a filter, had been produced before the Armistice in November 1918. Additionally, over three million RFK (Richardson, Flory, and Kops—the designers) masks had been produced for the army, as well as 197,000 Akron Tissot masks, 330,000 Kops Tissot masks, and 2,000 Kops Tissot Monro masks before the German surrender.[35]

Throughout the 1920s and 1930s, a number of improvements and modifications were made to the basic Kops Tissot Monro mask. It remained in production as the army's standard mask up to the beginning of World War II. The outbreak of hostilities in Europe in the late summer of 1939 stimulated a rush to prepare the United States for involvement. The rush included the creation and manufacture of a new protective mask, as well as the heightened focus on the development of lightweight, tightly sealing, non-fogging mask which was not reliant upon rubber components. Nearly 22.5 million gas masks were produced for the training of and field use by American troops during the World War II period.[36]

In consideration of the rising threat of nuclear, as well as biological and chemical, warfare, the Chemical Corps officially changed the name of the "gas mask" to the "protective mask" in the initial days of the Korean Conflict. As Mr. Jeffrey K. Smart notes in his fascinating history, "Preparing for Chemical Warfare: The History of the Infantry Protective Mask," the name change was deemed to be "more reflective of the purpose of the mask, to defend against biological agents and radiological particles, as well as traditional chemical agents." In the process of pursuing this goal, the M17 mask came to fruition. Canisterless, the mask utilized replaceable filters in the cheek pouches which reduced breathing resistance. In addition, the M17 mask came in three sizes, and provided greater vision and improved speech transmission. Over the course of several years, the mask was further improved with the addition of a drinking tube which enabled a soldier to avoid dehydration during lengthy exposures by allowing him to use a canteen; a resuscitation devise was also added. This mask constituted the greatest proportion of those utilized by American servicemembers and their civilian support staff during ODS.[37]

Other soldiers and civilians deployed to SWA were issued the M40 protective mask. Standardized in May 1987, the mask incorporated the latest in technology, included a cheek-mounted NATO (North Atlantic Treaty Organization) interchangeable canister and voicemitter, to enhance communication, that can be worn on either side of the facepiece. The mask also provides increased protection, improved fit and comfort, and comes in three sizes: small, medium, and large. Although currently in production, only a small proportion of Operations Desert Shield and Desert Storm deployees carried the M40 mask.[38]

Every American civilian and servicemember deployed to SWA during ODS carried a full complement of new chemical defensive equipment. From the suzerainty of AMCCOM, a total of 314,585 M17 series field protective masks were sent to SWA. Other varieties of protective masks shipped include 1,202 M9A1 gas masks, 680 M43 aircraft masks, 3,962 M24 aircraft gas masks, and 27,585 M25A1 tank gas masks. Not insignificantly, approximately 400 of the newly designed M40 protective masks were provided to "hard to fit" American soldiers deployed to the desert. Additional chemically oriented equipment sent to SWA in support of ODS by AMCCOM included 282 M12A1 decontaminating apparatus, 600 M17 lightweight decontaminating apparatus, 15 M87 gas particular filter units, 10 M56 gas particulate filter units, and 25 M59 gas particulate filter units. Other AMCCOM-supported chemical defense items shipped to the deserts

of SWA worthy of mention include 4,529 M841 chemical agent alarms (CAA), 66 chemical agent monitors, 348 M20 simplified collective protection units, 46 M51 shelter systems, and 22 protective entrances, 2 of the M12 variety and 20 of the M10 style. Five hundred Canadian chemical agent monitors were also shipped to SWA.[39]

Supplying the most significant number of the chemical protective devices enumerated was Pine Bluff Arsenal, Pine Bluff, AR. Indeed, to handle the increased number of requisitions it received during ODS, the facility hired an additional 85 workers. Not all of the new laborers, however, aided in the assembly of new protective devices. Some of the newly hired served their nation by refurbishing masks and filters. The refurbishing process consisted of testing and repairing masks and filters. Specifically, Pine Bluff refurbished M17, M24, and M25 protective masks, and upgraded as well as modified the M10 filter canister for M24 and M25 masks. Prior to the onset of Operation Desert Shield, Pine Bluff Arsenal had been refurbishing approximately 1,100 masks per week. But with the preparations for war in the early autumn, however, the number rose to 3,500 M17 masks per week. Additionally, during the last week of September 1990, 4,000 masks were reworked for the Marine Corps.[40]

The refurbishing of masks, as opposed to solely manufacturing new ones, was necessitated by a number of factors. Chief among the reasons was the lack of a M17 production base. With the decision to replace the M17 with the M40 had come the concomitant decision to cease production of the M17. Until the M40 was in full production capable of sustaining any conceivable American demand, M17 masks would simply be supplied to those requisitioning protective masks, or repaired, through existing stocks. Prior to the start of the waiting game in the sand, the demand for standard protective masks had stood at 5,150 per month, a number rapidly surpassed in the early autumn of 1990. Yet the M40 production capacity could not, on its own, meet this demand. The result was the massive refurbishing of M17 masks.[41]

Ultimately, the decision to cease production of one mask variety before the full-scale production of its replacement style had begun, came under fire. According to personnel from AMCCOM's Weapon Systems Management Directorate, 155mm, Chemical, Nuclear Division, the initial supplies of M17 masks and spare parts were insufficient to sustain the demands made upon them. The shortage eventually precipitated the need to procure additional spare parts for the M17, M24, and M25A1 masks. In many cases, the government could look to Mine Safety Appliances (MSA), headquartered in Pittsburgh, PA, for assistance. MSA was both the designated mobilization producer for the M17 mask, and also had existing army production contracts for the M40, M42, and M43 protective masks, air force contracts for the MCU-2A/P protective masks, and ongoing foreign military sales of the M17 mask. Such a workload, plus additional spare parts contracts, exceeded MSA's production capacities and resulted in the eventual prioritization of production decisions.[42]

The problems caused by the need to secure great numbers of protective masks and the limited production base were aggravated by several factors. Upon type classification of the M40 and M42 protective masks in 1987, protective mask and protective mask spare part mobilization requirements started to be stated in terms of the standard "A" M40 series protective mask. Unfortunately, however, the M40 and M42 protective mask production facilities had not attained full production capacity at the start of ODS mobilization due to the original contractor defaulting, and its initial supplies were rapidly depleted. Simultaneously, the M17 series production base was slowly being dismantled and had limited quantities of both masks and spare parts available. The most acute situation occurred with the M13A2 filter element production equipment package which was in the final stages of being closed out when ODS began.[43]

During ODS, the serviceability of both protective masks and their spare parts became recurring issues. Teams were dispatched to Saudi Arabia to verify that the equipment in the hands of the troops was of

acceptable quality. During the war, over 200,000 M17 series protective masks' outlet valves were declared unserviceable and over one million M6A2 protective hoods were suspended from use. Accordingly, the greatly increased demands and stresses placed upon fielded equipment resulted in the necessity to substitute where possible. For example, M40 protective mask carriers were issued in lieu of the M15A1 carrier for use by soldiers and civilians equipped with M17 protective masks.[44]

From these experiences, AMCCOM staffers felt several lessons had been gained. Accordingly, they noted that the production base for a system being replaced should not be dismantled until such time as the fielding of the new, replacement system had begun, and that the impact of mobilization and the consequential effect on new item fielding should be evaluated and included in the system management plan of all new systems. Furthermore, Weapons Systems Management Directorate personnel offered that components, accessories, and spare parts should be standardized to the fullest extent possible. As an example, they noted that preliminary engineering analysis indicated that a singular outlet valve could be adopted for a majority of the protective masks within the Department of Defense (DOD) inventory, and a universal carrier could be developed for the field protective masks (M17 and M42/43). They also recommended that the specifications for older equipment should be continually updated to take advantage of the state-of-the-art options; e.g., cotton duck—a heavy plain-weave fabric—should be replaced by nylon duck, etc.[45]

In consideration of the frailties of the protective mask supply and spare parts structure, the refurbishing of masks, particularly M17s, became paramount. And Pine Bluff Arsenal, the facility primarily charged with overseeing the production of the masks found itself repairing and refurbishing them in record quantities. Prior to the onset of ODS, Pine Bluff personnel were refurbishing approximately 1,100 masks per week. While AMCCOM hoped that the facility could increase this to 9,000 units refurbished per week, the actuality was approximately 3,500 per week at the Arkansas site.[46]

In August, as deployment commenced, the Pine Bluff facility refurbished 10,009 M17 protective masks. In September the number rose to 15,797, but fell in October to 10,065. November and December 1990 witnessed rebuild rates of 11,588 and 14,914, respectively. Projections for 1991, made in its opening days and after the initial days of the air war against Saddam Hussein, relied upon slightly higher refurbishing rates: 5,000 per week. With 48,000 voicemitters available, projection analysts felt that during January 1991, 15,000 refurbished masks could be made available for distribution. During February 1991, it was projected that with the additional funding which was being processed—$2 million—a total of 20,000 masks could be rebuilt. By March, however, even with additional funding, problems would start to appear in the effort to provide sufficient, effective masks. During March, the current on-hand supply of rebuildable facepieces would be depleted and insufficient quantities of carriers would be available. April rebuild rates were to be wholly dependent upon the number of field returns and the receipt of additional spare parts. The analysts' projections, fortunately, proved considerably more bleak than the reality, in part due to refurbishing efforts undertaken in the desert.[47]

Additional refurbishing operations were conducted by Pine Bluff Arsenal personnel at a chemical maintenance facility located with the United States Army Material Command's (AMC) Support Group on the outskirts of Dhahran, Saudi Arabia. The concept for the Saudi Arabian facility was nearly as old as President George Bush's order for the initial deployment of American forces to the desert. Early in the conflict, it was observed that a repair facility in the desert could not only save tremendous amounts of time and transportation costs, but could also provide soldiers and civilians in SWA with considerable peace of mind while they were deployed to a potentially chemicaloriented theater. Specifically, the desert facility was charged with receiving unserviceable gas masks from theater general support units, and then inspecting, cleaning, testing, rebuilding or repairing them, and sending them back to theater stock for

reissue. Only masks in need of minor repairs were intended to be serviced at the facility. Protective masks needing massive repairs or refurbishing still needed to be transported to the Pine Bluff Arsenal for more costly, as well as time-consuming, repairs.[48]

Initially, the Pine Bluff facility had been intended to directly serve theater general support units by receiving, repairing, and returning protective masks to them for reissue; individuals and their specific needs did not originally fit into the facility's mission. However, even before the mask "service station" officially opened a technician put up a sign reading "mask testing walk-ins welcome". The intention was that soldiers bringing in equipment for tank and automotive repair could have their chemical defensive items tested simultaneous to achieving other tasks. But news of the service rapidly spread, and the lines of soldiers awaiting mask testing lengthened. CPT John Murphy, facility commander from CRDEC (United States Army Chemical Research, Development and Engineering Center), noted that, "We had bunch of walk-ins with lines of 500 soldiers in front of the door. They would start forming at 3 or 4 a.m. The look of relief on soldiers' faces knowing they would have confidence in their protective equipment was phenomenal. Their gratitude was really unbelievable. I can't say enough about the work the guys who work for me did. They put in long hours and maintained a can-do attitude. They know the service provided was exceptionally important to soldiers in the field—possibly life or death." With the exception of CPT Murphy, all of the facility's employees originated from the Pine Bluff Arsenal.[49]

The facility also sent out contact teams to travel to forward units that could not visit the Dhahran site for necessary repairs and confidence building. According to CPT Murphy, such contact teams provided an essential sense of confidence to forward-placed units; he would recommended providing even more mobile services in future deployments.[50]

Testing conducted at the facilities, either at Dhahran or in the field, did indicate some deficiencies in the equipment carried by American soldiers and support personnel. Yet few of the deficiencies constituted failures. According to CPT Murphy, "Maybe a nose cup disc didn't pass, but that wasn't a catastrophic failure like a large leak in a drink tube or a high percentage of penetration through a face blank. They build a certain delta into those tests—a safe area. A mask may not meet specs like one right off the production line, but it will still protect and it's still safe. Just because it didn't meet production standards doesn't mean it isn't safe." Product assurance assessments of the mask testing illustrated field readiness rates in SWA were at least as good as rates in peace time. This perhaps came as the result of the exceptional care and preventive maintenance most soldiers gave their chemical defense equipment.[51]

In addition to the approximately 14,000 masks the SWA facility serviced between December 1990 and April 1991, it fulfilled a number of other missions as well. It was the SWA issue point for the 350-400 solders provided with the M40 mask due to fitting problems with the M17. Additionally, the chemical maintenance facility had the task of inspecting, repairing, and recertifying Toxicological Agent Protection (TAP) suits used by the 30 explosive ordinance disposal teams located in SWA. To do this, the suits were filled with air, maintained at a constant pressure, covered with a high emulsion soap to find microscopic leaks, and the leaks patched.[52]

Beyond such production, and re-production, both in Arkansas and Saudi Arabia, the Pine Bluff Arsenal provided a number of further services during Operations Desert Shield and Desert Storm. Chief among these was its production of 81mm smokegenerating red phosphorous mortar rounds designed for screening or masking soldiers' activities. Although the 81mm mortar round had not been produced at Pine Bluff in quite some time, and start-up plans had been f...nulated, impending hostilities in SWA caused its production line to be more rapidly reconstituted. Longhorn Army Ammunition Plant, Marshall, TX, equipped the rounds produced at Pine Bluff with tail fins and fuzes. Additionally, the arsenal produced and shipped

155mm white phosphorus smoke projectiles to the Persian Gulf, and had begun to gear up for the production of 60mm white phosphorous mortars, and 40mm smoke markers.[53]

While Watervliet Arsenal aided in the construction of the bunker buster, and Pine Bluff Arsenal refurbished in excess of 100,000 chemical protective masks, AMCCOM's remaining arsenal did not remain idle in the effort to contain Saddam Hussein. Located on a Mississippi River island (known as Arsenal Island), nestled between Illinois and Iowa, Rock Island Arsenal has been in continuous operation since its establishment in July 1862. Although the arsenal's mission has undergone distinctive changes since its founding, the onset of Operation Desert Shield found its 2,441 civilian employees and 23 military personnel prepared to fulfill their assigned mission. The primary mission of Rock Island Arsenal (RIA) is to manufacture assigned materiel, including engineering and product assurance; perform tool set and basic issue item assembly for AMCCOM, TACOM (United States Army Tank Automotive Command), and other national inventory control points; and provide administrative, logistical and facility support services to HQ, AMCCOM, and tenants, which are co-located on Arsenal Island. Its primary materiel responsibility also includes aircraft weapons, infantry weapons, artillery and air defense weapons, gun mounts and recoil systems for tanks, selfpropelled and towed artillery personnel and cargo carriers, as well as scout and reconnaissance vehicles. Additionally, RIA offers the nation's primary materiel responsibility for recoil simulators for proofing and testing, basic issue items, common and special tools and tool sets, kits, and outfits, shop sets and maintenance equipment. It also produces gymnasticators and functional fire simulators. The arsenal has justifiably earned the reputation as being a stellar performer for the production of job lot quantities which private industry has traditionally been unable, or unwilling, to supply. And it was in this realm that Rock Island Arsenal distinguished itself during the deployment of American servicemembers to the Persian Gulf.[54]

RIA's Commander COL Richard W. Bregard commented on the installation's job-lot role in relation to ODS in an end of tour interview granted in June 1992. He noted that as ODS could be considered "a come as you are war," and as the arsenal had been quietly doing its job well over the previous decade, there was neither the time nor the need to turn all of the facility's resources to emergency weapons production. The army held a sufficient stock of M198 155mm towed howitzers, as well as other RIA-supplied items, to stand prepared in SWA. Therefore, the arsenal's most significant contribution to the victory in SWA came not in the realm of newly constructed weapons, but rather in the fabrication of spare parts and job lots. And as the military trained for several months in the desert prior to the start of hostile actions, a significant number of parts were required.[55]

Accordingly, during Operations Desert Shield and Desert Storm, RIA's Operations Directorate processed 2,123 materiel release orders (MROs), accounting for 41,268 items valued at $12,696,961. Transportation costs for the shipment of this 1,088 tons of equipment totalled $468,408. Such blanket listings of orders and items provide little information on their own. More precisely, RIA's Operations Directorate supplied 7,000 ammunition spacers for the M109 self-propelled howitzer, 418 obturator pads for the M198 towed howitzer, 2,191 obturator pads for the M109 self-propelled howitzer, and an assortment of approximately 4,000 spare parts in support of ODS. The majority of the spare parts sustained operations involving the M198 towed howitzer, including recoil rails, replenishers, recuperators, etc. The balance of RIA's spare parts maintained the 8" M110 self-propelled howitzer, the 155mm M109 self-propelled howitzer, the 120mm M1A1 tank, and the 105mm M102 towed howitzer. Other materiel shipped from RIA to SWA included such diverse items as microcircuits, telephone sets, hoisting units, chemical and decontamination equipment, huge glass and canvas shelter sets, engine lathes, explosive ordnance demolition tool kits, small arms repair kits, tank track tool kits, radiator test and repair shop equipment, 5 1/2 ton truck-mounted shop sets, boresights, water testing kits, welders, and spacers. The Directorate of Logistics expended 6,549 scheduled hours and 1,857 overtime hours of labor supporting ODS.[56]

Much of RIA's production for ODS involved the simple reclassification of long-term, ongoing efforts. For example, if production had already begun on an order for 20 recoil mechanisms, and an ODS-related order then arrived for ten of the mechanisms, the first ten off the line would be used to support the ODS order.[57]

Chief among arsenal contributions was the fabrication of tool sets. Tool sets enable servicemembers to make field-level repairs and maintain weapons systems. As such, each tool set must be custom prepared to include not only all commonly utilized tools, but also the special ones needed for a particular weapons system. Thus tank tool sets contain not only standard items, but also turret, track, and engine repair equipment, as well as minor spare parts. Each kit, with its sets and subsets could easily have several hundred components. Making certain that each set had been properly configured, packed, and directed became the role of RIA's Directorate of Logistics during ODS.[58]

At the onset of Operation Desert Shield, Rock Island Arsenal received the call to supply 278 assorted tool sets with a value of $1.9 million. Ideally, all service units were to be provided the appropriate, detailed tool sets they would need prior to their deployment, although do to the rapidity of the deployment, some sets did catch up with their units in the Persian Gulf region. Upon receiving the call to mobilize for the deployment, RIA's Directorate of Logistics activated its emergency call-in program. Accordingly, key personnel were called at their residences by the staff duty officer. These people in turn called others to inform them of the need to report. Thus warehouse workers who did the stock selection in the storage areas, as well as preservation and packing personnel arrived to prepare the tool kits needed by the desert defenders. As the components of these tool sets could range upwards from several hundred items per kit, the process of selecting items from stock, placing them in a consolidation area, and properly packing them could not be considered a modest one. A frequently prepared kit for ODS consisted of eleven separate containers, and included not only tool cabinets, but also an engine analyser, oxygen and acetylene tanks, and numerous small parts. Supporting the operation by attention to quantity, quality, and packing format stood a number of quality assurance personnel.[59]

Preparing the tool kits for shipment required the use of overtime on a call-in basis. During the height of preparations for deployment, the Directorate of Logistics utilized a three shift operation that had individuals overseeing operations, controlling documentation, selecting material for shipment, packing the tool kits, and ultimately shipping them. RIA's tool kit shipments constituted approximately half of all service tool set requirements during ODS.[60]

Similar to its role in supplying the Desert Shield and Storm forces with tool sets, RIA also provided the troops with organizational shop sets. During the earliest days of the deployment, RIA's Directorate of Logistics modified and prepared for shipment a total of 43 trailer-mounted general purpose shop sets, 241 five-ton truck-mounted shop sets, and a number of two-and-a-half ton truck-mounted sets. More detailed and complete than tool kits, organizational shop sets serve as mini-machine shops containing equipment such as a lathe, welder, power vise, and a complete basic set of tools. The rolling machine shops could be driven to the front lines during battle to aid in the performance of field level repair and maintenance.[61]

Modifying the truck-mounted organizational shop sets involved repositioning the lathe from an interior mount to one which provided the operator with not only a more convenient location, but also a safer one. The modifications also entailed the addition of a few tools, altering the electrical system, and installing an exhaust system in each organizational shop set. Additionally, the spare tire mounting machine was modified to eliminate operator hazard.[62]

One potentially significant problem with the trailer-mounted shop set was averted due to the sharp-eyed and quick-thinking personnel of RIA's Directorate of Logistics. Logistics staffers had been told to ship

the trailer-mounted shop sets upon the completion of their stocking and physical modification. Yet, in consideration of their forest green paint, this order did not appear correct. Accordingly, Mr. Leslie H. Black, Director of the Directorate of Logistics, contacted AMCCOM's International Logistics Directorate for further guidance, and with the suggestion that RIA personnel paint the shop sets the appropriate desert sand color with CARC (chemical agent resistant coating). Praised for their alertness, the directorate received the order to paint the sets.[63]

Wearing special clothing and air packs, second shift arsenal employees completed the painting in a single night's labor, 15 August 1991. Just two days later, after the paint had had time to cure, the shop sets left Rock Island, bound for the Saudi desert. Later in the deployment effort, RIA's Directorate of Logistics employees painted approximately 240 truck-mounted organizational shop sets which had been modified and stocked at RIA the appropriate desert sand CARC, covering the forest green that presupposed a woodland-oriented conflict.[64]

Beyond the modification and painting of numerous organizational shop sets for the Persian Gulf War, RIA personnel prepared a significant number of National Guard unit vehicles to field in the desert. In early November 1990, the arsenal's Directorate of Logistics became aware of two Iowa reserve medical units whose vehicles needed to be painted with sand-colored CARC. These vehicles had previously been painted in the familiar camouflage green for the presumed western European land battle that had guided American military thinkers since the dawn of the Cold War. The units—the 209th Medical Company (Clearing), Iowa Army National Guard, Iowa City, IA, and the 134th Medical Company (Ambulance), Iowa Army National Guard, Washington, IA,—should have been repainted at Fort McCoy, WI, which served as the units' point of deployment. However, Fort McCoy had a very limited production capacity, as well as exceptionally limited CARC painting capabilities. Therefore, the two units needed to find a painting facility, and find it rather rapidly. RIA's Directorate of Logistics became aware of the problem, and volunteered to take on the extra mission.[65]

Accordingly, the National Guard units' vehicles began arriving in Rock Island on the evening of Friday, 16 November 1990, and continued to arrive in small convoys through mid-day Sunday, 18 November 1990. Driven to the island from their home stations by members of the medical units, the vehicles arrived with a coating of road grime. Thus, the vehicles needed to be power washed and driven a bit to remove any excess water. They were then dried, and warmed up in the production facility's craneway to allow masking tape to adhere to parts—wheels, hubcaps, windows, lights, canvas, etc.—which were not to be painted. Then, working in ten to sixteen hour shifts RIA's Directorate of Logistics laborers, aided by its Arsenal Operations Directorate, commenced the painting. By the close of business on Monday, 19 November 1990, all 105 vehicles-ambulances, trailers, five-ton wreckers, and two-and-a-half ton trucks—had been painted, as well as stenciled. And within days, the vehicles were enroute to SWA.[66]

Spare parts, tool sets, and CARC painting, however, mark but a portion of RIA's contribution to the desert victory. Shortly after the deployment had begun, AMCCOM called upon Rock Island Arsenal to produce the spacers necessary to properly secure projectiles in the M109 self-propelled howitzer's bustle rack and prevent their inadvertent damage. The army's newly designed M864 white phosphorous smoke projectile and M825A1 projectile, containing small multiple bomblets, were simply too short to safely and quietly stow. Yet despite the fact that the projectiles rattled in the howitzers' storage bustles, in consideration of the emergency that constituted Operation Desert Shield, the M864 and M825A1 were fielded without the benefit of spacers.[67]

The United States government had suppliers manufacturing the spacers for the army, but they could not produce them rapidly enough to have the army feel secure that a sufficient quantity existed to satisfy

its deadline for total combat preparedness in SWA. The army urgently needed 13,000 M864 spacers and 4,000 M825A1 spacers. Accordingly, the government contacted Rock Island Arsenal to ascertain if the facility could produce the small units. Having previously not seen or produced spacers, RIA engineers immediately inspected the technical data package to assure that they could indeed produce the needed items. Its ability to comply was the direct result of newly acquired, stateof-the-art, highly technical equipment like the numerically controlled Behrens Lazer which was capable of cutting pieces of metal at the rate of 200 inches per minute.[58]

Given the strictures of time, Rock Island Arsenal exercised options on drawings prepared elsewhere, foregoing the usual formal correspondence required by deviations from design. With the concurrence of engineers examining, marking, and signing off, the arsenal was able to provide a welded assembly that was produced in the same time frame that it took the necessary funding to arrive, approximately two weeks. The rather short turn around of the project came in part as a result of the arsenal having the appropriate equipment, an able, innovative crew, and readily available material.

Although relatively unassuming in design, the actual production of the spacers became surprisingly involved. Using the latest state-of-the-art technology, arsenal employees laser cut the shank of the spacer to 4.45" +/-.015". This was then inspected in accordance with the Quality Assurance Standard Improvement Program. Next, both sides of the shanks were deburred, blanchard ground to lay flat, inspected, and stamped with the part number. The surface of the shank was then filed flat, and inspected once again. Once stamped and inspected, the shank was bent to fit flush against the side of a projectile, inspected, and heat-treated to RC 28-32. The shank was then annealed to make the metal more pliable, less brittle, and yet stronger. A sample shank was then inspected, after which, the remainder were glass bead-blasted to remove any heat treatment scales remaining on the metal. Finally, the shanks were chamfered to remove any stress cracks resulting from the bending process.

For their part in the manufacturing process, arsenal machinists used numerical-controlled lathes to produce the spacer's disk base from tubular rod stock. The face of the stock was chucked, and the outside diameter turned down to 1.25" +/.015". The rod was then cut off to .54" +/- .03" in length, and had its sharp edges removed. The disks were then inspected, heat-treated to RC 28-32, inspected again, glass bead-blasted to remove heat treatment residue, and once again inspected.

Prior to the welding process, the two components, the shank and the disk base, were heat treated in accordance with engineering specifications. At this juncture, a minor problem developed but was readily rectified by Rock Island Arsenal tooling personnel. The dies utilized during the heat-treatment process proved to be too straight for both components, causing the spacer shank to twist during the treatment. Tooling developed a die which kept the shank of the spacer straight.

Working with the heat-treated shank and disk, welders initially tack welded the components into their proper positions. After this, they were continuous welded with fillet weld angles, and then, as per usual, sample inspected. From this point, the spacers were placed under stress relief temperatures not to exceed 950 degrees Fahrenheit in order to relieve stress caused by the welding process, and, once again, inspected to verify the RC 28-32 hardness of each heat-treated item. After the welding and follow-up inspection, the spacers were super heat-treated austenitized for an hour to 1,600 degrees Fahrenheit, then quenched in Uncon C water at 70 degrees Fahrenheit. The quenching cooled off the spacers quickly and also hardened the carbon which was then removed by breaking off the scales. The heating and rapid cooling process left the spacer brittle. To alleviate the brittle condition, the spacers were slowly reheated to 1,025 degrees Fahrenheit, which returned the steel to its original strength.

Following the de-brittlization, Rock Island Arsenal inspectors conducted magnetic particle examinations to verify that the welds had been thoroughly performed. The spacers were then degreased and glass bead-blasted clean in preparation to receive a cadmium finish, a dull, heavy metal which would be plated to the spacer. Once the cadmium finish was applied, the spacers were baked to relieve hydrogen embrittlement, and a supplementary chromate treatment was applied. Quality Assurance Specialists then inspected the spacers for a final time, and presented them to the Rock Island Arsenal's Directorate of Logistics to prepare them for flight shipment to Dhahran, Saudi Arabia. The first 4000 spacers, all of the M825A1 variety, were packed and enroute by 14 February 1991. The final order, consisting of 3,000 M864 spacers, was completed and started towards the desert on 22 February 1991, just days before the commencement of the ground war against the forces of Saddam Hussein.

From the initial contact to shipment of the second order of spacers, a mere three weeks elapsed, offering substantial testimony to, and greatly enhancing, Rock Island Arsenal's reputation as the army's "job shop". Since the close of the war, the spacers have been declared Basic Issue Items (BII), meaning they are now official components of the M109 self-propelled howitzer, and therefore, like the tool kit, the crew is accountable for them during inspection. Although the RIA maintains the capacity to produce the spacers, it has not been called upon to create spacers for peacetime use. Yet, the urgent production of these spacers has added another item to the already long list of ordnance weapons and equipment that the arsenal could produce at a moment's notice.

Not only Rock Island Arsenal, Pine Bluff Arsenal, and Watervliet Arsenal concerned themselves with the production of materiel for Operations Desert Shield and Desert Storm; other organizations under the hegemony of AMCCOM did so as well. For example, the United States Army Chemical Research, Development and Engineering Center (CRDEC) exerted prodigious efforts in the manufacture of special marking rounds. In response to an urgent request from the Marine Corps, innovative CRDEC scientists developed, in scarcely a week, a special marking round for employment in SWA in February 1991. The USMC needed a projectile to mark the terrain, a point, or a number of points in a line, so that a Forward Air Coordinator (FAC) could orchestrate close air support to minimize fratricide by creating a safe zone. The USMC wanted a system for both daylight and nighttime and needed it in SWA quite rapidly. This allowed CRDEC scientists a mere nine days to conceive a concept, fabricate it, and then test prototypes, as well as produce and package the system.[69]

The time constraint forced the scientists to consider only a payload that was commercially available and a carrier that already existed in the army's inventory. The scientists selected the M687 binary 155mm projectile due to its point detonating disseminating characteristics, availability, and liquid payload capability. An existing contract to produce the necessary quantities of M20 and M21 binary canisters, which carry the payload in the binary projectile, was modified to contain the marking materials. A single long canister was selected for the daytime marking payload, which was "Day-Glo" fluorescent blaze orange paint, because no flight mixing was necessary. A dual component chemiluminescence system, requiring the use of the two binary canisters, was selected for the nighttime projectile. The two chemical components mixed upon firing. When disseminated, the mixture was visable in the 400nm-700nm (nanometer) spectrum of optical sensing devices and did not produce heat, flame, or sparks. Furthermore, it could be seen with standard night vision goggles. These chemicals solutions were non-toxic, thus complying with healthy hazard assessment and environmental considerations. Testing and evaluation of the special marking projectile was performed in parallel with prototype developments.[70]

On 19 February 1991, the first operational use of the projectiles was conducted in SWA. The FAC, wearing night vision goggles, sighted the dissemination pattern approximately 500 meters distant and asked, "What the hell are you shooting? It's as bright as day over here!" What the FAC had observed

was the impact pattern of three nighttime projectiles, which were launched simultaneously from three M198 155mm towed howitzers. Earlier that day, three daytime projectiles had been fired from the same howitzers. This observation by the FAC indicated that the projectiles had arrived on time and worked rather well. Additionally, the experience illustrated that field units should continue to submit tactical requests for new and innovative techniques to the R&D centers. A potential requirements for future use study is currently underway based upon the observations that the specially designed marking round appears to have great value in a combat arena to create a night and day visual recognition symbol for attack aircraft.[71]

CRDEC also created a new power source for the CAM. The CAM (chemical agent monitor) is a lightweight, hand-held, soldieroperated monitor used to detect chemical contamination on personnel and equipment. It is ordinarily powered by a 6-volt lithium battery. The battery, however, tends to be rather expensive and requires special handling due to its status as hazardous waste. Units in SWA also expressed concern that replacement lithium batteries would not be available if the CAMs were used for training. Accordingly, CRDEC received the tasking to engineer an in-house design and development effort that provided the CAM with an alternate power source for training. Ultimately, working from November through December 1990, CRDEC designed and built an alternative battery pack for training which incorporated D-size flashlight alkaline batteries. Of a 5,000 battery pack order, CRDEC employees managed to ship 2,000 of them to SWA by 1 January 1991, less than two months after having received the charge to develop an alternative to the lithium power source. Reports from SWA indicated that the battery packs were a "huge success".[72]

The effort by CRDEC to rapidly conceptualize, fabricate, and test prototypes, as well as produce and package the system, while a quite stellar feat, was not unusual among AMCCOM subordinates during ODS. Other facilities worked just as diligently to assure the victory. For example, Crane Army Ammunition Activity (CAAA), in order to meet urgent, initial required delivery dates accelerated shipments of ammunition. Some employees worked 25 hours straight, although 16 to 18 hour shifts were more common. While such prodigious, bone-wearying efforts enabled the facility to deliver 7,546 short tons of ammunition in a mere ten days, as well as load 66 semi-trucks, and 52 railcars in 23 days, they did not allow as easily for the more painstaking efforts required to increase production. Yet in terms of production, as well as shipping, the government-owned, government-operated facility demonstrated itself not only as extraordinary, but also as exceptionally innovative.[73]

Tucked away in southern Indiana's farm country at the Naval Weapons Support Center, the activity center's 700 civilian employees manage a 350,000-ton stockpile of conventional ammunition for the army, navy, and Marine Corps. Additionally, it manufactures everything from smoke and illumination signals, signal flares, assorted shock test charges ranging up to 40,000 pounds, 2,000-pound MK84-4 Tritonal bombs for the air force, and 155mm M804 practice rounds. Furthermore, the ammunition activity is charged with the production of marine location markers MK254/MK58-1, assorted 76mm cartridges, demolition charge MK133-2, 16"/50 projectiles for battleships, and 5"/38 projectiles, as well as 5"/54 projectiles for the navy. During ODS, Crane also received the tasker to produce and ship 2,000-pound bombs for the Kuwaiti Air Force and to manufacture 1,500 linear demolition charges.[74]

Although Crane Army Ammunition Activity met the exigencies of the initial hectic days of ODS with great skill, coupled with long and tiring hours, it had some difficulty maintaining the pace as the standoff in the desert continued. As MSG Roger Fadroski, CAAA's Marine Corps liaison, noted the facility simply did not have sufficient blue-collar employees to work around the clock for an extended period of time. Yet the facility did not suffer unduly from the shortage of blue-collar labor. Due to a grassroots-type of management program that had begun at Crane AAA only months before the war started, the center was able to continue its mission without great difficulty. In the Quality Management Program instituted at Crane AAA a mere

month before the onset of ODS, white-collar workers, including engineers, analysts, and department directors who had designed work stations for blue-collar employees had been given the chance to labor in the conditions they had designed and to labor by the rules they had instituted. Thus just weeks before the invasion of Kuwait and the threats upon the territorial integrity of Saudi Arabia, Crane AAA's management team had gained valuable practical experience in the manufacturing and depot operations of the facility. And when American troops deployed to SWA, design and management personnel took their positions along side, and in place of, exhausted production and depot workers, frequently after their own, normal eight-hour day had been completed. Other administrative personnel volunteered to work on Saturdays to give blue-collar laborers badly needed respites, or to allow the manually skilled tradesmen and women to be utilized in the more taxing arenas where training requirements did not permit the white-collared to share in the toil.[75]

LTC Ken Rhylander, Crane AAA Commander, noted of the enhanced operations, "You [had] to see the teamwork to believe it. This [was] a magnificent work force. They [were] selfless and totally dedicated to supporting servicemembers in the field and at sea." Regardless of the selflessness and dedication demonstrated by Crane employees, and those of so many installations, in the production of the implements of war, as well as the shipping, the need to utilize white-collar employees in production and depot service positions when they quite obviously could have been better employed in their chosen career field while working fewer hours was addressed in the official AMCCOM Operation Desert Shield/Storm After Action Report. AMCCOM's Personnel and Training Directorate staff noted that the Department of Defense hiring freeze in place at the onset of ODS prohibited installations, such as Crane AAA, from hiring the civilian personnel required to perform essential war work. The submitted observation noted that in particular Crane AAA worked employees in double and triple shifts, and detailed white-collar personnel in a variety of operations due to the lack of authority to hire. It further noted that even with expedited procedures to obtain hiring authority, the short delay caused significant problems which jeopardized mission performance. In view of the problems incurred, the Personnel and Training Directorate recommended that current and future hiring limitations should contain a provision for local commanders to unilaterally hire temporary employees required to meet operation and mobilization mission requirements. The directorate thus recommended that AMCRM (Army Material Command Resource Management) work with the Department of the Army (DA), as well as with DOD, to obtain the required provision.[76]

Beyond the efforts of Crane Army Ammunition Activity, other ammunition facilities worked with great effort to supply American and allied soldiers and civilians deployed to SWA with the very best materiel possible. AMCCOM's Operation Desert Shield/Storm After Action Report recognized a number of army ammunition plants for their "extraordinary accomplishments" in the realm of production during ODS. Louisiana Army Ammunition Plant, Shreveport, LA, for example, produced 2.75mm rockets as fast as rocket motors were received from the vendor, and Kansas Army Ammunition Plant, Parsons, KS, built in excess of 10,000 155mm projectiles. Additionally, Longhorn Army Ammunition Plant, Marshall, TX, accelerated the production of 80,000 M721 60mm illuminating rounds, and Milan Army Ammunition Plant, Milan, TN, similarly expedited the production of the M853 81mm illuminating round. Other ammunition plants were cited in the report for their efforts in the packing and shipping of large quantities of munitions.[77]

Yet problems also resulted from the effort to maximize the production of ammunition during ODS. Planning for the maximum rate of ammunition production revealed to assorted army ammunition plant staffers, as well as product managers, that the United States production base for mortar fuzes significantly restricted the production capability for most mortar ammunition rounds. Through varying discussions, it was observed that one objective in the ammunition development-use community had been to reduce the proliferation of fuzes used on mortar ammunition to achieve a "three-fuze" family. By using the same fuzes on many ammunition rounds, and by striving for commonality of components among different types of

fuzes, e.g., on the M734 multioption fuze and the M745 point detonation fuze, a large bottleneck of demand for the same fuzes, which are produced by a very limited production base had been created. The production capacity for M734s and M745s combined is constrained at approximately 35,000 to 40,000 per month. This capacity must be allocated among six 60mm, 81mm, and 120mm high explosive (HE) and smoke mortar rounds.[78]

Likewise, four 60mm, 81mm, and 120mm smoke and illumination rounds all depend on the availability of mechanical time fuzes produced in Germany at a maximum rate of approximately 50,000 per month. There is no production base for MTFs (mechanical time fuzes) in the United States; a recent effort to identify a domestic electronic time fuze for use on these rounds revealed that even the electronic component production base predicted to exist in the U.S. was rapidly disappearing in favor of overseas producers. Apparently, ammunition procurement quantities in the 1980s have discouraged fuze producers from entering, investing, or remaining in the production base.[79]

From the experience of charting the potential for fuze shortages, mortar specialists recommended that the United States break out critical electronic components of mortar fuzes, and invest in the establishment of a production base for them. It also urged the development of a new electronic time fuze for mortars and the creation of a production base for it. Such efforts should prove to keep army ammunition plants properly supplied and producing without constraint in future deployments.[80]

Beyond the lack of an assured mortar fuze production base, alert AMCCOM personnel noted and commented upon the absence of adequate data on foreign ammunition production capabilities. According to staffers, the lack of adequate information on ammunition capabilities in allied and friendly nations became evident during ODS. And, as they observed, it is essential to have accurate and complete information on foreign ammunition production in order to augment United States capabilities for U.S. requirements, or to be able to provide information to allies on sources of required ammunition which the United States does not produce. Some staffers recommended the funding, establishment, maintenance and operation of an international ammunition production information system, although its adoption in fiscally limited times appears improbable.[81]

While AMCCOM's subordinate commands endeavored to supply it with the needed materiel either from on-hand stocks or via production efforts, not all necessary items could be so obtained. In some instances, items were procured from commercial production facilities. At the onset of Operation Desert Shield, members of AMCCOM's procurement community composed and presented a list of the significant actions they felt needed to be taken to ensure the successful completion of their mission. In order that procurement actions might be expedited, they recommended that the Head of Contracting Authority (HCA) delegate authority to the appropriate deputy commanding general for the release of production funds prior to the completion of a firm's first article test (FAT) or initial production test (IPT). Additionally they recommended that high priority (DX) be given to "surge" procurements, recognizing that restructuring or delays might be necessary for lower priority programs. Accordingly, procurement personnel urged that needs be identified by analysis, that technical data packages (TDPs) be prepositioned throughout the directorate, and that source control components be overbuilt.[82]

Furthermore, at the deployment's onset, procurement personnel recommended that local authority be granted permitting letter contracts for engineering services, as well as blanket purchase authority for selected equipment. They also requested additional funding and the authority to reprogram existing funds to support accelerated acquisition strategies.[83]

As in the case of in-house production, as well as off-the-shelf provisioning, problems could and did occur. Chief among the problems faced by AMCCOM's Procurement and Production Policy and Management Directorate were those imposed upon it by federal regulatory requirements. For example, members of AMCCOM's Competition Management Office observed that the Federal Acquisition Regulation (FAR) had been written to govern the acquisition process based on peacetime circumstances. Accordingly, the process was one designed to be ultimately fair, achieve the best good or service, and to do so at the best possible cost. Unfortunately, the process could also be exceptionally time-consuming. Thus when AMCCOM, or any similar command, was tasked with the acquisition mission to either ramp up to meet a threat or the actual support of a full-scale war, there arose a critical need to streamline the acquisition process. The Competition Management Office felt that relief from certain regulatory requirements, such as delegations of authorities, elevation of existing thresholds, and additional authority granted to the respective Heads of the Contracting Activities (HCAs), must be granted automatically with the onset of hostilities, or their imminent threat. Accordingly, the office recommended that the FAR council should be tasked with the development of an auxiliary regulation for use during wartime. And in consideration of the time which would be involved in modifying the process, it urged the exploration of amendments to FAR begin immediately. [84]

Of particular concern regarding FAR was the requirement that the approval of all justifications and approvals (J&As) over $10 million be made at the Department of the Army level. As AMCCOM's Materiel Management Directorate had identified, even before the start of the ground war, a minimum of twelve AMCCOM J&As that would require DA authorization, the probability of a stultifying backlog loomed. In order to attempt to hasten the approval process, the local J&A Signing Board determined that all J&As requiring DA approval should have urgency statements attached which specifically addressed the item being procured. Furthermore, all Procurement Directorate personnel were advised that regardless of the sense of emergency, no contracts for actions over $10 million could be awarded until the J&A had received concurrence from DA.[85]

Guided as they were by the FAR and its assorted rules concerning J&As, AMCCOM's procurement personnel spent considerable time and effort, and encountered numerous difficulties, attempting to adhere to the acquisition regulation. One problem involved the issue of the Surge Production Readiness Program. The program could not be utilized to its full potential during ODS due to conflicting implementation guidance personnel received from HQ, AMCCOM, AMC (United States Army Materiel Command), and the Office of Counsel. It became evident to the Production Directorate that a lack of uniform/unified guidance, as well as the absence of a universal understanding and compliance with the "Surge Program", were issues that required attention and resolution. The question of a "surge" clause in a commercial contract had resulted in a residual undermining effect to the total "Surge Program". This was recognized when the procurement community, who did not have, in their opinion, justification in accordance with the FAR and Defense Federal Acquisition Requisition (DFAR), and would not "surge" commercial contracts without first soliciting cost estimates from the individual contractors.[86]

This action was in direct opposition to the Surge Program initiatives and demonstrated an inherent reluctance on the part of the government to unilaterally exercise the contract surge clause. Such actions were not without predication, however, since DA and HQ, AMC decisions on unevaluated options, the use of emergency statements, and J&As had molded a systematic approach to contracting that ignored the implementation of surge contracting methods. In fact, the contracting agency was the strongest proponent for undefinitized contract actions (UCAs) as a substitute for accelerated acquisition.[87]

ODS demonstrated that the Surge Program was not totally effective in the transition period between peacetime and what could have developed into a full-scale mobilization scenario. The primary cause

appeared to be the lack of a total commitment to the Surge Program on the part of certain elements of HQ, AMC and AMCCOM which resulted in conflicting and inconsistent guidance, utilization, and implementation of surge initiatives that could have been avoided had a cohesive, "all on board" attitude been in place when Operation Desert Shield began.[88]

In consideration of the problems incurred with the effort to implement the surge program, members of AMCCOM's procurement community urged that a program be developed which could fill the void between peacetime production and mobilization of the industrial base, and could serve as a vehicle by which the government could unilaterally enforce an acceleration of the production schedule of a contractor, as well as exercise an option for additional quantities in order to meet national emergencies. Procurement personnel felt that the failure to develop a surge-type program would ensure that the issue of surge production remained open only to face them again in future Desert Storms.[89]

One solution to the problems presented by the J&A process, and accordingly the FAR, received additional attention in the Operation Desert Shield/Storm After Action Report in a submission prepared by the Procurement and Production Policy and Management Directorate. Its personnel noted in their submission that class, as well as standard, J&As for ODS were developed to enhance the J&A process and to reduce processing time. Class J&As were written with dollar values under $10 million to allow for local approval instead of Secretary of the Army (Research, Development, and Acquisition) (SARDA) approval. The use of class J&As was intended to allow statements of applicability to be processed rather than requiring the preparation of a new J&A.[90]

Just as the class J&A had been prepared to save time, so had the standard language J&A. Via the Sperry system, a standardized J&A form had been provided to all ODS contract specialists. Rather than devising a new J&A, the contract specialist had only to fill in information in some paragraphs and provide more extensive information as it pertained to their particular action in other paragraphs.[91]

Yet the efforts of the Procurement and Production Policy and Management Directorate did not flow as smoothly in the processing of J&As as its personnel had hoped. In regard to class J&As, the dollar limitation had been set too low. Funds ran out early and individual J&As had to be written in their stead. Therefore, the class actions saved the procurement community work on some of the smaller dollar actions, but not the larger quantity or higher dollar requirements. Similarly, all did not flow smoothly with the standard language J&As. While most of these J&As could be used simply as fill-in-the-blank approvals, others required extensive tailoring by contract specialists to fit the specific action.[92]

The procurement community's effort to secure secretarial level class J&As did not succeed. At the onset of Operation Desert Shield, staffers appealed to higher headquarters for authorization to permit other than full and open competition for urgency buys. This request was denied by higher headquarters with the explanation that the FAR allows after-the-fact individual J&As to be utilized. Thus rather than processing a small number of secretarial level class J&As during the war that would have covered all ODS requirements, procurement personnel posted hundreds of individual J&As during and after the war.[93]

As others before and after them would note, the procurement community offered that higher headquarters should have taken into account the wartime situation and not tried to conduct business as usual during the war. They observed that the urgent situation required an innovative approach that would have allowed the necessary supplies/support to reach the crisis area in the most expeditious manner. And by inference, they suggested that the innovation had not always been apparent. Accordingly, Procurement and Production Policy and Management Directorate specialists had a number of suggestions as to how the process might have been expedited, and, indeed, how it might be better handled during future engage-

ments. They suggested that relief or special consideration from regulatory requirements pertaining to approval levels of J&As over $10 million from SARDA. This would allow the use of class J&As and statements of applicability which would reduce the workload for the procurement community and expedite the approval process.[94]

Procurement personnel also recommended that local class J&As be limited to three to six months in length. Since the duration of a conflict cannot be known at its onset, a time-phased class J&A can allow the establishment of another class J&A to provide purchasing authority for new/additional wartime requirements. Additionally, they urged that in the future, some form of relief from the Competition in Contracting Act be obtained. They suggested that under urgent circumstances that a memorandum documenting the file in lieu of standard J&A procedures could suffice.[95]

Problems also occurred for the procurement community in connection with acquisition plans (APs). During ODS it was discovered by the community that there existed no clear guidance for complying with AP requirements for urgent situations. A request for deviation was thus submitted to HQDA (Headquarters, Department of the Army) requesting the Army Federal Acquisition Regulation Supplement (AFARS) requirement to submit a formal written AP, and its update, be waived. As an intermediary step, AMCCOM received permission from the Army Defense Acquisition Regulatory Council that a compressed format of the standard acquisition plan could be utilized during the emergency. The Head of Contracting Activity (HCA) also gained the authority to approve a modified AP. As a result, the Procurement and Production Policy and Management Directorate gained permission to write procedures which reduced the detail and formality of APs. Only after the war did the HCA approve minimum requirements for acquisition planning to meet urgent conditions. And in order to avoid awaiting such an HCA pronouncement in the future, the directorate undertook action to have the AP policy contain contingency options.[96]

Not only the Federal Acquisition Regulation along with its detailed commentary concerning assorted justifications and approvals consumed the time of Procurement and Production Policy and Management Directorate personnel. The matter of market surveys, also under the domain of the FAR, filled hours of their valuable time. Yet in the matter of market surveys, the directorate had an ally in the acquisition regulation. According to FAR 6.302-2, and in accordance with 10 USC (United States Code) 2304 (c) (2): Unusual and Compelling Urgency, the procurement had an ally. Through the regulation's provisions, a waiver was obtained permitting chemical detection equipment, decontamination equipment, gas masks, artillery, small arms, armor, aircraft, fire control equipment, training devices, and Direct Support Electronic System Test Set items, as well as their components to be acquired without the conducting of a market survey. The waiver applied only to ODS actions.[97]

By the conditions of the waiver, competition for ODS production and procurement would be limited to the current and/or past producers who had been determined by the federal government as being capable of meeting the required delivery time frames. In their request for the waiver, members of the procurement community had succinctly stated their goal for ODS, "Troops have already been deployed and the safety of our personnel is affected by our ability to provide adequate support. Failure to procure these requirements will result in the potential loss of soldiers' lives. Available assets are currently being released for issue in support of this operation. Continued sustainability requires immediate stock replentishment." By inference, the request suggested that only by the attainment of the market survey waiver could the constant "replentishment" be assured.[98]

Although the market survey waiver did become a reality during ODS, problems, quite naturally, arose over the action. One involved the Office of Counsel's observation that by the restriction of procurement operations to current and past producers of necessary acquisitions, the Procurement and Production Policy

and Management Directorate had not assured itself that any given past producer, especially one that had not supplied the item for number of years, could more rapidly supply an item than a producer responding to open competition. Despite the fears of the Office of Counsel, the directorate did not anticipate that such problems would be frequent. They noted that there are usually excellent reasons for the restriction of procurement, such as first articles being waived, the contractors being the only ones with government or special tooling, or the contractor being in production, or just recently in production as a subcontractor, for the same item. This could serve as the basis for the waiver of the first article. Other reasons could also provide the rationale for restricting competition and could be stated in the J&A to show how the restrictions proposed would result in faster delivery than in the case of a full and open competition. While the staff of the directorate had no doubt that the case limited competition procurements could be justified, they felt obligated to spell the reasoning out clearly in the attendant J&As.[99]

The need to avoid time-consuming market surveys continued to garner the attention of of the Procurement and Production Policy and Management Directorate even after the successful conclusion of ODS. An observation included in AMCCOM's Operation Desert Shield/Storm After Action Report noted a generic market survey waiver had been developed for most items being procured for ODS. Contract Specialists had been able to submit a generic waiver with each J&A processed under Desert Storm. All concurring offices simply accepted the waivers. Yet during the war, it had been discovered that not all ODS requirements were covered under the generic market survey waiver. As a result, some individual waivers still had to be processed. Accordingly, to save time in future engagements, directorate personnel recommended that at the onset of a declared national emergency a DA waiver could be issued to permit the larger-scale use of market survey waivers.[100]

Justifications and approvals, as well as market surveys, did not constitute the whole of the restrictions placed upon AMCCOM's procurement personnel. A number of other statutes and regulations existed, which in times of peace served the nation well, but which, however, in times of national emergency proved to be impedimentiary. The community was constrained in its acquisition of high value automatic data processing equipment (ADPE) by 40 USC (United States Code) 795, also known as the Brooks Act. According to the code, the procurement authority for all high value ADPE purchases rested with the General Services Administration (GSA). This only served to slow down the acquisition process in times when it most probably should have been speeded up. Additionally, exemptions to the acquisition code, via SARD-88-2, the Warner Amendment, had to pass through ISSAA (United States Army Information Systems Selection and Agency).[101]

Section 805, Public Law (PL) 101-189, the FY90 Authorization Act, further limited AMCCOM's response to the exigencies of ODS. It required that the Secretary of Defense certify support costs for any proposed multi-year contract. Additionally, 10 USC 2326 placed funding limitations on UCAs (unpriced contractual actions) and 22 USC 2770, as well as other statutes, limited AMCCOM, and other commands, authority to sell materiel to contractors. Another statute, 15 USC 637—the Small Business Act, granted the Small Business Administration (SBA) authority to grant certificates of competency to small businesses attempting to win government contracts.[102]

Further statutory limitations were imposed by 42 USC 6961, the Resource Conservation Recovery Act. The act placed restrictions on the processing and disposal of waste and hazardous material. Other restrictions on the ability of AMCCOM came in the form of 50 USC, the Defense Production Act. According to its strictures, AMCCOM could not compel a contractor to accept a contract. The act also placed the approval authority for seeking indemnification from defaulting contractors with the Secretary of the Army. A final statutory impediment to the actions of AMCCOM as concerned the industrial community came in the form of 10 USC 2319. It placed limitations on the establishment and fulfillment of qualification

requirements for materiel to be procured, e.g., qualified products lists (QPLs) and source controlled items. Other regulations restricted the freedom of AMCCOM to fulfill its mission as well.[103]

However, throughout the course of ODS, AMCCOM's production and procurement community received relief from a considerable number of the regulations which had constrained them at the war's onset. Within a week of the start of the air offensive in SWA, and in accordance with DA instructions, AMCCOM staffers received relief from the strictures of 10 USC 2336. By the authority of the DA, the Head of Contracting Activity (HCA) was authorized to approve unpriced contractual actions which were in direct support of Operation Desert Storm. The power could not be re-delegated and expired, unless sooner terminated, on 31 December 1991, but in the interim served to speed the acquisition process.[104]

Other bits of regulatory relief came throughout Operations Desert Shield and Desert Storm. Prior to the outbreak of hostilities, AMCCOM, as well as other commands within the military structure, were required by the terms of the FAR 5.303 (A), DFARS (Defense Federal Acquisition Regulation System) 205.303 (A) to notify the Congress of the United States prior to awarding any contract in excess of $5 million. The requirement for prior notification was waived, and Congressional notification to be made within four days of the award. Briefly, a 20-hour, post-award notification requirement had stood.[105]

Additionally, the procurement community received relief from the requirement to perform Equal Employment Opportunity (EEO) checks on contracting firms prior to the making of production awards. AMC ruled, in accordance with FAR 22.805 (A) (7), that in the case of an urgent or critical contract being at stake, and in a situation where the Office of Federal Contract Compliance Programs (OFCCP), Department of Labor cannot complete a preaward review of by the required date, the HCA, after informing the OFCCP region office, could approve the award without the preaward clearance. Preaward EEO clearances need not be obtained at all, according to Army Deviation 88-DEV-24 (Acquisition Letter 88-16) if the proposed prime contractor and subcontractors anticipated receiving contracts of at least $1 million had received clearances within the twelve months prior to the awarding of the ODS-oriented contract. AMCCOM procurement personnel simply needed to document the particulars of the earlier clearance in their later award.[106]

Procurement personnel also had concerns regarding AMC reviews of Business Clearance Memorandums for non-competitive procurement over $50 million and competitive procurements over $100. They felt that AMC involvement delayed the awarding of contracts by a minimum of two days. AMC did not feel its participation had an impact on the award process as it conducted their reviews on site as part of the MSC (major subordinate command) review. Yet AMCCOM staffers did feel that AMC participation adversely impacted the process in terms of time absorbed. This seemed particularly annoying considering that AMC did not have approval authority, but rather simply review and recommendation powers. Ultimately, AMCCOM received the right of deferring Business Clearing Memorandums on UCAs, but still had to have them completed prior to the definitization of contract awards.[107]

Other bright spots of relief in the acquisition process came for AMCCOM procurement specialists with the raising of the small purchases threshold for OCONUS (outside continental United States) to $100,000. Also, Desert Storm requirements could be placed ahead of other, previously contracted, defense orders at civilian production facilities.[108]

Despite efforts to the contrary, AMCCOM Procurement and Production Policy and Management Directorate staffers could not eliminate all of the regulatory restrictions which constrained them. For example, the effort to raise HCA's authority to approve J&As above the $10 million mark did not meet with success. While AMC officials recognized that the sought-for $50 million procurement ceiling had potential value in

the "unusual and compelling urgency" that constituted ODS, they did not allow the petition. Nor did AMC waive the requirement for J&As when unevaluated options were exercised.[109]

AMCCOM procurement specialists felt further stymied by their failure to gain relief from small business regulations. They sought to have the equal employment opportunity clearance requirement waived when seeking to offer a contract to a small business. At other times, they sought to avoid the goal instituted by FAR 19.302 that small businesses be utilized as frequently as possible in the procurement of the sinews of war. AMCCOM's Small Business Office, which had at one point disagreed with limited or sole source procurements when competitive technical data packages were available, rallied to the side of Procurement and Production Policy and Management and appealed for a waiver concerning the limitations attempts to comply with small business goals were placing on AMCCOM. And although AMCCOM's procurement personnel did manage to work through ODS with small business goals intact, they recommended in the Operation Desert Shield/Storm After Action Report that such goals be abandoned when wartime status had been declared.[110]

Regardless of AMCCOM's Small Business Office's fears concerning the ability of small firms to meet that challenges of a wartime scenario, at the close of the war it could proudly announce that the goods and services procured from such businesses had played a large role in the successful attainment of the nation's goals in ODS. Accordingly, the Small Business Office published a truncated listing of the minority-owned firms, as well as a workshop for people with severe disabilities, that provided items in direct support of the Southwest Asian deployment. As Mr. Bruce M. Myers, Chief, AMSMC-SB. noted, the list was by no means all inclusive of AMCCOM's small business program. Furthermore, he explained in a [Rock Island Arsenal] Target article, small businesses hold over 85 percent of the command's commercial contracts, and traditionally have shown themselves capable of producing critically needed items while meeting tight delivery schedules, yet maintaining high quality standards.[111]

Among the small businesses contributing to the success of the United States in Operations Desert Storm and Desert Shield were Nomura Enterprise, Inc., Rock Island, IL, producing maintenance publications for troops; Vinyl Technology, El Monte, CA, manufacturing waterproof bags for chemical protective masks; Witter Manufacturing, Grand Prairie, TX, making electrical transformers; and S&K Electronics, Ronan, MT, building specially designed heaters. Other small business producers utilized during ODS included Sandik Manufacturing, Passaic, N.J., built cover assemblies for the Vulcan Air Defense System (VADS) and the Product Improved, Vulcan Air Defense System (PIVADS); Infinite Creations, Bamberg, S.C., produced the M8 bandoleer; and Mohawk Valley Workshop, Utica, N.Y., made a head harness for the M17A1 gas mask.[112]

Regardless of their apparently needless fears concerning the required use of small businesses, AMCCOM's Production and Procurement Policy and Management personnel did not hesitate to voice other concerns, and seek further regulatory relief, during the war. Their appeals to AMC and assorted higher authorities concerning a moratorium on the fulfillment of socioeconomic programs, and permission to continue work despite labor protests did not meet with success.[113]

At the close of the war, and for inclusion in the official Operation Desert Shield/Storm After Action Report, procurement and production personnel had numerous comments concerning the regulatory conditions under which they had operated during ODS. They noted that regulations which had served them, as well as the nation, well during peacetime could prove overly restrictive in times of conflict. They commented that during the war when HQ, AMCCOM sought immediate relief that AMC insisted on specific examples of regulations and processes causing delays. Examples of existing problems were plentiful, but unacceptable to higher headquarters. AMCCOM's attempt at a proactive stance often met with AMC and

higher headquarter's reactive stance, resulting in a rather high degree of frustration as the war progressed. Deviations to procurement regulations frequently arrived in increments scattered throughout Operations Desert Shield and Desert Storm.[114]

Indeed, the incremental method of obtaining regulatory relief came to special attention in the war's wake. Members of the Procurement Directorate noted in their submission to the Operation Desert Shield/ Storm After Action Report that receiving incremental deviations to procurement regulations throughout the progression of ODS proved to be both inefficient and confusing. Some deviations did not arrive until Desert Storm had concluded. In consideration of the flaws they discerned in the acquisition variance process, procurement staffers recommended that a preestablished list of deviations, lowering of approval authorities, elimination of requirements, keyed to specific DEFCONs (Defense Readiness Conditions), and published in a booklet available to all contracting offices. Additionally, they felt that field contracting offices should be authorized to implement the deviations automatically upon the establishment of a specific DEFCON. They also noted that, if necessary, appropriate statutes could be revised to permit the essence of legality.[115]

To bolster their argument, Procurement Directorate (PC) officials provided a detailed example of preestablished deviations that could prove valuable in wartime. They noted as a base for their discussion that the dual requests they had been subjected to during ODS had been time consuming as well as confusing. For example, conflicting guidance had been received from the Deputy for Procurement and Production (DP) staff versus the materiel managers on such issues as surges and options. Similarly requirements for reports had been submitted by the DP and the ARDEC Emergency Operations Center through AMCCOM's Production Management Division. When such dual tracking occurred, it generated considerable confusion as well as delays. Also, when issues of duality occurred, the Procurement Directorate was obligated to respond to the procurement authority, i.e., DP, rather than any other authority.[116]

Accordingly, the members of the Procurement Directorate devised a revised approval schedule for use in times of changing DEFCON. In the case of seeking approval for UCAs, the extension of UCAs, and obligations of 100% of government estimates, the PC recommended that in DEFCONs 1 and 2 that any procuring contracting officer (PCO) with unlimited dollar obligation authority be deemed to have sufficient signing capacity. In DEFCON 3, they recommended that the approval of the Chief Contracting Office be obtained, and in the case of DEFCON 4 the Principal Assistant Responsible for Contracting (PARC) have authority. Similarly, PC had recommendations for business clearance approval currently settled at HCA or AMC level. In the case of DEFCONs 1 and 2, they urged that any PCO with unlimited authority have approval capacity, and in the case of DEFCON 3 that the Chief Contracting Office again have permission to approve. And in DEFCON 4, PARC was once again to be vested with approval capacity. The PC recommended the same standards be used in the approval and use of abbreviated J&As and the approval and use of abbreviated APs. [117]

Furthermore, PC urged that at DEFCON 3 or higher that the AP process be eliminated. Similarly at the activation of DEFCON 2 or higher, PC recommended that policy be deviated from to eliminate all contracting requirements below the FAR and DFARS level. At DEFCON 3 or 4, PC felt that this deviation should be held to the discretion of the Assistant Secretary of the Army (Research, Development and Acquisition).[118]

Additional thoughts regarding regulatory relief as concerned the Procurement Directorate were also voiced in the after action report. Procurement personnel felt that on site competition advocates with appropriate J&A approval authority could be established to expedite matters. Other J&A commentary from procurement folks included a waiver from the requirement that urgency J&As be written in the past tense

if they were being processed after the award had been made, providing that the J&A included the actual date of award. Additionally, they recommended that the PARC determine whether or not production J&As should include 100 per cent options and should be evaluated, that the "changes clause" be utilized to accelerate deliveries under existing contracts, regardless of cost impact, and that the extension of letter contract definitization should be considered in periods of crisis. In the latter case, they felt that approval should be automatically granted by HCA without a request from the field. And finally, in regard to their submission to the Operation Desert Shield/Storm After Action Report, PC boldly recommended that a "hard look should be taken as to guidance in the use of SURGE CLAUSES, OPTIONS FOR PRODUCTION and SPARE PARTS as well as PRIORITIES and URGENCY." They also felt that a mechanism for verification or validation of priority and urgency was required as potential existed for the abuse of the priority designation particularly on low dollar items. Many of PC recommendations for the easing of regulatory requirements flowed from their own confusing, time-consuming experiences during ODS.[119]

AMCCOM's Procurement and Production Policy and Management Directorate could justifiably congratulate itself on its efforts during ODS. And it did so in its contribution to the formal after action report. Its personnel noted that over 2,500 new Procurement/Work Directives (PWDs) had been initiated at AMCCOM during ODS. None of these had been for ammunition as those particular demands were filled by accelerating existing contracts and PWDs already in process. And while AMCCOM staffers reacted in an outstanding manner to a critical situation, they felt that AMC, higher headquarters, and the Congress of the United States should be apprised of the turmoil and wasted effort, as well as dangerous delays to procurement, which their inability to act more quickly, created at the working level. They concluded their submission to the after action report with the intonation, "Now is the time to preposition for the future."[120]

Regarding the need for deviations from peacetime acquisition processes in times of national emergency, not all Procurement and Production Policy and Management Directorate felt assured that the federal government could be relied upon to affect the changes they believed necessary. This belief flowed from their observation that the formal acquisition process had been built with the assumption that the United States would be at war, possibly on a global basis, with the Soviet Union or China. However, the reality is that Panama, Grenada, and Southwest Asia are the types of conflict the United States will face. The three most recent conflicts were of high intensity, but short duration. Such "come as you are" conflicts rely on the established stockpile and the logistical stockpile to fight. This means that the acquisition system must react using existing tools; e.g., there will not be time available to build up the work force, have statutory or regulatory changes, etc. Indeed, even when time is available to build up such supporting devices, events of the Persian Gulf War proved that it was not always used. The staffers noted that in the case of SWA, the United States had a substantial time between initial deployment in August 1990 and the time of actual engagement in mid-January 1991, yet little or nothing had been done to give the acquisition team of the logistics system relief from peacetime constraints. Only after the hostilities began, claimed procurement personnel, did higher headquarters become sensitive to the need to remove regulatory, as well as statutory, roadblocks to acquisition.[121]

While the Procurement and Production Policy and Management Directorate did all things within its power to streamline and accelerate the acquisition process, it still felt that it was capable of doing more, had the federal government allowed it to do so. For example the directorate considered that expanded delegations of authority in the areas of award approval, use of unpriced contractual actions, and other review processes could be initiated by the Head of Contracting Activity if higher headquarters regulations permitted such actions. And expedited processes could be implemented to obtain formal review/approvals if the regulations precluded such delegations. Additionally, class documents could be developed covering urgency statements, justifications and approvals, and unpriced contractual actions. Further, and most significantly, reallocation of personnel to high priority, direct war-related activities would permit expeditious

handling of the high volume of procurement work directives generated by an emergency footing. Many of these actions were undertaken during ODS.[122]

In consideration of the efforts undertaken by the Procurement and Production Policy and Management Directorate to process the over 2,500 ODS procurement work directives, its personnel had several recommendations for future action. It observed that in order to be properly prepared for deployments that it must effect "self-help" efforts and have a periodic review of contingency clauses and policies to ensure that they are up-to-date and supportable so that fatal flaws do not appear in the midsts of a conflict. Contingency clauses were to be annually reviewed to ensure that were legal. The report, contained within the Operation Desert Shield/Storm After Action Report, received the Lessons Learned Task Force's designation "significant".[123]

Also receiving the designation "significant" was the Procurement Directorate's similar submission. They noted that the entire range of mobilization planning needed to be rethought minus the present political restrictions, regulations, and policies which have rendered it "useless". The directorate's staff further noted that there could be little doubt that the setting aside of a company, or even part of a company, for the exclusive use in support of a Department of Defense peculiar items, costs money. But they noted that, "If the price of liberty is eternal vigilance, part of that price is MOB (mobilization)." Furthermore, to artificially restrict production to an equally artificial MSR (main supply route) impacts the cost to produce and restricts the production capability of the manufacturer; i.e., minimum operation curtails surge ability and seriously impacts the contractor's ability to rapidly meet expedited requirements.[124]

Furthermore, uncoordinated MOUs (memoranda of understanding) by the State Department also eroded the base for critical components, principally in areas of co-production. For example, the Secretary of Commerce inadvertently gave priorities to foreign nations to procure charcoal filters for gas masks from the United States MOB producer to the detriment of American forces. The SARDA (Secretary of the Army for Research, Development, and Acquisition) had bartered unity vision devices around with MSRs until several acrylic producers have pulled out of the American market and only one producer remains. The remaining producer is barely able to support peacetime production requirements.[125]

From the experience, Procurement Directorate personnel gathered that MOB items and their critical components should all be procured from United States or Canadian manufacturers, and should be made exempt from MOUs, unless they are coordinated with the mobilization's command. Accordingly, the directorate recommended that DOD reexamine MOB and issue policy and direction that strengthens and enhances MOB as a necessary cost of readiness.[126]

A further restriction upon procurement came in the form of environmental constraints. Members of the Production Directorate took note of the fact that there is no known, established, and approved procedure for the disposal of "red water", or plan for dealing with the issue in the event that surge or mobilization plans would be required in order to respond to a national emergency or joint national effort, as was experienced in ODS.[127]

The directorate noted that if ODS had continued at length and the need for explosives, particularly TNT, had become an acute issue, as it was projected to be, the production process would have resulted in the generation of a hazardous waste known as "red water". Although the TNT could have been produced, the resulting "red water" would have been a constraint without resolution. The essential lesson garnered from this observation was that there was no plan for dealing with the issue, and the need for explosives and propellants that generate hazardous material as a result of the respective production processes to support any war time scenario must be accompanied by a plan for dealing with the hazardous waste that

will negate the vilification of the producer through fines and restrictions levied by the Environmental Protection Agency under the current law.[128]

It has been the experience of commercial chemical producers such as DuPont and Hercules, as an example, that permits for storage of such hazardous waste products are limited to 90 days on site. After that time, a penalty of $1,000 per day is imposed. Quite recently, DuPont, while producing TNT for the Canadian government, was fined for retention of "red water" waste. Currently, no provision exists for "red water" disposal that has total Environmental Protection Agency approval. The only known incineration technique for this material is continually fined by the agency, and thus, it is readily obvious that any producer would display reluctance to make TNT, or any other hazardous material by-product producing explosives or propellants, due to the situation they are placed in by current Environmental Protection Agency constraints.[129]

Additionally, it is thought to be the agency's position that their environmental regulations are without alleviation during war time, short of a direct order from the president. Such information led the Production Directorate to comment that an obvious need existed to develop a resolution that would pave the way for surge or mobilization of the explosive and propellant base that would not be inhibited by environmental constraints and thus preclude a rapid response to the nation's need for readiness. For no plans were in place which would allow for the manufacture of explosives which resulted in the production of "red water" in the event of a national crisis. Accordingly, Production Directorate staffers recommended that the impact of current Environmental Protection Agency laws on the production of potentially critical explosives be brought to the attention of the Joint Chiefs of Staff, the Congress, and the president.[130]

Further hindrances upon AMCCOM's procurement community came in the form of questions concerning the manner in which PWDs (procurement/work directives) could be expedited for ODS. While procurement personnel apparently attempted during the initial days of the deployment to continue their standard form of PWD, by the early days of October 1990 other means had to be applied in order to hurry materiel to the desert. On 11 October 1990, production and procurement staffers received the guidance that all PWD in support of Desert Shield should have the code "DS" entered upon them in the SP-PRI (Special Priority Designator) block, in addition to including the necessity of expedited action in the "remarks" portion of PWD forms 825-1, 825-2, 825-3 with the simply notation DESERT SHIELD. COPS (contingency plans report) operators were to assure that DS had been properly entered by the manager in the SP-PRI block if DESERT SHIELD appeared in the remarks section. If it did not appear, the COPS operator was to contact the manager to ensure the proper processing of the document. The use of the DS code was to result in a message printed at the top of the PWD indicating its status as a Desert Shield requirement. It would also provide a means for the Procurement and Production Policy and Management Directorate's Systems Division to automatically pull a report of Desert Shield PWDs, thus eliminating the time consuming but, current, manual tracking effort.[131]

As the threat of a ground war and its inherent requirements loomed ever larger, further directions were received on how best to expedite the delivery of materiel to the desert of SWA. Production and procurement personnel were informed that as of 11 February 1991, two new codes would be utilized in conjunction with PWDs directed in support of ODS. DU (Desert Storm Urgent) would be applied to PWDs which were intended to fill a shortfall in SWA. The code was to indicate that the directive should be handled as being of the highest procurement priority. Only items whose acquisition could be accelerated were authorized to use the DU designation. Alternatively, the code DR (Desert Storm Routine) was to be filled in for items, which although an ODS requirement, should be processed using normal acquisition procedures. Specifically, materiel purchased to replenish the stockpile received the DR status. Furthermore, DR was to be utilized for urgent acquisitions which due to assorted obstacles could not be accelerated. The goal was

to keep DU requirements at the bare minimum. Requirements previously coded DS (see above) did not need to be recoded unless an amendment needed to be attached. Additionally, for ammunition PWDs, determinations of DR or DU status were to be made on the basis of the recently conducted Ammunition Laydown Briefings. And as in the case of the DS system, it had replaced the DR and DU structure allowed for sharp-eyed COPS operators to assure, by manager verification, that the proper code had been utilized in the "remarks" portion of the form noted DESERT STORM.[132]

"Tracking" the effort to follow, on paper, work processes and physical items, provided procurement personnel with a number of difficulties during ODS. Such difficulties were reported, with proposed solutions, in the official AMCCOM Operation Desert Shield/Storm After Action Report. In one such submission, the Management and Analysis division of the Procurement and Production Policy and Management Directorate noted that procurement work directives frequently became "lost" in the system. The problem arose when PASS (Procurement Aging and Staging System) numbers which had been assigned during the initial stages of a procurement operation by procurement personnel were not appropriately forwarded to the Central Processing Point (CPP) as well as the Procurement and Production Policy and Management Directorate's Management and Analysis Division's Procurement Package Input Branch. Thus, beyond the initial procurement stage, offices could not follow the effort to acquire materiel for ODS. Yet, simultaneously procurement personnel were hand-carrying the packages necessary to continue the acquisition process rather than stopping actions until PASS numbers had been forwarded. On some occasions, technical data package procurement package input processing had been completed before it became apparent that the packages were three or four steps ahead of the transference of the PASS number. Some offices, however, returned document packages, refusing to accept them until the appropriate numbers had been electronically advanced to their processing point. Due to the volume of PWDs, hand-carries, and failures to report PASS transactions in a timely fashion, a significant number of procurement procedures were rejected and forced time-consuming, investigative work. Accordingly, procurement personnel stressed that in future states of emergency action a memorandum of understanding between affected organizations be established to encourage the proper handling of hand-carried PWDs, as well as the correct method of transferring reference numbers.[133]

Keeping track of obligations kept procurement staffers at their closest attention throughout Operations Desert Shield and Desert Storm. And the Procurement and Production Policy and Management Directorate's Systems Division felt the need to comment on their observations, as had the directorate's Management and Analysis Division. In a submission to the Operation Desert Shield/Storm After Action Report, the division noted that as a result of efforts in support of ODS it became apparent that the Commodity Command Standard System (CCSS) data base should have been implemented at the onset of the deployment. If it had been, according to the Systems Division staffers, a considerable amount of confusion could have been saved, and more accurate reporting from the very beginning instituted. They observed that a designator should have been assigned to identify procurement actions from the onset of Operation Desert Shield. Unfortunately, this designator was not established until well into the operation. When it was found necessary to implement a data base, AMCCOM's Information Management Directorate, Application Development Division created one which easily allowed for the sorting of CCSS data into a variety of report formats.[134]

From the experience, procurement personnel noted that the early use of a designator would have saved considerable time, effort, and confusion in reporting their actions to higher headquarters. Additionally, they observed that the data base which ultimately was established was time-consumingly developed through trial and error. Once the data elements had been identified, however, it proved to be quite useful, and provided most of the data needed for reporting purposes. In consideration of the lessons they had garnered from their experiences tracking procurement processes, staffers recommended that in future deployments

a designator should be assigned to identify procurement actions from the initiation of the operation. Additionally, they urged that the data base established for use in ODS should be kept readily available for immediate implementation at the onset of an operation.[135]

Further commentary concerning the process of properly tracking procurement information during ODS came from AMCCOM's Command Surety Office. Their staff realized early in Operation Desert Shield that the finances behind procurement activities needed to be separately tracked for reporting purposes. Ultimately, AMCCOM's Competition Management Office established a data base to identify pertinent information allowing for the identification of actions, dollars, class J&A's threshold monitoring, and the TDP (technical data package) status on each ODS obligation or requirement. The data base developed served many purposes but the Competition Management Office had a difficult time of recording the actual awarded dollars and associated dates. This reflected that fact that the data base had been developed from the information on the J&As and the statements of applicability. However, if the dollars proposed on the J&As or statements of applicability there was no simple way to capture the change. Therefore, the recorded total dollars spent would not accurately reflect the total dollars spent on ODS acquisitions. To try to alleviate the problem, contract specialists were contacted by telephone for award information. Unfortunately, this procedure was extremely labor intensive and continually left doubts concerning the accuracy of the reporting.[136]

In consideration of the difficulty procurement and financial officers had keeping tabs on the total flow of dollars spent in support of ODS, it was recommended that during periods of war, a Central Tracking Office be developed within AMCCOM. Furthermore, personnel urged that a special automated program needed to be instituted to not only track the procurement awards but also to assure that the threshold(s) on the class J&As had not been exceeded. The recommended program would also have the capacity to segregate wartime obligations from routine ones. Accordingly, the suggestion was offered that the Information Management Directorate and Competition Management Office coordinate on the development of just such a program.[137]

Segregating costs gathered further attention from the procurement community, as well as members of the Competition Management Office staff. In a submission to the Operation Desert Shield/Storm After Action Report, they observed that the Department of the Army, in coordination with the Army Materiel Command, assigned each command with a yearly competition goal. The competitive goal is determined by the dollars awarded competitively each year. Yet in order to support Desert Shield and Desert Storm expedited sole source contracts had to be awarded in lieu of utilizing full and open competitive acquisition procedures. In order for AMCCOM to receive credit for their competitive efforts, meet the urgent requirement to support ODS, and still meet the FY 91 Competition Goal, the dollars awarded due to ODS had to be segregated from the competitive base and tracked/reported separately. Formal authorization from the Department of the Army, and with the consideration of the Army Materiel Command, permitted the utilization of this form of reporting procedure.[138]

At the conclusion of the war, Competition Management personnel recommended in the event of an operation similar to ODS that AMCCOM must have in place the ability to track and report the sole source obligations utilized in support of the war. Furthermore, a formal submission needed to be generated by AMCCOM to secure approval from the Army Materiel Command, as well as the Department of the Army, to segregate the wartime costs and obligations from the competitive base. Without initiating these two initiatives, the office warned, AMCCOM could not be expected to meet its assigned competition goals.[139]

Concerning the regulatory requirements of procurement processes during ODS, Ms. Donna White, former branch chief of the Procurement Directorate's Chemical Branch, noted that some of the regulations

which she labored to fulfill during the war need reexamination, and either exceptions or abbreviations for wartime conditions created. She felt this to especially be the case concerning the J&A process. Regarding the J&A process she noted that although the general peacetime process requires competition, wartime conditions did not allow for such a luxury. Accordingly, wartime regulatory relief allowed her branch, as well as others, to procure the accouterments of war, under a limited basis or sole source basis. Yet, as she observed, even this relief from the regulatory juggernaut did not truly allow sufficient time to process documents and pass them on to the Department of the Army.[140]

In consideration of such an unwieldy trail of paper, Ms. White recommended, as had others both before and after her, that the Congress of the United States needed to delegate the authority for the preparation of a new, less cumbersome, set of regulations granting exceptions to the J&A process for periods of national emergency. Such new regulations could take into consideration her branch's diligent efforts in arriving at "quick fixes" so, for example, anything costing under $10 million could be signed off by the Commanding General rather than taking a longer route to approval by the pursuit of higher level signatures. Additionally, she urged that AMCCOM should be provided with an ombudsman to sign for the Commanding General should he not be available.[141]

Indeed, she observed that it was not the actual buying that held up the processes of procurement, but rather all of the paperwork accompanying it. "Before anybody even picks up the telephone to discuss with a contractor what has to be procured or negotiated, a great amount of paperwork has to be done." And she plaintively commented that, "... we have to find a way to reduce this [paper]work; we need to streamline the acquisition process." However, AMCCOM could not undertake the process of streamlining procurement practices of its own accord. The Federal Acquisition Regulation (FAR) Committee, under direction of the United States Congress, and with the support of the Department of the Army, as well as that of the Department of Defense, is responsible for making changes in procurement procedures.[142]

Despite the problems Ms. White and her associates encountered, she felt that all had worked together quite well, and that the ordinary bickering that one might expect between offices and directorates during stressful times had not occurred. According to her observations, little proprietary behavior concerning functions and input to the war effort existed, giving her reason for pride in AMCCOM's efforts. Additionally, Ms. White noted in an after action interview, that all individuals concerned with procurement "hit the ground running" and performed responsively with a minimal amount of complaints and grumbling. Freely working overtime, and with what Ms. White perceived to be patriotism, procurement personnel accomplished their tasks with almost non-existent absenteeism.[143]

Yet she was not as certain of the supply system which she toiled to keep running at its full capacity. She noted in an after action interview that tracking problems in the production and procurement processes often spilled over to become legitimate supply system concerns. "Because it is often only a paper trail . . ., a computer could not keep up with it. This meant you were not absolutely positive where the materiel you wanted or needed was located." Accordingly she observed, that goods often arrived in SWA faster than they could be inventoried. Consequently, it could not be ascertained if the items were sitting in a Saudi Arabian depot, or if they had been distributed to the troops. As Ms. White noted, "you assumed everything was being distributed, . . . sent to the proper units and given to the soldiers or whoever."[144]

Ms. White was not the only individual to note, or be concerned with the frailties of the supply system. Indeed AMCCOM's official Operation Desert Shield/Storm After Action Report offered that the most significant supply lessons garnered during ODS dealt with the absence of a functioning retail supply system, particularly during the early months of the deployment. A prime contribution to this deficiency was that the Standard Army Intermediate Level Supply (SAILS) system was in the process of being replaced by the

Standard Army Retail Supply System (SARSS). As a result, accountability and visibility of assets received in SWA was practically nonexistent and in some cases materiel was taken by units on a first come basis. This resulted in an excessive number of requisitions as units continually ordered that which was not received, and, in turn, placed undue stresses upon the efforts of production and procurement personnel. Various workarounds were developed to resolve this situation. These included push packages, push shipments of specific items, and telephone/fax requisitions worked through logistics assistance representative (LAR) channels. Other retail problems included the use of ODS project codes by non-deploying units, improper use of non-mission capable supply (NMCS) requisitions, and the requisitioning of excessive quantities by deploying units. Ultimately, each supply issue became a production and procurement issue as the term of deployment lengthened.[145] The various work arounds utilized in circumventing this problem resulted in push packages, telephone and datafax requisitions, "priority" code abuse, supply discipline, Desert Express, etc.

While the problems with properly supplying soldiers and civilians in SWA could be traced to the failure to have SARSS operational before SAILS fell from use, other issues also contributed to the confusion. In a mature theater, supply and distribution facilities are in place to ensure an unimpeded flow of supplies to the requisitioner. This situation cannot exist when combat troops are the first deployees to a possible combat area. In the case of SWA, no established supply infrastructure was in place to receive and process materiel. As a result, supply personnel had problems identifying and subsequently locating materiel which had been received. In some cases it was diverted to, or by, customers who had not requisitioned the items. In other cases it simply went to a holding area. Command representatives spent many hours in these areas searching for AMCCOM items and locating customers. In the meantime, customers who knew their stocks were in country "somewhere" submitted new requisitions for the same requirement as it was deemed more expedient than trying to find a shipment. This frustration of shipments inflated the demand data, deprived customers of timely support, and kept production and procurement personnel continually striving to maintain stocks of materiel.[146]

Personnel from AMCCOM's Materiel Management Directorate's Policy, Plans, and Programs Division commented in a submission to the after action report that while it could not be considered logical to deploy supply personnel to a combat zone ahead of combat troops. Therefore, they observed, that the problems encountered in the attempt to properly supply the fighting women and men of ODS would undoubtedly reoccur, perhaps with more disastrous results than experienced in SWA when stock availability stood at over 90 percent. Accordingly, they recommended that plans should be made to deploy Materiel Management Center (MMC) personnel as early as possible so that supply problems might be brought under control. The proffered plan included the deployment of supply personnel familiar with the various commodities to assist units and the MMCs in getting stocks to customers.[147]

Other issues concerning the visibility and accountability of supplies in SWA also rose to the fore in submitted after action reports. Members of AMCCOM's Materiel Management Directorate noted that during ODS significant ranges and quantities of AMCCOM-owned stocks had been released to wholesale storage activities in SWA. As these storage facilities had no direct interface with the Commodity Command Standard System (CCSS). This resulted in an almost complete loss of accountability and visibility of wholesale stocks stored in SWA and a commensurate degradation in the ability of HQ, AMCCOM to provide materiel support to depot storage.[148]

In a discussion of the problem, materiel management personnel noted that the shipment of AMCCOM-owned assets to the United States Army Support Group (ASG) in Dammam, Saudi Arabia, in accordance with an HQ, DESCOM (United States Army Depot System Command) proposal of 4 October 1990. The Materiel Management Directorate subsequently released critical secondary items and line replaceable

units via inter-depot transfer actions to the ASG while raising concerns about the potential for the loss of accountability to HQ, DESCOM. HQ, DESCOM subsequently reported problems in ASG transaction processing and clarified ASG stock distribution procedures in late December 1990. In early February 1991, the ASG again reported problems in implementing systems links with NICPs (national inventory control points), and provided revised operating procedures. By early May 1991, receipt processing by the ASG did not reflect the receipt of all items released to them in October 1990.[149]

As a result of the limited visibility of assets released to the ASG, the Materiel Management Directorate released critical aviation weapon system support items to the AVSCOM (United States Army Aviation Systems Command) wholesale storage activity in Abu Dhabi, the United Arab Emirates, at a contractor-operated storage facility. The memorandum of understanding staffed through HQ, AMCCOM provided for daily transaction reporting to be datafaxed by the activity to HQ, AMCCOM for items released from CONUS depots as well as items repaired by contractor special repair activities in SWA. Items had been released to this activity from both CONUS depots and contractor special repair activities. By early May 1991, no receipt transaction had been forwarded to HQ, AMCCOM. Additional ranges and quantities of critical parts/assemblies had been released to the 321st Materiel Management Center, a retail level organization within the theater of operations.[150]

From the experience attempting to keep track of all materiel deployed to SWA, Materiel Management personnel gathered that fast moving operations, limited communication channels, and the complexity of the CCSS encouraging the transfer of accountability from the CONUS-based wholesale activity to the theater of operations. Accordingly, they recommended that all assets shipped in support of the theater of operations be managed and accounted for by the logistics community within the theater of operations.[151]

The visibility of materiel in transit to SWA, as well in the theater of operations, became further clouded by the fact that items traveled there via air force transportation channels. Once the equipment was in air force control, army visibility and accountability decreased precipitiously. Within the army supply system all items are tracked from wholesale to retail by the unit's Department of Defense Activity Addressing Code (DODAAC). However, during ODS most of the army's spare/repair items were moved OCONUS via U.S. Air Force aircraft. The air force tracks its items by pallet number; therefore, when an item reached the point of departure at the airfield and was loaded aboard an aircraft, it lost its DODAAC identity and took on the air force's pallet number. The problem was accentuated by the fact that Dover Air Force Base was thoroughly inundated with shipments for the Desert Express. Additionally, problems of tracability were compounded when consolidated army shipments were fragmented in order to conform to the space available and air pallet configurations. The NICP thus lost control and visibility of nearly all items. This created a problem for both the NICP and the user. The NICP was unable to tell the user when an item would arrive in country. Furthermore the NICP did not know which aircraft and pallet the item was on. The NICP could only tell the user that the item had left CONUS on a particular date. Where it went remained unknown. Unable to locate the item, the user could requisition another item and the same events would repeat themselves.[152]

In consideration of the problems encountered attempting to maintain contact with materiel shipped to SWA, materiel management personnel recommended that a uniform visibility and accountability system to track items from the depot to the user be developed. The system should be capable of incorporating the unit's DODAAC along with the air force pallet number.[153]

Materiel management personnel also observed that shipments to SWA during ODS were frustrated by the lack of operational receiving activity at the commencement of the deployment. At times, materiel

management staffers received instructions to direct shipments to the ASG, the 321st MMC, or King Khalid Military City. The shifting of staging site destinations was reportedly due to a lack of resources. Items were shipped from CONUS depots to assorted sites in the theater of operations. AMCCOM transportation personnel traced all shipments from point of origin to air force receipt for flight to SWA. Yet, as previously noted, visibility and accountability were frequently lost in flight. Additionally, upon arrival in SWA materiel became backlogged as adequate resources were not available that could receive equipment, establish audit and accountability trails, research discrepancies, and coordinate the issue of equipment to combat forces. Limited transportation available to move supplies away from air and sea ports to theater storage units also contributed to the inability to properly track items. Accordingly, materiel management personnel recommended that transportation authorities be enabled to trace equipment from the point of origin to its final destination utilizing a single TCN (transportation control number). They also suggested that the responsibility for the rapid establishment of a receipt, storage, and issue capabilities in a hostile theater should be preordained. Additionally, they recommended, that operational plans should be in effect that facilitate the immediate mobilization of vital resources; i.e., manpower and equipment, wholesale level staging activities.[154]

The presence of supply-oriented LARs might also have helped maintain the visibility and accountability of American materiel in ODS, or so believed members of AMCCOM's Readiness Directorate. They believed that the lack of commodity-dedicated supply LARs had adversely impacted unit readiness. The Readiness Directorate's Logistics Assistance Division officers believed that supply LARs were not adequately distributed at the unit or MMC levels to properly support wholesale or retail supply requirements in SWA. AMCCOM elected to deploy supply personnel from the AMCCOM Materiel Management Directorate to serve as supply LARs in SWA. The maintenance LARs were adversely impacted by having to carry the supply burden at the units and could not devote needed time to perform their assigned maintenance mission. Accordingly, the Readiness Directorate commented that "generic" AMC supply LARs are not as effective as commodity-dedicated supply LARs. Therefore, the directorate urged, commodity-skilled LARs should be deployed to assist field users in carrying out field supply operations.[155]

The Materiel Management Directorate's Light Weapons Division also recommended that supply and distribution problems in SWA might have been eased with the presence of a greater number of specialists. They noted that the failure to provide appropriate supply and distribution specialists had contributed to the development of an enormous backlog or "iron mountain" of materiel at air and sea ports, as well as theater storage areas, that soon overwhelmed the capabilities of the distribution system. Accordingly, the division's personnel recommended in future deployment scenarios that a significant increase in the numbers of depot supply and receiving personnel, NICP supply logistic assistance representatives, and other assorted logistics personnel be affected. The division concluded their submission to the AMCCOM Operation Desert Shield/Storm After Action Report with the stern comment that headquarters must "recognize that sufficient numbers of logistics specialists must be in place before resupplies begin arriving within the theatre."[156]

Additional supply-oriented problems focused on reporting ammunition stockages. Indeed, the lack of accountability of ammunition supplies became the object of an observation deemed "significant" in the after action report. That document stated that Class V (ammunition) supplies could not be properly accounted for without ammunition personnel present early on in the theater of operations. Also, accountability could not occur without a uniform accounting system such as TACCS (Tactical Army Combat Service Support Computer System) or SAAS (Standard Army Ammunition System) in place and operational. Accordingly, AMCCOM's SWA detachment urged that before future deployments were undertaken these matters be considered and planned for. Indeed, the topic was presented and discussed at September 1991's OMMCS (Ordnance Missile and Munitions Center and School) Conference as the "intransit visibility of ammunition is a systematic problem within the army and would have occurred within any theater." The problem was thus not limited simply to AMCCOM.[157]

Additional accountability and visibility issues were caused by the failure of AR 700-22's (WARS—World wide Ammunition Reporting System) reporting requirements to include ammunition already in the possession of troops. The only ammunition accounted for via the system included basic load assets stored in ASPs (ammunition supply points) which had been created after the arrival of logistical personnel. Thus any ammunition carried in by troops, or which arrived prior to logistics specialists concerned with recording its presence was not accounted for in the system. In order to better grasp the ammunition in theater, AMCCOM staffers recommended that the WARS structure be modified to require that those basic load items already in the possession of troops be accounted for. They also recommended that an ammunition support group should arrive in theater to plan support operations prior to units establishing storage sites.[158]

Such incorrect and delayed information caused a never-ending stream of headaches for production and procurement personnel, as it did for all subordinate command elements, throughout the course of ODS. Indeed, the lack of communications support became an issue reported in AMCCOM's Operation Desert Shield/Storm After Action Report. Inadequate supplies of essential communication equipment and personnel degraded the flow of information, as did improperly managed electronic forms of communication. Accordingly, theater support activities were unable to establish the necessary communication links with command elements; several units that relied upon the communication network were unable to retrieve or dispatch quality information.[159]

The numerous problems encountered (regulatory relief, communication crises, tracking troubles, environmental issues, contractual concerns, etc.) in the realm of production and procurement though were readily outweighed, however, by the number of successful efforts. The AMCCOM Procurement Directorate accelerated 149 actions, 53 contracts, 96 purchase orders, and awarded 503 contracts in support of the American effort in the Persian Gulf War. Consequently, the directorate administered a total of 1,434 procurement requirements during the war at a dollar value of $895,169,286. Many of these actions were executed with little or no additional cost to the government, or accordingly, the taxpayer, as they represented accelerations, not unbudgeted purchases.[160]

One of the more unusual attempts at acquiring the accouterments of war came under the direction of the Product Assurance and Test Directorate's Weapons Quality Operations Division. During Operation Desert Storm, they attempted to buy back short supply items that had passed into the hands of army surplus dealers. Significant procedural and policy problems became evident immediately as none of the functional elements, including procurement, engineering, quality assurance, and maintenance had any guidance on how to proceed with this effort. The main problems encountered in the re-acquisition included: the degree of conformance to technical requirements that should be expected and/or required; the ability to trace the item to a manufacturer; the amount of inspection and testing to be performed as well as when and by whom; and the contractual requirements to be included in the procurement documentation.[161]

In consideration of such issues, no purchases were made. But AMCCOM personnel determined that if army surplus dealers were to be considered a valid source of materiel, a buy-back policy and general guidance regarding policy and procedures for this type of procurement action had to be in place and available to the procurement, engineering, and quality assurance communities in order to expedite actions. Accordingly, the Weapons Quality Operations Division recommended that a working group representing AMCCOM's Procurement Directorate, Product Assurance and Test Directorate, Maintenance Directorate, and Office of Counsel, as well as SMCAR's Engineering Support Directorate, should be convened to establish policy and procedures for buying back army surplus materiel, if higher headquarters indeed determined that army surplus dealers could be considered as a viable source of supply for future conflicts and operations.[162]

More traditional efforts at procurement included the awarding of the XM951 leaflet round to Norris Industries on 19 October 1990. Delivery of the first 115 rounds was scheduled for early December 1990 at Dugway Proving Grounds, western Utah, for loading, assembling, and packing (LAP). The remaining 85 rounds arrived in early January 1991 for the same processing procedures. Approximately one and a half days were required to prepare the rounds for shipment to SWA after their arrival in Utah. Each round contained "standard surrender leaflets" prepared by the army's psychological operations group. Throughout the Persian Gulf War, a total of 29 tons of the 3" X 6" leaflets were dropped on Iraqi forces. While some were scattered by hand from helicopters, the majority fell upon the forces of Hussein by leaflet bomb. Carrying such messages as "Flee and live, or stay and die!", or "Yesterday, we demonstrated the power of the Multinational Forces. Once again, we offer you survivors the chance to live", as well as line drawings illustrating the solidarity of the coalition forces and their overwnelming power. The leaflets also contained surrender instructions. As evidenced by the large numbers of POWs who surrendered carrying leaflets, the bombs should be considered tremendously successful. This is particularly true if the premise that every enemy soldier who surrenders equals at least one less bullet fired at friendly forces is embraced.[163]

Additional noteworthy procurements included the acceleration by Alliant Techsystems, Edina, MN, and Aerojet Ordnance Company, Downey, CA, of the 25mm M791 cartridge used by the Bradley fighting vehicle in response to the needs of a nation at war. In less than 90 days, they went from a dead start to a monthly production rate of 270,000 rounds. Aerojet personnel also successfully maneuvered simulated Search and Destroy Armor (SADARM) with an explosive warhead during the war. The development represented a major step in support of the future Preplanned Product Improvement (P3I) SADARM effort and could lead to the creation of inexpensive "footprint" enhancements for a maneuverable SADARM. Also, in anticipation of the demands to be placed upon it, Alliance Techsystems purchased additional equipment in advance of receiving the contract—at no charge to the government—so they could increase their capacity for producing the rounds. Both Alliance Techsystems and Aerojet Ordnance received special certificates of recognition for the support they offered the nation during ODS.[164]

Also in support of ODS, Olin Corporation, St. Petersburg, FL, inserted into their December 1990 production schedule the manufacture of 5,000,000 rounds of 5.56mm M193 10-round clip. In addition, they were capable of fulfilling a request for 2,000,000 rounds of 7.62mm 4/1-1,500 round link belts and 50,000 5.56mm M14 links for shipment to SWA. Olin set aside regular business to complete the effort, demonstrating that they, as well as so many other of America's corporations, supported Operations Desert Shield and Desert Storm. Olin Corporation also received a certificate of recognition from AMCCOM's senior cadre.[165]

Sabre Industries, Mount Clemons, MI, received the contract for 2,000 SCRAMS, technical manuals, training, and spare/repair parts to support the urgent needs of ODS. The SCRAM (selfcontained respiratory assist mechanism) is a small air cylinder to be used by the gunner in an M1A1 Abrams tank in case of a fire within the turret. It provided an extra level of protection for the gunner, allowing him time to depart from his position at the bottom of the turret. As a result of Sabre Industries' accelerated production, the initial delivery of 1,000 SCRAMs arrived approximately six months prior to the scheduled date.[166]

Nor were the aforementioned contracts the only acquisition projects undertaken by AMCCOM's procurement community. During ODS, AMCCOM officials negotiated for the fabrication of 10,000 100 round reusable assault packs for the M249 squad automatic weapon (SAW) which were to be produced in less than ten weeks, for the emergency buy of 900 laser protective visors (LPVs) for the AH-64 Apache helicopter, and for the manufacture of M16 series rifle protective covers and experimental 30 round magazines. Nearly 900,000 experimental "followers" were purchased from the Colt Manufacturing Company when ones ordered from a competing firm became unavoidably delayed. Testing showed that

the experimental followers from the Colt Manufacturing Company, Hartford, CN, significantly improved the performance of the rifles' magazines.[167]

Further procurement efforts focused on KDI Precision Products, Incorporated, Cincinnati, OH. On 31 January 1991, the firm delivered, after the successful completion of the required lot acceptance tests (LATs), 79 safety and arming devices for the Patriot M143E1 missile. The delivery completed Contract DAAA-2189-C-0427 a full five months ahead of the original delivery schedule. This enabled KDI to accelerate the delivery schedule on a remaining contract, DAAA09-90-C-0179, for safety and arming devices by five months, allowing for an initial February 1991 delivery of 60 devices.[168]

Additionally, AMCCOM established two new sources for M72/M73 weapon systems cable assemblies to replace a decimated mobilization base. Mid-South Electronics, Annville, KY, produced the cables throughout the deployment; Star Glo Industries, East Rutherford, NJ, began contractual deliveries in mid-November 1990 and accelerated production thereafter.[169]

Such efforts were not singular in the effort to provide America's fighting women and men with the materiel of warfare. Indeed, as previously noted, during ODS, AMCCOM's procurement community accelerated 149 actions, 53 contracts and 96 purchase orders, while awarding a total of 503 new contracts directly in support of the Persian Gulf War. In consequence, the Procurement Directorate administered a total of 1,434 procurement requirements reaching a dollar value of $895,169,286. While no firm sought to disrupt the effort of AMCCOM to supply the needs of Americans in the desert, a significant number did go out of their way to ensure a desert victory. Eleven such firms were recognized by AMCCOM's senior leadership cadre for their contributions to the success named ODS. In addition to recognizing the previously mentioned Aerojet Ordnance Corporation, Downey, CA, for its accelerated production of 25mm ammunition, one of the most urgently required items in the war, Alliant Techsystems Incorporated, Edina, MN, was also recognized for 25mm ammunition production. Staffers at its New Brighton, MN, division increased production ten fold. BEI Defense Systems Company, Fort Worth, TX, was also lauded for its contributions to the campaign in SWA. Employees at its Camden, AR, division toiled to meet increased orders for Hydra 70 rocket systems.[170]

Other firms recognized by AMCCOM for their commitment to excellence during ODS include BGI Incorporated, Waltham, MA, for accelerating the development and production of an aerosol sampling system to meet the potential chemical and biological threat, and Day & Zimmerman/Basil Corporation, Philadelphia, PA, for accelerating the shipment of ammunition from Hawthorne Army Ammunition Plant, shipping 72,501 tons of ammunition during the war, and having processed 31,602 tons of retrograded ammunition after the war's close. Also recognized for excellence was Lau Technologies, Acton, MA, for speeding the production of A4 deck circuit cards for the Bradley fighting vehicle, and Manufacturer's Gasket Company, North Royalton, OH, for expediting the production of parts kits containing gaskets, seals, and washers for the manual turret drive of M1-series tanks. New Horizons Diagnostics, Columbia, MD, accelerated the development and production of biological detection test kits, and was duly commended for doing so. Similarly, Olin Corporation, St. Petersburg, FL, was honored for its production and shipment of critically needed 5.56mm and 7.62mm ammunition from Lake City Army Ammunition Plant, Independence, MO. Also recognized by AMCCOM officials was Spectra Physics, Mountain View, CA, for designing, in less than two months, a laser with sufficient energy to meet army requirements for remote sensing of chemical and biological agents.[171]

Such suppliers to AMCCOM could not be called rare. AMC, AMCCOM's parent organization, as well as AMCCOM could have commended dozens of firms that demonstrated teamwork and outstanding cooperation in the effort not only to fully equip the men and women fighting the forces of Saddam Hussein,

but also those supporting the fighting forces. For example, in a fine commentary on corporate contributions to the success of ODS, AMC News noted that hundreds of firms contacted military units asking for the opportunity to do their part. During ODS, firms sent their employees to the desert to offer advice, doubled shifts, surged production, set aside union problems, and demonstrated American ingenuity in problem solving. Detroit Diesel stopped its commercial production and worked multiple shifts to produce the engines required by the army's heavy equipment transporters (HETs). Within a week of contacting Detroit Diesel, 57 engines had been delivered.[172]

Perhaps no weapons system is as associated with the victory in the desert as the Patriot. Flickering television images made every school child aware of the damage wreaked upon the Iraqi morale and mission by the Patriot's interception and destruction of each inbound Scud. Yet at the time of deployment, the United States Army did not have a single Patriot missile capable of knocking down a Scud, or any other incoming ballistic missile. And had it not been fully operational at the onset of the air war, the mind must wonder at the effect of Scuds raining down unhampered on the populations of Israel and Saudi Arabia. How might the coalition have been affected? Would Israel have acted independently? Yet the questions are moot. The Patriot missile did exist, and did have the capability of intercepting inbound missiles. That such capacities existed at the start of the air war provides significant testimony to the skill and dedication of American industry.[173]

The Patriot's prime contractor, Raytheon, Andover, MA, built the missile guidance system and front end. Martin Marietta, Orlando, FL, built the launchers and control sections, as well as completes the final assembly of the missile sections. AMC's Harry Diamond Laboratory provided the fuzes. At the onset of the deployment, each of the prime subcontractors was asked to accelerate production. Each readily agreed, with Martin Marietta stepping up operations to include three shifts per day, seven days per week. Twice more during hostilities, the contractors were asked to expedite deliveries; they did so, as did their vendors. Production of the Patriot rose from zero to 400 missiles in less than six months, and by mid-February 600 per month. Nor did quality suffer with the increased focus on quantity. During the height of ODS, the operational readiness rate of the Patriot stood at 96 percent.[174]

Meanwhile, at the Harry Diamond Laboratory work progressed on helping the Patriot kill Scuds, specifically. The lab is responsible for the production of fuzes; the fuze recognizes targets and directs the warhead to explode at the precise instant necessary. As there is only one chance at recognition, the fuze must be capable of rapidly determining the target, and detonating. Mr. David Rodkey, chief of the Missile Systems Branch at the Laboratory Command, explained, "It's sort of like name that tune in one note. . . in order to say that's really a target and I've got to blow up the warhead now." Accordingly, Mr. Rodkey and his associates had to teach the Patriot what Iraqi Scuds looked like. To do so, the team built a facsimile of a Scud in order to make radar signature measurements of it. They mounted a Patriot fuze atop and instrumented van and drove it past the dummy missile about ten miles per hour. Returning to the laboratory, using a computer, they speeded up the Scud's movement to real time. It worked.[175]

But it was not only corporate giants that affected the course of Operation Desert Storm. Little guys also served to make a difference. For example, one Saturday morning during the deployment Mr. Ken Oliver, General Tire, Waco, TX, noticed a couple of tire orders from the military in his basket for Monday's shipment. While orders from the military for tires did not seem unusual, the telephone call from an item manager in Detroit did. She asked Mr. Oliver if he could possible deliver the tires to Tinker Air Force Base that day. After checking the carriers he was familiar with, Mr. Oliver made the decision to rent a truck and drive the nearly 300 miles to the Oklahoma base himself. But in sleepy, Saturday afternoon Waco, not only was a carrier not available, neither was a truck rental agency open. Ultimately, Mr. Oliver convinced the owner of a rental agency in another town to open his shop. Through his untiring efforts, Mr. Oliver and

his 74 HET tires reached Tinker Air Force Base late that night, and a few hours later, the tires were on a plane bound for SWA. And while tires may not seem like going to such difficulty for, consider that without HET tires, tanks could not be transported or positioned for GEN H. Norman Schwarzkopf's now famous end run.[176]

Similar to Mr. Oliver's extraordinary efforts, Mr. Tom Bolick also went the extra mile. An employee of Magnum Power Systems, a battery manufacturer in rural North Carolina that went from producing a thousand units a month to producing ten thousand units per month, Mr. Bolick filled his truck to the brim with batteries and headed out to Tobyhanna Army Depot, Tobyhanna, PA. He got as far as the first weigh station, where troopers found his truck to be overweight and threatened to pull him off the road. Mr. Bolick explained the urgency of his mission and who the batteries were for to the trooper, who considered the problem before him and slowly responded. "Saudi Arabia, you say? My oldest boy is over there. I'll tell you what I'm gonna do. I'm gonna give you a warning ticket and then I'm gonna call up north and clear you through all the weigh stations between here and Tobyhanna. Now get on outta here. And God bless you."[177]

Such efforts by corporate America and the nation's assorted citizenry could not be termed rare during the war to protect the territorial integrity of the Kingdom of Saudi Arabia. Many examples of the American spirit came in the form of voluntary, non-contractual gifts to the soldier in the field, and cannot truly be considered in the realm of production and procurement, but neither can they properly be left out of a story detailing the effort to supply soldiers and their supporting civilians in the sands of SWA. Among the donations: 150,000 boxes of Homer's Cookies, hundreds of cases of pickled peppers from the Bruno Pepper Company; 1,000 cases of non-alcoholic beer; 12,000 pounds of pretzels; thousands of radios and audio cassettes, hundreds of camcorders; thousands of portions of dehydrated ice cream; 2,000 pounds of Dustpro dust control chemicals, untold numbers of Wham-O and Wilson sporting goods, Bicycle playing cards, Milton Bradley games, and K-Mart stationery, magazines, books, sporting equipment, games, etc. Also aiding the soldiers: 2,100 cases of Washington apples, 7,000 cartons of Slim-Fast, 40,000 pounds of Colgate-Palmolive soap and toothpaste, 70 cases of a New Jersey firm's rinseless shampoo and shaving cream; 103,000 boxes of Nabisco Oreos (with 50,000 boxes being sent to soldiers' families in the United States); and 170,000 packages of Hershey chocolate kisses. This was in addition to the untold millions of Americans who on their own sent baseballs, footballs, dartboards, comic books, pantyhose (used to keep sand out of weapons), skin lotion, lip balm, and assorted toiletries. Additionally, 300 tons of mail arrived in SWA every day.[178]

AMCCOM, working together with associated commands, provided American soldiers, as well as many allied ones, and their deployed, supporting citizenry with all the accouterments of war necessary to secure victory. Never in the course of the Persian Gulf War did American servicemembers lack the sinews to stand for what the nation knew was right. Indeed, Mr. Perry C. Stewart, AMCCOM's Deputy for Logistics Readiness, has estimated that soldiers were provided with 180 to 250 percent of the actual required materiel. Of course, as noted, such a flood of materiel in an otherwise arid portion of the world represents a distinct problem. The supply system, as one logistics assistance representative (LAR) succinctly stated, was "broke" and resulted in undue efforts to fill an already full pipeline. Such efforts placed unnecessary strains upon not only transportation assets, but also materiel management personnel, and production and procurement staffers. As a result, CONUS materiel was both cannibalized and disassembled for spare parts, fabrications and acquisitions occurred, and surplus dealers frequently found the army on the line.[179]

Such a scramble for spare parts illustrated a lesson to AMCCOM's Commander, Major General Paul L. Greenberg. He observed in an after action interview that materiel must be extant, primed and ready for deployment. The industrial base simply should not be relied upon to mobilize quickly enough to support

a war similar to that fought in SWA. He urged that ways must be developed to store materiel with the units which will be the first called upon to fight, and that ways must also be developed to ensure that units have materiel readily available to them to meet any contingency. especially in light of a down-sized military structure. Ms. Donna White, former branch chief of the Procurement Directorate's Chemical Branch, echoed MG Greenberg's concerns in a post-war interview. She commented that the Congress must not give its support to stripped down defense bills which do not provide the financing to keep products in the supply line. "If we had not had products in the supply line, we would not have been able to respond," she warned. [180]

Regardless of MG Greenberg's and Ms. White's concerns about the industrial base's capacity in high intensity, limited time and geographical space warfare conducted by a down-sized military, AMCCOM served the nation exceedingly well in Operations Desert Shield and Desert Storm. Although noting a significant number of problems with supply and LAR support, LAR Deborah Rogers commented in an after action interview, based upon her seven months in SWA, that American soldiers had gone to war well equipped. Similarly, Ms. White, could proudly note that, "when each member of the military—be they man or woman—deployed to Southwest Asia, they were completely outfitted with all the chemical protection and detection types of equipment. . . . Our primary job was to get the soldiers provided with everything they needed for war," all the while staying within the rules outlined by the United States Congress.[181]

The AMCCOM motto states "Firepower—We Make the Difference," and during ODS, the command, production and procurement personnel included, most certainly did make a difference. And it was only because the system was already in place, only because so many of the needed parts and supplies were already on hand, only because an incredible number of ordinary folks did an extraordinary job that an operation of the magnitude of Operations Desert Shield and Desert Storm could be carried out with unprecedented speed and effectiveness.

NOTES

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[21]Bryant, "Big bomb digs deep," Leading Edge, June 1991, 20; and "The last-gasp effort to get Saddam," U.S. News and World Report, 20 January 1992.

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[28]*Ibid.*, 60-61.

[29]*Ibid.*, 61-62.

[30]"UN Resolutions," Military Review, September 1991, 79.

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Chapter Four

Logistics and Logistics Assistance Representatives

The closing months of 1990 and the opening ones of 1991 saw the largest and fastest military mobilization of all time as the armed forces of the United States deployed to the deserts of Southwest Asia (SWA). Beyond the 540,000 troops which ensured that after only one hundred hours of ground warfare the Iraqi Army was left shattered, tattered, and burning (that which had not surrendered), a multitude of other resources had made possible the victory: food, ammunition, vehicles, water, petroleum, oil and lubricants, chemical defense equipment, communication systems, medical supplies, and so much more. Indeed, the logistical preparations for the brief conflict can be likened to transporting the entire city of Atlanta—people and all things movable—and not only setting it up again in an uninhabited desert half a world away, but also sustaining it for six months. In all, 21 billion pounds of equipment and supplies were shipped.[1]

Overstating the logistics operation that began on 2 August 1990 is nearly impossible. In the first three weeks of Operation Desert Shield (ODS), as much materiel arrived in the Persian Gulf region as had arrived in Korea during the first three months of that war. Indeed more materiel was airlifted to the area in the first six weeks than during the entire Berlin Airlift of 1948. When Operation Desert Shield became Operation Desert Storm, 103,000 wheeled vehicles, 12,000 tracked vehicles, 26,000 containers and 400,000 tons of ammunition were in place. Ready.[2]

Behind—and sometimes along side—the 540,000 American troops, assuring that the multitude of vehicles and myriad of materiel was where it needed to be, when it needed to be there, and in the condition it needed to be was an army of civilian, logistics personnel. Over 2,000 United States Army Materiel Command (AMC) civilians, nearly 600 of whom were logistics assistance representatives (LARs), helped to make the desert miracle possible by their presence in SWA. And of those nearly 600 LARs present in SWA at the height of Desert Storm, 44 were United States Army Armament, Munitions and Chemical Command (AMCCOM) civilians and eight were AMCCOM military LARs.[3]

By definition, AMCCOM LARs are traditionally assigned to a particular unit and work beside that unit in the field, providing hands-on assistance and advice on maintenance, supply, and other logistical aspects of command-managed items. While their mission remained much as it would have had their particular unit undertaken a stateside task, the LARs quickly understood that theirs was no ordinary assignment. And while some AMCCOM LARs had time to adjust their thoughts and lives to the possibility of an extraordinary autumn in the Gulf, others were forced by circumstances to adapt their lives quite rapidly. Ms. Deborah Rogers, for example, AMCCOM's 1991 LAR of the Year, assigned to the 82nd Airborne of Fort Bragg, NC, followed her unit to the desert on rather short notice. Although she had made her willingness to deploy known shortly after Hussein's Kuwaiti take over, she had but six hours to prepare for transfer to SWA after AMCCOM's Readiness Directorate's Logistics Assistance Division received assurances from SWA that LARs would be well tended in matters of security, housing, and basic support. She left the continental United States (CONUS) from Fort Bragg on 24 August 1990 and, after a brief stop over in Spain, arrived in Dhahran on 25 August 1990 to become the first woman LAR deployed to SWA.[4] Although, Ms. Rogers deployed from Fort Bragg's Green Ramp staging area, Aberdeen Proving Ground (APG), MD, later served as the primary Preparation for Overseas Rotation/Mobilization (POR/M) center for deploying United States AMC personnel.[5]

Considerable effort was extended to assure that AMCCOM's deploying personnel, including LARs, had all the information and equipment needed to function in the Kuwaiti theater of operations. Information

packets were provided and individuals briefed upon their contents, chemical and biological defensive equipment (CDE) training was completed and CDE was issued, along with two uniforms, and other clothing and items deemed necessary for forward deployment to the desert. Each forward deploying individual was entitled to two two-quart canteens with covers, a helmet with cover, hat, belt, suspenders, mess kit, first aid pouch with dressing, parka with liner, poncho, two blankets, sleeping bag, mattress, two waterproof bags, and a duffel bag. Individuals deploying to rear positions were issued CDE. The designation of forward or rear deployment status was to be determined by HQ, AMC based upon the individual's mission and area of operations.[6] In addition, medical appointments were completed and flight arrangements to SWA were scheduled.[7]

Yet, problems occurred despite the fact that APG's staff did an exceptional job of processing in excess of 200 deploying AMC civilians per week during their peak periods of operation. Among the problems was the fact that APG could not issue weapons, and AMCCOM did not have weapons available to issue their front-line civilian personnel prior to leaving for APG. While weapons were not considered mission essential to all personnel, individuals entitled to carry one felt deprived and civilian morale as a whole was damaged. Weapons were ultimately issued on a case-by-case basis from a variety of other sites.[8]

Of greater importance to LARs was the failure of APG to stock sufficient quantities of desert clothing and equipment. LARs were frequently deployed not in desert camouflage battle dress uniforms (BDUs), but rather in APG-substituted green camouflage BDUs. Similarly, some LARs found themselves in transit to SWA wearing ill-fitting boots which had been issued on an emergency "fill or kill" basis when supplies of common sizes had been exhausted. Employees were told that boots and uniforms were not deemed mission essential. The unintentional result of these substitutions and shortages was frustrated personnel. When a few deploying individuals acquired their own clothing and equipment, reimbursement problems occurred.[9]

Looking back on the problems which occurred at the Aberdeen Proving Ground, AMCCOM Readiness Directorate (RD) officials noted that AMC had the responsibility to properly equip AMCCOM personnel. But AMCCOM's RD personnel were not without suggestions as to how best to avoid equipage problems in future endeavors. Specifically, they noted that for future POR/M deployments to an imminent combat zone, shortages of equipment and clothing contravened by POR/M centers using substitute articles of uniforms, boots and other authorized items should be back-ordered for direct delivery to the LAR (or other civilian) who departed for the theater of operations without their full complement of equipment. And in order that civilians might not need to deploy in a "fill or kill" equipment status, AMCCOM personnel urged that AMC mobilization regulations and standards should be altered to authorize the use of non-traditional imprest funds for the proper outfitting of LARs from local, nongovernmental sources, including Sears, Gander Mountain, Cabelas, and similar retailers. AMCCOM did recommend that requests to retailers be handled via their usual free 1-800 telephone numbers.[10]

Observations concerning the processing of LARs through APG did not only make their appearance at the conclusion of Operations Desert Shield and Desert Storm. Indeed, as early as 4 October 1990 problems with LAR, as well as other civilian, deployment became apparent. The AMC Commander noted on that date that too many individuals were reporting to APG without sufficient credited funds.[11]

Without sufficient credited funding, personnel deploying for SWA found themselves in constrained circumstances when they discovered that their home station was responsible for their billeting and cost of meals at APG, just as if the employee was on TDY (temporary duty) assignment. Message traffic reminded HQ, AMCCOM that it, as well as all sponsoring AMC units, were responsible for ensuring that their contract covered all expenses and that APG was properly reimbursed for the services rendered to their deploying

personnel. The sponsoring activity was expected to provide sufficient funding for adequate clothing and equipment to be issued to deploying personnel so that their job could be performed safely.[12]

LARs could find themselves in uncomfortable individual financial straits if they expected APG to provide them with personal items for their trek to the desert. The same message which prompted AMCCOM to provide sufficient credit to its deploying personnel for their billeting and dietary needs at APG reminded AMCCOM employees that the movement and replacement center was not responsible for supplying deployees with such items as toothbrushes, sunglasses, sunscreen, lip balm, shoes, boots, underwear, socks, towels, and other sundry items. It would, however, make opportunities available for personnel to purchase personal items at either APG's clothing sales store or commercial stores.[13]

In order that APG was not overrun with individuals attempting to deploy at all dates and times, AMC decreed that personnel would be batch processed through the facility. All rotations through APG would begin on Monday, with late arrivals being held over for processing the following Monday. And in order that APG might run smoothly, sponsoring activities were to provide time-phased estimates of the numbers of their personnel expected to be processed through APG. Indeed, to ensure the smooth flow of personnel through APG, only the Emergency Operations Center of AMCCOM's Readiness Directorate was authorized to make the necessary reservations for AMCCOM personnel passage through the Maryland facility.[14]

Processing through APG was in actuality one of the final steps of deployment to SWA. Prior to arriving at APG for travel to the theater of operations, deploying civilians, LARs as well as quality assurance specialists-ammunition surveillance (QASAS), and senior command representatives (SCRs), had numerous requirements to meet and obligations to fulfill. And in order that no steps might be omitted in the processing of deployees for SWA, AMCCOM ultimately issued a circular detailing the necessary progression of events for travel and transport to SWA.[15] The circular declared its purpose to be the prescription of "policies and procedures" as well as the assignment of "responsibilities for preparing for travel to Saudi Arabia in support of Operation Desert Shield."[16] The circular applied to all military and civilian personnel assigned to AMCCOM, including the U.S. Army Armament Research, Development and Engineering Center (ARDEC), the U.S. Army Chemical Research, Development and Engineering Center (CRDEC), Project/Product/Program Managers (PMs) reporting to HQ, AMCCOM, and subordinate installations and activities.[17]

The circular noted that the Deputy Director, Readiness Directorate (AMSMC-RD) was the sole individual authorized to sign travel orders as the approving official for all travel pertaining to Operation Desert Shield, and ultimately Desert Storm. And although the circular was designed to focus upon OCONUS (outside continental United States) travel, it commented that the Deputy Director's signature/approval was also required for supportive CONUS travel.[18] The Commanding General, AMCCOM bore responsibility for the approval of all OCONUS travel; his signature, or that of his designated alternate, was therefore required with that of the Readiness Directorate Deputy Director's on DARCOM (U.S. Army Materiel Development and Readiness Command) Form 1297 (a form requiring detailed justification for travel abroad) and on the AMC Clearance Sheet (a prescribed form required by AMC to obtain theater clearance for Saudi Arabia). The Emergency Operations Center (EOC) segment of the Readiness Directorate was responsible for onsuring that the proper signatures adorned the travel orders and DARCOM Form 1297.[19]

The circular assigned numerous responsibilities to AMSMC-RD beyond that of its Deputy Director's authorization of all travel orders. In addition to this, the directorate was required to ensure that all necessary forms were accurate and included in the travel packet. The EOC had special duties in conjunction with the deployment of civilians to SWA beyond the acquisition of signatures. Its staff was required to monitor the

travel of all AMCCOM personnel in support of ODS, to ensure that the appropriate approvals had been obtained, and that the necessary notifications had been made. Additionally, it maintained the records needed to determine when to initiate and terminate the deployees' foreign post differential (FPD) pay. Furthermore, the EOC was charged with the maintenance and routing of AMC Clearance Sheets, notifying AMC of estimated personnel requirements and identifying all AMCCOM deployees by name for POR qualification at APG.[20]

The Comptroller (AMSMC-CP) was tasked with the processing of all financially oriented paperwork in support of civilians deploying to SWA. Advances were to be processed, whenever applicable, through the appropriate servicing Finance and Accounting Office, and civilian pay was to be dispersed based upon an appropriately filed SF 1190, "Foreign Allowances Application, Grant, and Report."[21]

AMCCOM Circular 55-1 was also quite specific in detailing the actions LARs, as well as other deploying civilians, were to undertake before travel to APG could commence. The circular noted that LARs not attached to a specific unit were required to obtain their own visas while LARs attached to a particular unit were to obtain their visas in accordance with the unit's procedures. All deploying civilians were to prepare DD Form 1610, "Request and Authorization of TDY Travel for DOD Personnel" in quadruplicate, and forward all four copies of these official travel orders to the appropriate Readiness Directorate Logistics Assistance Division. And to ensure that the form was properly prepared and thus avoid any delays in processing, AMCCOM personnel devoted Appendix F of AMCCOM Circular 55-1 to this task. Later, AMCCOM officials amended DD Form 1610 to specifically address issues of Operation Desert Storm. The amended form addressed primarily the "remarks" portion of the form and included information on rental cars, excess baggage of up to 200 pounds, statements of nonavailability while at APG, corrective lens inserts for gas masks, and the authorization for medical care. Also in preparation for travel to SWA, deploying civilians were to ensure that their supported unit was prepared to provide billeting, mess facilities, etc. Additionally, deploying LARs were to notify the AMCCOM Senior Command Representative (SCR) at their return from detail, check their Leave and Earnings Statement upon return from detail to ensure that FPD pay had been terminated, as well as prepare and submit DD Form 1351-2 "Travel Voucher" to the appropriate servicing Finance and Accounting Office within 15 days of return.[22]

Appendix A of AMCCOM Circular 55-1 was specifically devoted to "Preparation for OCONUS Travel." All AMCCOM personnel preparing to travel to Saudi Arabia were responsible for reading and heeding the material it contained. Of special notice to LARs preparing for travel to SWA was paragraph 3, subsection "d." It noted that a fund cite would be forwarded by AMSMC-RDL (Readiness Directorate, Logistics Assistance Division) to the LAR located with a unit for preparation for travel orders. The LAR, in turn, was to return four copies of his/her travel orders to the Readiness Directorate where the responsible official in the directorate's Logistics Assistance Division would assist in the preparation of DARCOM Form 1297, SF 1190 (for civilian LARs only) and the AMC Clearance Sheet.[23]

Civilian travelers other than LARs were to prepare DD Form 1610, SF 1190, DARCOM Form 1297, and the AMC Clearance Sheet. These were to be forwarded to the Readiness Directorate for review, approval, and signature. The Readiness Directorate was responsible for forwarding approved orders to the EOC for notification of the AMCCOM Senior Command Representative (SCR) and the Chief, AMC-SWA.[24]

The EOC was tasked, according to Appendix A, with maintaining a list of personnel who would be traveling to Saudi Arabia and was to notify HQ, AMC weekly of the deploying individuals who would be arriving at APG for preparation for overseas rotation (POR) qualification the following Sunday. This tasking became the object of criticism by the close of Operations Desert Shield and Desert Storm. Indeed, Readiness Directorate's Policy, Plans, and Programs Division personnel noted in the required Operation

Desert Shield/Storm After Action Report that "Management made a wrong decision when they decided that the Operations Center staff should be responsible for controlling, tracking, and ensuring [that] civilian/military individuals received all the proper processing prior to deploying to SWA. The Operations Center staff is not a tasking organization." Indeed, the submitted observation continued that the EOC was to ensure the proper organizations were assigned taskers. It further noted that "Handcarrying documents from one end of the installation to the other to obtain required signatures by student aids or anyone who happens to be passing by is ridiculous and leaves a large chance for documentation to be misplaced or lost."[25] Readiness Directorate personnel recommended in future engagements that the Personnel and Training Directorate in coordination with the Transportation and Traffic Management Directorate should be responsible for all civilian/military deployment to OCONUS locations. The included rationale was that these organizations possessed the expertise in tracking, and that ultimately the EOC and Readiness Directorate were not functional tracking facilities.

The result of the EOC and Readiness Directorate being tasked with the tracking of deploying civilians was a bit of confusion, as well as consternation. For at no time during Operations Desert Shield and Storm was there ever a list of deployed personnel available which anyone felt was accurate. In order that accurate records might be available during further deployments, the staff of the Readiness Directorate recommended that a clerk position be established, to go into effect immediately whenever there was an operation such as ODS, in the Emergency Plans and Initiatives Branch to log in all travel orders as they arrived in that office for approval. Names of travelers could then be entered into a computer program outlining required information and kept up-to-date by the clerk daily. The ODS experience indicated that this position would need to be a full time job with all on-duty time being devoted to maintaining the status of deploying personnel. Due to the many levels of interest in such a listing, and its accuracy, the mission warrants the sole attention of the responsible individual. This individual would need to begin these duties as soon as an emergency was declared to assure that all deploying individuals were on the list.[26]

Part of the trouble in maintaining an accurate listing of deployed civilians, regardless of career classification, came from the shortage of employees available to staff the EOC. The thought of giving up resources, even in the case of a temporary, emergency scenario, was difficult for some directorates to contemplate. The brief advance time the deployment presented accentuated the confusion and resentment. Indeed, the Organization and Force Management Division of the Management Directorate noted somewhat dejectedly that "Much time, effort, and emotion was expended in arguing over which directorates/offices would or could afford to detail personnel in the Operations Center."[27] The office recommended that the Readiness Directorate should establish staffing requirements for the Operations Center and have pre-positioned agreements between Deputies/Organizations to streamline or simplify getting the Operations Center operational.

The problem of staffing had not been mitigated by the assignment of Individual Mobilization Augmentees (IMAs), Individual Ready Reservists (IRRs), or other activated reservists to the command Operations Center. Indeed, the Readiness Directorate's Mobilization and Operations Branch referred to such assignments as "a waste of resources which could be better utilized in other areas."[28] The office's personnel noted that the Operations Center had a full-time staff and did not have any IMA or IRR slots; the OC staff was to be augmented, when necessary, with civilian and military personnel already working full time for the command. These people are familiar with the overall mission of the command and the detailed functions of the organizations to which they are assigned. These understandings are essential to be a productive asset to the EOC.

Army reservists (IMAs, IRRs, etc.) called to active duty to work at a predominantly "civilian" installation are not knowledgeable of the inter-workings of the command. These individuals are usually sent to their

mobilization station (ir this case a commodity command) for one to two weeks per year to meet the annual training requirements. Often, the office/directorates they are assigned to do not want to take the time, or are reluctant, to assign anything meaningful to the reservists since they are only around for such short period. Frequently their "training" consists of being assigned to write or rewrite an interoffice Standard Operating Procedure (SOP). Or, they are told to report to the Operations Center, simply to get the reservists out of their assigned directorates' paths, without prior approval or knowledge of the Operations Center.[29]

The Readiness Directorate Mobilization and Operations Branch further noted that it was "neither the wish nor the responsibility of the Command Operations Center to train or find something for these 'unwanted' reservists to do. During times of crisis no one has the time to train individuals on areas that should already be basic knowledge to all who work for the command. The design and structure of the Operations Center is not conducive to having military officers milling around the center. The nature of the beast (officers) is to be a 'boss' and the Operations Centers already have too many bosses." The office also noted that individuals frequently made demands upon the EOC staff that it had no obligation to meet, then complained to superiors that the EOC staff was "unresponsive."[30]

Taking their cue from the problems encountered with the presence of reservists in their midsts, the EOC staff urged that augmentees be functionally knowledgeable of the organization they were to work for and understand the interrelationships of other directorates within the command. Furthermore, Readiness Directorate personnel advised that Individual Mobilization Augmentees should be required to remain at their MOBTDA (Mobilization Table of Distributions and Allowances) slot and not shunted off to other offices. And to avoid problems with IMAs, IRRs, and other activated reservists in future deployments, the EOC recommended that positions located CONUS army commodity commands should be reviewed for possible elimination. Offices currently with these positions on their MOBTDAs were encouraged to review their need for these individuals. If truly needed for a job in their organization, then effective training should be provided. If the requirement did not exist for these individuals, the Readiness Directorate recommended that the slots be dropped from the MOBTDA. The Management Directorate was recommended as the instigator of office MOBTDA updates.[31]

Regardless of the fact that EOC occasionally felt overwhelmed by their tasking, that an accurate list of deployed personnel seemed never to be available, as well as the absence of any official augmentation policies and procedures for the staffing of the EOC to support a long-term contingency, work was accomplished at the facility and with a relative degree of effectiveness. This occurred in part, initially, due to employees working overtime, but ultimately due to the assignment by the Command Group of various offices to detail personnel to the EOC for a minimum of 120 days. Despite the *ad hoc* success of the EOC's detailed personnel, its officials did encourage the preparation and coordination of a staffing plan for the augmentation of the Operations Center in the event of a crisis/emergency. This document would be a regulatory document and would be necessary to ensure that designated offices, do, in fact, provide the personnel required by the plan, without the usual squabbling encountered otherwise. According to EOC personnel, the preferred plan would include samples of each form necessary to detail an employee to the Operations Center. It should also include job descriptions, shift hours and days to be worked so no unnecessary overtime was entailed, meaning regular days off other than Saturdays and Sundays to keep a seven day, around the clock vigil.[32]

Also to avoid unnecessary confusion, misdirection, wasted time and effort, frustration and low morale in the EOC, its permanent personnel recommended a formalized chain of command. During times of peace, the chain was straight forward: Branch Chief, Division Chief, Deputy and Director. However, during ODS the chain of command became clotted with chiefs: Chief, Operations Center; Chief, Programs, Plans and Initiatives Division: Deputy Director Readiness; Director, Readiness; Chief of Staff; Deputy Commanding

General, Procurement and Readiness; Commanding General. From such an array of "chiefs", it was not surprising that the "Indians" were frequently given conflicting tasks, guidance, and orders. The EOC staff proposed two variant plans in the chain of command. In one scenario, the Operations Center would come directly under the Command Group and be divorced from the Readiness Directorate in times of national crisis or emergency. The Chief, Operations Center would then report directly to the Command Group for the duration, returning to its peacetime standing at the cessation of hostilities. Alternatively, the Mobilization and Operations Branch would become a staff office, reporting directly to the Command Group at all times. It would retain its standing mission and functions in this proposed format.[33]

Beyond providing information concerning the role of the EOC in the deployment of civilians, listing the forms needed for deployment and their disposition, Appendix A set guidelines for telephonic and datafax communication of authorizations and approvals, and referred employees to later portions of AMCCOM Circular 55-1 so that they might be familiar with preparation for overseas rotation (POR) qualifications. Tab C of Appendix A, for example, clearly stated the "Actions to be Accomplished at Home Station Prior to Movement to Aberdeen Proving Ground." Actions to be accomplished by civilians prior to travel to the Maryland facility included obtaining copies of their orders, as well as passports and visas (when appropriate), their Geneva Convention cards and identification cards. Deploying civilians were also reminded that they must prepare their wills and powers of attorney, arrange for transportation home of any vehicles taken to APG, and prepare to report to the facility on the designated Sunday.

The circular also contained information directed towards military personnel and civilian contractors in the process of deploying. It concluded with the notations that APG POR training was not applicable to personnel then assigned, attached, or under the operational control of another major army command, and that LARs, QASAS, and Test, Measurement, and Diagnostic Equipment (TMDE) personnel deploying with their assigned unit would be processed in accordance with the unit's procedures. Additionally, emergencies could be handled on a case-by-case basis, and excessively heavy baggage/equipment was to be mailed to SWA prior to the individual's departure for APG.[34]

Arguably the most time consuming, but most important "actions to be accomplished" by personnel before their movement to APG involved the status of their health. Deploying personnel were required to contact their local health clinic as soon as possible for medical screening. They were required to take their immunization record, a list of current medications, and their most recent eye glass prescription to the appointment in order that a decision might be made as to their serviceablity in SWA. Physicians were reminded that their assessment of a deploying individuals' capacity to serve in SWA should take into consideration that occupational health services were very limited in SWA and that any job-related or periodic tests/examinations necessary during the expected 180-360 day rotations should be completed prior to departure.[35]

In addition, a memorandum generated for distribution to potentially deploying personnel and their physicians noted that all individuals deploying should be assessed for ability to wear full chemical protective equipment. A thorough and proper screening for this ability would include the past history of heat injury and any medical condition that would preclude wearing a mask or protective clothing. Selective examinations were to focus on cardiovascular, pulmonary, dermatologic, and neurologic systems. Baseline ECG or pulmonary function tests, if not available were to be performed before deployment as well.[36]

Additionally, physicians and their deploying clients were advised that hearing should be adequate to ensure reaction to chemical agent alarms, that perishable medications (e.g., insulin, allergy desensitization shots) could not be guaranteed refrigeration or replacement in SWA, that personnel should be capable of

lifting and carrying 50 pounds on a daily basis, without restriction, and that newly diagnosed or unstable medical conditions might be adversely affected by the stress of deployment. Furthermore, physicians and deployees were to be aware that immunizations—typhoid, tetanus, immune globulin (hepatitis) and meninnococcal (meningitis)—should be assessed and completed in accordance with regulations, that HIV testing might be required of civilian personnel, but that a "current test"—one conducted within three years—was required of military personnel, that personnel should leave for SWA with a six month supply of chronic-need medications, and that personnel who required specialty care in a medical center might not find that care available in SWA and might therefore not be accepted for volunteer service. Concerning vision, potential deployees and their physicians were advised that contact lens wearers should be prepared to leave their contacts at home and to wear their spectacles, and that all individuals dependent upon glasses should have prescription mask inserts prepared by APG personnel prior to their departure. Deploying individuals dependent upon glasses were encouraged to take two pairs with them to SWA. Potentially deploying women were to discuss the possibility of pregnancy with their physician with the understanding that it might preclude their departure for SWA.[37] Information gathered from testing was to be forwarded to APG on HSC Form 621; regular medical records were not to accompany deployees. And while not of a truly medical nature, male employees were advised by the same memorandum that beards would need to be removed in order that an air-tight seal could be obtained with protective masks.

Information was also provided concerning the health risks of deployment to SWA. Deployees were warned that the greatest risks to their health came from the intense heat they would experience. Jet lag, psychological stress, physical exertion, and the lack of acclimatization, all coupled with the heat, would significantly compromise performance during their first three days in SWA. Acclimatization, which, dependent upon the individual, could take 10-14 days, proper work-rest cycles, and adequate hydration—up to two quarts per hour of liquid—were touted as the keys to vitality in the desert.[38]

In the case of jet lag, deployees were informed to expect fatigue, irritability, headaches, reduced efficiency, and early morning wakefulness within the first 24 hours, extending up to five days after landing. This, exacerbated by the need upon arrival to establish contacts and familiarize themselves with the area would result in exhaustion and impaired judgement deployees were warned. In order that they might avoid the worst features of jet lag, all personnel were encouraged to schedule sleep before deployment to coincide with Middle Eastern time zones, avoid alcohol and caffeinated beverages, maintain adequate hydration (two to three glasses of water during every four hours of flight), and refrain from overeating. Jet lag could also be countered by the ingestion of a small dose Halcion at departure, while simultaneously avoiding alcohol and sleep interruption.[39]

The uncertainty which accompanies deployments, the unknown threats in enemy strength and capabilities (e.g., chemical warfare), the foreign environment, the threat of strange diseases, the unknown duration of deployment, and the threat of personal harm, compounded by jet lag, were anticipated to affect sleep patterns, the ability to rest, and hence the performance of the mission. Physical exercise, adequate rest (when possible twelve hours on duty, twelve hours off duty and away from the work environment), and information concerning their mission were advocated as means of countering stress.[40]

Deploying individuals also had to face a rather unpleasant environment. The heat of SWA is worsened by dry breezes in some areas and high humidity in others, making it a significant factor even for indigenous people. Unacclimatized personnel, under stress, suffering jet lag, dealing with the logistical problems and physical exertions of their deployment were particularly susceptible to heat injuries. Heat injuries such as cramps, exhaustion, and stroke were expected by medical personnel to be the dominating initial threat to deployed individuals. Other sun-related problems like sunburn, vision disturbances, and lip chapping were also to be expected and prepared for by deploying individuals, civilian and military.[41]

Typically, individuals deployed to desert conditions could also expect increased bouts with colds, flu, allergies, and respiratory/sinus/ear infections due to the dusty, sandy environment. Deployees were encouraged to wear a cloth around their neck to cover their nose and mouth in exceptionally dusty conditions.[42]

Deployees could also expect to suffer during their first few weeks of residence in SWA with diarrheal diseases of variant sources. These diseases could spread rapidly and lead to tactically significant performance loss. Fluid loss due to diarrhea could greatly worsen the effects of the heat. Acute respiratory diseases could also be expected to surface due to the dusty environment. In consideration of these factors, a serious emphasis was to be placed upon food and water sanitation as well as personal hygiene.[43]

Insects and animal pests indigenous to SWA also presented deploying individuals with health risks. While some creatures served as vectors for disease spread, others were capable of inflicting bodily harm entirely on their own. The wolf spider, also known as the hairy tarantula, and a variety of black widow spider are found in the Gulf region. Their bites, as well as those of the scorpion, have been known to be fatal to individuals camped in the desert. Such creatures have a reported fondness for hiding in bedding and boots. Snakes also abound in the region and many can prove fatal: puff adders, desert black snakes, cobras, horned vipers, saw-scaled vipers, false horned vipers, etc. Additionally, deploying individuals were warned against the packs of feral dogs which inhabit the region. In order that rabies might be avoided by these individuals, they were urged not to attempt to make camp pets of the canines.[44]

While the deployees were advised concerning contact with animals which could in and of themselves be dangerous to health, they were also warned of disease-carrying creatures as well. Insects were specifically to be avoided. Mosquitoes can carry malaria, dengue fever and other arboviral diseases. Filth flies spread cholera, dysentery, and typhoid. Fleas can pass along murine typhus and be responsible for small, sporadic outbreaks of plague. Lice could also be a problem in the desert. By contact with local populations, new deployees could contract "relapsing fever." Ticks could also carry the malady, as well as typhus, and Crimean-Congo hemorrhagic fever. Leeches are present in the region as well and presented deployees with physical and well as psychological concern.[45]

Perhaps the greatest concern regarding a creature came with a knowledge of the sand fly. Sand fly fever is a self-limiting but debilitating flu-like febrile illness, and is the most widespread vector-borne disease in the Middle East; incidence peaks in August. The sand fly is also responsible for leishmaniasis. SWA is the classical region of the world for the cutaneous variety of this disease. This condition results in nodular skin lesions which evolve into painful, but occasionally painless, slow- or non-healing ulcers several centimeters in diameter. While leishmaniasis is not an acutely debilitating disease, its presence can be psychologically disturbing, and its inpatient treatment may be prolonged. Visceral leishmaniasis, an often fatal, albeit rare, disease, also occurs in this area[46]

Deployees were advised in preventive action against the dangerous sand fly. The use of personal protective measures such as repellent, clothing, impregnated bed netting, staying off the desert floor, checking all articles of clothing before donning them, shaking out bedding before entering, and "buddy" inspections, were all recommended in limiting the threat of sand fly bites, as well as other insect threats. The army's current approach to insect repellents involves use of two products, a DEET-containing repellent lotion for skin and a clothing repellent called permethrin. Proper wearing of the uniform issued in conjunction with the use of insecticides was deemed a "nearly complete protection from vector-borne diseases."[47]

Deploying civilians were also advised how to apply repellent. The lotion was to be applied to exposed skin including ears, face, and neck. Its area of application was to extend two to three inches under the edge

of the uniform to prevent sand flies from crawling under clothing. The permethrin repellent was to be directly applied to the uniform until it appeared wet. It was also to be applied to bed netting because the mesh was too large to prove a barrier to the small sand flies. The clothing impregnate was to be applied prior to deployment if possible and again after the fifth washing. Individuals were also warned that personal hygiene, effectively disposing of garbage and human waste, and keeping foods and water sources covered and fly-proofed, was of paramount importance in the struggle against sand flies, as well as other desert pests.[48]

Deploying individuals needed to be aware, as well, that the deserts of SWA were kind hosts to numerous bacterial viruses, hepatitis A, schistosomiasis (a fever induced by contact with many local water sources), Q fever, meningitis, brucellosis, trachoma, and the usual assortment of sexually transmitted diseases regardless of residence in a strict Muslim region. Stress-related problems might also be expected in the tensionridden area.[49]

An additional risk of deployment was termed post-traumatic stress disorder. Known in previous conflicts as combat fatigue and shell shock, deployees came to understand that developing the disorder did not mean that they had become unbalanced, but rather had reacted rationally to the life-threatening conditions in which they found themselves. Problems would arise, however, if upon return individuals continued their crisis responses in the relatively peaceful United States. Burying feelings would do no good declared counselors; for many the feelings would need to be talked through.[50]

Military personnel perhaps would have a somewhat easier time coping with the psychological rigors of deployment. Military personnel would have frontline facilities available for their counseling needs in SWA, as well as the advantage of the services offered by military hospitals and veterans' centers CONUS. In addition, many civilians deploying to SWA had no combat experience and had not received military training and thus were not prepared to face the terrors of warfare: Scud missile attacks, chemical warfare alerts, need deprivation, fear, and human suffering. Vietnam veterans traveling to SWA as civilians might expect a return of once-vanquished demons.[51]

Discussed symptoms of post-traumatic stress disorder that returning civilians and their families could be alert for included mentally reliving the psychological trauma over and over again, especially when triggered by a once-familiar sound. Thus a Fourth of July firecracker could suggest small-arms fire and a police siren splitting the night could recall a Scud missile attack. Psychic numbing could also occur with post-traumatic stress disorder. Individuals with the disorder frequently withdraw into themselves and avoid situations in which they might be called upon to discuss their stressful experiences. This could be a painful issue when families prepared to reunite after months of separation. Additionally, the disorder causes its victims to remain constantly on guard and to exercise their "flight or fight" response at inappropriate times. A constant sense of impending doom haunts many and leaves them feeling as if constantly on the frontlines. A final sign of post-traumatic stress disorder that deployees and their families were warned to watch for was a sense of survivor guilt. Returning civilians, as well as military personnel, might feel they did not deserve the good fortune of living.[52]

Even with a clean bill of health and a thoroughgoing understanding of the health risks of deployment, civilian deployees could not simply be sent to APG for travel to SWA. Before undertaking the health screening process, LARs and their fellow civilians had to obtain the proper documentation for foreign travel. Personnel alerted for deployment were urged to begin the process of obtaining passports immediately, even if their deployment status was undetermined. Official passports were required for travel to SWA in support of Operations Desert Shield and Desert Storm for civilian deployees; the use of regular, or tourist,

passports was not authorized. While LARs were to obtain visas through their supported units, QASAS, SCRs and other deploying civilians were to commence the process of obtaining visas by visiting either the Rock Island Passport Office or their local Passport Office if located at a subordinate installation or activity.[53]

If a visa was not needed immediately, AMC officials recommended that the request for one be delayed until after the passport had been received. This delay would allow for the previous processing of the passport request (a necessary step in obtaining a visa) and would also lengthen the period of the visa's validity. If the receipt of a passport or visa was time critical, the process could be expedited through the use of express mail, although at least five days could still be expected before even essential employees might expect their travel documentation. Of special concern to individuals deploying to the United Arab Emirates was the requirement to obtain a Saudi Arabian visa; all Military Airlift Command (MAC) flights were scheduled to land in that nation before proceeding to the UAE. In concluding his comments on the pursuit of travel documentation, AMC's commanding officer charged employees to "do it by the book," and "do it early" for AMCCOM personnel were not welcome at APG until their Department of the Army (DA) approval, passport, and visa were in hand.[54]

Civilian personnel traveling by military or militarycontracted aircraft to the United Arab Emirates, Oman, and Bahrain did not necessarily require a passport or visa. Travelers to Saudi Arabia or Qatar by military transport did, as did all Gulf country travelers on regularly scheduled commercial aircraft.[55]

The concerns of civilians deployed, or alerted for deployment to SWA, were plentiful and the AMC officials attempted to answer them before they clogged the channels of communication. Civilians deploying to SWA with AMC could expect to return to the United States after only 179 days of service, in consideration of the harsh working conditions: seven days per week, twelve to fourteen hour work days, tent dwelling, high temperatures, etc. AMC believed it had sufficient depth of personnel to manage this relatively brief TDY status for its civilians.[56]

As concerned the matter of a *per diem* for deployed personnel, AMC remarked that as all civilians in support of Operations Desert Shield and Storm were considered to be TDY and that as such they were operationally entitled to take their meals at military dining facilities. As such, the subsistence portion of their *per diem* was not to be authorized. And as most LARs, as well as other civilian employees, were living in central activity compounds, the taking of meals in military dining facilities was not a problem. Nor was it a problem for civilian personnel deployed to quarters in close proximity to their supported military activity. Civilians given a *per diem* were not allowed to take their meals in military dining halls.[57]

Life insurance also became an issue of concern for individuals facing the possibility of deployment to SWA. AMC officials noted that with Federal Employees Group Life Insurance (FEGLI) coverage that death benefits were payable regardless of cause of death. Double indemnity benefits would not be payable, however, if accidental death occurred under circumstances related to acts of war, declared or undeclared, nuclear weapons, or actual combat. The commander encouraged employees to consult their servicing civilian personnel office for eligibility questions and evidence of insurability issues.[58]

Employees who had purchased commercial life insurance were urged to review their policies to ascertain if they contained a war clause or nuclear/combat exclusions. Deployees without life insurance were gently prodded to consider purchases before their departure for SWA.[59]

Deployed civilians to SWA, LAR, QASAS, or SCR, had a multitude of questions that the commander of AMCCOM, and subordinate commands as well, sought to answer. Concerning workers' compensation, potential deployees were reassured that any injury incurred during a TDY experience would "normally" be

covered by the standards of the Federal Employees Compensation Act. Pre-existing injuries and illnesses would not be compensated unless the worker could medically prove that the condition had been aggravated by the TDY experience.[60]

As concerned pay for deployed personnel, LARs and other civilians were informed that the United States Code, Title 5, Section 5928, authorized the Secretary of State to determine where a danger pay allowance for civilians would be paid and the amount to be paid. The amount of danger pay allowance was to be determined by the level of danger not to exceed an amount equal to 25% of a civilian's base pay. This pay was not immediately available to deploying civilians as the Secretary of State did not perceive that the initial deployees were in inordinate danger.[61] Indeed, the war had started by some seven days before danger pay was authorized by the Secretary; it would not be paid retroactively to the start of the war.[62]

Foreign post differential (FPD), however, was payable to civilian deployees based in Saudi Arabia from the start of Operation Desert Shield. The rate of pay was set at 20% of base pay. Approximately 10% of this pay differential was associated with the threat of political violence and the remainder with the varied costs of living abroad as compared to the United States. While FPD was payable to civilian employees involved in a permanent change of station (PCS) on their first day of residence in SWA, AMCCOM personnel for the most part were more concerned with the fact that TDY deployees initially became eligible for FPD funds only after serving 42 days abroad.[63] Effective 24 February 1991, however, FPD payments were authorized for the first 42 days of in country service, but only after these days had passed would payment be made.[64] For purposes of calculating pay, each deployee's supervisor was required to furnish a daily report to the AMCCOM Operations Center listing the "wheels down" and "wheels up" schedule for the individual.[65]

The issue of the timely and proper pay of AMCCOM civilians deployed to SWA, regardless of status as LAR, QASAS, or SCR, became the subject of an information paper generated by the Personnel and Training Directorate, Civilian Employment and Compensation Management Division. Personnel officials noted that the State Department authorizations required to instigate both FPD and danger pay did not occur quickly enough to properly compensate civilians deployed to SWA. Danger pay was not retroactively authorized, and some civilians received FPD for all days of their deployment, even if paid after the fact, while others did not receive differential payment for the initial 42 days of service. Additionally, the pay of General Service/General Management (GS/GM) employees was capped at the GS-15 step 10 level, both in a pay period and an annual basis during the majority of Operations Desert Shield and Desert Storm. The regulation was not to be contravened by the offer of compensatory leave in the place of wages. The biweekly pay cap, however, was lifted effective 24 March 1991 for personnel in support of SWA, well after the most critical period and the return of many civilians to the United States.[66]

In their after action analysis of civilian compensation during Operations Desert Shield and Desert Storm, AMCCOM's Personnel and Training Directorate officials urged a reconsideration of statutes and regulations affecting the pay structure for deployed personnel. Specifically, the officials recommended that legislation be enacted for the retroactive authorization and payment of FPD and danger pay, and for retroactive payments after the removal of a pay cap.[67]

Personnel and Training Directorate personnel noted that such actions would require Congress to enact legislation to authorize the recommended retroactive payments. They commented that the Office of Personnel Management and the State Department were the appropriate agencies to propose such legislation, based on a HQDA (Headquarters, Department of the Army) recommendation.[68]

Early arrivals in the desert, as well as those preparing to depart for SWA, raised numerous questions concerning their entitlements to overtime and compensation. Employees were informed that their entitlement to overtime and its ensuing compensation derived from their status as either exempt or nonexempt employees. Employees, who were expected to know their own status, covered by the Fair Labor Standards Act (FLSA) and/or Title 5 United States Code, were termed nonexempt, while those not covered by the act and/or code were termed exempt. Employees with curiosity beyond the ordinary concerning the FLSA and Title 5 had references provided to presumably satiate their inquisitiveness. Information on FLSA rules is to be found in the 5 Code of Federal Regulations (CFR) Part 551, Subpart E, and Federal Personnel Manual Letters in the 551 series. Regulatory requirements for overtime under Title 5 are found at 5 CFR 550; Federal Personnel Manual Book 550, Subchapter S1; Federal Personnel Manual Supplement 990-2, Book 550, Subchapter S1; Army Regulation 690-990-2, Book 550, Subchapter S1; and AMC Regulation 616-4.[69]

The matter of status as exempt or nonexempt employee was not simply a moot one. Once an employee became entitled to compensation for overtime worked, compensatory time might be granted in its stead for certain employees. Wage grade employees, however, could not be granted compensatory time in lieu overtime wages. Also, for nonexempt employees, Federal Personnel Manual Letter 551-6 made clear that no statutory provision exists under the FLSA for the granting of compensatory time off in lieu of overtime pay. In other sources, overtime was defined as work performed by an employee in excess of eight hours in a day or 40 hours in an administrative workweek, including regular overtime work and occasional or irregular overtime. Wage grade employees were to receive compensation at one and a half times their normal hourly rate, not to exceed GS-10, step one, in lieu of compensatory hours.[70]

A separate AMCCOM publication laid forth the ground rules for GS/GM-13 through 15 employees. These employees could be paid overtime in direct support of ODS as an exception to standing Commanding General Policy 5-41, May 1989. AMCCOM Circular 55-1 noted that "while overtime dollars may be available for Operation Desert Shield workload, prudence is necessary for subject employees and should be limited to that considered absolutely essential after considering all other options."[71] Furthermore, GS/GM-13 through 15 employees serving their nation in SWA should remain aware of the rules and regulations governing use or lose annual leave, and the requirement to use compensatory time within 13 pay periods, should the inclination arise to utilize such measures for compensation.

In addition to making deployees aware of their status as either exempt or nonexempt employees, AMC fielded numerous questions from both deployed and deploying civilians concerning their compensation rights. Exempt employees were informed that in the majority of cases overtime was not to be authorized for time spent traveling a considerable distance from quarters or residence to a work site outside their normal tour of duty. Exempt employees were authorized to obtain the benefits of overtime when it was defined and justified in terms of "mandatory, discretionary, or emergency overtime" with one of the following situations: 1.) the travel involved the performance of work that could only be accomplished while traveling, 2.) the travel was incident to travel that involved the performance of work, 3.) the travel was to be carried out under such arduous and unusual conditions that the travel became inseparable from the work itself, or 4.) the travel resulted from an event that could not be scheduled or controlled administratively.[72]

In the majority of cases, nonexempt employees faced the same standards for claiming compensatory time in regard to travel time and their position. Under FLSA standards, the kind of travel involved would determine whether time spent traveling would be considered in hours of work performed. A nonexempt employee could claim compensatory overtime garnered from travel if: 1.) she/he performed work while traveling, including travel as the driver of a vehicle, 2.) traveled as a passenger to a temporary duty station and returned during the same day, or 3.) traveled as a passenger on nonwork days during hours which corresponded to his/her regular working hours.[73]

Potentially deploying civilians also learned that they were not entitled to overtime if awakened in the night by a supervisor and told to put on their gas mask and report to a shelter. They were informed that as the basic premise of overtime was to ensure that an employee received compensation for work performed, and that reporting to a shelter was to ensure personal safety, not the performance of work, so the time spent in the shelter could not be justifiably counted as overtime.[74]

Additionally, AMCCOM Circular 55-1 provided deploying civilians with information concerning their specific entitlements while in SWA, as well as basic definitions of work schedules and terminology. All AMCCOM civilians deploying to SWA were expected to read and understand the circular's Appendix E, "Rules, Procedures, and Policies Affecting Pay." Employees required to work on Sunday, in a non-overtime capacity, were informed of their entitlement to receive double their normal wage for the day. Work performed by an employee between the hours of 6 p.m. and 6 a.m. was regarded as nightwork and was compensated with a ten percent pay premium. The circular attempted to clearly spell out the instances in which the night pay differential would be applicable. For example, employees learned that they would be entitled to night pay differential regardless of whether or not they were actually performing assigned duties if they had been properly excused from their regularly scheduled night work on a holiday or other non-work day. Employees were also entitled to receive night pay differential regardless of work performed if in an official travel status. Also, an employee was entitled to a night pay differential for periods of paid leave only when the total amount of leave taken in a given pay period, including both night and day hours, was less than eight hours. Employees were further informed by the circular that they were entitled to a night pay differential when they were temporarily assigned during the administrative workweek to a daily tour of duty that included night work. This period of temporary change in a daily tour of duty within the employee's regularly scheduled administrative workweek was distinguished from a period of irregular or occasional overtime work in addition to the employee's regularly scheduled administrative workweek. In all cases, however, night pay differential was in addition to overtime, Sunday, or holiday pay and was not to be included in the rate of basic pay used to compute these premiums.[75]

Lunch periods were also covered by AMCCOM Circular 55-1 and provided LARs, as well as other deploying civilians, with guidance concerning what was to be considered duty time. The circular noted that lunch periods during which the employee was entirely free of duty were not to be considered duty time and must be scheduled outside the hours established for the daily tour of duty. Where three eight-hour shifts were in operation, however, and overlapping of shifts to permit time off for lunch was not possible, a lunch period of 20 minutes or less was acceptable and could be counted as compensable time worked. Where the on-the-job lunch period was in effect, however, employees were expected to remain close to their work stations. Where the lunch period was free time, or was longer than 20 minutes, the entire period could not be included in the daily schedule of working hours so that the employee was paid for the lunch period.[76]

For deploying civilians still not satisfied with their understanding of the regulations concerning overtime and compensatory time, AMCCOM provided an example:

> An employee has a regularly scheduled administrative workweek of 48 hours, Monday through Saturday, 4:00 to 12:00 midnight. The manager has specified that the work between 4:00 p.m. and 12:00 midnight on Saturday is regularly scheduled overtime work. If the employee works his or her entire regularly scheduled weekly tour of duty, he or she is entitled to 36 hours night pay differential for nightwork performed between the hours of 6:00 p.m. and 6:00 a.m., Monday through Saturday and 8 hours of overtime pay for the regularly scheduled overtime work performed between 4:00 p.m. and midnight on Saturday. In this example, the employee is entitled to night pay differential and overtime pay for the nightwork performed during regular overtime hours on Saturday.[77]

To ensure adherence to the circular's guidelines, it also tasked specific responsibilities. The traveling employee's supervisor was responsible for ensuring that the necessary controls were in place to provide an accurate accounting of the time worked. The deploying civilian was to familiarize him or herself with the contents of the appendix to ensure that the labor performed was accurately captured, and the timekeeper was not only to keep a tally of the quantity and variety of hours worked but also to annotate the time and attendance card with the travel order number from the first day of travel until the deployee's return to CONUS.[78]

Continuing along the line of compensation and employment concerns, deployees received information on how their performance in the desert would be assessed. Deployees were informed that while in SWA if they continued to perform their regular duties as if at their usual post, albeit with additional responsibilities, that no special ratings system would be applied to their efforts. Their SWA supervisor was simply to prepare a letter for inclusion in the employee's record listing the tasks assigned and describing how well the tasks were performed. And despite the difficulties in proper recognition of jobs well done, message traffic urged that outstanding contributions made by civilians should also be noted through the use of the Army's Incentive Awards Program.[79]

Deploying civilian personnel received considerable additional information concerning their finances during the build-up to their individual departures for the deserts of SWA. Concerning the matter of pay checks, regardless of their altered state due to FPD or danger pay, deployees were informed that they must make arrangements for the disposition of their checks prior to their deployment. In addition, they were urged to utilize traveler's checks while in SWA with the notation that the cost of obtaining the checks was a reimbursable one. They were, however, encouraged to take personal checks to the desert so that they might take care of personal business in the United States via the mail, and on occasion obtain small amounts of cash for use in SWA. Financial support would be available in country for the cashing of small personal checks and currency conversion. And, despite the hopes of deployees, their salaries did not become tax free while on TDY in SWA.[80]

Potentially deploying civilians, regardless of career classification, were also required to familiarize themselves with the laws and customs of their host nation, Saudi Arabia. As an understanding of Saudi Arabia's governing code of Islamic law could prove vital to the United States mission, all involved—DA, AMC, AMCCOM—sought to prevent inadvertent violations. Accordingly, deployees were presented with Desert Shield General Order 1, "Prohibited Activities for U.S. Personnel Servicing the USCENTCOM AOR (Area of Responsibility)." The order sought to make deploying personnel aware of the salient features of Saudi culture.[81]

Despite the presence of an estimated 3.5 to 4 million practicing Muslims in the United States, primarily located in Detroit, New York, Toledo, Washington, D.C., Los Angeles, Philadelphia, and Chicago, many deployees did not realize the impact of Islam on Saudi Arabian society. LARs, QASAS, SCRs and others learned that it was much more than the religion of 90% of all Arabs. Indeed, Islam, they came to realize, is a complete social, political, legal, and cultural system that prescribes a way of life for one of every eight people in the world.

Muslim daily life is prescribed by the Koran, the dictated word of God, given to the prophet Mohammed and his small band of followers early in the seventh century. The Koran establishes the five basic pillars of Islam: 1.) belief in God, 2.) prayer five times per day, 3.) a fast of one month per year, 4.) the gift of alms to the poor, and 5.) at least one pilgrimage to Mecca, the birthplace of Mohammed. During the month of fasting, Ramadan, believers must abstain from food, drink, smoking, and sexual intercourse between sunrise and sunset. Work hours are shortened during Ramadan to encourage meditation and intensive

self-evaluation. The end of Ramadan is marked with special ceremonies, sporting events, and parades while children receive gifts, money, and sweets.

While only Muslims are held to the dictates of Ramadan, all, visitors and residents alike, are subject to the Koran's meticulous code of moral and ethical behavior. This code, known as Shari'ah, is the official law of the land in Saudi Arabia, as well as other Arab nations and prohibits gambling, the consumption of pork products and alcohol, fraud, slander, perjury, hypocrisy, corruption, extravagance, and arrogance. In addition, it prescribes strict punishments for adultery, murder, and theft. Thus while an understanding of Islam was important as an aspect of cultural respect for the host nation, deploying U.S. civilians were also made aware of the legal aspects of Islamic society.

For civilians potentially en route to SWA, their crash course in Islam undoubtedly sounded like a list of "don'ts." Mosques, Muslim places of worship, as well as the holy cities of Mecca and Medina were off limits to non-believers. To avoid separating a believer from Mecca during the period of prayer, prayer rugs were not to be passed in front of during daily services. Crucifixes and Stars of David were not to be worn or displayed in public, even on the uniforms of military chaplains when outside U.S. areas of operation. There was to be no distribution of non-Muslim religious literature and no criticism of Islam in any fashion. Nor were non-Muslim religious services to be *overtly* conducted. The latter was in actuality a concession of sorts to the U.S. forces; Saudi law forbids all non-Muslim forms of religious expression.

Additionally, Americans could not drink any alcohol while in Saudi Arabia or use questionable language in the presence of Saudis. They were also prohibited from mailing or receiving "obscene" or "pornographic" material, including seemingly unoffensive photographs of women in bathing suits. The respect for women hinted at by this restriction, as well as a rigid interpretation of their place in society, would later prove problematic for female LARs, as well as other female civilians.

Respect for Saudi customs and law was also apparent in the guidelines deploying civilians received concerning clothing. Deployees were informed by November message traffic, as well as by a 25 January 1991 Travelers Update, that while civilian clothing had to be worn for off duty shopping tours or sight seeing, neither shorts nor t-shirts could be worn in public. Neither males or females would be permitted to wear blouses or shirts what were see-through or sheer. Their blouses and shirts were required to have collars and could not glamorize alcohol or in any way promote activities considered offensive by Saudi custom. Women's skirts—no pants or pant suits were permitted outside U.S.-only areas—were to fall well below the knees. Clothing which revealed the torso—defined as the area below the neck, above the knees, and inside the shoulders—could also not be worn in public by either sex. As a general guideline, the Travelers Update offered, "clothes should be loose fitting and concealing rather than revealing." Within the confines of U.S.-only areas, individuals were free to wear attire appropriate for the activity in which they were engaged.[32]

Beyond informing deploying civilians as to the appropriate attire for their forays into the socially and culturally opaque world of Saudi Arabia, Travelers Update 8 suggested that deployees take two to five civilian clothing changes, as well as sufficient undergarments to last two weeks. It also made numerous recommendations as to particular items the deploying civilian would need to be somewhat comfortable which the army was not prepared to provide. The Update encouraged deployees to take disposable razors or a shaving kit, personal hygiene items including toothpaste, shampoo, and soap in sufficient quantity to last several months, lotions and talcum power, sunscreen, lip balm, and petroleum jelly. Additionally, travelers were recommended to include moist towelettes, foot powder, insect repellent, and either baking soda or corn starch if the individual was prone to skin problems in their personal kits. The Update also urged deployees to take towels and wash cloths as well as self-sealing plastic bags in various sizes. These were to prevent sand from entering and damaging small items. A battery-powered FM or short wave radio with

plenty of extra batteries was also recommended by the Travelers Update, as were lap games. These devices would fill the relatively few leisure hours of deployed civilians, for as the Update declared, "There is no entertainment there (SWA)."[83] Deployees preparing for overseas rotation just days later had a few additional suggestions to take into consideration. Via message traffic from SWA, they were encouraged to take mosquito netting and a weapon cleaning kit, if they expected to be issued a weapon. And in consideration of the problems which were occurring at Aberdeen Proving Ground with the outfitting of deployees with desert BDUs, the message urged the purchase of these garments elsewhere.[84]

Even though deploying individuals had received seemingly endless quantities of information regarding passports, visas, life insurance, overtime, foreign pay differential, chemical defense training, Aberdeen Proving Ground, health care in SWA, etc., they were still not cleared for travel to Saudi Arabia. Before receiving authorization to fly out, deployees still had information to receive, and give. For example, all commanders were to ensure that their deploying DA civilians had in their possession a Geneva Convention identity card. This card identified its holder as a noncombatant entitled to special treatment if captured. In conjunction with their status as DA civilians serving their nation in a theater of war, deployees also received dog tags with two identifying plates. The tags were to provide the wearer's name, Social Security number, blood type, and religious preference. In consideration of their area of deployment, Jewish deployees were urged not to identify themselves as such on their tags. Chains and silencers for the government-provided dog tags could be purchased at local post exchanges if a civilian deployee's office provided him or her with a memorandum authorizing the purchase.[85]

Commanders were also required to inform deploying civilians about the services available to their families while they were abroad. Recommended points of reference included who to contact regarding pay problems and employment assistance, as well as how family members could contact the deploying employee, and information concerning provisions for emergency powers of attorney. Commanders were also to advise their deploying civilian and military personnel of emotional support facilities available to their waiting families. In some instances, the Family and Communities Activities Office, through Army Community Services, provided a "Waiting Spouses" group for not only husbands/wives of deployed individuals, both military and civilian, but also for local parents. Assistance in addressing loneliness, finances, and stress was offered to deployee families as were social opportunities. Rock Island Arsenal, home of HQ, AMCCOM, offered a 24-hour hotline for concerned family members as well as free childcare during "Waiting Family" support program meetings.[86] Information of a general nature concerning ODS could be obtained by waiting families through a variety of toll-free national hotlines whose numbers commanders provided their deploying civilians for dissemination.[87]

After the war, the success of the family support structure was lauded by AMCCOM's Personnel and Training Directorate. In the Operation Desert Shield/Storm After Action Report, they noted that the existing agencies of Army Community Services (ACS) were capable of being modified to handle local dependents of the total deployed force. The ACS had been augmented by state and local agencies.[88]

Perhaps the stark reality of the danger into which the LARs, and indeed all deployees to the deserts of SWA, were venturing became most clear when they were required to fill out forms directing AMCCOM whom to contact in case of casualties. The Emergency and Next of Kin Information sheet was considered a part of the travel package and was to be forwarded by the AMCCOM Operations Center to the Civilian Personnel Office for close hold retention. A memorandum entitled "U.S. Army Armament, Munitions and Chemical Command Casualty Reporting/Notification Procedures and the Civilian Survivor Assistance Program for Civilian Employees, Operation Desert Storm," detailed the use of the sheet and defined the responsibilities and taskings to be undertaken in the reporting, notification, and assistance provided for civilian employee casualties, and employees declared missing in action.[89]

In the unfortunate event of a casualty, notification to next of kin was to be made by a designated Notification Casualty Officer. The individual was to have been appointed by the Casualty Area Command, and was to be a member of the uniformed service. Attending the officer at the time of notification was to be the military chaplain, if available. While the memorandum noted that at many AMCCOM sites this would not be possible, it did recommend that the employee's or next of kin's minister/priest/rabbi could be called upon for presence and support during the notification. The notification was not, however, to be made by the cleric. Nor was notification of death, serious injury, or missing status to be made by the employee's co-worker or supervisor although that person might be called upon as well as the cleric for emotional support. In the case of a co-worker or supervisor, the action was to be voluntary on their part, not directed. Additionally, the memorandum recommended that while at least one person should accompany the Notification Casualty Officer, not more than two should do so. The notifying officer was to advise the next of kin that someone would be in touch within 24 hours to explain and subsequently assist in the application for various entitlements and benefits.[90]

In their presumably detailed and sobering reading of the memorandum, deploying civilian employees learned that equally important to the timely and compassionate notification made to the family was the requirement to assist the next of kin in understanding the myriad of entitlements and benefits which might be applicable. Deploying civilians also learned that the civilian survivor assistance counselor was not to be the same person as the notifier, nor would the notification visit be made with both individuals present. This would help the family/next of kin to disassociate the counselor from the impact of the tragic news of the notification. Conversely, however, the next of kin might request that the notifier or one of the others described in the notification procedures above accompany or be present when the civilian survivor assistance counselor called upon the next of kin.[91]

Sources of information which the survivor's family might rely upon, or so the deploying civilian was told, included the civilian personnel office retirement section, the Social Security Administration, and the Veterans Administration, if applicable. And while most funeral directors were well aware of routine entitlements, they might not be fully conversant with the benefits accruing to civil servants, and thus counselors were to intercede in behest of the family. Additionally, in dealing with their survivors, government counselors were to be proactive in assisting the grieving family by making the contacts; they were not simply to provide a list of whom to call.[92]

And closing with a somber reference for the deploying personnel, the memorandum noted that deceased civilian employee remains would be handled as they were for active military personnel until the remains arrived CONUS at Dover Air Force Base, Dover, DE. The Casualty and Memorial Affairs Operations Center would at that point obtain disposition instructions from the next of kin and so advise the entry mortuary at Dover. The entry mortuary would then advise the next of kin and the receiving funeral home of shipment details.[93]

For whatever comfort it provided deploying civilians, they learned that "the firm AMCCOM policy is that the responsible persons . . . will exercise the utmost courtesy, sympathy, and assistance to lighten the burden for the next of kin."[94]

The surviving next of kin of employees covered by the Civil Service Retirement System (CSRS) or the Federal Employees' Retirement System (FERS) were to be provided packets containing, at the minimum, an application for death benefits, a claim for the unpaid compensation of the deceased employee, a claim for Federal Employees' Group Life Insurance, and a request for the deceased's taxpayer identification number. Beneficiaries were also to be advised on the thrift savings plan. The account balance, if any, would be provided to the designated individual, and otherwise in the standard order of precedence.[95]

Deploying civilian employees could take minimal comfort in the knowledge that not only would their families be notified of their deaths, serious injuries, or missing status with compassion, that they would be aided in pursuit of the benefits due them as survivors, but also that they would be aided in acquiring the documentation necessary to successfully pursue their rights. Beneficiaries were to be advised as soon as possible to obtain certain documentary evidence to assist them in settling estates and other claims. The necessary evidence recommended included a certified copy of the death certificate for each benefit being claimed, copies of designation of beneficiaries filed by the deceased. certificate of the deceased's honorable discharge from military service, if applicable, and the birth certificates of minor children.[96]

And, with the hope that no step or bit of information might be inadvertently omitted in the process of aiding survivors, AMC's Commander noted that "perhaps the most important preparatory action CPOs (Civilian Personnel Offices) conduct is training for potential Civilian Survivor Assistance Counselors." Based upon the number of civilian employees serving their nation in the deserts of SWA, AMC Commanding General GEN W.G.T. Tuttle, Jr., urged installations to designate a number of potential Civilian Survivor Assistance Counselors and train them in survivor assistance procedures. Training was to parallel that conducted for Military Casualty Assistance Officers and include, as a minimum, familiarity with forms and rules governing their use, procedures employed by local agencies, i.e., Social Security, Veterans' Administration, sensitivity training, local rules on remaining in government quarters as applicable, post exchange/commissary privileges, etc. Tapes used to train Military Casualty Assistance Officers were made available to Civilian Survivor Assistance Counselors. That "training will produce confidence in the Civilian Survivor Assistance Officer and a uniform approach to survivor assistance" presumably offered a little comfort to employee preparing for travel to SWA. Similariy, deployees could take minimal comfort in the knowledge that their next of kin, both primary and secondary, would be notified of their death, serious injury, or status as missing before such information was released to the media.[97]

Unfortunately, the training was not in vain.

While contemplating the possibility of their deaths in the deserts of SWA while in service to their nation, LARs, as well as other deploying civilians, undoubtedly thought of ways to mitigate the level of danger to which they would be exposed. For some, the attempt to preserve themselves came with the attempt to acquire a sidearm. To the question, "Can an Army civilian member be issued a weapon for personal defense?," the Department of the Army replied a qualified "yes." Civilians who took part in hostilities might reasonably be regarded by the enemy as combatants and subjected to attack or even injured incidental to an attack on military objectives. In the law of war, "taking part in hostilities" has not been fully defined, but it is generally not regarded as limited to the civilians who engage in actual fighting. Since civilians were now augmenting the army in areas in which technical expertise was not available or was in short supply they, in effect, became substitutes for military personnel who would normally be combatants. As such, the civilians in SWA were considered to be at the risk of direct attack, injury incidental to an attack, or capture. Therefore, the DA decreed that "if the circumstances dictate," the theater commander might authorize the issuance of sidearms to civilians members for their personal self defense, subject, of course, to appropriate regulations regarding training and the safe handling of weapons.[98]

At war's end, AMCCOM's Readiness Directorate took up the question of defensively arming civilians. At one point, as noted in an observation submitted for inclusion in the official Operation Desert Shield/Storm After Action Report, LARs in SWA were issued M16 rifles for self defense. Then they were disarmed as the determination was made that a M16 rifle was a bit more than simply a means of self defense. LARs then went unarmed as pistols were not available. The lesson suggested that the question of arming civilians in military areas should be taken up by the Department of the Army and resolved as it had been a question during at least the last two conflicts and civilian employees deserved an answer.[99]

Some LARs had definite opinions on the matter. LAR Deborah Rogers, in SWA in support of the 82nd Airborne Division, urged that LARs be armed. She noted that "It is my opinion that if put on a military uniform you are automatically a combatant. The enemy is going to shoot anyone that he sees at the end of his rifle. So in the deployment packages, weapons should be included even for LARs in MSCs (major subordinate commands)." She did, however, hint that LARs should be properly trained in the handling of weapons before their blanket issuance to all deployees to war zones.[100]

Beyond the issuance of weapons, LARs, as well as other potentially deploying civilian employees, had numerous questions. The Department of the Army attempted to answer these with dispatch. In regard to the forward location of civilians during hostilities, the DA noted that there was not general standard of how far forward a civilian member can be deployed. While the DA commented that one option available was not to utilize civilian members in any area where, because of U.S. forces action, they might be subject to direct fire from enemy forces, it realized that this truly was not possible. The DA's alternative scheme was to institute a command policy which, as a general rule, permitted civilians to operate no farther forward that a particular unit boundary; i.e., the brigade rear boundary.[101]

Deploying employees were also reasonably curious as to the specific obligations theater commanders had for their protection, beyond reasonable care. They were informed that when assigned either permanently or TDY to areas where hostilities were either occurring or likely to occur, that their theater commander was required to provide civilian members "adequate" equipment and other protection and could not task them to perform a mission that involved unreasonable risk or death or serious injury. Deploying individuals were also told that as far as was practicable and consistent with the needs of the military mission, they would be temporarily relocated away from the area of immediate hostilities until they subsided. What constituted "unreasonable risk" and "adequate protection" would be answered by the appropriate commander in theater.[102]

Deploying civilians were also quite understandably concerned with the manner in which they would be evacuated from SWA should the need arise. They were informed by DA message traffic that the need for evacuation of civilians would be determined and conducted under DOD regulations and the evacuation order issued by the U.S. Department of State. Categories of civilian members designated for evacuation would be addressed in an evacuation notice issued by the appropriate State Department authority although exceptions to the categorization could be obtained. Army civilians occupying "emergency essential" positions were not subject to evacuation and would remain until released by the appropriate commander. Additionally, deploying civilians who were not assigned to emergency essential positions, but whose positions were essential to the military mission could be excepted from any evacuation order upon request of the appropriate commander.[103]

Commanders were also to inform their potentially deploying civilians that they would not be entitled to be returned to the United States at government expense should they, out of concern for their safety or otherwise, chose to terminate their federal employment during their service in SWA without fulfilling their TDY obligations. As private citizens they might be entitled to evacuation under an order issued by the Department of State should such an order be in effect.[104]

Deploying individuals were also quite reasonably concerned about the actions which could be taken against them should they refuse an assignment to, or in, SWA, or depart without proper authority. In response, the DA offered that if a civilian deployee refused assignment to SWA, refused to perform properly ordered tasks in theater, or departed without proper authority his commander should propose adverse action. Among the possibilities for recalcitrant employees was their removal from federal service. Unauthorized departures from the theater of operations might be dealt with as abandonment of position in

which case the threat of removal from federal service would be appropriate. In all instances of unauthorized absence, the deploying civilian would be considered as absent without leave (AWOL). The deployee's signature on an Emergency Essential Statement of Understanding could serve to support and strengthen any adverse action proposed, but was not a prerequisite to disciplinary action, or travel to SWA.[105]

The whole issue of the Emergency Essential Statement of Understanding became problematic during Operations Desert Shield and Desert Storm. HQDA stated that all individuals deployed to SWA were emergency essential and were therefore required to sign statements to that effect. HQ, AMC stated that persons to be deployed to Saudi were to be assigned there on a voluntary basis and did not have to sign Emergency Essential Statements of Understanding. AMCCOM's policy followed that of HQDA. This difference in policy resulted in much consternation and a myriad of telephone calls. Since disciplinary action could be taken depending on which policy was in effect, it became imperative that a coordinated decision be made. In consideration of this confusion, an information paper was generated by AMCCOM's Readiness Directorate for inclusion in Operation Desert Shield/Storm After Action Report. Readiness Directorate personnel recommended that prior to future deployments the Office of the Secretary of Defense, HQDA,and AMC resolve the identification of "emergency essential" designations vis-a-vis "volunteers."[106]

While the Readiness Directorate could with the benefit of hindsight recommend better communication and coordination, during the deployment of civilians to the deserts of SWA the issue of the Emergency Essential Statement of Understanding was a valid one warranting considerable paperwork. In response to the question "Must an army civilian have signed an Emergency Essential agreement before he/she can be required to perform TDY or accept permanent assignment to SWA, or to remain there in either status in [the] event of hostilities?", DA message traffic noted that an army civilian could be directed to perform duties essential to the military mission in SWA either before or during hostilities. Similarly, a civilian deployee who was already on TDY, or even permanently assigned, to SWA when hostilities broke out could be directed to remain at that location. While a signed Emergency Essential Statement of Understanding was preferable, it was not an absolute requirement if a commander needed to direct an individual to perform duties essential to the military mission. DA believed that a signed statement of the employee's role as essential helped in ensuring that the deployee was fully aware of the army's expectations and the possible consequences of not living up to the conditions of the understanding.[107]

By signing the Emergency Essential Statement of Understanding, deploying AMCCOM civilians, regardless of status as LAR, QASAS, or SCR, agreed that they would be excluded from the plan of evacuation of noncombatants from the danger zone until relieved by proper authority. They also agreed that by accepting assignment to the position that they would continue to perform the duties and responsibilities of the position until properly relieved of it. Their signature on the statement acknowledged their understanding that failure to adhere to the duties of their assignment could result in their separation for the efficiency of the Federal Service by the Department of the Army under the authority contained in Federal Personnel Manual, chapter 752. Adherence to the statement's guidelines was not entirely without its rewards. By affixing their signature, deployees became eligible for danger pay allowance, if applicable by the decree of the Secretary of State, foreign post differential pay, overtime pay, Government Quarters, if available or Living Quarters Allowance if not, and field ration mess privileges. In addition, the Emergency Essential Statement of Understanding allowed that signatories were eligible for the issuance of appropriate protective equipment, a noncombatant identification card, protection and treatment under the Geneva Convention if taken prisoner, and unaffected employment and pay status if captured or missing in action. Additionally, the signatory became aware that his/her needs would be treated with equal priority with those of active duty military personnel for medical treatment in the area of operations. As these entitlements also were granted to the majority of individuals not asked to sign the statements, the primary benefit of the document would seem to accrue to the DA. By signing the statement, the deploying individual simply agreed to stand firm in his position regardless of circumstances until properly relieved.

When finally allowed to travel to SWA, presumably with the majority of their questions asked and answered, LARs faced formidable challenges. According to the Joint Chiefs of Staff, as printed in their Department of Defense Dictionary of Military and Associated Terms, logistic assistance may be defined as a "generic term used to denote types of assistance between and within military commands both in peace and war." And it offers the definition of logistics as "the science of planning and carrying out the movement and maintenance of forces. In its most comprehensive sense, those aspects of military operations which deal with: a. design and development, acquisition, storage, movement, distribution, maintenance, evacuation, and disposition of materiel; b. movement, evacuation, and hospitalization of personnel; c. acquisition or construction, maintenance, operation, and disposition of facilities; and d. acquisition or furnishing of services."[108]

And while AMCCOM's LARs were not responsible for all logistical aspects of the American foray into the deserts of SWA, they were well occupied. Specifically, AMCCOM LARs tended to the needs of such groups as the 24th Infantry, the 1st Cavalry, the 82nd and 101st Airborne, the III Corps Artillery, the 75th, 196th, and 210th Field Artillery, the 6th Air Defense Artillery, the 197th Mechanized Infantry, the 5th Battalion of the 332 Brigade, the XVIII Airborne Corps, and the 1st Infantry Division. Other LARs were not assigned to specific units, but rather to specific locations. For example, some LARs were located at King Khalid Military City, and others at Dhahran. A senior command representative (SCR) also attended the deployed LARs and attempted to solve problems in country. A few LARs were assigned to float a circuit of support. And while in support of their assigned units, the LARs offered expertise on specified weapon systems. AMCCOM LARs, for example, were expected, as assigned, to aid their units with combat vehicles, artillery systems, aircraft armaments, the AH64 Apache and Cobra helicopters, as well as VADS/ PIVADS (Vulcan Air Defense System/Product Improved Vulcan Air Defense System). The few military LARs associated with AMCCOM had somewhat different areas of expertise. They frequently found themselves assigned to cover chemical materiel, as well as testing and evaluation (T&E), test, measurement and diagnostic equipment (TMDE) and the Fox vehicle.[109]

Such dry recitations cannot do justice to the work that the civilians in the deserts did to support their assigned units, and indeed their nation, in wartime. SCR Terry Spurrier related the duties of a LAR to the Rock Island Arsenal's Target in an article published before the Shield turned to a Storm. He noted that LARs were doing the same things in the desert that they would have done stateside, primarily. "They're seeing that spare parts are getting to where they're needed; providing hands-on advice on repair and maintenance; reporting problems to headquarters for resolution and passing information from headquarters on to the troops; and helping out in any other way they can."[110]

LAR Deborah Rogers, assigned to the 82nd Airborne throughout its deployment, defined her work in an oral interview conducted upon her return from the desert. Being one of the first civilian deployees to the desert, and, indeed, the first woman LAR to SWA, her initial task was to help establish a supply system to support her unit. Traveling from unit to unit of the 82nd Airborne, Ms. Rogers provided technical assistance for inoperable, or malfunctioning, weapons systems—in her case the M551 "Sheridan" tank and PIVADs. She additionally provided a great deal of instructional training when conditions permitted and reported on malfunctions which occurred during training sessions she witnessed. When breakdowns did occur, she was responsible for checking, and indeed double-checking, the proper part to order. Ordinarily her responsibility for an ordered part ended when the requisition was submitted and resumed when the part arrived. In the case of SWA, however, this division of duties did not occur. While deployed to SWA she was also required to react for a supply system which has been referred to as "broke." Rather than waiting for confirmation that datafaxed requisitions to CONUS had not been received, she would travel to her division materiel management center (DMMC) and seek to discover what was leaving there on a specific document number. By attentiveness to duty, Ms. Rogers would then track the document, and more importantly its

Members of the 787th Maintenance Battalion, Bravo Company, performed recoil mechanism repair and replacement on a M102 105mm towed howitzer under the watchful eye of LAR (and photographer) Deborah Rogers. During Operations Desert Shield and Desert Storm, AMCCOM LARs provided hands-on assistance and advice on maintenance, supply and other logistical aspects of command-managed items.

contents, to AMCCOM and all the way back to the desert. As she noted, "I would not wait for the system to react when it became an 02 NIMSC (nonconsumable items materiel support code) requisition. I would react for that system. Now supply is not supposed to be a big portion of our job. In Saudi Arabia, it became a major portion of our job."[111]

Another major portion of her job was to determine the validity of requisitions received. She, as well as other LARs, scrutinized materiel orders to discern whether or not an item truly was of significant priority to warrant the 02 NIMSC. If a part was needed to keep the appropriate system from becoming non-mission capable, it received the 02 NIMSC designator. Considering that a commander could never be certain how close to the supply line he was going to be, a significant number of somewhat larger than necessary orders were processed.[112]

The life of a LAR in the field was not an easy one. Mr. Terry Spurrier, AMCCOM's SCR in the initial days of Operation Desert Shield noted that a LAR could expect to work up to 14 hours per day, seven days per week during the early phases of the conflict. One hundred hour work weeks were common and sleep could be a rarity, especially during the early weeks of the build-up. Only with the passage of a few months could a LAR expect to enjoy a single day per week away from his/her duties. The early days of ODS also offered numerous Scud alerts. Replacement SCR Jesse Trent, stationed in Dhahran, commented that the alerts were doubly fear inducing. Beyond the general fear of attack was the knowledge that he had no place to seek safety. He, and other LARs, could only don their chemical protective gear and wait for the alert to pass.[113]

The days were hot and tiring for LARs deployed to SWA. Mr. Terry Spurrier noted as the conflict heightened that, "They're right out there in the field, wearing fatigues, eating MREs [meals, ready to eat] and living in tents." LARs assigned to port areas frequently found themselves sleeping in open warehouses, exposed to the scorching heat of the Arabian desert.[114]

Yet the experience was not without its sense of romance for some of the deployed individuals. LAR Rogers recalled that life in Saudi Arabia was "fun, exciting and challenging." During her seven months in the desert, she had "sweated in the heat of September, shivered in the cold of February, and saw the sky darkened at noon by oil well fires." She had also "heard the sounds of war and witnessed its devastating results."[115]

While LAR Rogers remained in the Persian Gulf region responding to the needs of the 82nd Airborne throughout the entirety of Operations Desert Shield and Desert Storm, many LARs did not and rotated in and out of SWA as necessity commanded. Thus the number of LARs in SWA varied over the course of the conflict. When LAR supervisor and SCR Terry Spurrier arrived in Saudi Arabia on 23 August 1990 only one other LAR was in country, Mr. Darrell Bast. Yet within days of his own arrival, a small contingent of additional LARs made their appearance in SWA. By the date of his departure, 7 November 1990, 15 LARs had been deployed to the desert. And as the deadline set by United Nations Security Council Resolution 678 demanding the withdrawal of Iraqi forces from Kuwait by 15 January 1991 approached, the number of LARs working in SWA increased. Approximately 25 AMCCOM LARs spent Christmas in the Gulf, and nearly 40 were in country as Hussein's deadline came and went. By the opening of the ground war, 24 February 1991, 44 civilian AMCCOM LARs were present in SWA, and during the brief war the number of AMCCOM LARs rose to nearly 60. And as the Iraqi threat subsided and Hussein's depredations were, at least momentarily, contained, the number of LARs present in country dropped off dramatically. By early April 1991 only 22 AMCCOM LARs were deployed and by late in the month a mere 15 were still present in SWA.[116]

Unfortunately, not all LARs who traveled to SWA in support of their nation returned safely to the United States. Tragically, Mr. James F. Neberman, a LAR in support of the 2nd Armored Division's tank and howitzer armament systems, became the first American civilian to be killed in the Gulf War, the victim of an ordnance accident.[117]

Other safety factors also came to the fore for LARs deployed to SWA. Among their natural concerns, in consideration of the area to which they were deployed and the conditions of their deployment, was the threat of chemical/biological contamination. As noted, all deploying civilians were instructed how to use, and provided with, chemical defense equipment before leaving CONUS. And upon observing that not all deployed individuals were properly attending to their chemical defensive equipment, AMCCOM issued a dictum regarding this inattentiveness. It noted that some individuals, especially those in support positions were not performing adequate preventive maintenance checks and services (PMCS) on their chemical defense equipment. Individuals equipped with the M17 series mask were informed that a proper check of their mask required that the voicemitter cover be removed to confirm the assembly was not bent and that there were no cracks in the metal, especially around the drink tube lever. They were also to ascertain the serviceability of their headharness on a regular basis as the hot, dry environment of SWA quickly reduced its elasticity.[118]

Individuals with the M24 or M25A1 protective masks were warned to be attentive to their lenses. They were not to be discolored or debonded from the facepiece. More recent iterations of both protective masks had polyurethane lenses which were susceptible to cracking at elevated temperatures. All deployees were warned against keeping their protective equipment in the bottom of duffel bags with the simple comment, "they are fragile."[119]

Such warnings were not lost on the LARs. LAR Rogers noted that masks were heavily used in drills and that the sand and dust created maintenance problems, especially in regard to filters and airways. Accordingly she endeavored to keep her mask's filters clean and properly changed, and its airways unplugged. She also offered a commendation to those who had arranged for the plethora of protective equipment which arrived in SWA. For she noted that had an actual chemical/biological attack occurred that all devices would have been called into service. She also noted the presence of a mask refurbishing facility in SWA operated by the Pine Bluff Arsenal which would not only repair or replace damaged masks but would also test masks for serviceability.[120]

Pre-deployment chemical defense training was vital to a proper response to gas alerts, yet regardless of training, the experience could be frightening. LAR Gladys Balough recalled of one such experience, "When you first hear over the radio the words 'gas, gas, MOPP (mission oriented position posture) 4,' that is so frightening. And you're struggling, and all of a sudden you feel yourself breathing, and you have to count one thousand one, one thousand two, so you don't lose it."[121]

Beyond the threat of chemical/biological attacks in the desert, LARs also understood the risk of terrorism. One LAR referred to terrorism as "the biggest fear that we had." With units widely dispersed, LARs frequently traveled early in the morning and late at night to rather isolated destinations. Yet the fear was mitigated by the option of military escorts in trans-desert treks, although not the requirement, and the presence of military personnel standing guard throughout the compounds. A demeanor of caution was also frequently assumed.[122] The attitude of caution assumed by some LARs caused them to request the privilege of carrying a weapon for their personal defense. The problems associated with the issuance of sidearms to deploying civilians for the self-defense, as well as the outspoken desire of some individuals to acquire them has been discussed in a previous passage.

Weapons were but one item on which returning LARs expressed an opinion. Based upon their experiences in the deserts, LARs, as well as numerous others, recommended that better channels of communication be implemented before future deployments were undertaken. Indeed, that the strained communications system had held up as well as it had was deemed little less than a miracle and noted as a "potential weak point" that might have proven disastrous had the Kingdom of Saudi Arabia not had a relatively substantial commercial telephone system in place. Yet despite the Kingdom's significant internal telephone structure, an Operation Desert Shield/Storm After Action Report observation warned against relying upon a host nation's telephone system. Doing so created a false sense of security and relative ease of operation although initial struggles with MCI trunk lines caused difficulties and forced an expansion to other carriers. An aftertaste of the potential for confusion with the delicate telephone structure occurred when the commercial circuits went out on 15 May 1991. Likewise, had the staging areas been elsewhere, e.g., Turkey, Jordan, Syria, Iran, the luxury of a sophisticated commercial telephone structure would not have been available to resolve the deployment and supply issues. If the communication system had been successfully targeted by enemy military, terrorists, or long range artillery/missiles, the disruption could have been extremely serious.[123]

For LARs, the potential frailties of the Kingdom's telephone structure were twofold. Not only were their numerous contacts with the MSCs, depots, and the National Inventory Control Points (NICP) concerning the resolution of repair parts and supply issues conducted on a system whose central focus could easily have been destroyed, but the placement of the telephones was problematic as well. The desert environment with its widely dispersed population and nomadic peoples did not promote the placement of telephone booths which LARs, isolated in enclaves with their units, could readily access. Upon return to CONUS, LARs reported traveling up to 70 Kilometers to use a standard telephone hook-up. Some LARs were provided with AT&T credit cards for use in contacting AMCCOM and other mission-oriented centers.

Mobile telephones could be utilized in the selected regions of SWA which were in range of a communications satellite. Additionally, the satellite communications as well as AT&T lines were only useful in making contacts outside the Kingdom of Saudi Arabia. Local lines connecting points within SWA were nearly nonexistent. In some cases, CONUS Operations Centers served as informational relay stations between Saudi elements.[124]

In consideration of this frailty, AMCCOM's Readiness Directorate, at the close of the war, recommended that LARs and other logistics support teams be equipped with satellite telephone communications to permit direct down-links to CONUS and LAR-to-LAR in theater, as well as permitting datafax capabilities. The recommended package was a suitcase style, portable unit that could be set up in 15-20 minutes and access CONUS/European dial tones. The Readiness Directorate noted that such units would be "essential" in theaters with limited or no telephone communications. Several devices were recommended for each deployed unit.[125] Communication issues remain a paramount consideration in the evaluation of the performance of the United States in the Persian Gulf War.

Not all individuals sought heightened communication avenues for LARs. It was observed at the war's conclusion by members of AMCCOM's Materiel Management Directorate, Policy, Plans, and Programs Division that abuses in the requisition system had occurred. The division's personnel noted that the system in place allows for off-line processing of urgent requirements and immediate status. In this usually computer-automated procedure, the requisition, as well as the materiel release order (MRO), were manually processed with entries made in the automated system after the fact. While the office recognized that telephone requisitions had been on occasion necessary, it felt that their use by LARs had been excessive, especially at the onset of Operation Desert Shield. The over-use of the telephone, as well as datafax, requisition structure required HQ, AMCCOM to staff three shifts, seven days per week, to receive and process off-line orders.[126]

For use in future requisition-from-the-field situations, Materiel Management personnel recommended that control channels be instituted. In the case of ODS, personnel began asking telephone submitters if they were a stock record account, and thus already financially provided for, or if they had approval to requisition from their supply support activity. If the answer was affirmative, the order was processed. And despite the problems caused by the call-in form of requisitioning, the directorate grudgingly recognized that it "became a valid method of expediting requisitions and circumventing existing problems."[127]

The "existing problems" which came to consume so much of the LARs time and energy included lost and misdirected requisitions and an ineffectual inventory tracking system. Briefly stated, LARs were called upon to overcome the absence of a functioning retail supply system, particularly in the early days of ODS. A prime contribution to this deficiency was that the Standard Army Intermediate Level Supply (SAILS) system was being replaced by the Standard Army Retail Supply System (SARSS). As a result, accountability and visibility of assets received in SWA was practically nonexistent and in many cases materiel was taken by units on a first come basis. This resulted in an excessive amount of requisitions as units and their supporting LARs continually reordered what was not received. Various workarounds were developed to resolve this problem, including the ultimately necessary telephone requisitions decried by the Materiel Management Directorate, as well as push packages. The issue of supply visibility and the ensuing problems caused to LARs might also have been mitigated by the presence of a significant number of supply-oriented LARs in country before the arrival of large quantities of supplies.[128]

A further issue of communication/information also caused problems for AMCCOM's civilian LARs, albeit in the form of technical documentation for equipment which had not initially been available for fielding in support of ODS. AMCCOM's Integrated Logistic Support Office noted that at the time of deployment a

serious deficiency existed in the U.S. Army's ability to detect and identify threatening nuclear, biological, and chemical (NBC) agents. The solution to this problem was to provide a system that used a combination of commercially available kits and government hardware developed during the early 1980s. The government program had been terminated prior to type classification and the developmental hardware was placed in storage. It was there, waiting for refurbishing, at the onset of ODS. However, no single, accurate maintenance manual was available for issuance with the hardware. With the invaluable assistance of the AMCCOM Historical Office, logistics documentation personnel rapidly developed a new manual specifying for both military and civilian personnel essential maintenance procedures, maintenance allocations, and repair parts and special tools listings.[129]

Additional communication issues for AMCCOM's LARs included learning to report equipment that required non-mission capable maintenance (NMCM) with an explanation of the reported status. As Maintenance Directorate personnel noted, it was difficult to react to NMCM items reported when the rationale for the status was not included in the SITREP (situation report). Yet AMCCOM personnel were reminded not to burden individuals deployed to SWA with needless requests for information and feedback.[130]

Communication capacities were not the only problem faced by LARs deployed to the deserts of SWA. Transportation also provided the individuals with a myriad of problems, primarily obtaining it. LARs returning to the United States following their deployment commented without fail on the difficulty of obtaining efficacious transportation in SWA. And as the units in need of support were frequently a great distance from one another—up to 150 miles in some cases—efficacious transportation was a necessity.[131]

LARs were not automatically provided military transportation and initially had to seek rental vehicles, at government expense, on their own. According to one returning civilian, fees for four-wheel drive rental vehicles ranged in cost from $3,000 to $4,500 during the height of ODS, although automobiles were available at lesser fees. Rental vehicles of any sort were hard to come by; hundreds of reporters, as well as other individuals on the scene, were vying for the limited supply. Only when civilians traveled close to Iraq and as the deadline for Hussein's withdrawal from Kuwait approached were civilians offered the opportunity to travel in military vehicles.[132]

For LAR Deborah Rogers the matter of transportation was somewhat more problematic. In consideration of the fact that Saudi women are not permitted to drive, special efforts had to be made to obtain a vehicle for her use. When, in the initial days of her deployment, she rented an automobile it was accomplished by listing her assigned male driver, a Sergeant First Class, as the primary driver and her as an additional one, albeit by using her credit card. This continued for two months until the rental agency allowed her to rent a vehicle on her own and be listed as the primary driver. However, while driving the vehicle, she had to be dressed in a military uniform, with sleeves which reached her wrists and wearing a hat, and act accordingly conservative. She also believed that by wearing her hair relatively short, she avoided the excessive attention an obviously female driver might have attracted. Despite the problems obtaining a vehicle, she believed that in consideration of her support role, it was in her best interest to drive. During the course of her deployment, she drove rental automobiles and four-wheel drive vehicles, and ultimately was provided a HMMWV (high mobility, multi-purpose wheeled vehicle) to cover the terrain.[133]

Other problems arose for LAR Rogers due to her gender. On occasion she felt over-protected by her male, fellow LARs and military personnel. And while she recognized that the surrounding men had her best interests in mind, she refused to allow them to hinder the performance of her duty. Somewhat more problematic for Ms. Rogers was her treatment by Muslim-oriented males. According to Islamic dictates, it is not proper for a female to speak to a male until spoken to or make eye contact, let alone instruct him.

As her job frequently required her to provide instruction on the function and maintenance of equipment, the usual societal mores had to be contravened. While the King's order that all women in military uniforms were to be regarded as male eased her position somewhat, other methods were more effective. For example, while performing maintenance procedures for Arabic allies at the 82nd Airborne Division's SWA installation at Safah, Champion Main, she frequently utilized a male warrant officer assigned to the facility to relay information, and continually asked permission of her Saudi hosts to allow her to perform a function. As she noted, "I stayed very guarded and was careful. I tried not to offend them."[134]

Beyond the issues of communication, transportation and gender was the matter of basic life support. When SCR and LAR Supervisor Terry Spurrier returned CONUS, he noted that it was not realistic to expect the troops supported by a LAR to take responsibility for that individual in terms of billeting, communication, transportation, food, etc. Indeed, he commented that during hostilities "warfighters have enough to concern themselves with," and that the role of a LAR is not to be a "hindrance."[135]

And in consideration of the need for LARs not to be a hindrance to soldiers in the field, and also for them to effectively accomplish their mission, AMCCOM's Readiness Directorate recommended the creation of LAR support packages (LSPs). In the recommended format, such support packages would be fully uploaded expandable mobile maintenance vans, or perhaps simple maintenance vans and would ideally contain cots, tents, communications equipment (datafax, computers, radios, etc.), generators, light sets, first aid kits, tools, MREs, bottled water, NBC gear, etc. Constantly maintained and periodically checked, the vehicles would be shipped when LARs deployed and provide the individual with both living quarters and a work site and ultimately make the LAR both self-supporting and selfcontained. Each deploying LAR would ideally be provided his or her own vehicle to facilitate the accomplishment of their mission. Some individuals recommended making the LSP a fourwheel drive vehicle and including a weapon.[136]

The development of such vehicles in troubled budget times remains questionable, however. What does not remain questionable though is the invaluable service provided by AMCCOM's Logistic Assistance Representatives. Their unflinching, selfless service to their nation and its soldiers undoubtedly saved lives and in turn aided in the subdual of Saddam Hussein.

NOTES

[1]"War and Pieces: The Logistics Story of Desert Storm," AMC News, December 1991, p. 5.

[2]*Ibid.*

[3]United States Army Armament, Munitions and Chemical Command handout, "Deployed to SWA: AMCCOM Personnel," February 27, 1991.

[4]Interview H.P. LePore, AMSMC-HO, with D. Rogers, AMSMC-RD, 1 November 1991.

[5]Lessons Learned, 52242-46234 (00150) (U), AMSMC-RD, Title: Preparation for Overseas Rotation/ Movement (POR/POM)-ODS, 17 May 1991.

[6]Message (U), Commander AMC to AIG 12113, Subject: Preparation for Overseas Replacement (POR), 042350Z October 1990; and Message (U), Alfred N. Bradley, Acting Director, AMSMC-RD, Travelers Update: Operation Desert Storm, Update 11, "POR Qualifications," 8 February 1991.

[7]Lessons Learned, 52242-46234 (00150) (U), AMSMC-RD, Title: Preparation for Overseas Rotation/ Movement (POR/POM)-ODS, 17 May 1991.

[8]*Ibid.*

[9]*Ibid.* After the close of the ground war, deploying civilians were informed that APG was then in a position to properly outfit all civilians enroute to SWA. As a result, AMCCOM would no longer authorize individual purchases of equipment and clothing for persons headed to SWA. See Message (U), COL David O. Lindsay, Travelers Update: Operation Desert Storm, Update 6, "Travelers Update Changes," 6 March 1991.

[10]*Ibid.*

[11]Message (U). Commander AMC to AIG 12113, Subject: Preparation for Overseas Replacement (POR), 042350Z October 1990.

[12]*Ibid.*

[13]*Ibid.*

[14]*Ibid.* and E-MAIL Directive (U), Emergency Operations Center, Subject: SWA Deployment Guidance, 2 December 1990.

[15]Department of the Army, Headquarters, U.S. Army Armament, Munitions and Chemical Command. AMCCOM Circular 55-1, Transportation and Travel for Operation Desert Shield, 20 December 1990.

[16]*Ibid.*, 1.

[17]*Ibid.*

[18] *Ibid.*, 2.

[19] *Ibid.*, 3.

[20] *Ibid.*, 3-4.

[21] *Ibid.*, 4.

[22] *Ibid.*, 5.

[23] *Ibid.*, 7.

[24] *Ibid.*

[25] Lessons Learned, 73139-03076 (00286) (U), AMSMC-RDP-O, Title: Civilian/Military Deployments, 21 June 1991.

[26] Lessons Learned, 52244-53842 (00151) (U), AMSMC-RD, Title: Travel Orders, 17 May 1991.

[27] Lessons Learned, 52347-16710 (00168) (U), AMSMC-MGO, Title: Staffing Requirements for the AMCCOM Operations Center, 20 May 1991.

[28] Lessons Learned, 72222-55877 (00282) (U), AMSMC-RDP-O, Title: Use of IMA and IRR in Operation Centers, 21 June 1991.

[29] *Ibid.*

[30] *Ibid.*

[31] *Ibid.*

[32] Lessons Learned, 72318-61534 (00283) (U), AMSMC-RDP-O, Title: Staffing of Emergency Operations Center, 21 June 1991.

[33] Lessons Learned, 72424-77831 (00284) (U),AMSMC-RDP-O, Title: Emergency Operations Center Chain of Command, 21 June 1991.

[34] Department of the Army, Headquarters, U.S. Army Armament, Munitions and Chemical Command, AMCCOM Circular 55-1, Transportation and Travel for Operation Desert Shield, 15.

[35] Message (U), MAJ Donald T. Bodeau to "Plant", Subject: Medical Clearance for Travel to Southwest Asia (SWA), 26 December 1990.

[36] *Ibid.*

[37] *Ibid.* This information was ultimately updated to require an HIV antibody test to have been conducted within six months of military personnel deployment. See Message (U), COL David O. Lindsay, Travelers Update: Operation Desert Storm, Update 3, "Medical," 22 January 1991; Message (U), Alfred N. Bradley, Acting Director, AMSMC-RD, Travelers Update: Operation Desert Storm, Update 11, "POR Qualifica-

tions," 8 February 1991; and Message (U), COL David O. Lindsay, Travelers Update: Operation Desert Storm, Update 8, "General," 25 January 1991.

[38]Department of Advanced Preventive Studies, Division of Preventive Medicine, Walter Reed Army Institute of Research, The Threat of Disease and Non-Battle Injury to US Military Personnel on Operation Desert Shield, working draft, 16 August 1990. This document was not directly provided to individuals deploying to the Gulf, but they, through their physicians, were expected to be familiar with the health risks of deployment.

[39]*Ibid.*, 7.

[40]*Ibid.*

[41]*Ibid.*

[42]*Ibid.*

[43]*Ibid.*

[44]*Ibid.*, 9.

[45]*Ibid.*, 9-11.

[46]*Ibid.*, 13-14. Approximately 22 individuals of the over half million did indeed contract leishmaniasis while deployed to the deserts of SWA. Although complete recovery was expected from the afflicted individuals, the nature of the parasitic disease required that soldiers and civilians who had been to Saudi Arabia, Oman, the United Arab Emirates, Kuwait, Iraq, Oman, Yemen, Qatar, or Bahrain after 1 August 1990 refrain from blood donation until 1 January 1993. See "New Blood Donation Policies are Announced," Target, December 13, 1991, p. 3; and Message (U), Michael Finnegan, AMSMC-OB to LTC Eric T. Evenson, AMSMCSG, Subject: Medical Information for Desert Shield/Desert Storm Veterans—Military and Civilians, 14 November 1991.

[47]*Ibid.*, 21.

[48]*Ibid.*

[49]*Ibid.*, 12-22.

[50]Paul Levesque, "EAP is here to help Persian Gulf Veterans," Target, 9 August 1991, 10.

[51]*Ibid.*

[52]*Ibid.*

[53]Department of the Army, Headquarters, U.S. Army Armament, Munitions and Chemical Command, AMCCOM Circular 55-1, Transportation and Travel for Operation Desert Shield 20 December 1990, 22; and Message (U), CDRFORSCOM to AIG , Subject: Passport/Visa Requirements for Operation Desert Shield-Update 6, 18 December 1990.

[54]Message (U) Commander AMC to AIG 12113, Subject: Preparation for Overseas Replacement (POR), 042350Z October 1990; Department of the Army, Headquarters, U.S. Army Armament, Munition and Chemical Command, AMCCOM Circular 55-1, Transportation and Travel for Operation Desert Shield, 20 December 1990; and Message (U), CDRAMC to AIG 865, AIG 12383, and AIG 8876, Subject: Passport/ Visa Requirements for Desert Shield, 191400Z November 1990.

[55]Message (U), CDRUSATSG Redstone Arsenal to AIG 11537 and AIG 12159, Subject: Desert Shield Guidelines for Deploying DA Civilian Employees to Southwest Asia (SWA), 260800Z October 1990.

[56]*Ibid.*

[57]*Ibid.*

[58]*Ibid.*

[59]*Ibid.*

[60]*Ibid.*

[61]*Ibid.*

[62]Lessons Learned, 51755-09944 (00141) (U), AMSMC-PTE, Title: Pay for Deployed Civilian Personnel, 17 May 1991.

[63]Message (U), CRUSATSG Redstone Arsenal to AIG 11537 and AIG 12159, Subject: Desert Shield Guidelines for Deploying DA Civilian Employees to Southwest Asia (SWA), 260800Z October 1990.

[64]Lessons Learned, 51755-09944 (00141) (U), AMSMC-PTE, Title: Pay for Deployed Civilian Personnel, 17 May 1991.

[65]Message 85 (U), Joseph L. George to all AMCCOM Headquarters Elements, Subject: Post Differential Pay for Travel to SWA, 28 January 1991.

[66]Lessons Learned, 51755-09944 (00141) (U), AMSMC-PTE, Title: Pay for Deployed Civilian Personnel, 17 May 1991.

[67]*Ibid.*

[68]*Ibid.*

[69]Memorandum (U), AMCPE-CE-L Memorandum for Distribution, Subject: Overtime for Civilian Employees, n.d.

[70]*Ibid.*; Department of the Army, Headquarters. U.S. Army Armament, Munitions and Chemical Command, AMCCOM Circular 55-1, Transportation and Travel for Operation Desert Shield, 28.

[71]Department of the Army, Headquarters. U.S. Army Armament, Munitions and Chemical Command, AMCCOM Circular 55-1, Transportation and Travel for Operation Desert Shield, 28.

[72]Memorandum (U), AMCPE-CE-L Memorandum for Distribution, Subject: Overtime for Civilian Employees, n.d.

[73]*Ibid.*

[74]*Ibid.*

[75]Department of the Army, Headquarters. U.S. Army Armament, Munitions and Chemical Command, AMCCOM Circular 55-1, Transportation and Travel for Operation Desert Shield, 29.

[76]*Ibid.*

[77]*Ibid.*, 28.

[78]*Ibid.*, 27.

[79]Message (U), Department of the Army to AIG 9150 and AIG 9893, Subject: Desert Storm Personnel Policy Message—Performance Appraisals for Civilians Temporarily Assigned to SWA during Desert Shield/Desert Storm, 011420Z April 1991.

[80]Message (U), CRUSATSG Redstone Arsenal to AIG 11537 and AIG 12636, Subject: Desert Shield Guidelines for Deploying DA Civilian Employees to Southwest Asia (SWA), 260800Z October 1990.

[81]Desert Shield General Order 1. This document has not been properly archived and is seemingly unavailable. Muslim dictates are discussed in by Donna Miles in "Islam Observed," Soldiers, December 1990, pp. 20-21.

[82]Message (U), CDRAMC to AIG 12113, Subject: Civilian Attire for Desert Shield, 011600Z November 1990; Message (U), COL David O. Lindsay, Travelers Update: Operation Desert Storm, Update 8, "General," 25 January 1991.

[83]Message (U), COL David O. Lindsay, Travelers Update: Operation Desert Storm, Update 8, "General," 25 January 1991.

[84]Message (U), COL David O. Lindsay, Travelers Update: Operation Desert Storm, Update 10, "General Lessons Learned," 25 January 1991.

[85]Message (U), CRUSATSG Redstone Arsenal to AIG 11537 and AIG 12159, Subject: Desert Shield Guidelines for Deploying DA Civilian Employees to Southwest Asia (SWA), 260800Z October 1990; and Message (U), COL David O. Lindsay, Travelers Update: Operation Desert Storm, Update 4, "ID Tags," 22 January 1991.

[86]Message (U), CRUSATSG Redstone Arsenal to AIG 11537 and AIG 12159, Subject:Desert Shield Guidelines for Deploying DA Civilian Employees to Southwest Asia (SWA), 260800Z October 1990; and Message (U), COL David O. Lindsay, Travelers Update: Operation Desert Storm, Update 5, "Waiting Families Support Group," 22 January 1991.

[87]Message (U), Alfred N. Bradley, Acting Director, AMSMC-RD, Travelers Update: Operation Desert Storm, Update 12, "Desert Shield Hotlines," 20 February 1991.

[88]Lessons Learned, 32143-01264 (00089) (U), AMSMC-PT, Title: Support to Waiting Families, 19 March 1991.

[89]Message (U), LTC Melvin A. Miller, Travelers Update: Operation Desert Storm, Update 15, "Casualty Reporting/Notification," 26 February 1991.

[90]*Ibid.*

[91]*Ibid.*

[92]*Ibid.*

[93]*Ibid.*

[94]*Ibid.*

[95]*Ibid.*

[96]Message (U), CDRAMC to AIG 865, AIG 7459, AIG 8876, AIG 12383, Subject: The Civilian Survivor Assistance Program, 161600Z January 1991.

[97]*Ibid.*

[98]Message (U), DA to AIG 9150, AIG 9893, AIG 9158, AIG 7406, Subject: Desert Shield Personnel Policy Message No. 38-Guidelines for Assignment, Utilization and Protection of Army Civilians in Southwest Asia, 042200Z January 1991.

[99]Lessons Learned, 52249-99356 (00153) (U), AMSMC-RD, Title: LARs, DA Civilians Issued Weapons in Combat Zone, 17, May 1991.

[100]Rogers Intvw, 1 November 1991.

[101]Message (U), DA to AIG 9150 AIG 9893, AIG 9158, AIG 7408, Subject: Desert Shield Personnel Policy Message No. 38-Guidelines for Assignment, Utilization and Protection of Army Southwest Asia, 042200Z January 1991

[102]*Ibid.*

[103]*Ibid.*

[104]*Ibid.*

[105]*Ibid.*

[106]Lessons Learned, 52247-07252 (00152) (U), AMSMC-RD, Title: Civilian Volunteers versus Emergency Essential Statements, 17 May 1991.

[107]Message (U), DA to AIG 9150, AIG 9893, AIG 9158, AIG 7408, Subject: Desert Shield Personnel Policy Message No. 38-Guidelines for Assignment, Utilization and Protection of Army Civilians in Southwest Asia, 042200Z January 1991.

[108]Joint Chiefs of Staff, Department of Defense Dictionary of Military and Associated Terms, JCS Publication 1, 1 June 1987, 213-14.

[109]Materiel collected and reproduced from a variety of AMCCOM sources, most undated and without a point of origin. For a partial listing, see "Deployed to SWA: AMCCOM Personnel," 27 February 1991 and a similar document for 28 February 1991.

[110]Quoted in Paul Levesque, "Employee brings good news from Saudi Arabia," Target, 14 December 1990, 1 and 12.

[111]Rogers Intvw., 1 November 1991.

[112]*Ibid.*

[113]For the human side of LAR life in SWA see Paul Levesque, "Employee brings good news from Saudi Arabia," Target, 14 December 1990, 1 and 12; "Senior LAR experiences war's triumph, tragedy," Target, 8 March 1991, 5; "Command's support provided in person," Target, 14 September 1990, 1B; "Anywhere, anytime: LAR stays with 82nd Airborne throughout desert deployment," Target, 11 October 1991, 1 and 7.

[114]*Ibid.*

[115]*Ibid.*

[116]Rogers Intvw., 1 November 1991; interview, H.P. LePore, AMSMC-HO, with Terry Spurrier, AMSMC-RD, 19 February 1991; Paul Levesque, "Employee brings good news from Saudi Arabia," Target, 14 December 1990, 1 and 12; "UN Resolutions," Military Review, September 1991, 79; Memorandum (U), SMCRI-PC-R (500-5c), Subject: AMC Personnel Deployed or Scheduled to Deploy to SWA in Support of Operation Desert Shield, 15 January 1991; United States Army Armament, Munitions, and Chemical Command, handout (U), "Deployed to SWA: AMCCOM Personnel," 27 February 1991; Memorandum (U), Alvin M. Schwartz, Chief, AMSMC-IN, Subject: Statement Concerning Civilian Employee, 27 February 1991; United States Army Armament, Munitions, and Chemical Command, handout (U), "Total AMCCOM Personnel Deployed," 19 April 1991 (?).

[117]Paul Levesque, "Employees pay honor to fallen colleague," Target, 8 March 1991, 1; and "GIs hurt, killed by bomblets," The [Rock Island, Illinois] Argus, 19 September 1991. Mr. Neberman lost his life when apparently transporting a series of cluster bomblets from the field for study elsewhere. He was buried at Rock Island [Illinois] National Cemetery with the full military honors due him as an air force veteran. The Rock Island Arsenal's flag flew at half mast on the day of his burial, 6 March 1991, and the island's staff lined its main artery, Rodman Avenue, as the funeral procession of their slain colleague passed by. The death of Mr. James F. Neberman and the use of cluster bomblets by the United States forces in the Persian Gulf remains an issue of contention. That the bomblets failed to detonate as designed leaving a plethora of unexploded ordnance and that soldiers and civilians in the Gulf were not properly trained to recognize and handle the devices has sparked Congressional hearings. Beyond Mr. Neberman, at least 19 U.S. soldiers were killed by the bomblets.

[118]Lessons Learned, 11158-74841 (00032) (U), HQ, AMCCOM, Title: Protective Masks Preventative Maintenance Checks and Services (PMCS), 11 November 1990.

[119] *Ibid.*

[120] Rogers Intvw., 1 November 1991.

[121] "War and Pieces: The Logistics Story of Desert Storm." AMC News, December 1991. Ms. Gladys Balough is an AMC civilian LAR.

[122] Rogers Intvw., 1 November 1991; Spurrier Intvw., 19 February 1991.

[123] Operation Desert Shield/Storm After Action Report, Summary Analysis—"Communication"; and Lessons Learned, 52357-67995 (00174) (U), AMSMC-RD, Title: Commercial Telephone Communication Dependency, LAR, 23 May 1991.

[124] Rogers Intvw., 1 November 1991; Lessons Learned, 52357-67995 (00174) (U), AMSMC-RD, Title: Commercial Telephone Communication Dependency, LAR, 23 May 1991.

[125] Lessons Learned, 52357-67995 (00174) (U), AMSMC-RD, Title: Commercial Telephone Communication Dependency, LAR, 23 May 1991.

[126] Lessons Learned, 40939-14391 (00095) (U), AMSMC-MMP, Title: ODS Telephone/Datafax Requisition Abuse, 5 April 1991.

[127] *Ibid.*

[128] Operation Desert Shield/Storm After Action Report, Summary Analysis—"Supply"; Lessons Learned, 32143-87959 (00093) (U), AMSMC-MML, Title: Identification of Logistical Support and Supported Customers within Theatre, 19 March 1991; and Lessons Learned, 61235-53789 (00245) (U), AMSMC-RDL, Title: Supply Logistics Assistance Representatives (LAR) in Southwest Asia (SWA), 12 June 1991.

[129] Lessons Learned, 12149-81901 (00076) (U), AMSMC-LS, Title: Technical Documentation for Surge Equipment in Support of Desert Storm, 24 January 1991.

[130] Lessons Learned, 22130-90278 (00068) (U), AMSMC-MA, Title: Not Mission Capable Maintenance (NMCM), 14 December 1990; Lessons Learned, 10744-89461 (00073) (U), AMSMC-MA, Title: Lack of SWA Feedback, 7 January 1990.

[131] Interview, H.P. LePore, AMSMC-HO, with Steve Lovely, Rich Albrecht, Rick Relfe, Jim Wagner, and Dick Thissen, SMAC-AV, 4 April 1991; Rogers Intvw., 1 November 1991; Spurrier Intvw., 19 February 1991.

[132] *Ibid.*

[133] Rogers Intvw., 1 November 1991.

[134] *Ibid.*

[135] Spurrier Intvw., 19 February 1991.

[136] Operation Desert Shield/Storm After Action Report, Summary Analysis—"Logistics Assistance/LAO"; Lessons Learned, 5235871848 (00175) (U), AMSMC-RD, Title: LAR Deployment, Communication, Transportation, Life Support, 23 May 1991; Rogers Intvw., 1 November 1991.

Chapter Five

Ammunition

The largest Class V supply movement in history began with President George Bush's 6 August 1990 order for the deployment of United States land, sea, and air forces to the Persian Gulf to protect the territorial integrity of the Kingdom of Saudi Arabia after the invasion and take-over of tiny, neighboring Kuwait by the Iraqi troops of Saddam Hussein. The massive movement of Class V supplies thus begun continued throughout Operations Desert Shield and Desert Storm and only drew to a close with the retrograde movement of ammunition in the spring of 1992. Class V supply, broadly defined, includes "any device charged with explosives, propellants, pyrotechnics, initiating composition, or nuclear, biological, or chemical material for use in connection with defense or offense, including demolitions."[1]

In consideration of its prescribed mission to:

> exercise total Life Cycle Management over research, development, engineering, product assurance, logistics support, industrial preparedness, procurement, production, security assistance, and material readiness for assigned systems; Single Manager for Conventional Ammunition for DOD; manage Production Base Modernization Expansion Program; maintain a technical base to accomplish development, procurement, production and Life Cycle support of conventional and nuclear weapons and ammunition (artillery, infantry, gun-type air defense, surface vehicle mounted and aircraft mounted); certain weapons systems/subsystems and chemical system materiel; related components and conventional ammunition as assigned; peculiar equipment, test, measurement, and diagnostic equipment; and tools maintenance equipment; command and control assigned centers, activities, and installations. Maintain the Ammunition Chemical and Armament Production base which includes initial production facilities programs, modernization, expansion projects, facilitization to satisfy peacetime surge and mobilization[2]

the United States Army Armament, Munitions and Chemical Command (AMCCOM) was intimately involved in fulfilling the ammunition needs of the American servicemember. Increasing AMCCOM's level of responsibility in the supply of ammunition was its bureaucratic predecessor's 1977 designation as the Single Manager for Conventional Ammunition operations. And adding to this vital responsibility during Operations Desert Shield and Desert Storm was AMCCOM's endorsement by the Military Traffic Management Command (MTMC), as well as its designation by the Transportation Command (TRANSCOM), as the single focal point for ammunition ship planning. The designation provided for both enhanced movement control and total visibility over all ammunition and missile shipments, both for Single Manager Conventional Ammunition (SMCA) and non-SMCA, albeit with significant additions to AMCCOM's work load.[3]

AMCCOM's "Fast Release" database system was not the only contributing factor to the triumphant fulfillment of the Department of Defense's designation. Assisting AMCCOM in this success story, as well as the whole of Operations Desert Shield and Desert Storm, were its supporting research centers, arsenals, ammunition plants, and assorted facilities: the United States Army Armament Research, Development and Engineering Center (ARDEC), Picatinny Arsenal, NJ; United States Army Chemical Research, Development and Engineering Center (CRDEC), Aberdeen Proving Ground, MD; Rock Island Arsenal, Rock Island, IL; Watervliet Arsenal, Watervliet, NY; Pine Bluff Arsenal, Pine Bluff, AR; Crane Army Ammunition Activity, Crane, IN; United States Army Defense Ammunition Center and School (USADACS), Savanna, IL; McAlester Army Ammunition Plant, McAlester, OK; Hawthorne Army Ammunition Plant, Hawthorne, NV;

Holston Army Ammunition Plant, Kingsport, TN; Indiana Army Ammunition Plant, Charlestown, IN; Iowa Army Ammunition Plant, Middletown, IA; Kansas Army Ammunition Plant, Parsons, KS; Lake City Army Ammunition Plant, Independence, MO; Lone Star Army Ammunition Plant, Texarkana, TX; Longhorn Army Ammunition Plant, Marshall, TX; Louisiana Army Ammunition Plant, Shreveport, LA; Milan Army Ammunition Plant, Milan, TN; Radford Army Ammunition Plant, Radford, VA; Scranton Army Ammunition Plant, Scranton, PA; and Sunflower Army Ammunition Plant, DeSoto, KS.[4]

Behind the primarily government-owned, contractor-operated ammunition plants—the McAlester and Crane plants are government-owned and operated—and assorted support facilities were a total of 17,934 civilian employees and 633 military personnel, albeit augmented during Operations Desert Shield and Desert Storm (ODS) by approximately 700 temporary employees. Working together, frequently on lengthened shifts, these employees were responsible for the loading, assembling, packing, shipping, delivery, etc., of all conventional ammunition utilized in ODS by the U.S. Army, U.S. Navy, U.S. Marine Corps, and the U.S. Air Force, as well as much of that needed by coalition allies. A total of 1,619,552 civilian hours were expended in support of AMCCOM's mission in ODS with a concomitant expenditure of $52 million.[5]

At the onset of the war, only ten ammunition items were considered to be in short supply. All other ammunition items were at 100 percent of the requirement, either on hand or in transit to Southwest Asia (SWA). A relatively strong inventory, acquired and maintained over a significant period of years, made this major accomplishment a possibility. No inactive production facility was brought into operation during the relatively brief Persian Gulf War, and, indeed, it is doubtful that given the exigencies involved that any further production lines could have been made operational during the span of the conflict. Once again, the price of liberty was shown to be eternal vigilance.[6]

In the initial hectic days of deployment, HQ, AMCCOM worked at a frenetic pace. Among the activities undertaken in the opening days of Operation Desert Shield by the command was the rapid identification of the units designated for deployment. From that point, AMCCOM ascertained the needs of the deploying units with an eye to the weapon systems and ammunition for which it carried responsibility. This included activating prepositioned requisitions prepared in peacetime and stored at ammunition depots and army ammunition plants in order to round out deployees' basic ammunition loads. The initial units supported included the 82nd Airborne, the 101st Airborne, and the 25th Mechanized Division.

Identifying the deploying units, processing requisitions, packing MILVANs (military vans), arranging for transportation, and scheduling shipments to avoid overwhelming depots, units, ports, army ammunition plants, etc., meant placing AMCCOM on a 24 hour, seven day per week schedule. This included, of course, the directorates most centrally involved with providing the firepower: the Defense Ammunition Directorate, headed by COL Scott W. Hull; the Transportation and Traffic Management Directorate, headed by Mr. Gary L. Anderson; the office of the Deputy for Logistics Readiness, headed by Mr. Perry C. Stewart; the Materiel Management Directorate, headed by Mr. Deane L. Warnecke; and the Readiness Directorate, headed by COL David O. Lindsay, among notable others. Also placed on initial, 24 hour, seven day per week schedules were the nation's active army ammunition plants.

Of the fourteen active army ammunition plants (AAP), thirteen participated in the supplying of munitions during ODS. Government-owned and operated, the McAlester AAP and the Crane Army Ammunition Activity (AAA), greatly accelerated their production efforts. The McAlester AAP dramatically increased its U.S. Navy bomb program. To do so, the plant hired 200 temporary workers and activated a process by which orders for practice bombs were converted to orders for tactical bombs. Over 45,000 short tons of bombs were shipped from the facility in support of ODS.[7]

Other significant accomplishments included Hawthorne AAP's switch from one to three shifts, placing it on a twenty-four hour, seven day status. With such a schedule, its employees were able to ship 65 short tons in a mere 90 days, as well as, in a herculean effort, prepare 258 semi-truck loads and 138 railcars for shipment in a single week. Additionally, Indiana AAP shipped 235,000 propelling charges during the course of ODS, and loaded 63 MILVANs and 15 railcars in a single week. The Iowa AAP managed, during ODS to ship over 80 railcars and 190 truck loads, amounting to 8,500 short tons, of tank ammunition, mines, demolitions, and missile warheads.[8]

Elsewhere within the AMCCOM AAP structure, Kansas AAP produced over 10,000 155mm projectiles, and in one five day period managed to load 77 semi-trailers. Additionally, Lake City AAP shipped over 320 million rounds of small arms ammunition, and Lone Star AAP shipped 60 railcar loads over the Christmas holidays. Louisiana AAP produced 2.75mm rockets as fast as rocket motors were received from the vendor, meanwhile conducting the first ever ammunition container shipment for U.S. Army requirements. Milan AAP shipped over 30,000 short tons of ammunition during the war, including 105 MILVANs and 24 truck loads in a single week. And Mississippi AAP shipped over 60 short tons of support equipment and assisted in moving over 119 MILVANs in a ten-day period.[9]

Crane Army Ammunition Activity demonstrated itself as an extraordinary facility with the efforts of its 700 civilian employees. Tucked away in southern Indiana's farm country at the Naval Weapons Support Center, the activity center's employees manage a 350,000 ton stockpile of conventional ammunition for the army, navy, and Marine Corps. They also manufacture everything from hand-held flares to 16-inch projectiles for battleships and 40,000-pound shock charges. Of the conventional ammunition stored in the United States, the Crane AAA holds 25 percent of all the army's supply, nearly 50 percent of the navy's ammunition supplies and approximately 20 percent of the Marine Corps'.[10]

With the onset of conflict in the Middle East, Crane AAA swept rapidly into action. Five days after Saddam Hussein overran Kuwait, depot employees began working around-the-clock to load crates of ammunition for shipment to forces deploying to the Persian Gulf region. In the ensuing ten days, 72 railcars, 141 semi-trailers, and 20 shipping containers were prepared for shipment, representing nearly 7,546 tons of ammunition, much of it destined for the desert. To meet the urgent, initial required delivery dates, some employees worked 25 hours straight, although 16 to 18 hour voluntary shifts were more common. But not all of Crane AAA's efforts supported the forces of the United States; it also produced and shipped 2,000-pound bombs to the Kuwaiti Air Force.[11]

Although Crane AAA met the exigencies of the initial hectic days of ODS with great skill, coupled with long and tiring hours, it had some difficulty maintaining the pace as the standoff in the desert continued. As MSG Roger Fadroski, Crane AAA's Marine Corps liaison, noted the facility simply did not have sufficient blue-collar employees to work around the clock for an extended period of time. Yet the facility did not suffer unduly from the shortage of blue-collar labor. Due to a grassroots-type of management program that had begun at Crane AAA only months before the war started, the center was able to continue its mission without great difficulty. In the Quality Management Program instituted at Crane AAA a mere month before the onset of ODS, white-collar employees who designed work stations for blue-collar employees had been given the chance to labor in the conditions they had designed and to labor by the rules they had instituted. Thus just weeks before the invasion of Kuwait, Crane AAA's management team had gained valuable practical experience in the manufacturing and depot operations of the facility. And when American troops deployed to SWA, design and management personnel took their positions along side, and in place of, exhausted production and depot workers, frequently after their own, normal eight-hour day had been completed.[12]

LTC Ken Rhylander, Crane AAA Commander, noted of the enhanced operations, "You [had] to see the teamwork to believe it. This [was] a magnificent work force. They [were] selfless and totally dedicated to supporting servicemembers in the field and at sea." Regardless of this selflessness and dedication, the need to utilize white-collar employees in production and depot service positions when they quite obviously could be best employed in their chosen career field was addressed in great detail within the official AMCCOM Operation Desert Shield/Storm After Action Report. AMCCOM's Personnel and Training Directorate staff noted that the Department of Defense (DOD) hiring freeze in place at the onset of ODS prohibited installations, such as Crane AAA, from hiring the civilian personnel required to perform essential war work. The submitted observation noted that in particular Crane AAA worked employees in double and triple shifts, and detailed whitecollar personnel to shipping operations due to the lack of authority to hire. It further noted that even with expedited procedures to obtain hiring authority, the short delay caused significant problems which jeopardized mission performance. In view of the problems incurred, the Personnel and Training Directorate recommended that current and future hiring limitations should contain a provision for local commanders to unilaterally hire temporary employees required to meet operation and mobilization mission requirements. The directorate thus recommended that AMCRM (Army Materiel Command Resource Management) work with the Department of the Army (DA), as well as with DOD, to obtain the required provision.[13]

And despite the success of the army ammunition plants, the problems at Crane AAA with the hiring of sufficient workers were not the only ones deemed worthy of inclusion in the Operation Desert Shield/Storm After Action Report. Crane AAA also voiced what became a frequent refrain in the post-war period concerning MILVANs and commercial containers. The AAA noted that it could have been more responsive to emergency wartime required deliveries of ammunition if MILVANs or commercial containers were kept on hand instead of at remote locations. The activity's personnel felt that having to order the containers after the request to ship material had been received hampered their effectiveness. In partial response, AMCCOM recommended that Crane AAA, as well as all AAPs, be stocked in anticipation of future requirements with 200 to 500 commercial containers.[14]

Lake City AAP (LCAAP) also had difficulty handling the MILVANs needed to ship ammunition. In the After Action Report, AMCCOM's Transportation and Traffic Management Directorate's Defense Munitions Distribution Traffic Division noted that irrespective of LCAAP's tasking during ODS to ship small caliber munitions in MILVAN containers, it did not have this capacity. After several discussions with AMCCOM regarding the constraints imposed by the lack of a container handling facility, LCAAP attempted to devise safe procedures for the inspection, staffing, and loading of MILVAN containers utilizing existing facilities on a one time or short-term basis. However, the requirement was cancelled before any shipments were actually made.[15]

Determining that MILVAN handling was a surge or mobilization contingency for which there was not adequate planning, Lake City AAP personnel set about rectifying the problem. They recommended that AMCCOM's Transportation and Traffic Management Division as well as its Industrial Readiness Directorate, in conjunction with additional army planners, should re-examine the need for MILVAN shipments during surge or mobilization, and define probable requirements—ship quantities, frequencies, container handling capacity, etc. Lake City AAP should then prepare a construction project or define a mobilization deficiency for a container handling facility of the required capacity. Deliberation should also be given to providing limited container handling capability which could be economically used during peacetime.[16]

Indeed, Lake City AAP personnel noted in their submitted observations to the Operation Desert Shield/Storm After Action Report that a container handling facility had been planned for and designed in a modernization program of the early 1980s. The container handling facility was to be located adjacent to

the existing warehouse area. The planned facility included a concrete pad for container loading and storage and extension of roads, rail, security fencing, and utilities to the new area. The facility's estimated cost was in excess of $1 million. A 50,000-pound capacity container handler was provided to Lake City AAP at that time under an army-wide contract, although it has never been used for a single MILVAN shipment. Periodic maintenance having been performed, the Lake City AAP submitting personnel did not perceive that completing the proposed facility would prove too onerous. AMCCOM's Transportation and Traffic Management Division apparently held the same beliefs.[17]

Longhorn AAP similarly suffered from MILVAN problems. During ODS, the plant was unable to load ammunition into MILVANs when required to do so. Although Longhorn AAP has apparent MILVAN loading capacity, when it was called upon to utilize this potential during December 1990 and February 1991 to ship 155mm projectiles, it was unable to comply. In consideration of the fact that the port of Sunny Point, NC, had become congested and could no longer accept non-containerized ammunition, the need to prepare MILVANs for expeditious transshipments became great. Yet the facility could not comply with the urgent request due to the inability of the dock and/or pad surface to withstand the weight of a container handler with a loaded MILVAN. Additionally, safety-oriented "quantity distance" factors limited the efficacy of Longhorn AAP's MILVAN loading facility. Reflecting upon these issues, Longhorn AAP personnel encouraged the funding of construction which would allow for pads and/or loading docks at their own, as well as other, facilities with the true capability to handle MILVANs. Limited port facilities for non-containerized ammunition transshipment in a contingency situation commanded that AAPs be prepared to load MILVANs.[18]

The issues of port congestion and containerization of ammunition became paramount in ODS. Despite the fact that since the Vietnam era efforts had been extended to convert the Defense Transportation System (DTS) to predominantly containerized ammunition movement, as opposed to breakbulk, the Containerized Ammunition Distribution System (CADS) was not used during the Persian Gulf War. The effort to impose a containerized system was taken to allow the DTS to be more conducive to perceived commercial shipping capabilities. Regardless of the efforts undertaken years before, the onset of ODS, very few requirements, ammunition or otherwise, were moved using commercial containers or MILVANs. The Military Sealift Command and the Military Traffic Management Command (MTMC) were able to procure vessels with limited or no container capabilities. The effort to determine theater capabilities and desires regarding containerized ammunition was in vain. Only at the conclusion of ODS was it discovered that theater support systems were not in place early enough in the Operation to handle containerized ammunition. Container handling equipment, including variable reach forklifts, were needed but unavailable.[19]

From the experience, AMCCOM's Transportation and Traffic Management Directorate discerned that containerized ammunition shipment desires, capabilities, requirements, and plans need to be discussed and documented with Commander in Chief (CINC) logistics representatives during the deliberate planning process. They also noted that the mix of containerized versus breakbulk ammunition needed to be determined in advance, as well as in requisitions, with attention to the support facilities available in the theater of operations. In regard to the identified needs and issues, the directorate's personnel recommended that actions be taken to include MILVAN/container handling equipment in the flow of material as early as possible. If container movement became an authorized mode, the MTMC and MSCs (major subordinate commands) must then consider container ship capabilities when procuring vessels for use in mobilization.[20]

Further discussion of the use of containerized ammunition shipments occurred with the observation by United States Army Defense Ammunition Center and School (USADACS) personnel that port congestion could be reduced by the increased use of containerized ammunition shipments. Container capability would

not only reduce build-ups at port by permitting throughput to storage area, but would also aid in retrograde operations. Before containerized ammunition could be utilized in any theater, however, USADACS personnel noted, an assessment would need to be conducted which included the ability of the area's facilities to receive, transport, and unload containers. Additionally, new technology and methods to improve containerization capability would warrant exploration. Indeed, USADACS personnel quickly undertook this exploration, and concluded that recently improved methods for stuffing containers that used less costly load restraining and dunnaging methods made containerization a better option than ever before, albeit in the intermodal form.[21]

Yet the capacity to use containerized ammunition shipping was not the only issue of transportation facing the thirteen AAPs and one AAA in the AMCCOM structure. Also causing the AAPs and Crane AAA difficulties, as well as HQ, AMCCOM, was the lack of timely and accurate information in the hands of HQ management in regard to installation capabilities. During CDS, it was discovered that the command had no means to accurately determine the current shipping capabilities of subordinate installations. Further, there was absolutely no correlation between outload capabilities required by the Master Mobilization Plan (MMP) and the plant contract, or those capabilities stated in AMCCOM file reports. For example, after approximately six weeks of shipping munitions, hiring and training additional personnel, and leasing additional equipment, Hawthorne AAP was outloading about 3,000 tons per day, the equivalent 150 trucks per day. This was in comparison to a MMP requirement for 5,269 tons from the first day forward, a contract requirement for 5,200 tons per day, and a file report stating the capacity to prepare 263 trucks per day.[22]

Noting that without timely and accurate information concerning a plant's actual capabilities, HQ planners could not distribute the shipping workload to utilize its shipping capabilities in the most efficacious manner, Hawthorne AAP sought to rectify the situation. Part of the effort to properly channel accurate information came as a result of that AAP's 21 February 1991 outstanding materiel release order (MRO) backlog of 52,000 short tons of high priority ammunition. Even had adequate transportation assets been available to support outloading, it would have taken a minimum of 18 days to fill the MROs. Given that other installations could have filled some of the orders, Hawthorne AAP personnel considered the situation "unacceptable."[23]

In regard to the situation which had developed at Hawthorne AAP, and other installations as well, its personnel recommended that a solution must be predicated upon the development of a method to accurately determine each installation's outload capability. The capability was at optimum to be defined in tons and reflect the total lift capability so that double handling could be given consideration. Secondly, a capability report should be filed monthly, and whenever a significant change occurred in the interim. Finally, the new capability report should be used to control the dissemination of MROs to installations. Ultimately, by using standard required delivery dates and realistic capability reports, HQ planners could be expected to readily determine when an installation had reached its maximum outloading capacity.[24]

Hawthorne AAP submitted several observations, most ultimately cut from the final draft of the Operation Desert Shield/Storm After Action Report, which helped to explain its difficulty in meeting the demands placed upon it. Personnel of the AAP noted that their capabilities were hampered by their inability to acquire additional, experienced supervisors, as well as blockers and bracers, from the civilian sector. LTC O.B. McCane, Hawthorne AAP's commander, observed in his submission that the lack of experienced supervisors forced the facility's contractor to use two twelve hour shifts as opposed to the anticipated three eight hour shifts. And since the AAP operated seven days per week for approximately five weeks, he felt that the situation contributed to numerous minor injuries due to fatigue, and represented a major long-term safety concern. The lack of additional bracers and blockers also proved to be the primary constraint to rapidly expanding the facility's loading capacity. And although Hawthorne AAP was, indeed, able to expand

its outloading, the actual number of shipments was limited to its ability to block and brace loaded vehicles. Loading dock activity would often arrive at a standstill as loaded railcars stood for several hours awaiting blocking and bracing.[25]

Considering the difficulty arranging for the proper blocking and bracing of ammunition loads, plant officials urged a review of load drawings to reduce and simplify the blocking and bracing requirements. They also offered that deliberation should be given to the development of emergency requirements which reduce manpower needs while retaining the same level of restraint through the use of large-size coarse lumber. Secondly, the plant's personnel suggested the need for the command to establish an affiliation program with Reserve Component Ammunition units who could train at the plants during peacetime and be partially activated during emergencies to provide critically short skills, such as blocking and bracing, and transportation assets. AMCCOM's Transportation and Traffic Management Directorate offered to explore the issue as did CRDEC. CRDEC personnel noted that vehicles arriving at ports, particularly the Port of Wilmington, were frequently not in compliance with transporation regulations as outlined by the Department of Transportation (DOT) and the Code of Federal Regulations (CFR).[26]

The issue of blocking and bracing was not the only one which Hawthorne AAP officials felt hampered their performance during ODS. The plant's commanding officer noted in a submitted lesson learned that the primary storage area for 1.1 explosive material, the south magazine grouping at the facility, was a shipping bottleneck due to a lack of rail structure. Commander LTC O.B. McCane observed that in addition to having the largest number of magazines, the south magazine area also had the highest explosive limits per storage location. As a result, munitions with high net explosive weight (NEW), such as bombs are normally stored in this area to maximize storage space. Unfortunately, the area only has rail service to the four loading docks. And while the extensive use of the south magazine storage area greatly enhances the plant's storage capability, it degrades the plant's rail outload capability by necessitating the double handling of all rail shipments from the area. All rail shipments from the south magazine area had first to be loaded on a truck at the magazine, transported to a loading dock, and transloaded into railcars, representing an unacceptable waste of limited manpower during emergencies.[27]

Hawthorne's personnel recognized that in times of budget cutting, their chances of a rapid rectification of the identified problem were slim at best, impossible in probability. They thus urged, as a "reasonable solution", the construction of a previously proposed container handling facility in the southern portion of the central magazine area. This would largely eliminate the double handling of individual pallets of munitions while deriving the benefits of rail transport and storage in the south magazine area.[28]

Yet MILVAN/containerized ammunition shipments, loading facilities, and the availability of laborers were not the only problems encountered in providing the firepower to America's servicemembers in the desert. One additional issue was that of the availability of commercial transportation assets. Hawthorne AAP noted that during the emergency situation which constituted ODS that it had inadequate transportation assets to accomplish its shipping mission in a timely, efficient, and cost-effective manner. Due in part undoubtedly to its isolated location, Hawthorne AAP discerned that the major cause of its shipping delays during ODS was the nonavailability of transportation assets. Of particular concern was the limited number of trucks available even at exorbitant rates, guaranteed loads, and considerable deadhead payments. After expending valuable resources to expand the plant's loading capability, on several occasions it was forced to send loading crews home because there were no trucks to load. Secondly, due to the lack of transportation assets, CONUS (continental United States) customers requiring training munitions were placed on indefinite hold or had only a limited portion of their requirements satisfied.[29]

As it had with the need for qualified blockers and bracers, Hawthorne AAP suggested that their problems could be mitigated with the establishment of an affiliation program between the plant and specific reserve component transportation units. Its personnel felt that a reserve unit capable of transporting munitions 350 miles would allow it to satisfy the training needs of the majority of its customers, while providing an in house capability to move limited quantities of munitions to the port at Concord, CA, in a matter of hours, thereby enhancing item managers' ability to respond to unprogrammed requirements from the field. Additionally, Hawthorne personnel suggested that a project should be instituted to improve that facility's ability to consolidate MROs to better utilize available transportation assets. AMCCOM's Transportation and Traffic Management Directorate took the suggestions under advisement.[30]

Yet isolated Hawthorne AAP was not alone in its difficulty securing adequate transportation. HQ, AMCCOM personnel noted that commercial carrier (truck) capability for the transportation of class A and B ammunition and explosives appeared to be inadequate to support the shipment requirements. This was particularly true during the first few days of Operation Desert Shield when spot shortages of trucks occurred at key plants and depots, jeopardizing their ability to meet stated required delivery dates (RDDs) for unit ABL (ammunition basic load) requirements to installations and shipments to the ports.[31]

Indeed, during the initial days of Operation Desert Shield, AMCCOM was literally inundated with orders for ABL requirements. RDDs of one to three days were common as units sought to prepare themselves for the coming conflict. Material Release Orders (MROs) were phoned out to both depot and ammunition plant supply and transportation managers simultaneously, thus giving the transportation managers advance information to determine the truck requirements and seek assistance from AMCCOM and MTMC. Yet spot shortages of trucks occurred at key plants and depots almost immediately. AMCCOM coordinated these shortfalls with MTMC and the munitions carriers to obtain the trucks needed.[32]

Additionally, two other factors affected the number of available trucks: Department of Defense (DOD) intransit security rules and rising fuel prices. For security purposes, two drivers are required when transporting class A and B ammunition and explosives. Certain items require one of these drivers to be armed with a shotgun, while some items require an escort vehicle as well for additional protection. While these rules are important security measures, there were simply not enough drivers to accomplish all the shipments.[33]

The issue of fuel prices became critical in view of the number of deadhead miles truckers were required to travel to pick up their loads when the fixed rate structure was too low to cover the costs incurred. AMCCOM asked MTMC to take immediate action to seek class A and B hauling authority to additional carriers, review intransit security rules and seek authority for a general rate increase from the Interstate Commerce Commission. These problems were rather rapidly overcome with the 10 August 1990 granting of temporary hauling authority along with the relaxation of intransit security rules. By 14 August 1990, the MTMC had taken action to streamline procedures for filing fuel-related tenders. AMCCOM personnel also recommended National Guard and reserve unit support be obtained to supplement commercial carrier capability. Additionally, AMCCOM Transportation and Traffic Management Directorate personnel urged that the MTMC establish procedures for quickly obtaining additional carriers—perhaps to include class A and B carriers on a standby list under a civil reserve air fleet (CRAF) type program.[34]

Further easing AMCCOM's commercial carrier woes during future engagements, according to some staffers, would be the wiser utilization of vehicles designated to transport small shipments. Louisiana AAP personnel suggested the consolidation of small shipments when possible for geographically colocated plants. The plant recommended that AMCCOM's Transportation and Traffic Management Directorate scrutinize MROs closely for shipments outbound from Louisiana AAP, Longhorn AAP, Lone Star AAP, and Red River Army Depot with an eye to the possible consolidation of transportation assets.[35]

Iowa AAP noted a further transportation problem incurred in the effort to supply America's fighting men with sufficient ammunition. Plant personnel observed that they experienced difficulty meeting all suspenses for the shipment of munitions. This occurred in part due to the rather short suspense dates on orders. To meet these, the AAP was forced to utilize commercial trucking assets despite the fact that rail service was both readily available and the most cost efficient. In consideration of the noted difficulty in obtaining commercial trucks to transport ammunition, Iowa AAP observed that strict attention to required delivery dates, as well as sailing dates for ammunition vessels and the priority of shipments could save the federal government significantly and reduce the number of difficulties experienced by AAPs and depots.[36]

Individuals from the United States Army Chemical Research, Development and Engineering Center (CRDEC) noted additional problems with the transportation of ammunition, beyond locating and loading vehicles. CRDEC personnel noted that some vehicles arriving at the Port of Wilmington were not in compliance with 49 CFR (Code of Federal Regulations) and Department of Transportation Exemption (DOT-E) 3498 in regard to packaging and restraint of ammunition loads. As it stands DOT-E 3498 does not give relief from two key safety factors during road transportation: 1.) ammunition must be in standard packagings, and 2.) loads must be secured in accordance with procedures established by the DOD. Yet many loads arrived in Wilmington without regard to the letter of the law concerning packaging and restraint requirements. Alert to the frequent violations of packaging requirements, CRDEC personnel recommended the review of DOT-E 3498 by DA (Department of the Army) officials with the purpose of seeking the true intent of the exemption, and the possibility of gaining a waiver.[37]

The DA did obtain a waiver concerning the need for United Nations performance oriented packaging (UN/POP) markings. Requirements for such markings exist for ammunition shipments intended for OCONUS (outside continental United States) destinations. Due to short suspense times, however, in filling MROs and the necessity of breaking down pallets to accomplish marking applications, DA did obtain the authority to waive UN/POP markings for ODS ammunition. Noting that the DA was quite responsive to easing restrictions that prevent expedited delivery of ammunition shipments to troops, McAlester AAP urged continued research on the absolute necessity of UN/POP markings in light of budget shortfalls.[38]

Ammunition plants were not the only ones concerned, however, with federal regulations regarding the transportation of ammunition. Production Base Modernization Activity personnel from Picatinny Arsenal, NJ, observed that during the early stages of deployment, limited liaison existed between inspection personnel at the ports and combat units loading tactical/combat vehicles at home stations. And what communication did exist between the MTMC and localized transportation services did not adequately address ammunition peculiar requirements or issues according to Picatinny sources. Thus vehicles arrived at ports improperly prepared for transport to SWA. In order that future deployments might be made both more safe and efficient, Picatinny ammunition logisticians urged that communication between ammunitionknowledgeable personnel at the ports of debarkation and home stations be established early, preferably in person, but acceptably via telephone.[39]

A further concern for AMCCOM concerning the initial movement of ammunition involved the ABL (ammunition basic load), its transportation from depots and AAPs to the deploying units, and the site to which it was called forward. Indeed, as the troops departed for the deserts of SWA, the issue arose regarding the manner in which their ammunition basic load was to be made available to them. Prior to ODS, approximately 90 percent of prepositioned FORSCOM (United States Army Forces Command) Class V ABL requisitions at HQ, AMCCOM were for rounds that were not intended to accompany troops. This ammunition was stored at depots to be shipped directly to the theater of operations and picked up there by deploying troops, in accordance with FORSCOM regulations. However, during ODS most FORSCOM

units called forward their requisitions to be shipped to their mobilization stations. HQ, FORSCOM was aware of this action, but did not intervene, resulting in undue port congestion and transportation problems at mobilization stations due to the unplanned receipt and shipping of ammunition. AMCCOM personnel suggested in future engagements that FORSCOM should reassess the need to assign such a large portion of their ABL as TAT (to accompany troops). Otherwise, FORSCOM was encouraged to resubmit their prepositioned requisitions to AMCCOM with a TAT deployment code.[40]

The size of ABL shipments also came under scrutiny as ODS materialized. Defense Ammunition Directorate personnel observed that the current HQ, AMCCOM ABL files contained prepositioned requisitions for the quantity of required basic load not on hand at the unit. However, in most cases, this quantity was too small to economically transport, two or three grenades, four signals, etc., as basic load awaiting supply distribution. In consideration of such small requisitions, AMCCOM urged that the NICP (national inventory control point) ABL files be changed by the mobilization stations or internal procedures to reflect an economic disbursement of ammunition by the elimination of small quantity requisitions.[41]

Additionally, AMCCOM personnel urged the consolidation of small unit ABL requisitions. It observed that during the initial deployment phase of Operation Desert Shield that it received numerous orders for ABL destined for the same mobilization station that had to be consolidated by HQ, AMCCOM to lessen the quantity of ammunition overshipped due to the need to ship complete unit packs. The many requisitions for company level units increased the need and difficulty of consolidating requisitions as well as the time that was needed to process the orders. To avoid such problems in future engagements, AMCCOM's Defense Ammunition Directorate suggested that prepositioned and other basic load requisitions should be consolidated at mobilization stations to the level of the smallest deployable unit prior to submission to HQ, AMCCOM. They additionally recommended that existing prepositioned ABL requirements should be changed to reflect deployable unit sizes.[42]

On the opposing side, some FORSCOM units called forward ABL requirements in excess of their organic transportation capacities. This occurred when units requisitioned ABL for movement to home installations for loading on or in unit vehicles and equipment for subsequent movement to sea ports of embarkation (SPOE). These ABL requisitions apparently exceeded unit capability to transport, requiring a number of shipments of excess materiel from home stations to MOTSU (military ocean terminal-Sunny Point). This situation may also have contributed to congestion at home stations resulting from delivering commercial carrier trucks. Certain home stations were inundated with trucks, resulting in delayed offloading. And at the same time these units were offloading delivered materiel, they had to load unit vehicles with ammunition and prepare to go to their designated SPOEs.[43]

To combat this problem, AMCCOM's Transportation and Traffic Management Directorate personnel urged FORSCOM to explore and implement the use of Army Reserve and National Guard units to assist offloading trucks delivering unit ABL. Simultaneously, it was encouraged to take action to review unit ABL requisitions to ensure that they were limited to only the ammunition which could be transported in or on unit organic equipment and vehicles, while encouraging units to evaluate RDDs for requisitioned ABL to determine installation capability to receive the materiel within the stated time frame.[44]

AMCCOM personnel also perceived that unauthorized quantities of ABL had been shipped to some deploying units. They noted that as prepositioned basic load requirements maintained by FORSCOM had no automated means of validating the accuracy of the requisitioned quantities and items against authorizations, it was entirely possible that some units had requested and received more than their allotted ABL. Beyond the initial shipments, problems also occurred in validating the additional basic load requisitions received during Operation Desert Shield. Validation was accomplished on a case-by-case

basis with FORSCOM ascertaining that the units making requisitions were actually deploying, but not examining the quantity and variety of items requisitioned. In the future, AMCCOM Defense Ammunition Directorate personnel recommended the creation of a validation system for prepositioned requisitions which involved not only AMCCOM and FORSCOM, but also AMC (Army Materiel Command) and ODCSLOG (Office of the Deputy Chief of Staff for Logistics).[45]

ABL also garnered the attention of AMCCOM personnel in conjunction with bracing and blocking. The need, as well as the ability, to properly restrain ABL aboard tactical/combat vehicles was apparently not properly articulated to deploying units. At several ports of embarkation—Wilmington, NC, Houston, TX, Beaumont, TX, - the United States Coast Guard, together with the assigned quality assurance specialist-ammunition surveillance (QASAS), determined that minimally acceptable standards had been employed in the process of blocking and bracing uploaded vehicles, and indeed that DOT-E3498 which states that "loading and stowage of military explosives . . . on unit vehicles shall be in accordance with procedures established by DOD" had been violated. In order that such violations would not occur in future exercises and engagements, AMCCOM urged the clarification of standards, as well as their clear and emphatic communication to units and U.S. Coast Guard members. QASAS would also be made available to deploying units as needed.[46]

Bracing and blocking, MILVANs and commercial containers, the shortage of semi-trucks and railcars, and ABL were not the only issues affecting the deployment of ammunition to the fighting men and women in the Persian Gulf. Perhaps more important than any of these factors was the condition of the stockpile. At least one AAP noted that due to a number of seemingly unrelated cost-saving decisions made in response to fiscal constraints in the years prior to ODS a significant portion of the stockpile being in a "not ready for issue" status at the onset of preparations for the conflict. For example, at Hawthorne AAP, thousands of bombs received as part of BRAC (base realignment and closure) were known to have bad pallets, but were not repaired due to a lack of funding. Additionally, the condition of a substantial portion of the stockpile was unknown due to a backlog of thousands of lots requiring periodic inspections. Until the plants were able to determine the actual condition of required munitions, the HQ's ability to determine what to ship and when to ship it was greatly impaired. At the plant level, limited resources were stretched to the breaking point. The need to inspect a backlog of 60,000 750-pound bombs, 24,000 of which required repalletization, during a shipping surge jeopardized Hawthorne AAP's ability to meet RDDs.[47]

After deliberating the issue, AMCCOM personnel noted that funding shortages affected everyone across board, and that such shortages were "typical of the function." Yet it offered that as fiscal constraints were not likely to lessen in the immediate future, and that accordingly the entire stockpile could not be maintained in a "ready for issue" status, that contingency plan requirements be reviewed and that a specified quantity of selected munitions be designated as deployment/contingency stocks. These stocks would have the highest priority for the command's limited inspection and COSIS (care of supplies in storage) funding and receive intense management. Illustrating their idea with an example, AMCCOM personnel suggested that Hawthorne AAP could be assigned responsibility for maintaining 50,000 750-pound bombs and 50,000 155mm projectiles in a "ready to issue" status. Then Hawthorne would be expected to use whatever surveillance and COSIS funding that was provided to ensure that those stocks were ready for issue prior to inspecting or maintaining noncontingency stocks. This would guarantee the command's ability to satisfy initial customer demand while providing a buffer period during which additional munitions could be inspected, repaired, and shipped.[48]

Regardless of the initial problems securing sufficient trucks, railcars, blockers, bracers, MILVAN/containerized ammunition equipment, properly inspected ammunition, and accurate information, AMCCOM ultimately directed 620,000 short tons of ammunition to the Persian Gulf before the war's end. Of this

tonnage, bombs comprised 274,000 short tons, artillery shells made up 245,000 short tons, small arms rounds totalled 34,000 short tons, mortar, tank, and navy gun ammunition made up 36,000 short tons, and all other classes of munitions totalled 31,000 short tons. The total dollar value of ammunition shipped by AMCCOM during Operations Desert Shield and Desert Storm amounted to $4 billion.[49]

This tonnage did not include the approximately 60,000 short tons of assorted Class V ammunition stores carried on three Marine Corps Near Term Prepositioned Fleet (NTPF) vessels—the *Green Island,* the *Green Harbor,* and the *Austral Rainbow.* Each of the vessels had been restocked with fresh ammunition within the previous two years, and was prepared for rapid deployment. Indeed, the first prepositioned vessel departed the British Indian Ocean Territory port of Diego Garcia on 7 August 1990, just one day after President George Bush ordered the first U.S. forces to the Persian Gulf. A mere ten days later it arrived in Saudi Arabia. Such a quick response appears to prove the worthiness of the NTPF program. Additionally, given the problems with determining resupply requirements, the program seems to have shown that by its expansion ammunition can be made readily available when, and wherever needed.[50]

Also proving its worth during the Persian Gulf War was the designation of AMCCOM as the single focal point for ammunition ship planning. While AMCCOM's bureaucratic predecessor had been declared the Single Manager for Conventional Ammunition (SMCA) in 1977 when the army assumed control of all the nation's ammunition facilities, it was not until the opening of Operation Desert Shield that AMCCOM's responsibilities expanded to include ammunition ship planning.[51]

The designation came about after a significant amount of chaos in the initial days of ODS. During the opening stage of the operation, some ammunition shipments were "free flowing" into the ports without the prior knowledge of the Military Traffic Management Command (MTMC) through Export Traffic Release Requests (ETRRs). Heavy depot workloads contributed to a backlog in their capability to submit separate ETRRs with the result being inefficiencies, delays and a distinct lack of visibility over all ammunition moving to port. Noting the problem, AMCCOM proposed that by using a single data system-its "Fast Release"—as a focal point, some of the confusion could be eliminated and the servicemember more effectively served. Persuaded by the argument, MTMC endorsed AMCCOM's proposal and TRANSCOM designated AMCCOM as the single focal point for ammunition ship planning.[52]

AMCCOM then took action to document both AMCCOM and Single Manager for Conventional Ammunition (SMCA) ammunition ship requirements to MTMC, the customer services, and the CINC using its "Fast Release" system. Defense Standard Ammunition Computer System (DSACS) transportation modules provided automated assistance and management report capability. Using these formats, AMCCOM's designated duties were performed and a knowledge of AMCCOM and SMCA capabilities attained, including the consolidation of all AMCCOM and SMCA requirements into shipload segments serving as both the cargo offering and the ETRR. The unity of action reduced and eliminated workload for plants and depots. Such ship planning messages also provided complete visibility over what was planned for each vessel. They were sent to the MTMC, customer services, CINC, depots, plants, ports and the overseas theater.[53]

AMCCOM also generated advance reports of shipments, comparing the vessels' planned versus actual ammunition shipped, utilizing the ship's manifest. Such messages were provided to all members of the team and provided visibility support for prioritization decisions by the CINC and/or customer services, flexibility for diversions as necessary, and preparation for reception and onward transportation in theater. The services do not currently have a similar system covering non-SMCA ammunition and missiles. This requires depots and plants to work with two systems and prevents total visibility over non-SMCA items.[54]

Indeed, this factor was the tangential concern of an observation included in AMCCOM's Operation Desert Shield/Storm After Action Report. AMCCOM personnel hinted at the value of including non-SMCA ammunition and missiles in the "Fast Release" system. They also recommended that regulatory changes be initiated which would ensure that the role AMCCOM played in coordinating ammunition shipments would be continued for peacetime requirements just as it was used for contingency, mobilization and wartime requirements.[55]

And although AMCCOM managed to maintain pipeline visibility in CONUS at a remarkable level, it, as well as other commands, was unable to sustain the visibility in SWA. As a submitted observation noted, no system similar to AMCCOM's "Fast Release" was in place for ammunition shipments from Europe or other theaters. The result was a distinct lack of accurate information regarding ammunition on vessels loaded OCONUS. This lack of information impaired decision makers' abilities to prioritize flow from all theaters and the warfighters' capability to plan the war based on accurate data concerning the receipt of required ammunition. In view of such frailties, AMCCOM took action to upgrade its reports, tailoring them to meet user demands. Yet it was handicapped by the DSACS. That system provides the baseline automated assist but does not have an interactive data base for tailored reports. Procedures were implemented to download data in the DSACS data base to PC Dbase software to enable manipulation as required to generate the reports. However, additional data to the currently available DODIC (Department of Defense Identification Code), quantity, tons, etc., was required by storage planners. Specifically, they desired lot numbers, NEW (net explosive weight), and condition codes. AMCCOM was able to supply some of this information, but only via manual manipulation with extremely limited automated assist. Complete automation is required, along with interactive data bases and full interlinking capabilities between AMCCOM, MTMC area command, port, and depot automated systems on a worldwide basis, and for purposes of storage planning must include lot number and condition codes.[56] The price of liberty thus requires not only vigilance, but visibility as well.

Regardless of the problems with visibility encountered OCONUS, AMCCOM managed its role as the single focal point for conventional ammunition and ammunition ship planning in stellar fashion, safely coordinating the movement of ammunition from AAPs, depots and home stations to ports of embarkation, across the turbulent sea, to points of debarkation, and onward to ammunition supply points (ASPs) scattered throughout the Saudi Arabian desert, ultimately placing it in the capable hands of American and allied combat units. An important step in that process was that of port operations, both CONUS and OCONUS. In the United States, AMCCOM oriented ammunition port activities were undertaken at the military ocean terminal-Sunny Point (MOTSU), Southport, NC, Wilmington, NC, Beaumont, TX, Houston, TX, Jacksonville, FL, Bayonne, NJ, Naval Weapons Station (NWS) Earle, NJ, NWS Concord, CA, and Savannah, GA. Vital CONUS vehicle uploading operations in preparation for port movement were conducted at Fort Campbell, KY, Fort Hood, TX, and Fort Riley, KS. In each of these locations, as well as a number of OCONUS ones, AMCCOM personnel were on site assuring that few problems arose, and that those which did arise were addressed with celerity. In consideration of the size of the operation undertaken by AMCCOM in support of ODS, however, the problems encountered, with few exceptions, seemed relatively minor.

At the onset of Operation Desert Shield, AMCCOM made tentative plans for 60 ammunition-carrying vessels to leave CONUS in support of the territorial integrity of Kuwait and Saudi Arabia. Of these planned vessels, 24 were intended to support the needs of the army, in terms of SMCA, with the transport of 222.5 thousand short tons. Twenty-two vessels were intended to carry 226.4 thousand short tons for the use of the air force, and 14 ships were scheduled to move 117 thousand short tons for the Marine Corps. Yet before all scheduled vessels could depart CONUS, or even be loaded, Operation Desert Storm had ground to a close. By the war's conclusion, however, only 49 of the planned 60 vessels had been loaded and

otherwise prepared for transit to SWA. Of the prepared vessels, 23 were loaded with army ammunition, 17 with air force conventional ammunition, and nine with Marine Corps ammunition. The loaded vessels carried an ammunition total of 477,000 short tons. A total of 44 ships actually sailed toward SWA under the suzerainty of AMCCOM during ODS. Of the vessels actually leaving CONUS ports, 23 carried army ammunition, 12 bore air force supplies, and nine transported Marine Corps conventional ammunition. The total tonnage of ammunition the vessels bore was 434,000 short tons. The remaining ammunition provided Americans in the desert was supplied from OCONUS facilities.[57]

The process of arranging for vessels to transport ammunition abroad after AMCCOM's designation as the single focal point for Department of Defense ammunition ship planning was complex. The process of delivery simply to a port in SWA was expected to consume a minimum of 55 days. Approximately two days were spent in the receipt and examination of the requisition. Another two days were spent processing the materiel release order (MRO). Arranging land transportation from the AAP or depot to the port absorbed nearly five days, some of which overlapped the loading process at the installations. Thus by the eleventh day after receiving a requisition, AMCCOM had the ordered ammunition loaded and enroute to a port. On average, depending on the locations of the stored ammunition and the port utilized, the process of overland transportation consumed another eleven days. Port activities took, on average, ten days, while ocean transport absorbed 20 days. And before ammunition could be passed on to the soldier, port activities in SWA usually required eight days.[58]

With such advanced and detailed planning, there is little wonder to be found in the fact that a great deal of ammunition was in transit at the time of President George Bush's 6 March 1991 announcement before a joint session of the United States Congress that "aggression is defeated. . . . The war is over." Indeed, from all sources, CONUS and OCONUS, AMCCOM directed and otherwise, an estimated 50 vessels were either loaded and prepared for transit, or enroute to SWA on 7 March 1991. Two vessels had CONUS loading suspended at the declaration of peace, and five had the offloading process begun immediately. Four loaded ships at MOTSU awaited instructions, 14 vessels were enroute to SWA and 19 were at ports of safe haven on 7 March 1991. At Saudi Arabian ports, 13 vessels were at anchor awaiting further directions and three were in the process of offloading.[59]

Obviously, such large amounts of ammunition were of limited value in SWA at the conclusion of the conflict. Although a variety of recommendations were made as to its best disposition, it ultimately resulted in the largest Class V retrograde movement in United States military history. According to AMCCOM statistics, 270,909 short tons of ammunition were returned to inventory, both CONUS and OCONUS, 11,486.2 short tons were destroyed in theater, and 2,891 short tons were given to the nation of Kuwait for its defense. The contractor team, Brown and Root Saudi Ltd., overseen by the United States Army, completed the mission without significant accident and ahead of the initial schedule.[60]

The initial shipments, as well as the retrograde action, encompassed a variety of conventional ammunition types. For example, ships departed CONUS carrying 30mm cartridges, 155mm projectiles, 12 gauge cartridges, 50 caliber cartridges, demolition charges, proximity fuzes, both M532 and M732, 5.56mm rounds, both tracing and ballistic, 40mm cartridges, 7.62mm rounds, grenades, both smoke and violet, Cruise, Tomahawk and Hydra missiles, signals, flares, blasting caps, 120mm training cartridges, demolition cratering charges, assorted bombs, mines, rockets, and projectiles. In all, AMCCOM was responsible for some 181 varieties of conventional ammunition conceivably needed in SWA. In consideration of safety factors, some varieties of ammunition could not be shipped in close proximity to other varieties. Thus, vessel planning with regard to the safe combinations and the needs of the soldier had to be carefully undertaken. AMCCOM's "Fast Release" data system aided considerably in the scheduling process.[61]

Part of AMCCOM's success came from its implementation of the Movement Control Center (MCC). The MCC accomplished coordination between depots and the ports to distribute the workload, adjust port windows, and ensure an uninterrupted flow of ammunition to support vessel loading operations. Massive requirements inundated depot outload, port reception, and transportation asset capabilities. Initial port dates did not account for depot capability to ship, truck and rail capability to transport, or port capability to receive and process. As AMCCOM was responsible for sourcing ammunition requirements and providing movement direction to the depots, it established a MCC to coordinate the actions between MTMC area commands, depots, ports, and commercial carriers. AMCCOM MCC took action to coordinate port windows recognizing depot and port workload issues as well as truck and rail asset requirements. Truck and rail analyses were implemented for each ship planning increment. This enabled AMCCOM to conduct intensive telephone coordination with MCC, depots, ports, MTMC, and carriers, and was critical to establishing port dates based on comprehensive movement plans which reduced congestion and facilitated the smooth, on time, flow of ammunition. However, many of these actions were accomplished in a manual mode, with little computer-driven assistance.[62]

At the war's conclusion, reflecting upon the role of the MCC, AMCCOM personnel noted that the center had indeed worked and should be implemented at the onset of any contingency to prioritize or synchronize depot and port workload through ammunition sourcing actions and coordinating port windows. Automated assistance, however, would greatly enhance the facility's ability to support truck/rail/container analyses and depot workloading decisions to ensure that requirements were met. Thus, AMCCOM transportation managers recommended the formalization of AMCCOM MCC into TRANSCOM policies, plans, and procedures. Accordingly, the automation facet of the MCC needed upgrading to provide decision support models for depot selection, port windows, and transportation mode decisions. A central control agency should also be designated to manage and prioritize competing requirements for commercial transportation assets during peak demands.[63] Despite AMCCOM's call for improvements in the methods of managing transportation assets, the actions undertaken allowed for the largest, most successful Class V operation in world military history.

Yet given the complexity of port operations, problems did occur. One such issue at MOTSU, as well as other port facilities, was the congestion encountered due to large numbers of truck shipments and virtually none by rail. The use of trucks over railcars resulted from the contingency nature of the operation. As shippers struggled to meet their initial short-notice required delivery dates most contracted truck transportation rather than the more port-efficient, albeit slower, rail service. And as the initial RDDs were not based on pre-coordinated in-port dates, congestion occurred as semitrailers flooded the facilities in an effort to meet the tight schedules. During the first three weeks of ODS, MOTSU received over 1,100 trucks. Considering that MOTSU's optimum mode mix is 80 percent rail versus 20 percent truck, not to exceed 100 trucks per week on a continuing basis, the port and its facilities were strained to their maximum extent. Causing additional difficulty was the fact that these trucks had to be immediately offloaded and released for other priority shipments. As MOTSU's storage capabilities are somewhat limited, materiel offloaded from trucks was placed in railcars for temporary storage. Later, this materiel had to be located and loaded aboard SWA-bound vessels.[64]

MOTSU's burden was not eased by shippers who failed to properly and successfully prepare transportation documentation. Cargo initially shipped to MOTSU arrived there under domestic releases and was not address labeled or identified with transportation control number (TCN) markings. This cargo freeflowed into the port without Export Traffic Releases and was thus not scheduled for a given vessel. The demand for fast truck turn around was also placed on the port which occasioned the transfer of cargo to DOD and leased commercial railcars. MOTSU being a transshipment terminal did not have warehouse or long-term storage capabilities. When vessels were then available, ammunition was loaded directly from

the railcars, trucks, and containers. This format created a serious problem as no vessel load integrity could be maintained with such a loading procedure.[65]

Even as MOTSU recognized that it was receiving munitions shipments from 35 separate, over-worked facilities, it noted that the adherence of those facilities to Military Standard Transportation and Movement Procedures (MILSTAMP) documentation regulations was obligatory and their failure to do so a hindrance to the process of properly arming the services. Thus, MOTSU reminded shippers that they were required by MILSTAMP to provide Advance Transportation Control and Movement Documents (ATCMDs) for all shipments entering the Defense Transportation System (DTS) to the clearance authority who in turn would enter it in the manifest system. Such information was necessary to provide clearance authorities, ports, receivers, and interested transportation personnel with advance notice of shipments and the information necessary to process the shipments through the DTS. Yet throughout the course of ODS, MOTSU prepared 58% of 13,010 ATCMDs required by the port, greatly burdening the facility.[66]

Shippers were also required by MILSTAMP to provide Reports of Shipment (REPSHIP) as soon as possible but not later than 24 hours after the load left its point of origin. The stringent time frame ensured the REPSHIP's receipt at the port prior to the shipment's arrival. Failure to provide REPSHIPs could cause undue delays in planning and resulted in valuable personnel time being absorbed tracing cargo with shippers and carriers. When the status of cargo was unknown, vessel loading could easily be delayed.[67]

While MOTSU managed to survive the onslaught of semitrailers loaded with undesignated ammunition and to successfully transship all received materiel, AMCCOM endeavored to assist it in doing so by challenging RDDs and coordinating extended in-port dates to allow shipments by rail. It also launched a concerted effort with the customer services to submit their requirements as early as possible to provide the lead times necessary for rail shipment. AMCCOM also sought to prevent repeat problems in the advent of future mobilizations. To do so, AMCCOM urged the better management of shipment flow into the ports. Noting that a key element of movement control is the coordination of in-port days for shippers, AMCCOM transportation personnel recommended the planning of in-port dates to ensure adequate attentiveness to port reception, as well as shipper capabilities and the proper mode mix. Such planning and coordination should ensure the optimum mode mix is used and thus maximize throughput, and minimize the possibility of a port bottleneck. Also, AMCCOM suggested that services should identify their requirements as early as possible and as far into the future as possible to provide the lead times necessary for rail shipment. Additionally, transportation managers at HQ, AMCCOM urged the full coordination of in-port dates among AMCCOM, MTMC, and the port. Further, they recommended AMCCOM's designation at Movement Control Center (MCC) to develop the movement plans in coordination with the depots and ports, providing movement direction to the depots and AAPs.[68]

Also of concern to AMCCOM personnel regarding the port facilities available to them was the ammunition throughput capability. The massive requirements of ODS exceeded the peacetime capacities of all three—MOTSU, NWSs Earle, and Concord—ammunition ports. Net Explosive Weight (NEW) waivers were required to process the huge volume of ammunition which passed through each facility. Additionally, each ammunition port had its own special problems. Earle had insufficient capability to process rail shipments. MOTSU could initially use only four of its six available berths. Also, the MOTSU channel was not deep enough to handle fully loaded LASH (lighter aboard ship) vessels. MOTSU later expanded to six ships at a time with an average load time of only eight days. NWS Concord could initially handle only one ammunition vessel at a time even though it technically had six berths available. (This was later expanded to two vessels at a time.) Staging areas and container capability at Concord also appeared to be quite limited. Its loading time averaged approximately 15 days per vessel. Based on MOTSU's capability to respond and expand its capability as well as its location, 3,000 miles closer to SWA, it became the preferred port, ultimately handling the great bulk of ammunition requirements and ships.[69]

MOTSU was, indeed, the hero of the ammunition ports. It was able to fully utilize its total expanded capability, e.g., receiving and processing ammunition to enable loading six ships at a time and in the process compiling an excellent record of meeting requirements. If containerized ammunition had been fully available for utilization, MOTSU's record would stand even better. An estimated 90 percent of AMCCOM's ammunition shipments passed through MOTSU. Other ports' records, while impressive given the contingency nature of the operation, were not as stellar as MOTSU's.[70]

In spite of MOTSU's successes, AMCCOM observed that it, as well as the remaining ammunition ports, could be improved upon. AMCCOM transportation personnel noted that all three ammunition plants could more efficiently gear up to meet massive surge requirements. In order to accomplish a more efficacious mobilization, transportation managers suggested that rail shipments to both Concord and MOTSU would be greatly preferred to truck shipments for improved ship loading operations. Rail use would eliminate considerable port congestion and the build up of truck assets at the ports. Transportation personnel noted that beyond congestion, truck assets focused at ports reduced responsiveness for the entire transportation system due to a lack of sufficient trucks for other high priority shipments. Truck shortages, as well as congestion, were of particular interest to NWS Earle. Earle lacks rail capability. A bridge to its pier needs to be upgraded to handle railcars.[71]

Beyond the three designated ammunition ports, AMCCOM also utilized commercial ports in its effort to supply ammunition to America's fighting force. And it occasionally received ammunition requisitions specifying direct delivery of unit basic load ammunition to a commercial port. Yet AMCCOM had no waivers in its control to authorize such shipments. Waivers in its control concerning shipments allowed only the shipment of ammunition loaded on unit vehicles and equipment. Commanders of deploying units did not seem to understand this distinction and frequently sought to unite their entire ammunition basic load and unit equipment in commercial ports. When requisitioned ammunition exceeded a unit's organic capacity to transport it, AMCCOM immediately raised the issue with the Military Traffic Management Command (MTMC) for clarification. In each case, the issue was elevated to HQDA level for a decision based on the MTMC's position that commercial port waivers did not apply either to breakbulk or containerized ammunition but only to what was loaded on or in unit vehicles. As the HQDA sided with the MTMC in all cases, AMCCOM transportation personnel recommended that in the future time not be wasted on attempting to obtain a waiver to unite troops and their excess basic load. Instead, they suggested that FORSCOM should make certain that the issue was thoroughly addressed with unit commanders on a continuing basis to ensure that shipment expectations and ammunition basic load requirements to accompany troops were adjusted accordingly.[72]

Yet congestion, commercial port waivers, and truck shortages were not the only concerns of AMCCOM and port officials. MOTSU reported that their work was complicated, as well as delayed, by the need to repalletize ammunition. Despite the fact that it was not staffed to do so, and did not have the appropriate facilities, the port was on occasion forced to repair, repack, and repalletize ammunition before shipping it. AAPs and depots could have saved ports considerable time and effort, and were reminded of their responsibility to do so near war's end, by adequately packaging and packing munitions to withstand handling and transportation through to the intended destination, either CONUS or OCONUS.[73]

Regardless of problems with pallets and packaging, railcar and truck availability, and port throughput capacity, perhaps the greatest issue arising from the facilities during the mobilization for ODS came to be visibility. In order to track ammunition shipments, three documents were to be prepared. Hardcopy ship manifests were generated by the applicable HQ, MTMC, dependent upon east or west coast shipment. Magnetic tapes of the manifests were disseminated by AMCCOM, as were REPSHIPs. The purpose of

preparing manifest messages grew from concern over the accuracy of the data received in Saudi Arabia on incoming ammunition shipments. In addition, NEW (net explosive weight), hazard classification information, and packaging data was needed to assist personnel with storage and handling concerns in the theater of operations. This was provided by USADACS.[74]

Notwithstanding the effort to maintain clear and correct records, difficulties appeared in the attempt. Receipt of the manifest, magnetic tape, and REPSHIP frequently did not arrive in Savanna, IL, home of USADACS, the facility charged with maintaining and transmitting manifests, until two, or more, weeks after the sailing date of a vessel. This caused a severe time problem in the preparation and transmittal of documents before the arrival of the vessel at its final destination as sailing time to SWA was approximately 20 days. At least eight ships arrived in SWA without any of the three documents having been received at USADACS for forwarding.[75]

Data accuracy in the manifest documents also became an issue of no mean significance. In order that a set criteria might be available for judging the accuracy of a manifest, the total quantity (round count) per Department of Defense Identification Code (DODIC) became the yardstick for comparing the manifest, magnetic tape, and REPSHIP. In comparison, all three documents matched 53 percent of the time. The hardcopy and magnetic tape indicated 68 percent uniformity. This appears rather strange considering that the two documents should contain the same information, simply in variant formats. A comparison of the manifest to the AMCCOM-prepared REPSHIP revealed an accuracy of 72 percent and the magnetic tape agreed with the REPSHIP just 61 percent of the time. Additionally, an examination of the three documents revealed problems concerning the total quantity of an ammunition type shipped, the national stock number (NSN), and the DODIC. In some instances, items were identified on final REPSHIPs as shipped which did not appear on the manifest or magnetic tape. Thus, false information was transmitted to the ultimate consignee on a number of occasions. Such false information undoubtedly caused ports in SWA to make unnecessary preparations for some items and instilled a general lack of confidence in the accuracy of other information contained the REPSHIP.[76]

Quite naturally, such discrepancies disturbed USADACS personnel for they were responsible for gathering and forwarding such documents to SWA. After examining the information they had assembled, the facility's Logistics Review and Assistance Office concluded that Southwest Asian consignees needed to be informed about what they were to receive as soon as possible in order to make necessary preparations for movement and storage. This data in turn needed to have a high degree of accuracy to be of any real benefit. Inattention to detail appeared to be the biggest problem in achieving the necessary accuracy. Accordingly, USADACS personnel felt that more attention needed to be placed on the quality of the reports submitted and perhaps a little less on the speed of transmitting the information, although within appropriate constraints They also pondered the possibility of too many organizations expecting too much from the documents, and using them beyond their intended scope. In consideration of their ruminations, USADACS staff recommended that the scope and applicability of the documents be reviewed. If their use had expanded beyond the original intent, thought should be given to filling unmet customer information needs from other sources. Regardless, a more diligently applied quality control program seemed warranted.[77]

USADACS was not the only organization concerned with manifest variations; AMCCOM's Transportation and Traffic Management Directorate was interested as well. Its personnel suggested that the Transportation Command (TRANSCOM) should establish an action plan to review manifesting procedures and identify improvements which would help to ensure the reflection of accurate data. This, in turn, would be part of a total systems approach which would integrate ship planning, stow planning, movement planning, and provide updates to the plans as actual movements took place. Ultimately, bar coding technology should be applied to facilitate both the accuracy and the ease of tracking information.[78]

Further vessel-oriented confusion arose for transportation planners of AMCCOM. In the official AMCCOM Operation Desert Shield/Storm After Action Report, they noted that changes in vessels nominated against ship plans led to a loss of visibility of assets in the logistics pipeline. Although vessel substitutions might be expected in any large operation, the alternate ships frequently had totally different stowage characteristics and capacities than the originally planned vessels. Thus on occasion, items planned for shipment on the first scheduled vessel had to be delayed until a considerably later one. In one particular instance, three sailings were consolidated to travel on a single vessel. Then in reversal, the new, planned single shipment was broken into three. Obviously, such operations made it extremely difficult to provide total visibility of requirements until well after vessel departure dates.[79]

From the experiences of ODS, AMCCOM transportation personnel learned that ship-planning actions must be integrated with vessel scheduling and stow planning. And that in order to provide accurate and timely visibility of ammunition by item and quantity, that it must be able to track ship plans against scheduled vessels. AMCCOM was not alone in its desire for visibility; all involved—MTMC, CINC, theater ammunition managers, and customer services—recognized the value. Yet all realized as well that visibility was possible, however, only to the extent that major changes in ship type and stow plans did not occur. Close coordination regarding ship type was necessary upfront and continuously to ensure planning efforts were fully synchronized and capable of providing the desired level of visibility.[80]

Accordingly, AMCCOM managers determined that procedures emphasizing close and continued coordination be extended, and that replacement vessels be consistent with the characteristics of the originally nominated vessel whenever possible to maintain the integrity of the ship plan and facilitate intransit visibility.[81]

Assisting AMCCOM with port operations were a number of quality assurance specialists-ammunition surveillance (QASAS) personnel. These individuals were on site to ensure that ammunition was properly uploaded on tactical and combat vehicles for transport to the Persian Gulf. They also provided explosives technical guidance. AMCCOM's QASAS offered support to port operations at the Military Ocean Terminal; Sunny Point, Southport,SC: Wilmington, NC; Beaumont, TX; Houston, TX; Jacksonville, FL; Bayonne, NJ; and Savannah, GA; but were not called upon to assist at the ammunition-only ports of Earle, NJ, or Concord, CA. They also provided support to troops making preparations for deployment at Fort Campbell, KY; Fort Hood, TX; and Fort Riley, KS. Approximately 30 QASAS served AMCCOM at these sites. Other QASAS provided expertise at a variety of points in SWA.[82]

Initially providing the expertise at the port of Beaumont, TX, was Rock Island Arsenal-based QASAS Owen Wasmoen. Temporarily assigned to the port from 24 August to 26 September 1990, Mr. Wasmoen's mission entailed providing technical assistance to the port's commander during the receipt, temporary storage, staging, and shiploading of uploaded military vehicles bound for the Persian Gulf, and to provide such services as rapidly and safely as possible. More specifically, he provided technical assistance to the individuals responsible for loading the 13 vessels which had been prepared for sailing at the time of his departure. The vessels carried over 5,000 uploaded vehicles all of which required inspection for the adequacy of their blocking, bracing, and tiedown procedures. Deficiencies were corrected prior to loading the vehicle aboard a vessel. The operations were monitored for safety with violations brought to the attention of MTMC personnel for correction. Few violations, and no significant damage or injuries occurred during Mr. Wasmoen's tenure at Beaumont.[83]

In a post-effort trip report, Mr. Wasmoen delineated observations made during his temporary duty assignment. He noted that port operations were conducted in accordance with 46 and 49 Code of Federal Regulations (CFR), as well as DOT (Department of Transportati xemption 3498, which permitted the

otherwise prohibited shipment of vehicles uploaded with unit basic load ammunition and other hazardous material. Yet his attempt to verify the existence of an explosive safety waiver or even that a safety survey of the port had been conducted failed. Additionally, he wrote, violations of mandatory provisions contained in Army Regulation 385-64 concerning "Ammunition and Explosives Safety Standards" had been identified. Most notable among these was the nonobservance of regulations concerning the distance which must fall between inhabited buildings in Beaumont and the port installation boundaries.[84]

Mr. Wasmoen further noted the presence of problems with vehicles prepared for vessel transport at unit home stations. Initial shipments received at Beaumont from Fort Bliss, he commented, had a major problem with ammunition stowage in vehicles. Basic load ammunition had been placed in vehicles on top of other equipment just prior to or even following vehicle loading onto railcars. No tiedown or blocking and bracing procedures had been adhered to. Accordingly, in the name of safety procedures unit personnel at Beaumont removed all equipment from the vehicles and completely restowed ammunition and equipment. And in order to prevent restowing each arriving vehicle, discussions were instigated among MTMC, Coast Guard, and QASAS personnel, and relayed to various points of deployment, to assure that home stations would learn to properly secure ammunition and equipment in vehicles, making port operations more safe and efficient.[85]

The failure to properly secure vehicles at home stations did, indeed, cause problems beyond the simple inconvenience of repetitive actions. As Mr. Wasmoen noted in his trip report, and as ultimately gained inclusion in AMCCOM's Operation Desert Shield/Storm After Action Report, M1A1 tanks from Fort Bliss were improperly prepared for transport. As the tanks had not been provided with environmental covers at their home station, the driving rainstorm encountered enroute to Beaumont permitted water to enter the vehicles. At least 129 of the tanks actually contained standing water. And although unit personnel dried out the compartments, but again failed to utilize environmental covers, a second storm recreated the problem. As there was not time available before the sailing date, unit logistics representatives instructed military personnel traveling aboard the vessel to once again dry the tank interiors. Yet the time-consuming burden of drying tank interiors was not the only problem to arise from the lack of environmental covers. Due to the flooded interiors, stowed 120mm ammunition, that with combustible cartridge cases, received water damage, and in some instances became unserviceable. QASAS estimated that up to 20% of the ammunition involved was thus rendered. The transporting units were accordingly advised that uploaded rounds were to be inspected, and future deployees were instructed to inspect tanks for water in their ammunition compartments before uploading.[86]

The failures, however, proved to be learning experiences, and later deploying units frequently sent personnel to the port of Beaumont to observe and learn. Other units, discovering the enormity of their mission, requested and received valuable technical assistance from AMCCOM QASAS. Fort Hood and Fort Riley, in particular, benefitted from the guiding presence of QASAS. Thus as the deployment of men, materiel, and munitions passed from the initial days, the effort became more routine, and less fraught with difficulty.[87]

Regardless of the decreasing number of incorrectly stowed, braced, blocked, and tied down vehicles and ammunition, Mr. Wasmoen could still point to valuable improvements, and make insightful comments, regarding port operations. He urged the continued participation by QASAS at port facilities, noting they were essential to safety and quality as the assigned MTMC and transportation units he had come into contact with had no ammunition experience. Nor did most deploying units have the necessary experience to properly ship uploaded vehicles.[88]

He further observed that earlier coordination at decisionmaking levels appeared necessary to permit

timely notification and deployment of QASAS. By the time of his arrival at the port of Beaumont, a number of trains had already been received. His late arrival prevented his participation in planning for the operation to the degree of his preference. His immediate involvement in the process of inspecting and restowing ammunition further delayed his investigation of explosive safety issues as did the absence of security clearance information in his orders.[89]

Other absences hindered Mr. Wasmoen's work as well. He felt that essential information was not provided to him prior to leaving on TDY (temporary duty) concerning the type of operations with which he would be involved. Information concerning the applicability of DOT-E-3498, the layout and capability of the port, the status of the explosive safety survey, basic guidance on tiedown of ammunition in vehicles, the lifting of vehicles, and the tiedown of vehicles on railcars and in vessels was not readily available. MTMC restricted the flow of information in an awareness of security classifications. But accordingly, work was impeded by the nonavailability of valuable planning information before his arrival in Beaumont. The selection of the port of Beaumont for the deployment of uploaded vehicles had been based primarily upon its proximity and capability. Mr. Wasmoen suggested in the case of future engagements, that other factors be taken into deliberation, primarily the port facility's available space to provide quantity distance separation for ammunition and explosives. A waiver would be necessary if Beaumont were to be used solely as an ammunition, as opposed to an uploaded tactical/combat vehicle, port.[90]

Concerning the variation in port facilities needed for each type of ammunition shipment, Mr. Wasmoen stopped to ponder the need for uploading basic load ammunition. He noted that it could and "probably should" be shipped separately from deploying soldiers and their tactical/combat vehicles. The rationale for uploading ammunition in vehicles could be questioned in light of increased hazard to operations as well as the shipment itself and the vessel. Considering that most shipments of basic load ammunition are relatively small, positioning them for unit pick-up at arrival should not prove an overwhelming problem. This method of shipment would also reduce security problems at the ports and enroute, as well as reduce the potential for damage to ammunition due to handling or intransit storage conditions. Additionally, given the Coast Guard's unfamiliarity with handling ammunition, uploaded or otherwise, Mr. Wasmoen noted the totally different standards applied, despite the DOT exemption which specified tiedown using army standards. Accordingly, he recommended that QASAS dealing with the uninitiated have vehicle and weapon manuals available, and that they closely coordinate with port officials to nip potential problems in the proverbial bud.[91]

And in a comment that was to become the refrain of deployed civilians, Mr. Wasmoen noted the minimal level of support available for port-based ammunition inspectors QASAS effectiveness was limited by the lack of office space, commercial telephone capabilities, the absence of portable communications equipment, continually changing personnel, the variable level of support furnished by deploying units, and the lack of accurate and timely information. Also hindering QASAS performance was the changing focus of responsibility for operations. At the port of Beaumont, power initially rested with MTMC, but rapidly devolved to the 1192nd Terminal Transit Unit. Port conditions did not vary considerably throughout CONUS.[92]

Port activities were also conducted OCONUS, most notably in Germany. From the port of Nordingham, Germany, QASAS assisted the deploying VII Corps by loading their ammunition as well as uploaded tactical/combat vehicles aboard vessels bound for SWA. QASAS serving the port noted that due to the number of vessels to be loaded, and the duration of the loading activities, the stevedores and dock crews became quite skilled, resulting in relative speed as well as safety. On occasion, however, crews had to be cautioned against their tendencies to load ammunition in a hurry by short-cutting bracing and blocking procedures or simply trying new, ineffective techniques. Beyond the effort at speed, the most problematic

occurrence at the port of Nordingham appears to be organic ship crews. Many crew members had not been told of their mission before they arrived in Nordingham. And when they realized their cargo and mission, many of the crewmen, frequently of Korean, Japanese, or Greek origin, would refuse to work with the ammunition. It seemed that the crews were afraid of their cargo, and had not properly had their fears allayed by an explanation of ammunition safety factors. According to maritime law, if a crew is not informed of their intended cargo upon starting to sail to pick it up, they receive paid tickets back to their port of debarkation. Thus, many of the crew members asked German police to take them to airports so they could arrange flights home. And obtaining new crews in such circumstances was not always easy.[93]

Yet little delay occurred in the movement of vessels from port. Working on a 24-hour schedule, Nordingham personnel could load a large, three-hold cargo vessel in two and a half to three days. Some delays did occur, however, in correcting the stowage of uploaded vehicles before their transport to SWA. As in the case of CONUS activities, some commanders apparently suspected they would need to fight their way ashore in Saudi Arabia and sought the munitions preparations to do so. Thus, they frequently ordered tactical/combat vehicles excessively uploaded, an order that QASAS had to rectify and explain against to avoid the continuation.[94] Overall, however, QASAS deployed to OCONUS ports of ammunition embarkation noted a relative smoothness of operation.

And while safety, celerity, and visibility were always concerns of dock crews, QASAS, AMCCOM, AAPs, arsenals, and HQDA, truck, railcar, and ship were not the only means of transporting ammunition to SWA. In limited instances, ammunition and explosives were transported via aircraft. And as might be expected, the federal government had voluminous instructions on its proper handling. When deploying individuals had been issued their basic issue load at their home station, they were permitted to transport it in their ruck sacks, field packs, duffel bags, etc., when flying in support of ODS on cargo aircraft or passenger-carrying aircraft operated by the Civil Reserve Air Fleet (CRAF), U.S. civil aircraft not in the CRAF program but operated by a carrier identified to the DOT by the DOD, or foreign aircraft made available to the U.S. government to support the deployment. Such baggage, however, had to be stored in the aircraft's baggage compartment and could not be personally transported in the passenger compartment. Doing such, obviously, creates the potential for a serious incident. Furthermore, not all anticipated problems concerned passenger safety. Noncompliance with briefing requirements makes it difficult for loading personnel to identify incompatible hazardous material, places crew members at risk, and makes it impossible to brief air traffic control personnel on the hazards aboard a given aircraft.[95]

To enhance safety, troop commanders were required to brief aircraft commanders, or their designated representatives, on all hazardous materials placed aboard SWA-bound aircraft. Yet, this safety procedure was frequently omitted in the race to get men and materiel into theater. To counter this omission, the commander of FORSCOM (United States Army Forces Command) issued troop commanders a message detailing the need for the briefing and setting forth a statement format for use in the brief. Troop commanders were instructed to prepare a hazardous material statement for both himself and the aircrafts' commander. The commander's statement declared simply, "I certify the following hazardous material(s) and quantity(ies) are contained in the baggage of personnel for whom I am the troop commander:," followed by a listing of the material, its class, and quantity. He was to sign and date this statement as well as provide a similar one for the aircraft's commander which declared that, "I certify that I have been briefed in accordance with AFR (Air Force Regulation) 71-4, paragraph 2-1, on the class(es), quantity(ies), and location(s) of hazardous material contained in troop baggage." This statement was also to be signed either by the aircraft commander or a designated representative thereof. The statements could be prepared on plain bond copy, could be legibly handwritten or typed, and were to be prepared in duplicate for each flight. Loading agencies were to attach one signed copy of the statements to the aircraft commander's manifest and retain a signed copy for station files. Units were reminded by the commander's message that failure

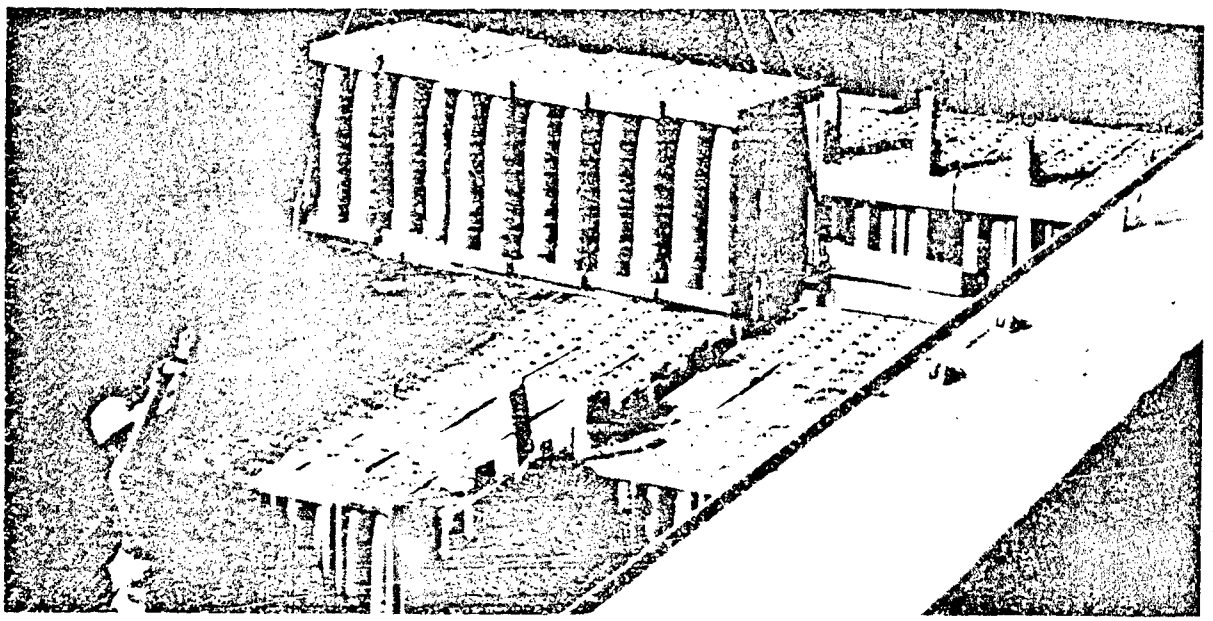
to comply with the directions could result in severe civil penalties against personnel involved and suspension of the waiver which allowed the use of commercial aircraft. This, of course, could severely impact the ability to support troop movement.[96]

In actuality, a very limited quantity of AMCCOM-directed conventional ammunition arrived in SWA via commercial flight, carried by deploying servicemembers. The majority of AMCCOM's 620 thousand short tons of ammunition deployed to the Persian Gulf reached its destination in the hold of a vessel. A most significant, albeit limited, quantity of ammunition was air freighted there as part of the Desert Express. High priority shipments, especially those called forward by ARCENT (Army Central Command), which had lost their placement in the holds of vessels bound for SWA in the ship shuffle of the docks frequently arrived in the desert via a government-owned and operated aircraft. Operating from either Dover or Charleston Air Force Bases, the Desert Express flights departed CONUS at the rate of one per day until the commencement of the air war in mid-January 1991 when they increased to two per day. Ammunition air freighted to SWA on government-owned and operated planes, and not in the specific possession of deployees, did not face the same rigorous procedures prior to departure that commercially carried troops and ammunition did. However, AMCCOM and HQDA in general faced a potentially more rigorous challenge. As Desert Express space was quite limited, ARCENT-initiated orders from AMCCOM competed with other commands, and, indeed, other services for space. Ultimately, the army was allocated 15,000 pounds of equipment, five pallet positions, or 2,500 square feet for each daily flight, all predicated upon the general nature of the shipment. The air force accepted responsibility for discerning whose requests warranted priority.[97]

Regardless of the numerous, delineated problems in preparing ammunition for shipment, arranging for proper transportation from AAPs and depots to deploying units, both at ports and home stations, and to ammunition ports, as well as in finding adequate skilled laborers to load vessels, and in scheduling ship transportation, not a single required delivery date (RDD) for ammunition shipment from CONUS was missed during the entirety of ODS.[98]

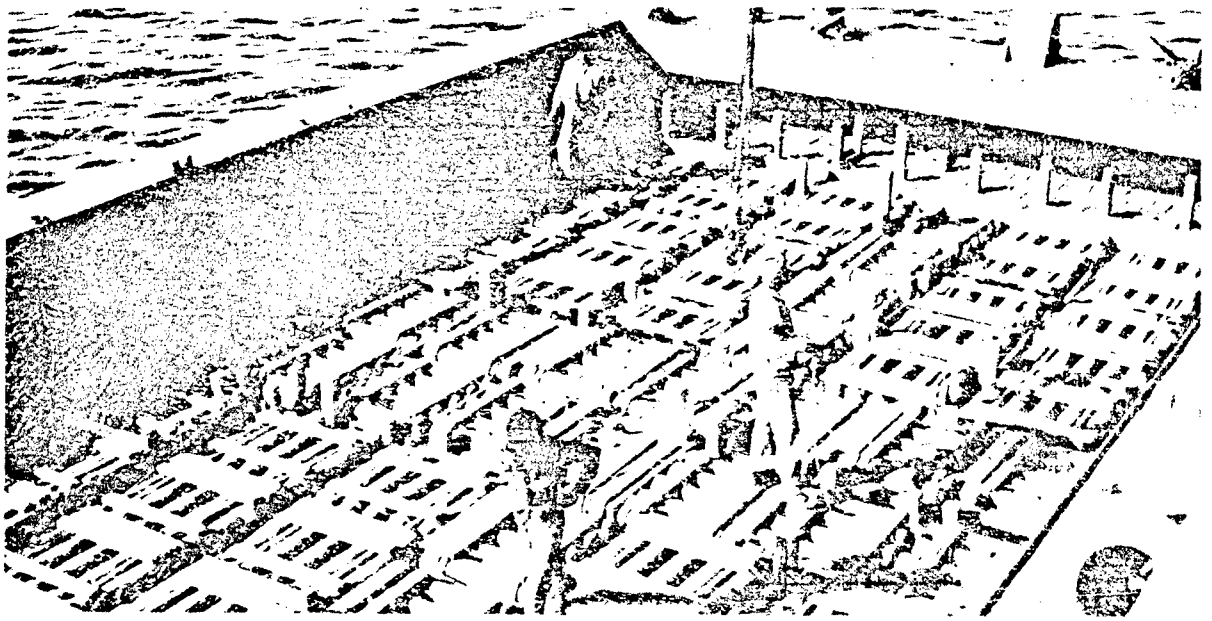
From the ammunition ports of MOTSU at Southport, NC; Earle, NJ; and Concord, CA; as well as the commercial ports of Beaumont and Houston, TX; Wilmington, NC; Jacksonville, FL; Bayonne, NJ; and Savannah, GA; and numerous OCONUS sites, and the Dover and Charleston Air Force Bases; a plethora of ammunition traveled to the seaports, and occasionally airports, of SWA. Al Jubayl and Ad Dammam served as the only two Saudi Arabian ports of debarkation, although the air force on occasion used ports in the United Arab Emirates and Bahrain. From the ports of debarkation, as well as the assorted air facilities, ammunition was transferred to inland, desert theater storage areas (TSAs). King Khalid Military City (KKMC), Al Artawiyah, Al Jubayl, and Dhahran all served the allied coalition as TSAs. And from the TSAs, ammunition was forwarded to ammunition supply points (ASPs), and from there to the deployed units arrayed against the minions of Saddam Hussein.[99]

Just as they had served their nation at the home stations of deploying units, at commercial as well as ammunition ports in CONUS, and assorted OCONUS ports, QASAS toiled to make the process of unloading ammunition from vessels and transshipping it to TSAs and ASPs for storage and future dispersal as safe and efficient as possible. Approximately 60 QASAS served in SWA; many QASAS provided expertise at CONUS facilities either before or after their Southwest Asian tours. And just as they did at the CONUS sites, QASAS observed and commented on the proceedings, seeking to praise that which was efficacious, and improve that which was deficient. One observation made by a number of the men and women deployed to SWA concerned the quality of the Saudi ports. The consensus noted that security problems were non-existent at Ad Dammam and Al Jubayl, and that the ports were well-appointed, even over-constructed in consideration of the pre-war requirements of the ports. Notwithstanding the quality of



Southwest Asian ports frequently did not possess sufficient crane capacity for the heavy loads of ammunition they were called upon to move. By reinforcing the horizontal support of this sling, servicemembers were able to increase its lift capacity by 50 per cent.

During Operations Desert Shield and Desert Storm, AMCCOM dispatched 620,000 short tons of ammunition to Southwest Asia. All ocean-transported ammunition passed through the ports of Dammam, as illustrated, or Jubayl. Local laborers frequently aided in the downloading of vessels.



the ports and their security, the facilities did not always have sufficient quantities or varieties of unloading equipment and thus backlogs of vessels awaiting unloading occasionally developed.[100]

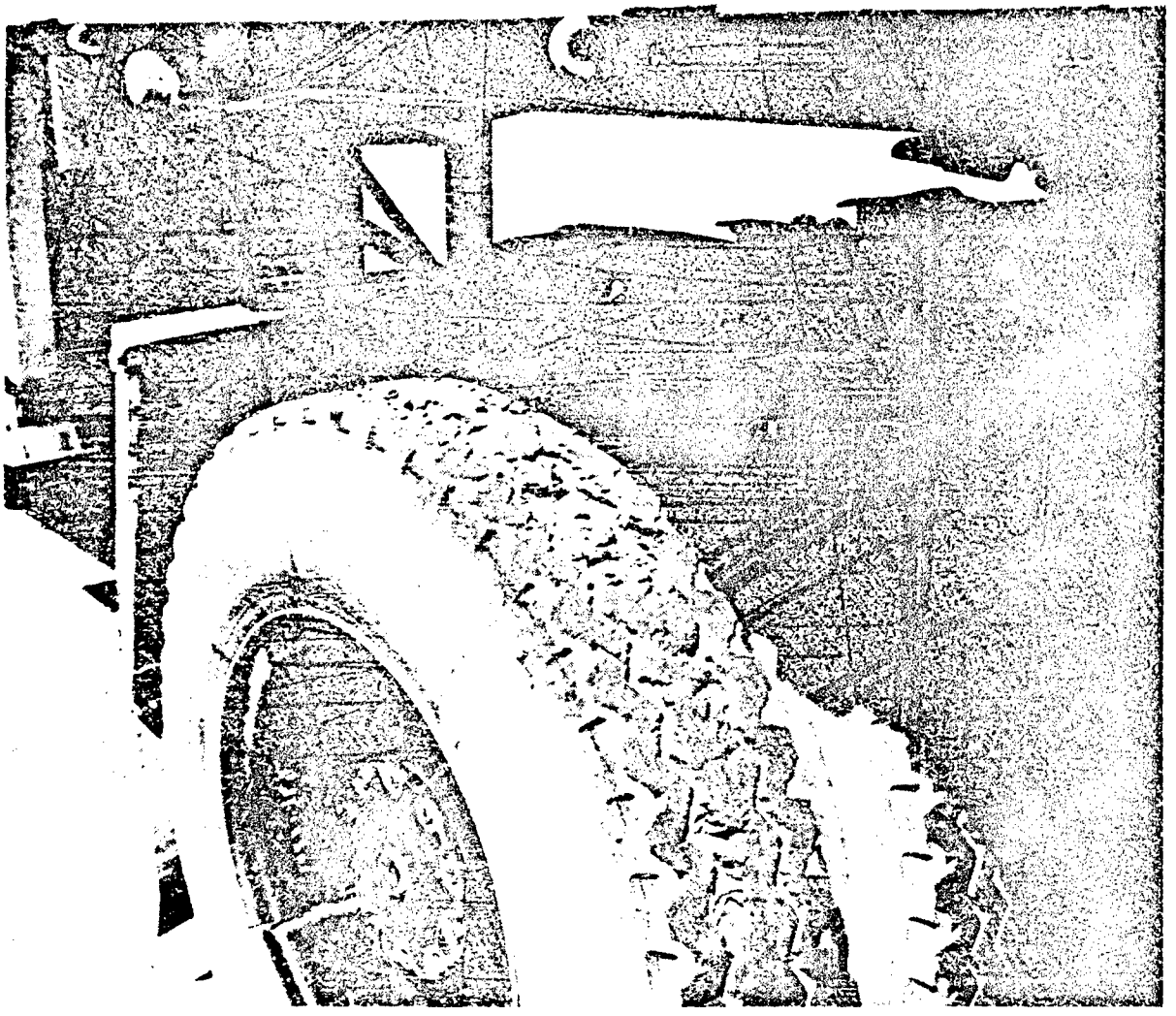
Problems, however, in the Southwest Asian theater of operations occurred for the QASAS when they realized that initially only third-world nationals with contractor vehicles were available to transport munitions from the ports of Ad Dammam and Al Jubayl to the TSAs and ASPs. The United States military transportation assets in SWA had all been diverted to carry equipment and supplies, and the vehicles available for ammunition transport did not approach the U.S. standards. A major problem involved the lack of strapping to hold ammunition pallets on truck beds. In at least one instance, a nationalist-loaded truck had not even left the port area when its entire load of bombs shifted, and its pallets skidded across the metal truck bed, nearly falling to the ground. And even with the purchase of tie-down straps from Saudi sources, and the importation of even more from U.S. suppliers, there never seemed to be quite enough to ensure that trucks would arrive at their off-road locations, intact. Additionally, trucks frequently had tires so bald that their cording was exposed to the multitudinous hazards of desert travel.[101]

At the onset of Operations Desert Shield and Desert Storm, QASAS did not have the luxury of always adhering to the letter of the regulation concerning ammunition transport. Given ideal conditions, they would simply have refused to utilize the third-world nationals and their vehicles, preferring to wait for allied military transportation assets, or the correction of contractor trucks to code. Yet in the early hectic days, this option did not exist. Thus in order to achieve the delivery of needed training and defensive rounds with some degree of safety in the urgent days of late 1990, QASAS bent the rules of ammunition transport. Bending the rules included arranging for the initial ill-tied truck convoys to be headed and trailed by a Saudi security force with an American in each vehicle. Contractors were also provided with fire extinguishers. And in the case of extremely worn tires, QASAS determined that if tread still existed on the tires the contractors could still haul ammunition. They simply lessened the load to 45,000 pounds.[102]

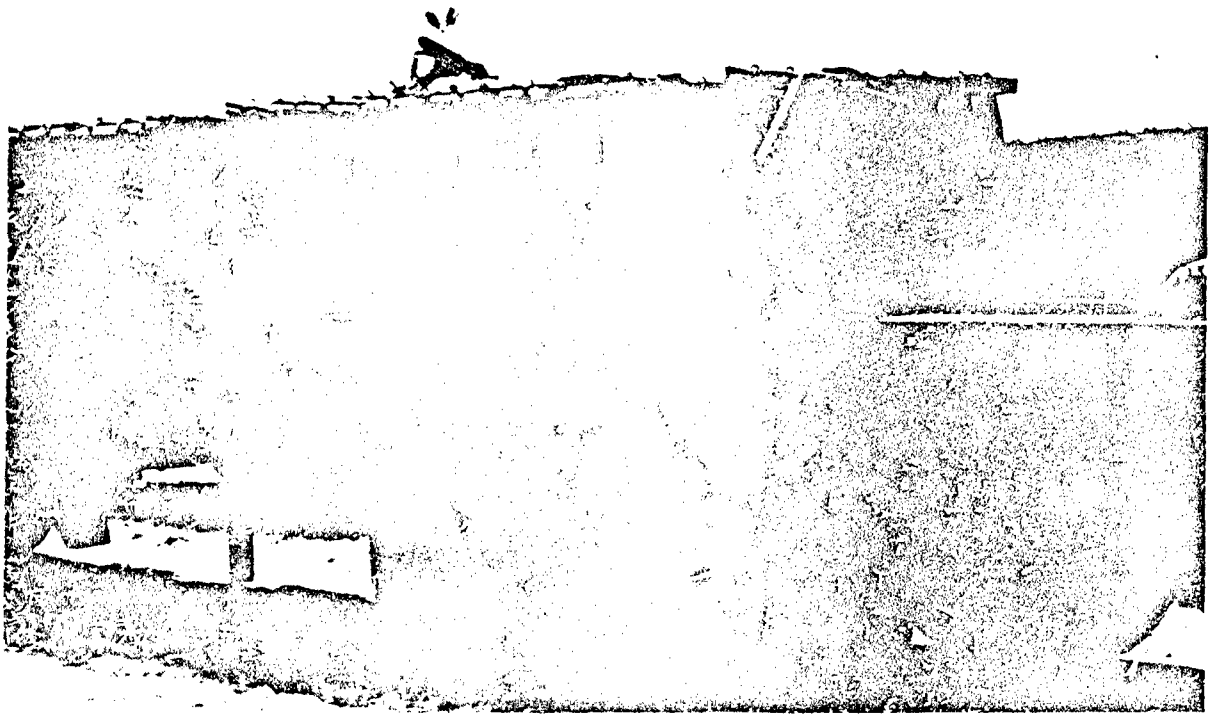
Third-world contractor personnel also provided the QASAS with difficult moments in their race to the desert. Frequently QASAS would discover, much to their consternation, that drivers of ammunition trucks cooked pots of food and smoked in the shade of their trailers. Prior to the war, many of the contracted truckers lived in their vehicles and used a large box mounted underneath their trailers to store food, cookers, gear, etc. The QASAS faced a constant battle to get such drivers to cook and smoke away from the ammunition. And of course, as QASAS Paul Stone noted, they did, at least while they were being observed. Yet once the watchful QASAS turned to other matters, most of the third-world nationals would return to their previous practices. After discerning the problem, Saudi personnel tried to take the cookers away from the drivers, but soon realized that this was not a viable solution: the drivers, who frequently lived in their vehicles, often had to wait several days to a week to get a destination call for a specific load to carry inland, and needed to use their cookers during the waiting period. Only when the Saudis removed several drivers from the port area, thereby decreasing the number of available transportation assets did the services act. The 7th Transportation battalion then set up tents away from the ammunition stocks, and told the drivers to do their cooking and smoking there.[103]

Due to the initial shortage of transportation assets, native and allied military, unsafe vehicles could simply not be dismissed but rather had to be carefully marshalled in an effort to relieve the tremendous port congestion. Substantial port congestion occurred for a number reasons. One reason involved the lack of an operations plan (OPLAN) for SWA. At the onset of ODS, the Department of Defense did not have a functioning plan for military operations in the region. The standing plan was one drawn up in the 1960s, and updated through the 1970s, in fear of Soviet aggression in Iran, then an ally of the United States. And despite the presence of prepositioned military stores aboard vessels afloat in the Indian Ocean, the majority of U.S. political, tactical, and strategic interests focused on the possibility of fighting a ground war against

Contract vehicles used to transport ammunition in Southwest Asia from ports to ammunition supply points were frequently not up to United States Army specifications. Bald tires or those missing sections of tread resulted in procedural changes to ensure American servicemembers had sufficient supplies.



Beyond weather conditions, balding tires, and unschooled third-world drivers, AMCCOM QASAS in SWA also faced a shortage of tie down straps. In their absence, loads could, and did, shift dangerously enroute to forward-deployed servicemembers.



the Soviet Union and members of the Warsaw Pact on the broad plains of central Europe. With regard to such a fear, DOD, DA, and AMCCOM were not truly prepared to fight a war in the deserts of SWA against the forces of Saddam Hussein. AMCCOM's support mission had focused primarily on Europe, and to a lesser extent on Korea. The likelihood of SWA conflict was seen in a "brushfire" scenario: few personnel and a limited amount of equipment for a short involvement. Accordingly few AMCCOM personnel had spent time in the region, or had become otherwise familiar with it. Thus, a good timephased plan to place logistics support staff and ancillary equipment in theater did not exist. Nor had the points placement for men, materiel, ammunition supply points, or theater support areas been determined.[104]

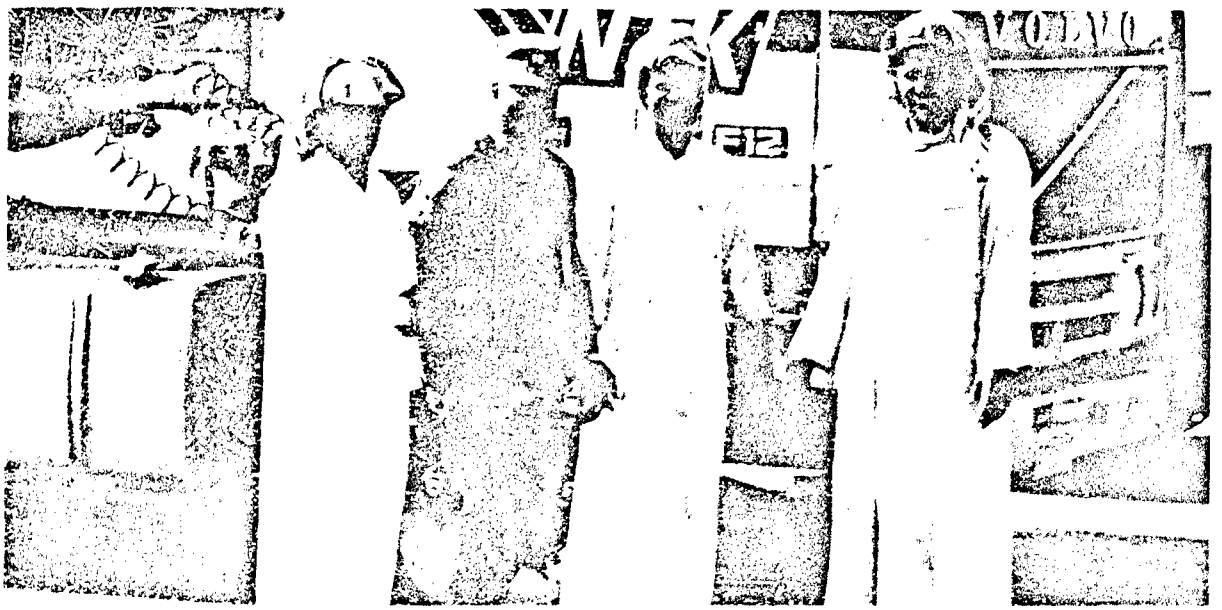
Accordingly, when the first of the pre-positioned vessels arrived in Saudi Arabia a mere ten days after President George Bush's declaration of troop deployment, port personnel had no idea where units were going to be or even where they would be supplied from. So from the docks, ammunition, as well as other materiel, was transferred to nearby holding points while units got in country, picked up their equipment, and then moved on to their stations to await the arrival of additional items. In the holding areas, the arriving stockpile of ammunition, as well as other materiel, lost visibility; ultimately accountability also suffered.[105]

At the conclusion of the successful operation, with the benefit of hindsight, at least one QASAS became quite critical of the proceedings he had witnessed. According to him, the admittedly inadequate planning could account not only for the loss of visibility and accountability, but also in the unsafe billeting of arriving units in too close of proximity to ammunition stores. A combat service support structure, he believed, needed to be instituted with, or even prior to, the arrival of the fighting forces. Such a support structure might have prevented the unsafe stockpiling of ammunition at the docks by arranging for its appropriate storage or transfer to theater supply points, ammunition supply points, and specific units, as well as kept the voluminous collection of ordnance and ammunition visible, and accounted for. In view of the obviously uncertain duration of the forthcoming conflict and the ill-defined term "basic load", units had for all intents and purposed a blank check to obtain ammunition. And accordingly, units frequently took as much ammunition as they could, and just as frequently improperly uploaded it in their vehicles in eliminate the problem of carrying wooden boxes, cardboard, and fiber containers. It was not until the 321st Materiel Management Center (MMC) arrived in SWA in October 1990 that accountability apparently became a concern, according to the disgruntled QASAS. Yet even after the unit's arrival, their system of accounting was not functional until November 1990 when it attempted to make visible the iron mountain that had been arriving in country since mid-August. He commented that the structure was much akin to opening the doors of a bank at 9 o'clock in the morning, but not bringing in the tellers until noon.[106]

Beyond the loss of accountability and visibility, as well as the inefficient storage of ammunition on and near the docks, the lack of an effective OPLAN also resulted in inadequate equipment, in addition to the shortage of transportation assets. QASAS noted that the forklifts supplied by the Saudi government were not available in sufficient quantity or quality. Indeed, some of the forklifts became so overloaded in the attempt to rapidly unload vessels and transfer pallets of ammunition that personnel occasionally sat on the back end of the vehicles to keep them in rough balance. A shortage of hand tools also existed in SWA. As one QASAS observed, "it was difficult to even find a hammer," let alone banding gear for pallet loading and repair. Crews also lacked the appropriate equipment and packing to properly repalletize ammunition for movement in country after it had arrived uploaded on combat and tactical vehicles. Additionally, as had been the case in loading trucks, railcars, and vessels in the United States, a distinct shortage of skilled labor existed. Several QASAS noted on their return CONUS that third-country nationals hired to offload ships had not been trained at all to do the work, and so had no idea how to perform their mission but attempted to do their best with the available equipment.[107]

Todd, a child in a local Somali village, was among the many who benefited from AMCCOM OASAs arranging transport of ammunition from the ports to remote forward supply points. Todd's days frequently smoked, took tea, and cooked in the shadows of their mother's huts. Todd's family was typical of society and customs.

Contracted trucks and drivers moved much of the 620,000 tons of AMCCOM directed ammunition in SWA. OPT Weaver, 1st Transportation Group, Fort Eustis, VA, created a number of third world drivers.



A more critical shortage involved safe, sufficient ammunition storage in the raging heat of SWA. Reflective of the lack of an established OPLAN, no improved storage facilities had been provided away from the docks. And while ammunition and other assorted materiel accumulated on the docks, losing visibility and accountability by the minute, simple flat spots in the desert, sufficiently distanced from similarly chosen flat spots, were designated as storage sites -- TSAs or ASPs. No improvements existed, initially, and the ammunition bore the direct brunt of the Saudi sun.[108]

Indeed, as the war took shape in the Persian Gulf, the rather harsh environment became a concern of AMCCOM's quality assurance personnel. Of particular concern was their belief that the design and development community did not completely understand the true climatic conditions and the implications of these upon munitions in open storage in An Nafud, the Saudi Arabian desert. Based upon information gathered in the deserts of SWA and from testing conducted at Yuma Proving Ground (YPG) during desert storage testing conducted in June 1990, a data base had been constructed. From those tests, quality assurance staffers noted that the average daily high temperatures during the period from 1 May through 30 September ran from 105 to 110 degrees Fahrenheit. During such a five month period, 70 percent of the days could be expected to exceed 100 degrees. During the peak months of June through August, some areas could expect to exceed the 100 to 110 degree mark 100 percent of the time. Yet the maximum ambient temperature could not be expected to exceed 126 degrees.[109]

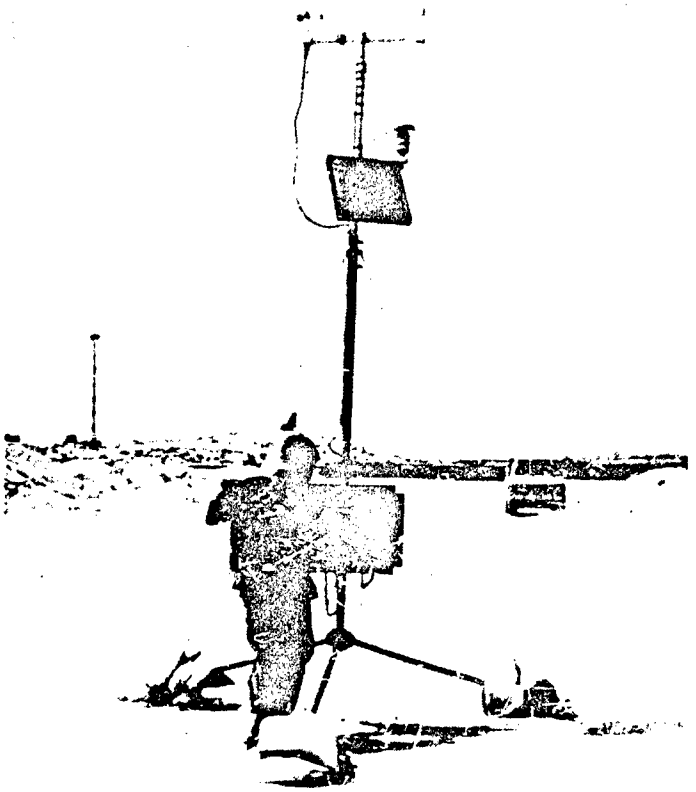
As a result of solar radiation, ground temperatures could be expected to reach 140 to 150 degrees Fahrenheit, and the surfaces of exposed containers and projectiles could rise to 170 to 185 degrees. Also as a result of solar radiation, temperatures inside containers and projectiles rose to 150 to 160 degrees. But more importantly, the duration of these high temperature conditions in the center of ammunition was extensive; six hours at temperatures greater than 140 degrees, and twelve hours at temperatures exceeding 120 degrees could be expected. The effects of solar radiation could be nearly eliminated by shading suggested the quality assurance personnel. For the temperatures of properly shaded items would rise only 0 to 10 degrees higher than the ambient temperature.[110]

Beyond solar radiation and ambient temperatures, several other aspects of the natural environment of SWA caused quality assurance personnel anxious moments. Studies of the area disclosed that its temperature could fluctuate wildly during the course of a day. Variations of 40 degrees Fahrenheit are possible with fluctuations of 20 to 30 degrees relatively common. The maximum temperature variation recorded was one of 20 degrees in a mere three hours. Coastal variation, however, is usually considerably less with only 10 to 20 degrees difference between minimum and maximum temperatures.[111]

Several other natural surprises awaited soldiers deploying to the Persian Gulf and bedeviled quality assurance personnel concerned with ammunition stores. Static electrical charges up to 150,000 volts can occur during dust storms, and the highest dew points in the world occur along the Red Sea and Persian Gulf. The region also sports the highest ocean salt content in the world. Subsequently, greater chloride content in the air at coastal storage sites created a prime environment for rapid corrosion of metals and non-metallic materials. Such were the physical burdens facing the design and development community as concerned the environment for ammunition, and which in turn challenged the QASAS on site as well.[112]

Personnel from the United States Army Defense Ammunition Center and School (USADACS) reacted to their understanding of SWA's natural environment with celerity. By late August 1990, USADACS staffers addressed their concerns regarding the environment in a memorandum to AMCCOM's Commanding General MG Paul L. Greenberg. They noted that the need to deploy ammunition to Saudi Arabia and the adverse effects that prolonged high storage temperatures were likely to have on the operational reliability and the safety of the ammunition caused them concern. Their past experiences and subsequent

The environment of Southwest Asia caused innumerable concerns for AMCCOM's QASAS deployed to the desert. Heat, humidity, static electricity, high dew points, and ambient salt content all warranted QASAS attention. Mr. Stephen Dragan, United States Army Defense Ammunition Center and School QASAS, set up this weather station in Theater Support Area (TSA) -1 to closely monitor conditions.



exhaustive studies had taught them that high temperatures accelerated chemical reactions as well as physical changes, most probably resulting in reduced performance and safety. Particularly susceptible to change in the harsh environment of prepositioned ship (PREPO) holds, where the first ammunition to arrive in SWA had been stored, were 4.2-inch cartridges and M-77 time fuzes. They also noted that Picatinny Arsenal studies, as well as Australian Army studies of the early 1980s, further identified serious problems associated with prolonged exposure of ammunition to high temperatures.[113]

Ruefully, USADACS staffers noted that due to their deployment, no fixes could be offered for the ammunition which had been stored on the blistering PREPO vessels. And, indeed, it was entirely conceivable that in the unloading and movement of the PREPO ammunition to the newly-established ASPs that they would be exposed to even higher temperatures than they had already experienced. Thus not only could personnel expect problems with PREPO ammunition, but also with supplies recently transported to the blazing desert. Accordingly, USADACS recommended that tarps could be utilized as an effective means of reducing temperatures, and offered the "best" alternative for the moment. And although any

temperature reductions were welcome and would undoubtedly buy time in the form of shelf life, storage temperatures were going to be high, and safety, as well as reliability, problems were going to result. Armed with such information, USADACS urged the undertaking of "prudent" actions, or at very least their planning, to avoid potentially dangerous consequences should the ammunition continue to be exposed to high storage temperatures for extended periods, and should it ultimately be needed for combat operations.[114]

Accordingly USADACS personnel recommended that an *ad hoc* team of experts be formed to develop a detailed plan of action to overcome to the extent possible the environmental issues that would beset AMCCOM. Specifically, they recommended the development of an intensive surveillance program for ASPs and basic load stocks to validate condition codes, determine deterioration rates, predict remaining service life, and make plans for resupply. In support of the objective proposed, USADACS recommended that surveillance teams, at the bare minimum, should monitor the ASPs and selected basic loads to gather environmental data, review inventory and identify potential problems based on PREPO and other environmentally oriented experiences, determine the scope and frequency of the required program to include in storage surveillance, laboratory and ballistic testing, and make initial qualitative assessments. They were also to forwarn users of potential problem areas pending the implementation of testing, and determine projected ammunition replacement requirements. USADACS further recommended that ammunition personnel consider and develop innovative and inexpensive storage techniques to reduce the heat's effect on ASPs and basic load ammunition to extend its service life.[115]

USADACS was not the only organization within the hegemony of AMCCOM to concern itself with the effects of climate upon ammunition supplies. Within weeks of the start of Operation Desert Shield, Picatinny Arsenal, located in New Jersey, forwarded a memorandum for distribution to AMCCOM members. The memorandum made recipients aware of the arsenal's collection of Southwest Asian climate data. The arsenal could provide, on request, information on 119 sites in Jordan, Iran, Syria, Saudi Arabia, the United Arab Emirates, Yemen, Lebanon, Bahrain, Israel, Pakistan, Oman, Cyprus, and Afghanistan. It enclosed a listing of the principal cities of Saudi Arabia, Iraq, and Kuwait along with the number of days that each city could be expected to exceed the 100 degree Fahrenheit mark, and the 90 degree mark for the 1 May to 30 September time period. In addition, Picatinny could provide a comprehensive stack of references (technical reports, military standards, Army Regulations, etc.) for use in characterizing and assessing the climatic conditions in the Middle East.[116]

The memorandum also included open storage information for ammunition and guided missiles in the heat of the desert. Noting that the storage of ammunition and guided missiles at high temperatures which would be experienced during Operation Desert Shield could have a serious effect on their functioning and safety, the arsenal's personnel urged that every effort must be taken to reduce the temperatures at which the ammunition was stored. And accordingly, they provided valuable information on the storage of ammunition.[117]

Among the information provided by Picatinny Arsenal personnel was their belief that the upper limits indicated for various ammunition items in their respective TM-43 series manuals were misleading since they did not address the consequences of long term storage, intermittent storage, temperature rate of change, etc., regarding the upper limits specified. Some limitations specified were qualified by stating that the temperature should not be reached or exceeded for periods of more than a given number of hours or days. However, the consequences of exceeding the limit in terms of duration, frequency, and cumulative effect were not known, or reported. Temperature limitations specified in the TM-43 series manuals vary significantly, noted Picatinny staffers, from 160 degrees Fahrenheit for many artillery items to 115 degrees for certain grenades. These limits were for ambient temperatures only, and did not reflect that dependent upon the storage configuration, the level of solar radiation, etc., the internal temperature of the munition

item could be considerably higher than the air temperature, thus grossly exceeding the permissible limit specified. Unfortunately, no practical means of measuring internal temperature existed for field conditions.[118]

Taking such matters under advisement, the arsenal made specific recommendations regarding the storage of ammunition in the blazing sun of SWA. All ammunition stored in the open was to be tarped or shaded with the lightest colored tarps or nets available. The color would aid in reflecting the sun's rays. Additionally, for the best protection of ammunition, all tarps and nets were to be erected with a minimum of 18 inches clearance above the ammunition, and in such a manner as to allow for their quick lowering in the event of high winds.[119]

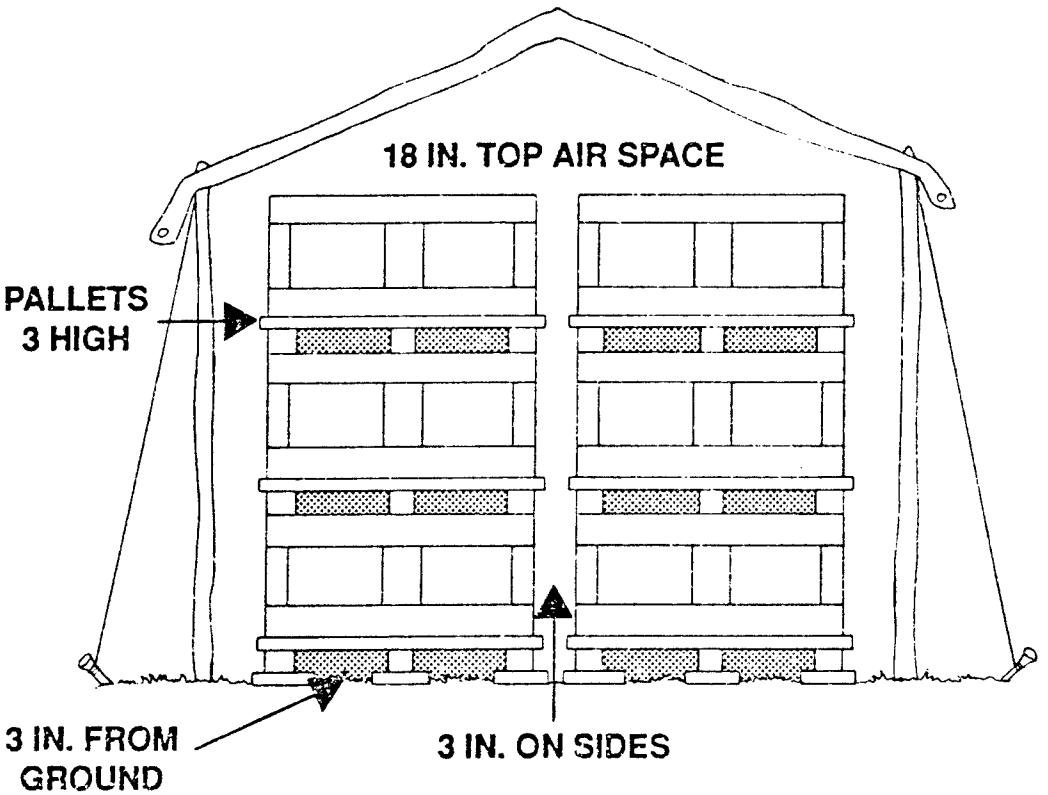
Picatinny personnel also outlined provisions for the safe storage of ammunition on the ground. All ammunition on the ground was to be placed on pallets or dunnage to allow a minimum of three inches clearance above the ground. Ammunition stored on sandy soil was not to be stacked over three pallets high in order to ensure stack stability, although stack heights could be altered to meet local conditions. Additionally a minimum of three inches of clearance on all sides of stacks was to be provided for ventilation purposes. All white phosphorus (WP) projectiles were to be stored with a base down orientation, as it could melt and shift causing a ballistically unstable projectile. And concerning WP, units were reminded by the memorandum that firing temperature limits existed for the D528 and 155mm SMK WP M825 varieties of the device. Normal maximum firing temperature limits were 145 degrees Fahrenheit; however, some lots manufactured from January 1985 through May 1986 were restricted to firing at temperatures below 110 degrees. Lot numbers beginning PB-85A through PB-86K were affected.[120]

The proper covering and shading of ammunition should be prioritized, suggested the Picatinny folks, according to the need to minimize temperature in order to ensure the serviceability and safety of the item. Those items more susceptible to the effects of high temperatures and humidity, e.g., propelling charges, fuzes, pyrotechnics, guided missiles, and rockets, should be given the highest priority for proper protection. Improper covering ammunition in the desert environment with a tarpaulin placed directly on the ammunition would cause the item to experience higher temperatures than if it were not covered at all. And unpalletized ammunition should be provided with as much ventilation between individual rounds, boxes, and containers as possible. In all cases, blown sand should be cleared away from ammunition stores.[121]

Information was also provided for ammunition which was to be temporarily stored on vehicles. All armored vehicles with ammunition aboard were to be left open to the maximum extent possible to allow for ventilation. Similarly, wheeled vehicles with closable compartments where ammunition was stored were to be left open. Trucks with open cargo areas were to have pallets or ammunition placed with space between individual boxes or pallets for purposes of ventilation. And vehicles loaded with ammunition were to be parked to take advantage of any shade provided by buildings, sheds, or covered parking, providing that the safety of personnel would not be violated.[122]

And with regard to ammunition packaging, Picatinny personnel recommended that as relatively high humidity prevailed in the region, and varied greatly throughout the day, ammunition should remain in its packaged configuration until immediately prior to use. Items opened and not used should be repacked as soon as possible; desiccant was to be returned to boxes that originally contained it when the ammunition was repacked. But special care was to be taken that propelling charges, guided missiles, and rocket containers, or items packed in barrier bags were not to be opened until the last possible moment to avoid environmentally induced problems.[123]

Recommended Ammunition Storage Configuration for Operations Desert Shield and Desert Storm



Providing palletized small arms ammunition and fuzes with protection from solar radiation and shifting sands involved tarps, ventilation spaces, stacking restrictions, and stable foundations.

AMCCOM officials also realized that not all ammunition would rapidly reach the flat desert sites designated as storage areas, but would rather sit for a period in MILVANS and commercial containers awaiting forward movement. Yet the effects of solar radiation made the use of the metal devises thoroughly undesirable storage facilities of the last resort. And it was with this understanding that guidance was offered for the storage of ammunition in MILVANS and other containers. If forced by circumstances into use, the containers, offered DA officials, should be shaded by a cover at least 18 inches from their top, sides, and ends to allow for the free circulation of air. In order to minimize the containers' surface area exposed to the direct rays of the sun, they were to be positioned with the long axis oriented in an east-west direction. In this fashion, the low angle early morning and late evening sun would strike the smallest surface of the container, and maximum shading would be provided to the top of the container due to the very high angle of the sun due to the low latitudes. Doors should also remain open to permit ventilation when conditions and security permitted. Additionally, sand and or sand bags should be placed against the sides and rear of a container planned for extended use, but should not cover the container. Placing sand bags around the container would greatly limit the cover required by reducing the surface exposed to the sun. A 20 foot by 40 foot tarp would then adequately cover an exposed container.[124]

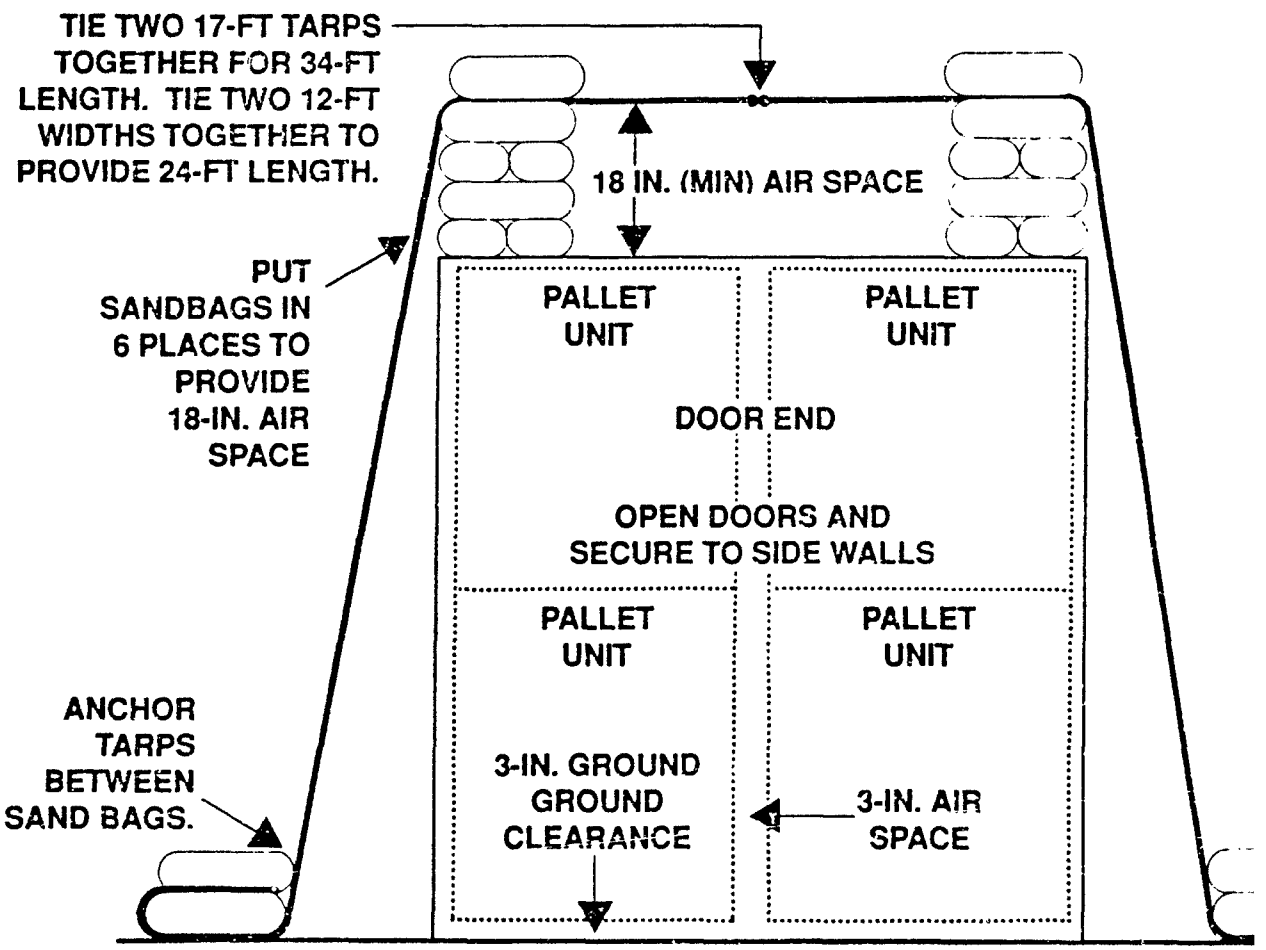
If no subsequent movement of the container was anticipated, DA officials offered that mechanical restraints, blocking and bracing, etc., could be removed. Blocking and bracing lumber could then be used to provide separation between the top/sides of the container and the cover used for shading. It also offered that the shading of containers should be prioritized so that the items most susceptible to heat deterioration, e.g., guided missiles/rockets, propelling charges, pyrotechnics, white phosphorus fill items, etc., were given first consideration. And as concerned the quantity distance safety factors that must always be taken into consideration in ammunition deals, MILVANS had to be viewed as an unbarricaded above-ground magazine. Thus separation distance among containers, and between containers and external exposures had to be determined accordingly to prevent the propagation of an unintended explosion from one container to another, protect personnel from death or injury, and protect equipment and facilities from damage. Reduced distances could only increase the hazard unless terrain features or barricades between containers were utilized to lessen the separation distance requirements.[125]

Earth-covered magazines could offer some respite for heat-stressed ammunition, when and where available. Testing of U.S.-designed, earth-covered magazines in Saudi Arabia revealed that when the ambient air temperature stood at 102 degrees Fahrenheit, and the temperature at ground level reached an unpleasant 130 degrees, the magazine itself stood at 99 degrees even though the door had been open for several hours. Yet such facilities were not readily available, or easily and rapidly constructed for the storage of U.S. ammunition. Nor were the tarps suggested by Picatinny personnel readily available. By the end of September 1990, some ASPs were still without tarps.[126]

In addition to the heat, high winds also became an obstacle to the safe storage of ammunition in SWA. As 1990 turned to 1991, AMCCOM noted in message traffic that the season for strong desert wind storms had arrived and must consequently be prepared for. Severe winds could easily displace the tarps or camouflage netting covering ammunition, making it more susceptible to heat, and just as easily sand could blow drifts between stacked ammunition, thus reducing accessibility and air circulation. Essential markings might also be obliterated by the incessant "sand blasting" action. Most importantly, sand accumulated on critical areas, or in gun tubes, could easily cause the ammunition to malfunction.[127]

In order to enhance ammunition safety in light of such observations, AMCCOM offered a number of suggestions. Ammunition should be left in its original packing as long as practical. Tarps and netting should be rigged to allow for their rapid lowering in the event of high winds as the air space created by their suspension could easily cause damage and displacement both to tarps and ammunition. The command

Recommended Ammunition Storage Configuration for Operations Desert Shield and Desert Storm



Properly protecting MILVAN-stored ammunition from the harsh environment of Southwest Asia involved tarps, open doors, sandbags, and an east-west long axis orientation.

suggested that small caliber ammunition should be stored in pouches, wraps, or sacks if the need arose to unpack them. It also recommended that materiel should be stored in such a manner as to reduce the effects of traditional prevailing wind direction. End-opening containers, such as those for 120mm cartridges or propelling charges, and critical markings should be protected from the direct effects of prevailing winds. Exposed materiel, i.e., separate loading projectiles, should be stored behind barriers. berms, or other stacks of packaged ammunition. Furthermore, AMCCOM advised that critical surfaces be cleaned with a soft, lint-free rag prior to assembly and/or loading.[128]

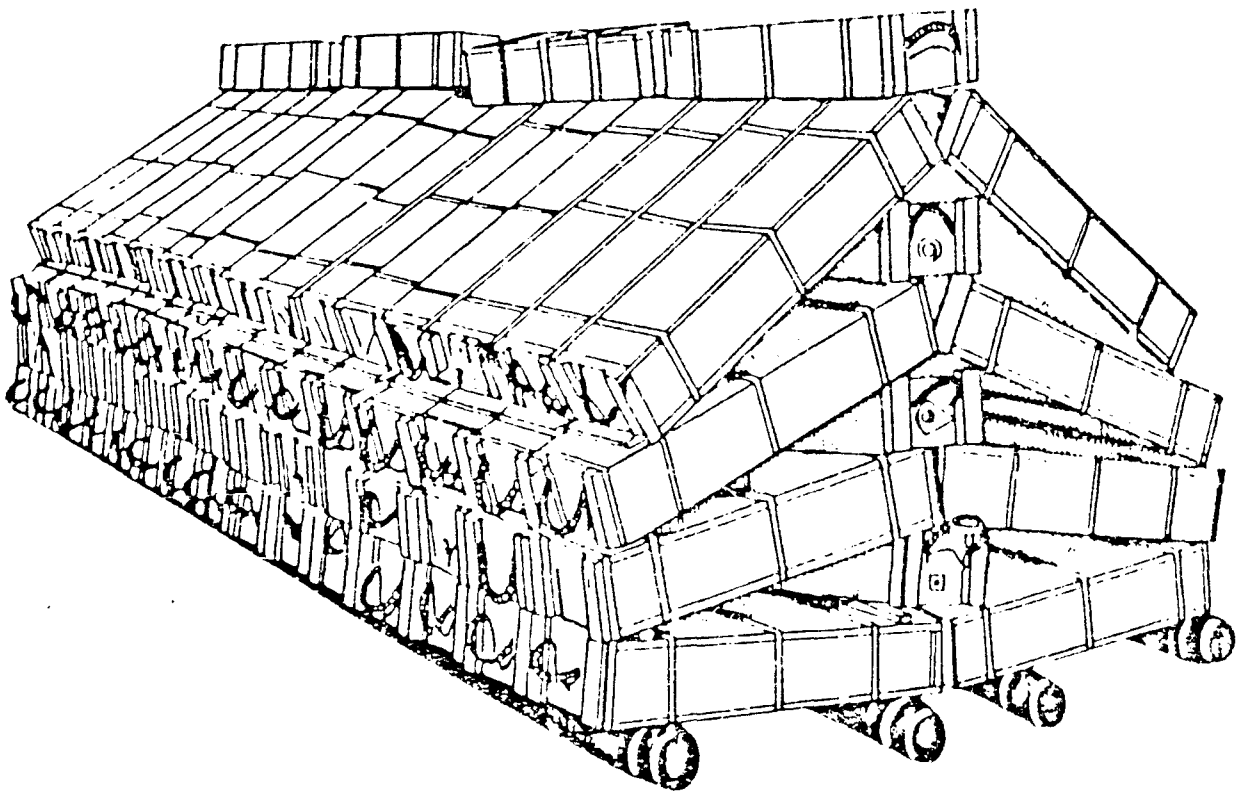
AMCCOM personnel also noted that with high winds and blowing sand came the danger of static electricity generation and dissipation. Electro-explosive initiated items, i.e., electric primed ammunition, blasting caps, 2.75 inch rockets, or guided missiles were be packaged, shorted out, or grounded as much as possible. Additionally, they advised that with the prudent and practical use of excess materials—dunnage, and packing—ammunition could be given even more protection. Empty fiberboard, or wooden or metal containers could be filled with sand and used to construct walls around exposed ammunition, or to provide a "snow fence" against the prevailing winds. Testing continued throughout Operations Desert Shield and Desert Storm in an effort to attain the best methods of ammunition storage possible.[129]

Regardless of the fears expressed at the onset of operations in the desert, an adherence to the policies rapidly set forth by Picatinny Arsenal, USADACS, and HQ, AMCCOM resulted in few weather-related, ammunition-oriented problems during the conflict. Regardless, some individuals felt that the operation could have proceeded somewhat more smoothly had information concerning the environment of SWA been available to them more readily. Accordingly, at the conclusion of the Persian Gulf War, AMCCOM's quality assurance staff recommended that before the possibility of another deployment arose that technical reference materials normally used by combat service support personnel be made more available to them. Specifically, ARDEC personnel noted that the job of receiving, handling, storing, and issuing huge quantities of ammunition had been immense, and that during the routine conduct of such activities technical reference material had frequently been referred to in order to correctly perform such functions as shipment and storage planning, control of ammunition suspensions and resirictions, as well as the performance of required inspections to insure the serviceability of the stocks. The available reference material consisted primarily of hard copy publications which could be hand carried by deploying personnel, both military and civilian. Yet, the recommendation was offered that efforts to field an automated Ammunition Surveillance Information System (ASIS) be continued. The need for such a portable reference information storage and retrieval system had been identified several years previous, but funding had never been allocated.[130]

Soldiers had also been handicapped to some degree in previous exercises—Bright Star and Preposition Ammunition—by their lack of information concerning the effects of environment. In such exercises, the degradation of equipment and ammunition performance had occurred. Product Assurance and Test Directorate personnel sought to prevent a reoccurrence of this and at the onset of Operation Desert Shield aided the Maintenance Directorate's Technical Publication's Division in the rapid production of three booklets; one each focusing on ammunition, chemical defense equipment, and armament. Approximately 179,000 copies of each booklet were printed for dispersment to deploying units. At the war's conclusion, Product Assurance and Test Directorate staffers recommended the development of booklets for use in other extreme conditions -- arctic and tropical, for example. It also urged that the booklets be available for immediate issue.[131]

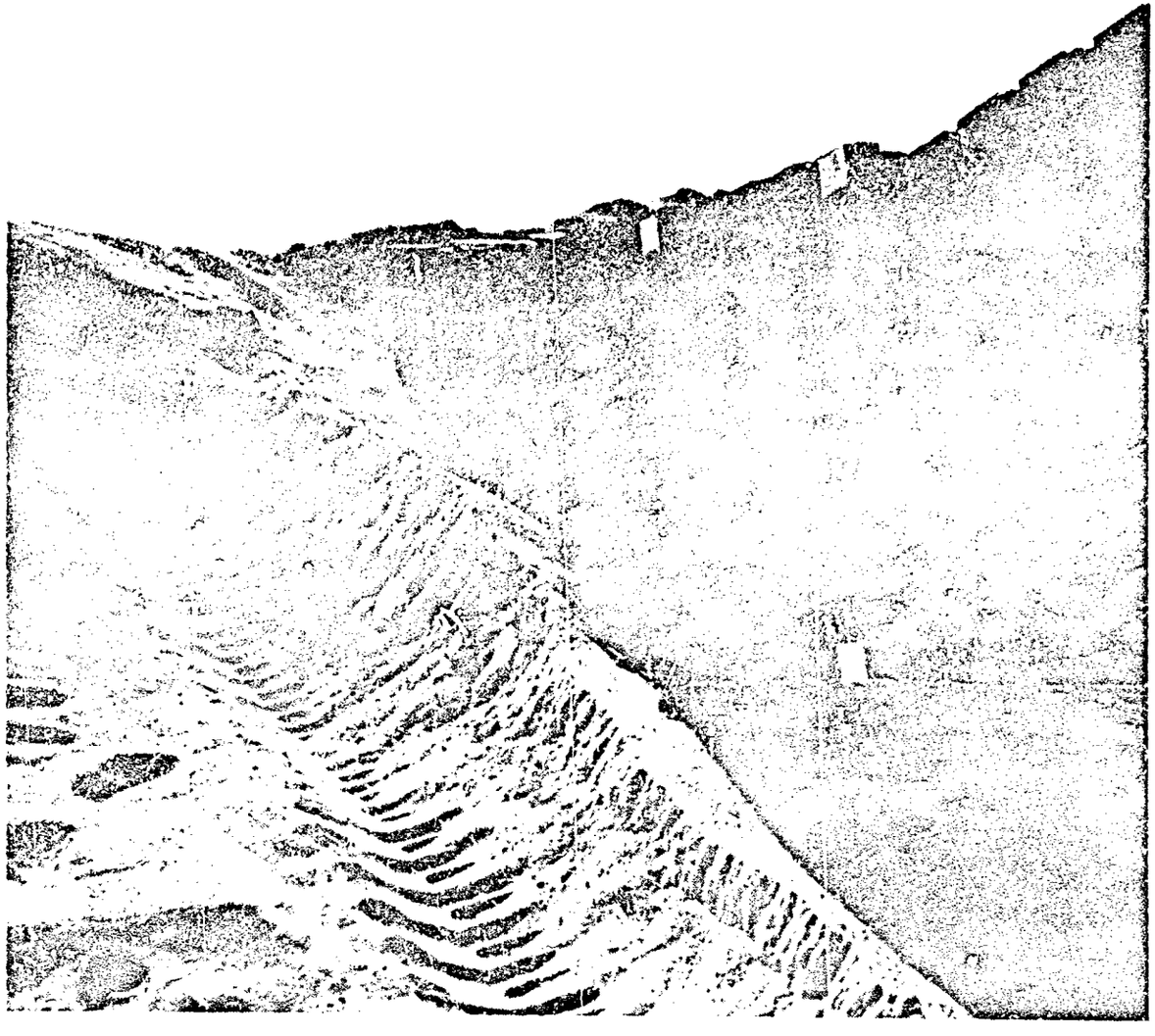
If these observations could rightly be called lessons learned from the experience of ammunition handlers in SWA, a few others must be added. Some QASAS reflecting on their experiences in ODS urged that they be better integrated into the military structure. Some had the feeling that they were always on the outside looking in as far as the military was concerned, and were attempting to train troops as well as

Recommended Ammunition Storage Configuration for Operations Desert Shield and Desert Storm



Tarping, as well as ventilation spacing, provided boxed artillery and tank rounds with the best, temporary protection from the effects of the searing desert sun.

Blowing sand presented AMCCOM's OASAS in the desert with numerous difficulties. Unprotected pallets of ammunition, as in the illustrated anti-tank mines, fell victim to reduced accessibility and air circulation, as well as the obliteration of lot markings by the "blasting" effect of blowing sand.



their commanders in the safe storage, transportation, and use of ammunition without any authority to insist upon configurations. Indeed some QASAS had the impression at the war's end that the military had actually perceived them as a hindrance rather than a help as their insistence upon safety had on occasion slowed down the handling of munitions, and also that as civilians they were not perceived as being fully deployable to the forward area or fully knowledgeable in military matters. QASAS ultimately had no authority excepting their powers of persuasion over military actions.[132]

In order to prevent the development of what some QASAS perceived as an adversarial relationship with the military units they supported, deliberation is being given to arranging for mobilization slots for ammunition specialists in tactical units. Advisors might also be placed on such levels as that of the division, the corps, and the battalion. Beyond saving time by having QASAS ready to deploy with their unit at the moment of mobilization and aiding in the development of a working relationship, such a proposal could easily save the federal government, and ultimately the taxpayer, a considerable sum. This could be the result if QASAS were available for mobilization TDA and could be assigned for a one year, unaccompanied tour of duty. While expenses on assignment would most probably remain much the same, funds currently expended on processing individuals through Aberdeen Proving Ground would be saved. Continuity could also be better maintained by the implementation of such a program.[133]

QASAS also suggested the implementation of a number of other programs to improve the deployment process. A significant number of their suggestions dealt with crucial communication links. As noted in a previous passage, the number of individuals recommending that better lines of communication be forged prior to future deployments was considerable. That the strained communications system had held up as well as it had was deemed little less than a miracle; it was noted as a "potential weak point" that might have proven disastrous had the Kingdom of Saudi Arabia not had a relatively substantial commercial telephone system in place. Despite the Kingdom's significant internal telephone structure, an Operation Desert Shield/Storm After Action Report observation warned against relying upon any host nation's telephone system. Doing so created a false sense of security and relative ease of operation, although initial struggles with MCI trunk lines forced an expansion to other carriers. An aftertaste of the potential for confusion with the delicate telephone structure occurred when the commercial circuits when out on 15 May 1991. Likewise, had the staging areas been elsewhere, e.g., Turkey, Jordan, Syria, Iran, the luxury of a sophisticated commercial telephone structure would not have been available to resolve the deployment and supply issues. If the communication system had been successfully targeted by enemy military, terrorists, or long range artillery/missiles, the disruption could have proven extremely serious.[134]

In observation of this frailty, AMCCOM's Readiness Directorate, at the close of the war, recommended that combat support teams be equipped with satellite telephone communications to permit direct down-links to CONUS and other support teams within the theater of operations, as well as permitting datafax capabilities. The recommended package was a suitcase style, portable unit that could be set up in 15-20 minutes and access CONUS/European dial tones. The Readiness Directorate noted that such units would be "essential" in theaters with limited or no telephone communications. Several devices were recommended for deployment with each support team.[135]

Yet without such devices, and perhaps even had they been available, QASAS found reason for complaint concerning the information available to them. Some noted that the lack of technical information reporting channels, as well as mature ammunition logistics support, limited asset visibility and an ability to adequately disseminate suspension and/or restriction notices. This arose from the fact that the initial inventory of ammunition occurred not at the ports when REPSHIPs (reports of shipment) could easily have been utilized, but rather at the storage site. Thus no theater level visibility for suspensions and restrictions was readily generated. QASAS further noted that the inability to issue suspenses and restrictions could

be catastrophic. Given the possibility of tragedy, QASAS recommended that ARCENT (United States Army Central Command) be advised of the importance of a theater ammunition feedback and reporting system and the urgency of establishing just such a system.[136]

Indeed, the lack of accountability of Class V supplies became the object of an observation deemed "significant" in AMCCOM's Operation Desert Shield/Storm After Action Report. That document stated that Class V supplies could not be properly accounted for without ammunition personnel present early on in theater. Also, accountability could not occur without a uniform accounting system such as TACCS (Tactical Army Combat Service Support Computer System) or SAAS (Standard Army Ammunition System) in place and operational. Accordingly, AMCCOM's SWA detachment urged that before future deployments were undertaken these matters be considered and planned for. Indeed, the topic was presented and discussed at September 1991's OMMCS (Ordnance Missile and Munitions Center and School) Conference as the "intransit visibility of ammunition is a systematic problem within the army and would have occurred within any theater." The problem was thus not limited to AMCCOM.[137]

Additional accountability and visibility issues were caused by the failure of AR 700-22's (WARS—World Wide Ammunition Reporting System) reporting requirements to include ammunition already in the possession of troops. The only ammunition accounted for via the system included basic load assets stored in ASPs which had been created after the arrival of logistical personnel. Thus any ammunition carried in by troops, or which arrived prior to logistics specialists concerned with recording its presence was not accounted for in the system. In order to better grasp the ammunition in theater, AMCCOM staffers recommended that the WARS structure be modified to require that those basic load items already in the possession of troops be accounted for. They also recommended that an ammunition support group should arrive in theater to plan support operations prior to units establishing storage sites.[138]

Beyond the generalities of accountability and visibility came the issues raised by specific types of ammunition. QASAS noted that some difficulties arose during Operations Desert Shield and Desert Storm because of selected ammunition types. For example, the 30mm M789 HEDP (high explosive, dual purpose) cartridge, which utilizes a factory-installed M759 PIBD (point initiating, base detonating) fuze. The fuze is sealed in place with an anaerobic thread adhesive, and a sample inspection of the cartridges is performed after the sealant has had time to cure. The inspection requires the application of 20 inch-ounces of reverse torque without evidence of movement between the fuze and the projectile.[139]

Even with the cautionary inspections, in the field the M759 fuze kept coming lose; M789 HEDP cartridges jammed in the Apache feed system were found to have loose fuzes. The cartridge had been in the aircraft for in excess of 100 hours of flight time. The ambient conditions in the ammunition bay were hot, but undetermined. Field observation indicated that there was no evidence of sealant on the threads of the loose fuzes. After an intense engineering review, an ammunition information notice (AIN) was issued directing that all cartridges presently loaded in aircraft be down-loaded and inspected. Feedback was requested on the results of the effort.[140]

After action efforts included inspections of sample inventories of the M789/M759. In 250 rounds representing five ammunition lots, there were no cartridges that did not contain thread sealant. Additional testing is ongoing to characterize the torque and de-torque characteristics of the M789/M759 projectile/fuze thread with and without sealant and at various assembly torque levels. This work continues to the present. And from the experience, a number of key observations have been gathered. First, the present production de-torque sampling inspection is not sufficient to verify the presence of thread sealant on the fuze/projectile thread. Second, the de-torque level required to remove the fuze from the projectile in the presence of approved thread sealant was significantly higher than the de-torque values specified in the TDP (technical

data package), but quite variable. Third, attempts to gain further feedback from the field were relatively fruitless; no further information was received on the occurrence of loose fuzes or the guidance provided to the field. And from the observations, a few recommendations concerning the fuze and projectile came into being. The primary recommendations involved a 100 percent visual or gauge inspection for the presence of thread sealant, the addition of a specific level of assembly torque, and a commensurate de-torque requirement in the production TDP.[141]

Not all fuze-oriented experiences turned out negatively. Interviews with user units in Saudi Arabia revealed that during action, the combination of 4.2-inch M329A2, HE cartridge with the M732 proximity fuze performed well. The cartridge and fuze combination had been qualified for use only in the Southwest Asian theater. A short, precise test program had indicated this combination should have satisfactory functioning with expected higher lethal effects than with the authorized point detonation fuze. Irrespective of the fact that ammunition-oriented personnel declared that the cartridge/fuze combination had been a "definite plus" in the battle against Saddam Hussein, and considered the pursuit of formal qualification of the combination for worldwide use, it could not come to pass. According to other personnel, a 1989 act of Congress prohibited such efforts.[142]

Better luck was hoped for in the effort to achieve the adoption of a special artillery marking round developed especially for use in Operation Desert Storm. In response to an urgent request from the Marine Corps, innovative CRDEC (United States Army Chemical Research, Development and Engineering Center) scientists developed a special marking round for employment in SWA in February 1991. The USMC needed a projectile to mark the terrain, a point, or a number of points in a line, so that a Forward Air Coordinator (FAC) could orchestrate close air support to minimize fratricide by creating a safe zone. The USMC wanted a system for both daylight and nighttime and needed it in SWA quite rapidly. This allowed CRDEC scientists a mere nine days to conceive a concept, fabricate it, and then test prototypes, as well as produce and package the system.[143]

The time constraint forced the scientists to consider only a payload that was commercially available and a carrier that already existed in the army's inventory. They selected the M687 binary 155mm projectile due to its point detonating disseminating characteristics, availability, and liquid payload capability. An existing contract to produce the necessary quantities of M20 and M21 binary canisters, which carry the payload in the binary projectile, was modified to contain the marking materials. A single long canister was selected for the daytime marking payload which was "Day-Glo" fluorescent blaze orange paint, because no flight mixing was necessary. A dual component chemiluminescence system, requiring the use of the two binary canisters, was selected for the nighttime projectile. The two chemical components mixed upon firing and when disseminated, the mixture was fixable in the 400nm-700nm (nanometer) spectrum without heat, flame, or sparks and could be seen with night vision goggles. These chemical solutions were non-toxic, thus complying with health hazard assessment and environmental considerations. Testing and evaluation of the special marking projectile was performed in parallel with prototype developments.[144]

On 19 February 1991, the first operational use of the projectiles was conducted in SWA. The FAC, wearing night vision goggles, sighted the dissemination pattern approximately 500 meters distant and asked, "What the hell are you shooting? It's as bright as day over here!" What the FAC had observed was the impact pattern of three nighttime projectiles, which were launched simultaneously from three M198 155mm towed howitzers. Earlier that day, three daytime projectiles had been fired from the same howitzers. This observation by the FAC indicated that the projectiles had arrived on time and worked rather well, and that field units should continue to submit tactical requests for new and innovative techniques to the R&D centers. The potential requirements for future use study is currently underway based upon the observations that the specially designed marking round appears to have great value in a combat arena to create a night

and day visual recognition symbol for attack aircraft. While the 4.2-inch M329A2, HE, cartridge coupled with the M732 proximity fuze will not be included in the army inventory, the marking round might well be.[145]

Other ammunition-specific observations garnered from ODS include the DA's authorization of an increase in the 82nd Airborne Division authorization for 81mm mortars. The new authorization for the 3/73rd Armor, the division's armor battalion, was for M29A1 mortars. Logistics personnel felt that the DA had erred in authorizing the division to have the older M29A1s which are being replaced by the M252. The M252 had been handed off to the division in September 1988, along with an initial support package and new equipment training. The M29A1 mortars used the old 300 series ammunition, while the newer M252s use 800 series ammunition. A major safety concern was that the unit might use the 800 series ammunition. The 800 series ammunition, due to a a higher bore pressure, may be fired from M29A1a at charge one and two without restriction. Charge three may be fired in a combat emergency, while charge four is prohibited. Indeed, the unit requisitioned the old mortars, which were then released and shipped. Fortunately the MTMC, at AMCCOM request, located the mortars at Dover AFB before they were loaded on a plane bound for SWA. The correct mortars were then requisitioned and the shipment expedited. It appears that in order to prevent potential tragedy, the DA needs to establish a process to assure that the authorization of weapon systems do not pose safety or operational hazards.[146]

Safety was also the concern at heart with attaining 40mm round removal tools for the MK19 MOD3 Grenade Machine Gun (GMG). Prior to the initiation of a program to provide these tools, only Explosive Ordnance Disposal (EOD) personnel had procedures to remove lodged rounds from these weapons. Their procedures were not always completely successful and in many cases had resulted in damaged barrels and/or weapons. There were no approved procedures for using units to remove lodged rounds from this particular weapon system.[147]

A RRT (round removal tool) program was offered by ARDEC to provide immediate assistance to the forces of ODS and was found acceptable. It was proposed that 100 RRTs would be available for shipment by 15 February 1991 and that a contract statement of work would be established for the procurement of an additional 3600 tools to support fielding of the MK19 GMG. This required an accelerated effort by all the ARDEC support organizations.[148]

Coordination with USAIS (United States Army Information System) and HQ, TRADOC (United States Army Training and Doctrine Command) was essential in order to determine the projected authorized use of RRT by the army. A position was established that the RRT could be used at the gunner/operator level and that one RRT tool would be required for each MK19 weapon. This would allow its use in both a training environment and in a combat scenario.[149]

The initial design of the RRT developed by ARDEC consisted of a two-piece assembly. Prototypes were fabricated in house to this design and tested. This testing successfully demonstrated the capability of removing lodged rounds from the barrel of the MK19. A test plan was developed by TECOM (United States Army Test and Evaluation Command) to safety certify the use of the RRT. Ultimately, testing of the RRT was conducted and safety confirmation was received from TECOM using the RRT to remove lodged M430 HEDP, M385A1 TP, and M918 TP cartridges. (Additional testing may allow the safety certification of the RRT for the removal of M383 HE cartridges.) A contract was awarded for the procurement of 100 RRTs, and delivery was received at ARDEC on 14 February 1991, but due to the cessation of activity in SWA, they were not shipped. A contract has also been awarded for an additional 3,600 RRTs, with an option on the creation of an additional 2,500.[150]

The initial two-piece design has been improved by ARDEC to incorporate a one piece assembly design. This enhancement facilitates the storage and handling of the tool while meeting all performance criteria. The USAIS has conducted validation testing of the new design at Fort Benning and the round removal procedures have been approved for incorporation into the operator's manual. These procedures will be packaged with each tool to support the fielded MK19 weapons. In order to project RRT procurement needs, the other services have been requested to identify their future RRT requirements. The unit price of the RRT is approximately $87.00, well under the projected $100.00 item cost estimate.[151]

Safety factors were at the heart of many of AMCCOM's ammunition concerns. Yet reliability also played a role in the command's efforts. Early on in the conflict—November 1990—it was discovered during testing and demonstration that the MICLIC (mine clearing line charge) M58 would not fire. During the testing, it came to light that when the MICLIC rocket pulled the line charge out of its carrier, the arming cable would pull loose. By pulling loose, the charge did not explode; thus the already fielded M58 could not be considered 100 percent reliable. The Marine Corps had discovered the same problem with their units, and had accordingly devised a method of repair. The repair involved threading the arming wire through the rope braids which helped to lock it in place during the line charge's extension. AMC and AMCCOM then turned to the matter of identifying money and personnel to repair the charges in the field and those still remaining in depots.[152]

Within hours of the reported difficulty with the MICLIC, HQ, AMCCOM personnel had devised a repair schedule. MG Paul L. Greenberg, AMCCOM's Commanding General, declared that the repair of assets in SWA would be accomplished by 15 January 1991. This would be achieved by a Director of Supply and Maintenance (DSM)-supplied team with considerable input from other offices. The Product Assurance and Test Directorate's Surveillance Operations Division ascertained lot numbers and quantities shipped to SWA, as well as obtained lot suffixes. Ultimately it was discerned that a total of 527 items in, or on their way to, SWA needed repair procedures. Albeit not without difficulty, the repairs were accomplished.[153]

The MICLIC also required a team from AMCCOM to travel to Louisiana AAP in order to examine ones which appeared to be incorrectly assembled. Through the briefing process, AMCCOM personnel discovered that some MICLICs with rocket motor cable receptacle keyways in the six o'clock position would not fire. Yet not all MICLICs with thusly positioned keyways misfired. Misfirings occurred only when the line charge cable was not connected. AMCCOM staffers concluded that an inverted keyway did not in and of itself cause misfiring, but when coupled with an apparently malfunctioning line charge receptacle connector it was a contributing factor to misfirings. As the problem could not be thoroughly discerned, 101 MICLICs with inverted keyways were temporarily reclassified as unserviceable.[154]

QASAS could, and did, classify other ammunition stores as unserviceable as well. At numerous points throughout ODS QASAS put forth ammunition information notices (AINs). Such notices, issued throughout the war, warned soldiers, as well as their commanders, about the use of a number of ammunition varieties. For example, 27 August 1990 correspondence from the Product Assurance and Test Directorate's Surveillance Operations Division concerned M21 mines. Specified lots which had been subjected to outside storage could suffer from fuze rust and units were alerted to this fact.[155]

Additionally, the Product Assurance and Test Directorate's Process Quality Engineering Division demonstrated their concern with reported difficulties involving the M825, 155mm, WP (white phosphorous) projectile. Based upon an Australian Ordnance Counsel Report which indicted internal components of projectiles could rise as much as 90 degrees above ambient temperature due to solar radiation, an examination of the projectile's test data took place. It indicated that during solar radiation tests the temperature of internal components could rise to approximately 140 degrees Fahrenheit, well below the Australian projections. The projectile could be regarded as safe.[156]

Projectiles, as well as other forms of ammunition, can be tested, among other ways, by subjecting them to increasing temperatures in order to expand the canisters' contents and pinpoint leaks. The leak test is performed on all canisters and its purpose is to check the adequacy of the closure plug weld. When the selected lots of the M825, 155mm WP projectile were subjected to 160 degrees Fahrenheit, insufficient internal pressure was created to find any leaks. At 200 degrees, too much pressure was generated. It swelled the canisters to the point where they could not be assembled into the projectile. Tests at 190 degrees and finally 180 degrees, the current specification requirement, were conducted. At 180 degrees the generated temperature allowed for an adequate check for leaks, yet did not swell the canister to the point where further assembly was impaired. The result of the extensive testing could be reported in capital letters and offers testimony to the great safety precautions taken by ammunition personnel to provide a quality product to the men and women in ODS: "THE DIFFERENT TEMPERATURES WHICH CANISTERS HAVE BEEN TESTED TO DOES NOT INDICATE THAT SOME LOTS ARE BETTER THAN OTHERS. NOR SHOULD THERE BE ANY STOCKPILE RESTRICTIONS BASED ON THE FACT THAT SOME CANISTERS WERE NOT TESTED TO AS HIGH OF TEMPERATURES."[157]

Further testimony can be offered to this concern. Nearly 4,000 155mm projectiles had been restricted from firing in temperatures exceeding 110 degrees Fahrenheit as they carried some possibility of a flight stability problem when filled with liquid white phosphorous. However, this issue was considered a low risk problem since the lots had been tested during LAT (lot acceptance tests) at 145 degrees with no stability problems noted. Despite believing that the projectiles could be safely used, quality assurance personnel sought to replace the rounds.[158]

Yet loose fuzes, proximity fuzes, the fielding authorization for the M252 mortar, MICLICs, and RRTs did not constitute the entirity of ammunition issues during ODS. Also of concern were 25mm cartridges. On 2 November 1990 direction was provided by the Deputy Chief of Staff for ammunition to accelerate low rate initial production (LRIP) of the M919 round in support of ODS. As a consequence, an undefinitized contract action was awarded to Aerojet Ordnance Company, Downey, CA, on 6 November 1990 to accelerate LRIP deliverables by five months, commencing in February 1991 with the completion of all due out cartridges by August 1991. Owing to the short duration of ODS, none of the M919 cartridges produced under the accelerated schedule were fielded. And since full-scale development was incomplete at the time of LRIP acceleration initiation, the cartridges were produced on a "best effort" basis pending contract definitization, and first article has been delayed until the design has been finalized. These factors may have a potential negative affect on material release of the "best effort" M919 ammunition. Additionally, the accelerated production schedule urged upon the contractor caused other projects it was facilitating for the military to slip behind schedule causing potential budgetary problems due to anticipated obligations past 30 September 1991.[159]

Dutch-manufactured 25mm APDS (armor-piercing, discarding sabot) ammunition caused difficulties as well for AMCCOM when its use was attempted in the M242 cannon. Since the Dutch-manufactured ammunition is made with nonheat-treated cartridge cases, it is usable in the Dutch 25mm cannon which has a fluted breech that allows for heat expansion of the cartridge cases. The M242 cannon has a constant, tightly dimensioned breech, which will not allow for cartridge case expansion of the nonheat-treated rounds. Cartridge jams which could not be removed by the extractor occurred when using the Dutch-manufactured ammunition in the U.S. M242 cannon. Consequently, DOD was unable to use 1.2 million rounds of 25mm APDS ammunition manufactured by its NATO (North Atlantic Treaty Organization) ally, the Netherlands. Accordingly, AMCCOM staffers recommended that during future development processes, NATO allies should test new ammunition families to assure compatibility with associated weapons systems.[160]

Beyond the incompatibility of Dutch-manufactured ammunition and U.S.-manufactured cannons, ARDEC personnel further concerned themselves with the world ammunition production base. Staffers there felt that the U.S. Army lacked adequate data on foreign ammunition production capabilities. This lack of adequate information on ammunition production capabilities in allied and friendly nations became quite evident during ODS. It is essential that the United States have accurate and complete information on allied production in order to augment U.S. capabilities for U.S. requirements or to provide sources of ammunition which it does not produce for allied requirements. Accordingly, ARDEC personnel recommended the funding of the establishment, maintenance, and operation of an international ammunition production information system. Yet HQ, AMCCOM chose to delete this recommendation from a draft of their Operation Desert Shield/Storm After Action Report, and urged the focus on RSI (rationalization; standardization; and interoperability) agreements, not foreign production of U.S. ammunition.[161]

Allied nations and ammunition garnered further concern from AMCCOM personnel with regard to a Saudi Arabian National Guard (SANG) request for numerous varieties of ammunition. The request included several ammunition types and weapons which were not United States standard and, by the title given in the request, were obviously of foreign manufacture. As the description in the request did not provide enough information to fully identify the requirements to obtained the required price and availability (P&A), numerous telephone calls and messages had to be made in order to accurately identify the ordered materiel. The actions took a number of weeks to complete. Indeed some actions never were completed and, regardless of the absence of sole source justification and end user certificates, ammunition and weaponry was issued. Upon reflection, it appears that foreign military sales (FMS) customers and their U.S. advisors must understand that when non-standard or foreign-made materiel, especially ammunition and weapons, is requested, they need to provide complete nomenclature of the materiel, including make, model, and manufacturers, the end item applications, unit pack, special information such as explosive net weight and explosive hazard codes, prior sources of procurement, justification for sole source procurement, and end user certification. In order that this information might be passed on, AMCCOM officials recommended that the security assistance quarterly newsletter be used to provide and reiterate the need for the inclusion of such data whenever non-standard/foreign ammunition is requested. A course might also be offered to discuss the situation, and keep foreign ammunition personnel aware of ordering procedures and requirements.[162]

And although a considerable amount of time, effort, and resources had been consumed assuring that allied ammunition was interchangable with that of the United States, it came to the attention of ARDEC staffers during the Persian Gulf War that information concerning compatible ammunition had not always been exchanged with the items themselves. Soldiers must know the ballistic solution to hit the target and this information is not in allied artillery fire control computers. For example, the United Kingdom required the capability to fire U.S. 155mm ADAM, RAAMS, and HERA ammunition, which they do not have in inventory. Since both nations use the M109A2/A3 howitizer and the U.S. M198 and U.K. FH70 howitzers meet the same quadrilateral 155mm ballistics memorandum of understanding specifications, then the U.S. ammunition could safely be fired from U.K. weapons. However, it took the U.K. three months to acquire the U.S. ballistic data, and modify the fire control computers in their howitzers. Accordingly, ARDEC personnel recommended that before further conflicts arose, ballistic solutions be shared.[163]

Production matters concerning ammunition absorbed time beyond that concerning interoperability, loose fuzes, RRTs, and 25mm cartridge production. Planning for maximum rate ammunition production for ODS revealed to staffers that the U.S. production base for mortar fuzes significantly restricted production capability for most mortar ammunition rounds. Through varying discussions it was observed that one objective in the ammunition development-user community had been to reduce the proliferation of fuzes used on mortar ammunition to achieve a "three-fuze" family. By using the same fuzes on many ammunition

rounds, and by striving for commonality of components among different types of fuzes, e.g., on the M734 multioption fuze and the M745 point detonation fuze, a large bottleneck of demand for the same fuzes, which are produced by a very limited production base had been created. The production capacity for M734s and M745s combined is constrained at approximately 35,000 to 40,000 per month. And this capacity must be allocated among six 60mm, 81mm, and 120mm high explosive (HE) and smoke mortar rounds.[164]

Likewise, four 60mm, 81mm, and 120mm smoke and illumination rounds all depend on the availability of mechanical time fuzes produced in Germany at a maximum rate of approximately 50,000 per month. There is no production base for MTFs (mechanical time fuzes) in the United States; a recent effort to identify a domestic electronic time fuze for use on these rounds revealed that even the electronic component production base predicted to exist in the U.S. was rapidly disappearing in favor of overseas producers. Apparently, ammunition procurement quantities in recent years have discouraged fuze producers from entering, investing, or remaining in the production base.[165]

From the experience of charting the potential for fuze shortages, mortar specialists recommended that the United States break out critical electronic components of mortar fuzes, and invest in the establishment of a production base for them. It also urged the development of a new electronic time fuze for mortars and the creation of a production base for it.[166]

Contemplating their capacity to provide an uninterupted supply of ammunition to the men and women in the desert of SWA absorbed a significant portion of AMCCOM's time. Indeed, prior to the initiation of the ground war, 24 February 1991, a complex and complete sustainability analysis had been conducted laying forth the problems facing AMCCOM in terms of sufficiently supplying the forces deployed to the deserts of SWA with conventional ammunition. The analysis began with the United States Army Central Command (ARCENT) requirement list of 152 items. To this listing was added 29 items representing other service branch requirements; 60 items with obviously sufficient assets were subtracted from the listing. The remaining items were loaded into a data base and manipulated to generate sustainability charts for 121 items. According to the study, 106 items currently existed in such quantities as to be available in the desired quantities for at least a year after the commencement of actual hostilities and then to be sustained by continuing production. Of the 106 items currently available at the full rate, 60 existed in sufficient quantity to last the duration of any expected war, without additional production.[167]

HQ, AMCCOM believed that seven additional items would reach full-rate sustainability within one to three months, and an additional 12 items could reach this level of sustainability within four to six months. In many instances, a single component part of a munitions device kept it from being fullrate sustainable. The same could be said of the four items that could not be fully sustained until a period of seven to nine months had elapsed. Nine items required ten to twelve months to be fully available at the rates deemed necessary, and an additional 43 could not be considered available at full sustainment rates for in excess of a year. In many instances, items falling into the multi-month full sustainability categories represented ammunition which had been dropped from production due to budgetary cuts, and could be considered of reduced value to defending the interests of the United States as compared to immediately sustainable munitions.[168]

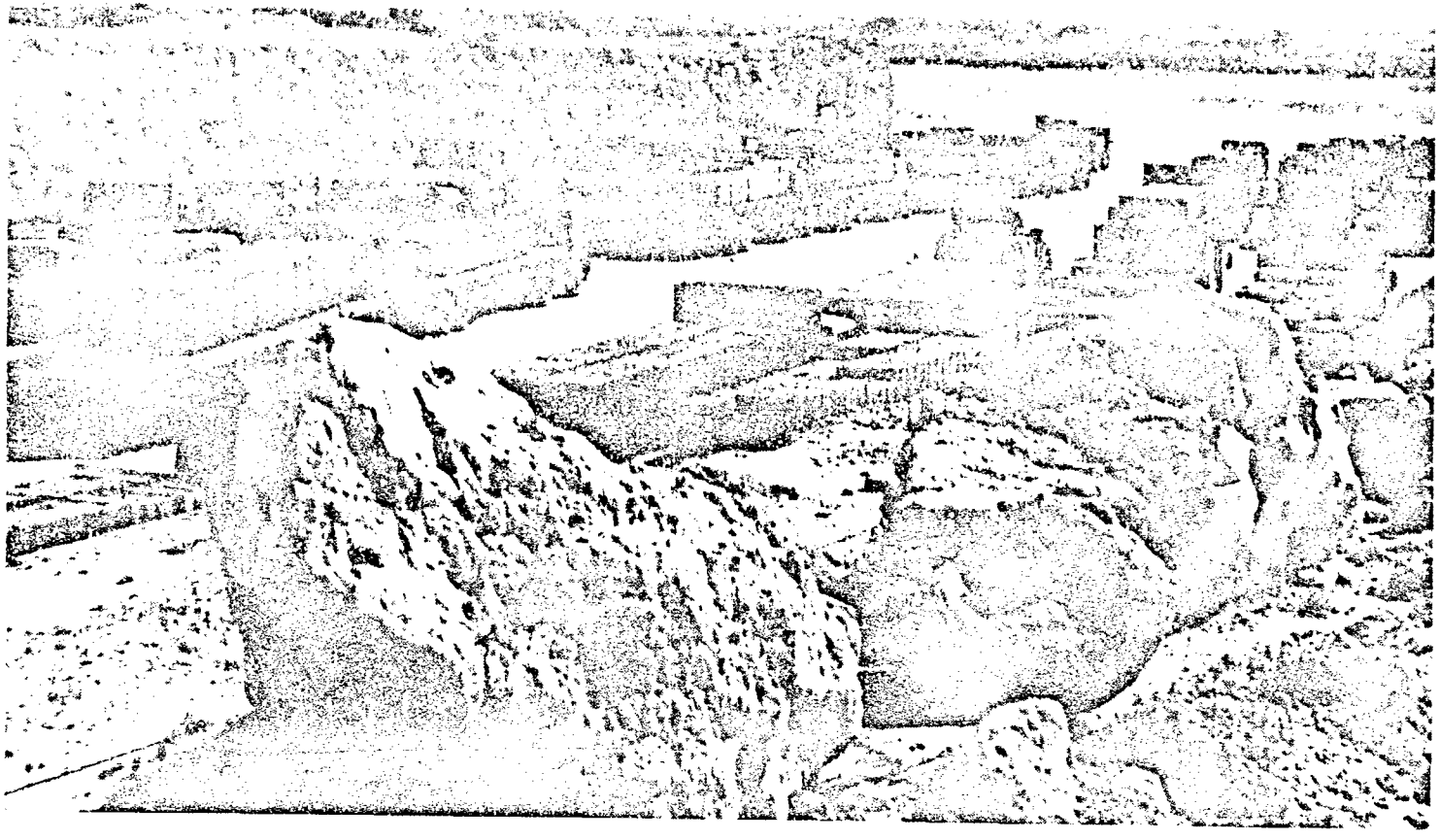
HQ, AMCCOM created an ammunition base priority listing of recommended strategic facility actions in order to bring more items into full-rate sustainability. Of the highest order, according to the report, was the need to increase domestic base capability for 25mm tungsten penetrators by purchasing special tooling and equipment. The action was already underway at the time of the report—1 February 1991. Additionally, it was urged that Aerojet be reactivated for the production of 30mm gauge-8 ammunition, and that Line Eight at Holston Army Ammunition Plant, Kingsport, TN, be reactivated for the production of MICLIC components.

The production of TNT at Radford Army Ammunition Plant, Radford, VA, also was considered, as were an additional eight prioritized recommendations for bringing AMCCOM's stock of conventional ammunition to full sustainability rates.[169]

Some ammunition production plants accelerated their schedules to help meet full sustainability rates. Yet this method of meeting the challenge was not without its drawbacks. If an AAP's production schedule was compressed so that the production of a twelve month supply was met in a matter of six months, the plant was entirely out of the wherewithal of production at the end of six months and then needed an additional six months to a year to get the long lead time needed to start production again. According to many, the production base must be examined in detail before the possibility of another armed conflict arises. Regardless of this observation, the structure in place worked to such a degree that only a single production line had to be opened for the sustainment of ODS, that for 25mm ammunition. That some 270,909 short tons of ammunition were retrograded from SWA in the year following the Persian Gulf War provides sufficient testimony to the stockpile and transportation management capabilities of AMCCOM, as does the educated estimate that soldiers in the field had ammunition available to them at a rate of 180 to 250 percent beyond actual need. This of course, as noted, had its drawbacks in terms of accountability.[170]

And despite what problems can be dredged up-accountability, CONUS transportation, port crowding, staff capabilities, third-world drivers, climatalogical woes, surge capacity, etc.—none negate the fact that the combat units had more ammunition of the right kinds, in the right places, and of sufficient lethality to perform their mission. AMCCOM thoroughly fulfilled its mission of providing the firepower.

Backlogs of ammunition in staging areas such as Ammunition Supply Point (ASP) Quarry, above, were not unusual. These vehicles await directions to offloading sites after their recent arrival from Dammam's King Abdul Aziz Port



NOTES

[1]Joint Chiefs of Staff, Department of Defense Dictionary of Military and Associated Terms, JCS Publication 1, 1 June 1987, 26.

[2]Operation Desert Shield/Storm After Action Report, Executive Summary, I-1.

[3]United States Army Armament, Munitions and Chemical Command, Army Ammunition Plants and Activities, AMCCOMP 360-3, February 1990; Lessons Learned, 52348-94169 (00170) (U), AMSMC-TM, Title: Single DOD Focal Point for Ammunition Ship Planning, 20 May 1991.

[4]United States Army Armament, Munitions and Chemical Command, AMCCOM Facts, AMCCOMP 5-1, 1 October 1991.

[5]Operation Desert Shield/Storm After Action Report, Executive Summary, I-1, 4; *ibid.*, Commander's Assessment, V-2; *ibid.*, Executive Summary I-9.

[6]*Ibid.*, Summary Analysis—"Ammunition".

[7]Operation Desert Shield/Storm After Action Report, Executive Summary, I-4.

[8]*Ibid.* , I-8.

[9]*Ibid.*

[10]Heike Hasenauer, "Bullets and Bombs," Soldiers, February 1991, 18-20.

[11]*Ibid.*, "Crane accelerates ammunition shipments," Target, 14 September 1990, 2B-3B.

[12]"Crane accelerates ammunition shipments," Target, 14 September 1990, 2B-3B; Heike Hasenauer, "Bullets and Bombs," Soldiers, February 1991, 18-20.

[13]"Crane accelerates ammunition shipments," Target, 14 September 1990, 2B-3B; Lessons Learned, 52359-69829 (00177) (U), AMSMC-PT, Title: Hiring Authority for Operation Desert Storm, 23 May 1991.

[14]Draft of Lessons Learned, 60734-74498 (00229) (U), Crane AAA, Title: MILVAN/Commercial Containers, 11 June 1991; Lessons Learned, 71533-39684 (00280) (U), AMSMC-TMD, Title: MILVAN Handling, 21 June 1991.

[15]Draft of Lessons Learned, 60568-21076 (00223) (U), Lake City AAP, Title: MILVAN Handling Facility, 23 May 1991.

[16]*Ibid.*

[17]*Ibid.*

[18]Draft of Lessons Learned, 52342-89983 (00167) (U), Longhorn AAP SMCLO-XC, Title: Ammo Plant MILVAN Loading Capability, 20 May 1991.

[19]Lessons Learned, 80933-82202 (00297) (U), AMSMC-TM, Title: Containerized Ammunition Shipments, 21 June 1991.

[20]*Ibid.*

[21]Lessons Learned, 12750-29983 (00060) (U), USADACS, Title: Containerized Ammo Shipments, 26 November 1990.

[22]Draft of Lessons Learned, 51760-07135 (00143) (U), Hawthorne AAP, Title: Installation Shipping Capacity, 17 May 1991.

[23]*Ibid.*

[24]*Ibid.*

[25]Draft of Lessons Learned, 51762-57546 (00145) (U), Hawthorne AAP, Title: Expanding Installation Outloading Capabilities, 17 May 1991.

[26]*Ibid.*; draft of Lessons Learned, 61830-81896 (00252) (U), CRDEC, PM-AMMOLOGMCPM, Title: Compliance with 49 CFR and Transportation Exemption (DOT-E) 3498, 21 June 1991.

[27]Draft of Lessons Learned, 51763-72082 (00146) (U), Hawthorne AAP, Title: Lack of Rail in South Magazine Area, 17 May 1991.

[28]*Ibid.*

[29]Draft of Lessons Learned, 51764-31577 (00147) (U), Hawthorne AAP, Title: Lack of Commercial Transportation Assets, 17 May 1991.

[30]*Ibid.*; draft of Lessons Learned, 11150-31186 (00020) (U), Hawthorne AAP, Title: Commercial Carrier Availability to Support High Priority Shipments, 11 November 1990.

[31]Lessons Learned, 80824-47276 (00291) (U), AMSMC-TM, Title: Adequacy of Commercial Carrier Support for Class A and B Ammo and Explosives, 21 June 1991.

[32]*Ibid.*

[33]*Ibid.*

[34]*Ibid.*

[35]Draft of Lessons Learned, 11150-31186 (00021) (U), Louisiana AAP, Title: Utilization of Empty Space on Carrier Equipment, 11 November 1990.

[36]Draft of Lessons Learned, 11151-29612 (00022) (U), Iowa AAP, Title: Outbound Transportation, 11 November 1990.

[37]Draft of Lessons Learned, 61830-81896 (00252) (U), CRDEC, PMAMMOLOGMCPM, Title: Compliance with 49 CFR and Transportation Exemption (DOT-E) 3498, 21 June 1991.

[38]Draft of Lessons Learned, 10239-94659 (00072) (U), McAlester AAP, Title: UN/Performance Oriented Packaging Markings, 2 January 1990.

[39]*Ibid.*, 61724-80083 (00251) (U), Picatinny, PM-AMMOLOG, Title: Ammunition Shipment from Posts, Camps and Stations, 21 June 1991; and *ibid.*, 61724-76282 (00250) (U), Picatinnny, PM-AMMOLOG, Title: Shipment of Ammunition Basic Load, 21 June 1991.

[40]Lessons Learned, 11142-91768 (00011) (U), AMCCOM, Title: Ammunition Basic Load (ABL), 11 November 1990.

[41]Lessons Learned, 11144-78811 (00013) (U), AMCCOM, Title: Ammunition Basic Load (ABL), 11 November 1990.

[42]*Ibid.*

[43]Lessons Learned, 11152-16125 (00023) (U), AMCCOM, Title: Shipment of Ammunition Basic Load (ABL) Requirements, 11 November 1990.

[44]*Ibid.*

[45]Lessons Learned, 11145-13084 (00014) (U), AMCCOM, Title: Ammunition Basic Load (ABL), 11 November 1990.

[46]Lessons Learned, 71647-59574 (00281) (U), AMSMC-QA, Title: Shipment of Unit Vehicles with Uploaded Ammunition Basic Load, 21 June 1991; Draft of Lessons Learned 61724-76282 (00250) (U), Picatinny, PM AMMOLOG, Title: Shipment of Ammunition Basic Load, 21 June 1991.

[47]Lessons Learned, 51761-09203 (00144) (U), Hawthorne AAP, Title: Condition of Stockpile, 17 May 1991.

[48]*Ibid.*

[49]Operation Desert Shield/Storm After Action Report, Executive Summary, I-14.

[50]*Ibid.*, Summary Analysis—"Ammunition"; Military Review, "Tracking the Storm," September 1991, 66-67; Message (U), AMSMC-QAS-C, Subject: 155mm SMK, WP, M825 (1320-D528), 201600Z September 1990.

[51]Lessons Learned, 52348-94169 (00170) (U), AMSMC-TM, Title: Single DOD Focal Point for Ammunition Ship Planning, 20 May 1991.

[52]*Ibid.*

[53]*Ibid.*

[54]*Ibid.*

[55]*Ibid.*

[56]Lessons Learned, 80943-95412 (00302) (U), AMSMC-TM, Title: Pipeline Visibility, 21 June 1991.

[57]Viewgraph (U) AMSMC-TM, Title: CONUS Ammunition Ships Planned and Executed by AMCCOM, n.d.

[58]Viewgraph (U), AMSMC-TM, Ammunition Pipeline, n.d.

[59]"Tracking the Storm," Military Review, September 1991, 77; Viewgraph (U), AMSMC-TM, Ammo Ship Status, as of 7 March 1991, n.d.

[60]Viewgraph (U), AMSMC-TM, Ammo Ship Disposition as of 7 March 1990: Service Recommendations, n.d.; Viewgraph (U), AMC-MCCOM, Ammunition Retrograde Team, Class V Retrograde, SWA, Mission Accomplished 231549Z March 1991.

[61]Chart (U), AMSMC-TM, Ammunition Ship Plan AS45, as of 12 Feb[ruary 19]91, 12 February 1991 (?); HQ, AMCCOM, Ammunition Base Sustainability Analysis, 1 February 1991.

[62]Lessons Learned, 80945-34687 (00303) (U), AMSMC-TM, Title: Movement Control Center, 21 June 1991.

[63]*Ibid.*

[64]Lessons Learned, 80930-64079 (00294) (U), AMSMC-TM, Title: Port Reception Capability, 21 June 1991.

[65]Information Paper (U), MOTSU, Title: MILSTAMP Documentation-Desert Shield/Storm, 1 May 1991.

[66]*Ibid.*; see also Lessons Learned, 80932-35842 (00295) (U), AMSMC-TM, Title: Transportation Control and Movement Documentation (TCMD), 21 June 1991.

[67]Information Paper (U), MOTSU, Title: MILSTAMP Documentation-Desert Shield/Storm, 1 May 1991.

[68]*Ibid.*

[69]Lessons Learned, 80939-49939 (00300) (U), AMSMC-TM, Title: Ammunition Port Thruput Capability, 21 June 1991.

[70]*Ibid.*; interview, H.P. LePore, AMSMC-HO with COL Scott W. Hull, AMSMC-DS, 27 March 1991.

[71]Lessons Learned, 80939-49939 (00300) (U), AMSMC-TM, Title: Ammunition Port Thruput Capability, 21 June 1991.

[72]Lessons Learned, 80831-38113 (00292) (U), AMSMC-TM, Title: Use of Commercial Ports for Ammunition Shipments, 21 June 1991.

[73]Message (U), CDRAAMCCOM to AIG 6630 and 6759, Subject: Ammo Shipments for Desert Storm, 211445Z February 1991.

[74]Memorandum (U), SMCAC-AV (Subordinate to the Major Command Ammunition Center-Logistics Review and Assistance Office), Subject: Ammunition Manifest Documentation, n.d.

[75]*Ibid.*

[75]*Ibid.*; see also Lessons Learned, 80933-77879 (00296) (U), AMSMC-TM, Title: Impact of Documentation Errors on Ships Manifests, 21 June 1991.

[77]Memorandum (U), SMCAC-AV (Subordinate to the Major Command Ammunition Center-Logistics Review and Assistance Office), Subject: Ammunition Manifest Documentation, n.d.

[78]Lessons Learned, 80950-70023 (00304) (U), AMSMC-TM, Title: Ammunition Vessel Manifest Documentation, 21 June 1991.

[79]Lessons Learned, 80933-84750 (00298) (U), AMSMC-TM, Title: Impact of Ammunition Vessel Changes on Intransit Visibility, 21 June 1991.

[80]*Ibid.*

[81]*Ibid.*

[82]Information Paper (U), SMCAC-AO (Subordinate to the Major Command Ammunition Center-Ammunition Civilian Career Management Office), Subject: Quality Assurance Specialist (Ammunition Surveillance) (QASAS) Support to Operation Desert Storm (ODS), 4 April 1991.

[83]Memorandum for Record (U), Owen G. Wasmoen, QASAS, Subject: Trip Report, n.d.

[84]*Ibid.*

[85]*Ibid.*

[86]*Ibid.*; and Lessons Learned, 11145-94198 (00016) (U), AMSMCMG, Title: 120mm Tank Ammunition, 11 November 1990. See also Message (U), Hygie Reynolds, Chief, Operations Center, AMCCOM, to CDR, AMCCOM, *et al*, Subject: Operation Desert Shield-Inspection Requirements for Shipments of Uploaded M1A1 Tanks, 052120Z September 1990.

[87]Interview, H.P. LePore, AMSMC-HO, with O. Wasmoen, *et al*, AMSMC-QAS, 24 September 1991.

[88]Memorandum for Record (U), Owen G. Wasmoen, QASAS, Subject: Trip Report, n.d.

[89]*Ibid.*

[90]*Ibid.*

[91]*Ibid.*

[92]*Ibid.*

[93]Wasmoen, *et al*, Interview, 24 September 1991.

[94]*Ibid.*

[95]Message (U), CDRFORSCOM to AIG 7481, Subject: Movement of Hazardous Materials with Troops on MAC-Contracted Commercial Contract and Foreign Flag Passenger Aircraft, 141745Z December 1990.

[96] *Ibid.*

[97] FONECON H.P. LePore, AMSMC-HO with T. Burke, AMSMC-MM, 21 February 1992.

[98] Hull Interview, 27 March 1991.

[99] Viewgraph (U), AMC-AMCCOM, Ammunition Retrograde Team, Class V Retrograde, SWA, Class V Locations, 231549Z March 1992.

[100] Information paper (U), SMCAC-AO (Subordinate to the Major Command Ammunition Center-Ammunition Civilian Career Management Office), Subject: Quality Assurance Specialist (Ammunition Surveillance) (QASAS) Support to Operation Desert Storm, 4 April 1991; Wasmoen, *et al*, Interview, 24 September 1991. Information concerning the process of civilian deployment, including such issues as pay, emergency essential statements, preparation for overseas rotation, necessary clothing, waiting family support mechanisms, the appropriateness of arming civilians, life support, etc., has already been discussed in Chapter (LARs), and interested parties should reference it for desired material.

[101] Wasmoen, *et al*, Interview, 24 September 1991.

[102] *Ibid.*

[103] *Ibid.*; see also Interview, H.P. LePore, AMSMC-HO, with S. Lovely, *et al*, SMCAC-AV, 4 April 1991. A further problem with the use of third-world nationals and their vehicles arose with the multitude of languages spoken by the drivers. Communicating needs and wants among drivers who might speak only Nepalese, Korean, Pakistani, Afghani, or Arabic became just another of the daily challenges of moving ammunition in SWA. See Interview, H.P. LePore, AMSMC-HO, with T. Lighthiser, SMCAC-AV, 7 November 1991.

[104] Interview, H.P. LePore, AMSMC-HO, with COL D.T. Morgan, Jr., AMSMC-CS, 14 March 1991; interview, H.P. LePore, AMSMC-HO, with P.L. Stewart, AMSMC-DL, 23 April 1991.

[105] *Ibid.*

[106] Lighthiser Interview, 7 November 1991.

[107] Wasmoen, *et al*, Interview, 24 September 1991; Lovely, *et al*, Interview, 4 April 1991; Lessons Learned, 12733-16395 (00059) (U), USADACS, Title: Repalletization Kits, 26 November 1990; Lessons Learned, 12730-84000 (00057) (U), USADACS, Title: Preservation and Packing Activities—Potential Retrograde, 26 November 1990; and Lessons Learned, 12750-42011 (00061) (U), USADACS, Title: Downloading Equipment, 26 November 1990. Repalletization became a serious issue at the conclusion of hostilities when literally tons of formerly uploaded ammunition needed to be palletized for transport to CONUS.

[108] *Ibid.*

[109] Lessons Learned, 52256-57232 (00158) (U), AMSMC-QAN, Title: True Climatic Conditions, 20 May 1991.

[110] *Ibid.*

[111] *Ibid.*

[112] *Ibid.*

[113] Memorandum (U), SMCAC-AV to Major General Paul L. Greenberg, Commanding General, U.S. Army Armament, Munitions and Chemical Command, Rock Island, IL 61299-6000, Subject: Reliability and Safety of U.S. Forces Ammunition in Saudi Arabia, 29 August 1990.

[114] *Ibid.*

[115] *Ibid.*

[116] Memorandum for Distribution (U), Picatinny Arsenal, Subject: Climatic Conditions for Middle East Locations, 29 August 1990.

[117] *Ibid.*

[118] *Ibid*

[119] *Ibid.*

[120] *Ibid.*

[121] *Ibid.*

[122] *Ibid.*

[123] *Ibid.*

[124] Message (U), HQ DA to COMUSARCENT, *et al*, Subject: Storage of Ammunition and Guided Missiles in MILVANS and Commercial Containers, 031900Z September 1990.

[125] *Ibid.*

[126] Memorandum for Record (U), SMCAC-AV, Subject: Temperature in Earth-covered Magazine in Saudi Arabia, 25 September 1990.

[127] Message (U), CDRAMCCOM to AIG 9874 and AIG 7481, Subject: Ammunition Information Notice (AIN) 28-91: Environmental Protection of Ammunition in Saudi Arabia, 031500Z January 1991.

[128] *Ibid.*

[129] *Ibid.*; Memorandum for Distribution (U), SMCAC-DEV, Subject: Operation Desert Storm, Environmental Monitoring of Ammunition Temperatures, 15 March 1991; Lessons Learned, 12646-72006 (00055) (U), USADACS, Title: Predictive Technology, 26 November 1990; and Lessons Learned, 62136-71609 (00255) (U), CRDEC, PMAMMOLOG, Title: Solar Covers and Environmental Protection, 21 June 1991.

[130] Lessons Learned, 62137-04631 (00256) (U), ARDEC, PM-AMMOLOG, Title: Availability of Technical Reference Material, 21 June 1991.

[131] Lessons Learned, 11162-52602 (00038) (U), AMSMC-QAL, Title: Information Related to AMCCOM

Equipment Operation in Adverse Conditions, 11 November 1990; see also Lessons Learned, 11162 02466 (00037) (U), HQ, AMCCOM, Title: Technical Publications for Unique Climatic Conditions, 11 November 1990.

[132]Wasmoen, *et al,* Interview, 24 September 1991; Lovely, *et al,* Interview, 4 April 1991; and Lighthiser Interview, 7 November 1991.

[133]Lovely, *et al,* Interview, 4 April 1991.

[134]Operation Desert Shield/Storm After Action Report, Summary Analysis—"Communication"; and Lessons Learned, 52357-67995 (00174) (U), AMSMC-RD, Title: Commercial Telephone Communication Dependency, LAR, 23 May 1991.

[135]*Ibid.*

[136]Lessons Learned, 12731-14731 (00058) (U), PM AMMOLOG, Title: Theater Feedback and Reporting, 26 November 1990.

[137]Lessons Learned, 61227-74231 (00237) (U), AMCCOM-SWA, Title: Accountability of Class V, 11 June 1991; and Lessons Learned, 12731-14731 (00058) (U), PM AMMOLOG, Title: Theater Feedback and Reporting, 26 November 1990.

[138]Lessons Learned, 11167-86808 (00051) (U), HQ, AMCCOM, Title: Asset Reporting through WARS, 11 November 1990; Lessons Learned, 61148-60823 (00234) (U), AMCCOM-SWA, Title: Sequence of Activation and Arrival of Units into the Theater, 11 June 1991; and Lessons Learned, 32143-87959 (00093) (U), AMSMC-MML, Title: Identification of Logistical Support and Supported Customers within Theater, 19 March 1991.

[139]Draft of Lessons Learned, 70327-77510 (00265) (U), ARDEC, Title: 30mm M789 HEDP Cartridge; Loose Fuzes, 21 June 1991.

[140]*Ibid.*

[141]*Ibid.*

[142]Draft of Lessons Learned, 60633-64823 (00228) (U), SMCARFSS-DM, Title: M329A2, HE Cartridge/ M732 Proximity Fuze, 6 June 1991.

[143]Lessons Learned, 52356-58715 (00173) (U), AMSMC-RT, Title: Special Artillery Marking Round for Friendly Troop Positions, 23 May 1991.

[144]*Ibid.*

[145]*Ibid.*; see also Draft of Lessons Learned, 60537-15237 (00221) (U), CRDEC SMCCR-OPA, Title: Use of the M687 Binary Round for Prototype Day/Night Marking and Illumination, 23 May 1991.

[146]Lessons Learned, 52968-01995 (00206) (U), AMSMC-LSS, Title: Fielding Authorization of the M252 Mortar for the 82nd Airborne, 23 May 1991.

[147]Lessons Learned, 62743-82334 (00259) (U), ARDEC, Title: 40mm Round Removal Tool for MK19 MOD3 GMG, 21 June 1991.

[148]*Ibid.*

[149]*Ibid.*

[150]*Ibid.*

[151]*Ibid.*

[152]Message (U), CDRAMC, to CDRAMCCOM, *et al*, Subject: Mine Clearing Line Charge, M58, 192015Z November 1990.

[153]Memorandum of Executive Session (U), Theodore E. Hansen, Chief, Ammunition Surveillance Division, AMSMC-QAS, Subject: Modification of Mine Clearing Line Charge (MICLIC), M58, (11375-M913), 20 November 1990. According to a memorandum from Thomas Rucker, AMC SWA, to Commander, AMCCOM, Subject: MICLIC Modification Team Report on Charge, Demolition Linear, HE, Comp C-4 M58A4 NSN: 1375-01-237-5933 1375-01-287-0719 (M913), n.d., problems arose during repair procedures due to rain, the lack of training manuals, and insufficient repair materials.

[154]Memorandum of Executive Session (U), Theodore E. Hansen, Chief, Ammunition Surveillance Division, AMSMC-QAS, Subject: Travel to Louisiana AAP Regarding Charge, Demo, Linear, M58 (MICLIC), 19 February 1991. The MICLICs were later reclassified as serviceable after further testing. See also Message (U), CDR AMCCOM to AIG 9874 and AIG 7481, Subject: Ammunition Information Notice (AIN) 49-91: CHG, Demo, Linear, M58 Series (MICLIC), 261500Z February 1991.

[155]Memorandum (U), AMSMC-QAS to AMSMC-QAD-P, Subject: Operation DESERT SHIELD, 27 August 1990.

[156]Memorandum of Executive Session (U), C. Carlson, AMSMC-QALA, Subject: M825, 155mm, WP Projectile, 18 September 1990.

[157]*Ibid.*

[158]*Ibid.*

[159]Lessons Learned, 62744-11000 (00260) (U), ARDEC, Title: Cartridge, 25mm, APFSDS-T, M919, 21 June 1991.

[160]Lessons Learned, 52261-00085 (00161) (U), AMSMC-QAM, Title: 25mm Ammunition, 20 May 1991.

[161]Draft of Lessons Learned, 52951-01271 (00200) (U), ARDEC SMCAR-AST, Title: World Ammunition Production Base, 23 May 1991.

[162]Lessons Learned, 32137-48351 (00083) (U), AMSMC-IL, Title: FMS Non-Standard/Foreign Ammunition Weapons and Requirements, 19 March 1991.

[163]Lessons Learned, 52952-41644 (00201) (U), ARDEC SMCAR-AST, Title: Ammunition Interchangability, 23 May 1991.

[164]Lessons Learned, 62137-53602 (00257) (U), AMCPM-MO, Title: Fuze Production for Mortar Ammunition, 21 June 1991.

[165]*Ibid.*

[166]*Ibid.*

[167]United States Army Armament, Munitions and Chemical Command, Ammunition Base Sustainability Analysis, 1 February 1991.

[168]*Ibid.*

[169]*Ibid.*

[170]Morgan Interview, 14 March 1991; Interview, H.P. LePore, AMSMC-HO, with MG P.L. Greenberg, AMSMC-CG, 31 July 1991; Hull Interview, 27 March 1991; Viewgraph (U), AMC-AMCCOM, Ammunition Retrograde Team, Class V Retrograde Southwest Asia, Mission Accomplished, 231549Z March 1992; Stewart Interview, 23 April 1991.

Chapter Six

Observations on AMCCOM in Desert Shield/Desert Storm

Historian George Santayana's (1863-1952) oft-quoted, but ill applied dictum "those who cannot remember the past are condemned to repeat it" might well serve as the unofficial motto of the Center for Army Lessons Learned (CALL) of Fort Leavenworth, KS. CALL came to fruition in order that the lessons garnered from prior military endeavors might not be forgotten but rather, be effectively utilized. The realization that much of the information generated from the National Training Center at Fort Irvin, CA, as well as other combat training centers, "was simply boxed up and nearly forgotten, shelved for only top-level officials to see" spurred the center's creation.[1]

With its establishment in 1985, the collection and analysis observations on tactics, plans, and policies utilized throughout the army as well as monitoring the corrective actions became the Center's tasked mission. It was expected that future experiences of a similar nature could be handled with greater efficiency if past experiences could be systematically applied. Not only did CALL generate lessons learned with the observations garnered from the National Training Center and training exercises such as the mid-1980s' Bright Star maneuvers in Egypt, but also 1989's Operation Just Cause. Indeed, Wartime Army Lessons Learned Program (WALLP) observers followed closely on the heels of troops during the Panamanian invasion to garner material for the Center and ultimately future troops.

Army Regulation 11-33 requires all units to submit copies of their after-action reports to CALL within 120 days following a major training exercise or combat operation. Furthermore, CALL may request further information from any of the army's major command units concerning a particular piece of equipment or system. Thus CALL remains active.

In order that the information gathered might be utilized, ALLMIS (Army Lessons Learned Management Information System) was devised so that CALL materials could be accessed by qualified users. This in house tool does not simply provide answers on a golden platter, notes data base manager MAJ Anne Godsey. "Users have to work to use the data base's information," for "lessons learned don't just pop-up at you."[2] Classified information is available to cleared individuals through the Joint Universal Lessons Learned System (JULLS). And as CALL officials are quick to point out, material not available in the computer data base might well exist in hard-copy format.

And, as with all military installations, CALL's level of activity rose dramatically with the onset of hostilities in Southwest Asia. As per army regulation and in keeping with CALL's tasked mission, CALL observers and wartime reinforcements sprang into action with the news of deployment. Commands from throughout the army supplemented the early reports as did individual soldiers. Not only were reports filed concerning deployment and dehydration, but also logistics and loneliness, maintenance and morale, chemical detection devices and communication systems, hygiene and heat protection, among a multitude of other observed issues.

Before war's end, CALL distributed over 350,000 copies of its Winning in the Desert and Winning in the Desert II newsletters to Desert Shield and Desert Storm soldiers. The newsletters, according to CALL executive officer MAJ Rick Bogdan, Jr., were not intended to provide doctrine "but rather helpful hints for conducting everyday tasks."[3]

Beyond the rapidly produced newsletters, CALL was responsible for generating a formal and

comprehensive after action report of the observations gathered from Operations Desert Shield and Desert Storm. Among the contributors to CALL's final report was the U.S. Army Materiel Command, in turn the recipient of feeder reports from the U.S. Army Armament, Munitions and Chemical Command (AMCCOM). As with observers directly serving CALL, individuals at AMCCOM headquarters in Rock Island, IL, and its subordinate commands intensified their search for ways to improve the response to crisis situations immediately upon hearing of the deployment of troops to SWA. Individuals, military and civilian, from procurement and production to security and intelligence, from logistics readiness to quality assurance, from materiel management to transportation, from maintenance to resource system management, from individual army ammunition plants to the Chemical Research, Development and Engineering Center (CRDEC) as well as the Ammunition Research, Development and Engineering Center (ARDEC) and beyond sought ways to improve their performance and ultimately help the soldier in the sand so far away.

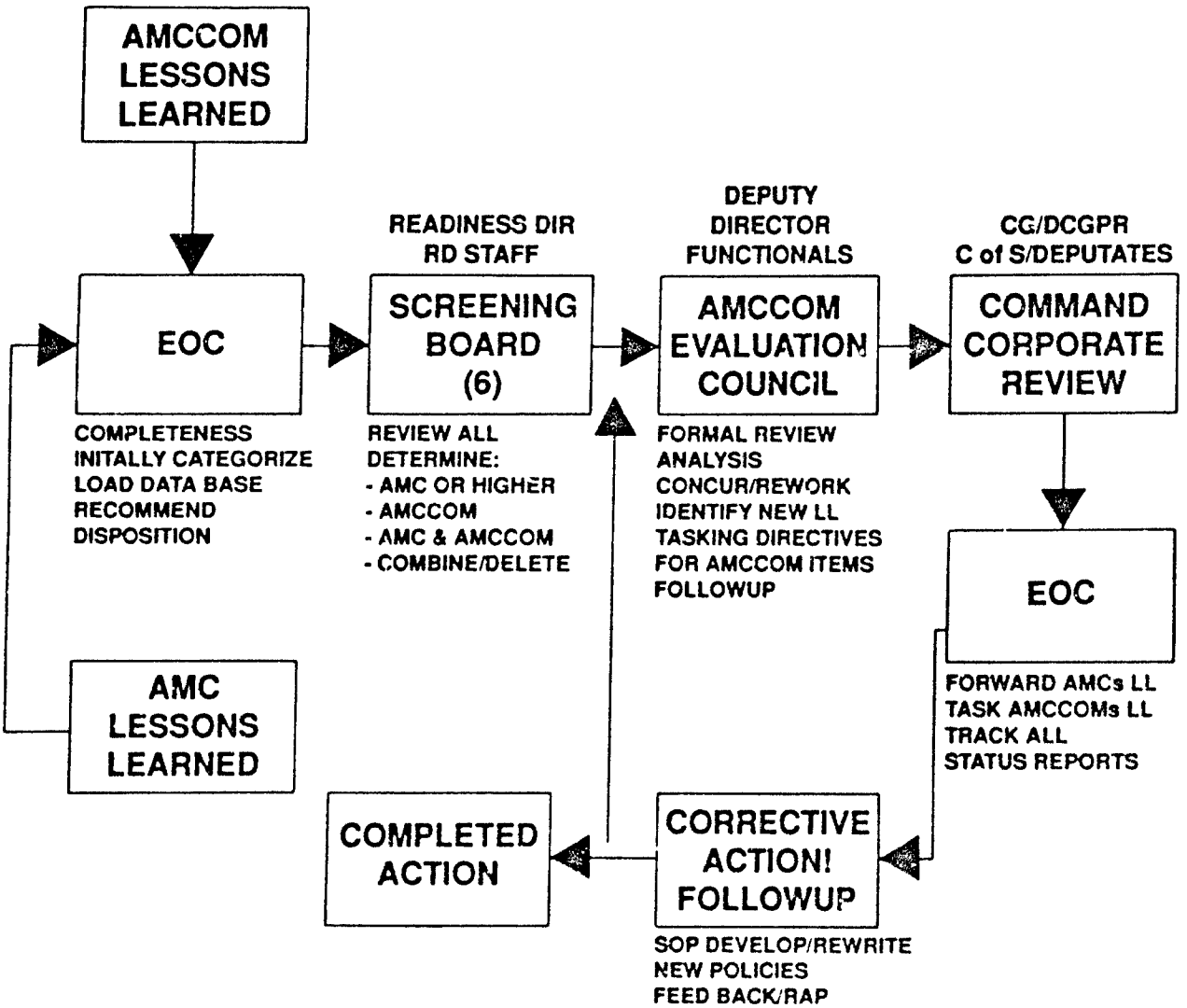
The effort to find ways to improve performance was ongoing. A 2 November 1990 AMCCOM memo reminded "addressees" that "for the duration of Operation Desert Shield" they would be required to examine their day-to-day operations for applicable lessons. In addition to the usual lessons which dealt with "plans, policies and procedures which were either not followed or need correction," ones which concerned mechanical "fixes" or "experiences in the Desert Shield environment" were "highly desired" in order that performance might be improved and the ability to wage war both at present and in the future enhanced.[4]

Ultimately the command's 17,934 civilian employees and 633 military personnel submitted hundreds of observations to the Emergency Operations Center at AMCCOM's Rock Island headquarters.[5] Along with their multitudinous other responsibilities, the Emergency Operations Center (EOC) categorized the observations upon their submission as well as evaluated them for completeness. The EOC also loaded the central data base and made initial recommendations concerning submitted lessons' disposition. The Joint Universal Lessons Learned System (JULLS) was utilized as a management tool to track the lessons learned from the time of their submission to dissemination for action either within AMCCOM or to the United States Army Materiel Command for follow-up tracking. Beyond simply creating AMCCOM's JULLS base, the EOC managed the submissions and hosted internal working group meetings to develop taskings for those lessons learned remaining within AMCCOM.

By early May 1991 an additional Lessons Learned Task Force had been formulated. Created to "establish and implement local lessons learned management and evaluation processes," the task force consisted of seven members, all from the Readiness Directorate. Appointed as members of the Lessons Learned Task Force were LTC Bill Hannah, chief; Mr. Ed Lowenberg, deputy; SFC Leon Killens, noncommissioned officer in charge; Ms. Jennifer Wich, emergency planning officer; Mr. Carl Smith, technical advisor; and Ms. Chris Schumacher and Mr. Les Wilcox, EOC staff members.[6] The Lessons Learned Task Force created a multilevel flow chart to direct the myriad of submitted observations.

After compilation and initial action by the EOC, the AMCCOM Screening Board, composed of Chief of Staff, COL David T. Morgan, Jr., and Readiness Directorate staff members, evaluated the submitted observations and determined their disposition: AMC or higher, AMC and AMCCOM, AMCCOM, or combination/deletion. Upon passage from the screening board, the AMCCOM Evaluation Council examined the surviving, presumably educative, items. The evaluation council, composed of directors, deputies, and divisional chiefs of the logistics readiness, defense ammunition, materiel management, procurement and production, resources and management, research, test, development and evaluation integration, readiness, product assurance and test, weapons systems management, and industrial preparedness and installations directorates, analyzed the surviving observations and subjected them to a formal review. The Evaluation Council then offered its concurrence or ordered a reworking of the submitted lessons learned. The Evaluation Council also identified new lessons learned from the submitted material

LESSONS LEARNED MANAGEMENT PROCESS



and tasked directorates at AMCCOM for further information as desired. It also arranged for follow-up procedures.[7]

From the AMCCOM Evaluation Council, the submissions passed to the Command Corporate Review, composed of Commanding General MG Paul L. Greenberg, Chief of Staff COL David T. Morgan, Jr., Deputy Commanding General for Procurement and Readiness, and a variety of directorate deputies. After Command Corporate Review the submissions were returned to the EOC where, as designated, some were forwarded to AMC and some were tasked to AMCCOM offices. All were tracked and had status reports maintained.[8]

A number of the submitted observations received the designation "significant" from the top management of AMCCOM during the review process. Top management also developed a number of "significant" lessons on their own. To be declared "significant", a submitted lesson needed to:

1.)cover major areas of interest,
2.)be comprehensive and pertain to general categories,
3.)be singularly outstanding, and
4.)reflect the direct interest of the AMCCOM Commander.[9]

Forty-five of the submitted lessons received the status of "significant."

The Operation Desert Shield/Storm After Action Report submitted to the Commander, U.S. Army Materiel Command by AMCCOM's Commanding General MG Paul L. Greenberg in the summer of 1991 contained all the accepted observations generated by AMCCOM and its subordinates to date. It also included a number marked "delete" but which due to time factors remained in place. The "Lessons Learned" portion of the report was divided in 15 subsections: ammunition, chemical/biological, communications, equipment, force structure, logistics assistance/LAO (logistics assistance office), maintenance, mobilization/logistics planning, personnel, procurement/production/quality assurance, resource management, supply, total package fielding, transportation, and weapons.

Individuals concerned with ammunition generated 23 lessons learned which were accepted for inclusion in the After Action Report. Of these, six were deemed significant by AMCCOM's top management. AMCCOM officials designated the fact that manuals for unique climatic conditions were not available for all severe operating conditions as significant. Information contained in operator-level manuals did not adequately describe precautions and procedures required to achieve optimum performance in the desert of SWA according to AMCCOM's maintenance publication personnel. And while the problem was met by the rapid production of pocket-size reference manuals containing specific information regarding the storage, maintenance, and use of ammunition, chemical defense equipment, and armaments in a desert environment, the production of similar pocket-size manuals for other severe operating conditions (arctic or tropical, for example) was recommended in preparation for potential, future conflicts.[10] A subsequent significant lesson simply expanded upon this one and urged the pre-printing of numerous climatic condition manuals for dispersal to troops at the point of deployment.[11]

The availability of logistics documentation such as inspection criteria, quality deficiency requirements, unitization, storage and outloading drawings, and item drawings also presented AMCCOM with difficulties during Operations Desert Shield and Desert Storm and ultimately produced a significant lesson learned. As the shortage of logistics documentation occurred in part due to funding inadequacies, the recommended action involved attempting to secure adequate funding for the development of a field-portable computer system to contain logistics documentation information.[12]

A further significant observation from the ammunition perspective involved the design and develop-

ment community's failure to completely understand the true climatic conditions of SWA and the ensuing problems for the open storage of munitions there. To better understand the exceedingly high temperatures, large diurnal temperature fluctuations, high dew points, high ocean salt content, and the creation of static electrical charges of up to 150,000 volts during dust storms, it was determined that further data should be gathered during retrograde operations in SWA and that this information be made available for the design and development community's use in desert scenarios.[13]

Ammunition interchangeability was the focus of another significant submission. While the ability to interchange allied ammunition in combat has been a high priority goal of NATO and one on which a considerable amount of resources has been expended, ODS made it apparent that this had not been thoroughly achieved. Even though the United States and the United Kingdom knew that their ammunition was compatible and could be fired safely from one another's weapon systems, information concerning ballistics had not been exchanged. It took the UK over three months to acquire the U.S. ballistic data and modify their howitzers' fire control computers to assure properly targeted firing. In consideration of this failing, the board screening observations recommended that computer ballistic solutions be made available to allies.[14]

Furthermore, AMCCOM's top cadre deemed it significant that an accounting of Class V items in SWA was lost quite early on in ODS due to the rapid arrival of prepositioned ships and the lack of ammunition personnel at points of entry. Unidentified unit basic load (UBL) and reserve Class V brought in by units also caused inaccuracies in accountability. To counter this lack of accountability in future operations, AMCCOM officials recommended ammunition personnel and standardized accounting systems—TACC or SAAS—be in place before the arrival of Class V items.[15]

An additional 17 valued observations generated by ammunition personnel were included in the Operation Desert Shield/Storm After Action Report although not with the "significant" designation. These lessons, in general, focused on the ammunition basic load (ABL), its handling, shipment size and requisition format, the proper care of specific ammunition types in the desert, and materiel release order (MRO) instructions in consideration of transportation shortages.

Despite the inevitable problems incurred by ammunition personnel during ODS, the experience provided valuable lessons for future engagements. And regardless of any problems which arose during the Gulf Crisis "none of them negated the fact the combat units had more ammunition of the right kinds (and tremendous lethality) than they needed."[16] The army's ability to meet the ammunition needs of a longer, more intense war were not addressed by the study.

Similarly, the personnel of AMCCOM who concerned themselves with chemical and biological matters took pride in their efforts to properly provide defensive equipment for the soldiers of ODS. Yet, they too realized that problems had occurred and lessons had been learned from the experience. Overall, chemical/biological personnel generated 18 presumably enlightening observations concerning the effort in SWA. Of these, eleven were designated significant. One observation deemed significant dealt with the use of chemical/biological protective devices in high ambient temperatures. At 110-120 degrees Fahrenheit, fully protected personnel can perform at moderate to high rates for less than one hour. Rest, relief, "cool down", mask filter change, etc. are essential, but remove the soldier from mission-necessary activities. In consideration of the industrial base and the level of research and development already underway, AMCCOM's top cadre recommended that a simple, transportable collective protection device be fielded allowing soldiers to work for lengthy periods of time in high temperatures in relative comfort as well as safety.[17]

In addition to personnel collective protection devices, the After Action Report recommended the development of a vehicular collective protection device. Uncooled, armored vehicle interiors can quickly rise above 140 degrees Fahrenheit, or even higher when the vehicle is closed. In consideration that such temperatures might make mission achievement impossible, AMCCOM sought the installation of collective cooling and overprotection devices at the time of retrofit.[18] AMCCOM personnel also noted that deploying units needed quicker access to intelligence on the chemical/biological threat of their destination. Knowing the specific agents, delivery systems, and enemy employment doctrine more thoroughly as well as quickly would allow commanders to make final battle preparations and inform their troops of these with greater dispatch, or so officials believed. The creation of a worldwide database on the threat of chemical/biological materiel performance and the increased use of analysis on this information as well as its dissemination was thus recommended.[19]

The After Action Report also noted that at installations where units were deployed in support of preventive maintenance checks and services were not being conducted on chemical protective equipment as thoroughly as at the user's level. Considering that preventive maintenance checks on such items is critical, AMCCOM management urged that via the Joint Chiefs of Staff, the need to conduct routine checks and maintenance be stressed.[20] Of particular concern in the case of the M17 series mask, chemical/biological experts noted that the voicemitter cover must be removed to confirm the assembly's safety; the head harness' elasticity must also be maintained. In the case of the M24/M25A1 protective mask, concern focused upon the facepiece lenses.[21]

Miscellaneous consumable chemical/biological defense materiel also attracted the attention of AMCCOM personnel. It was noted that several items of chemical/biological defense were in short supply during ODS: vaccines, advanced skin decontimination kits, medical treatment items, nerve agent pretreatment and NATO standard filters. CONUS (continental United States) and OCONUS (outside continental United States) sources were drastically reduced during the Gulf Crisis. While the After Action Report did not specifically note that a lesson had been garnered from the use of CONUS and OCONUS materiel in SWA, it did recommend that these stocks be rapidly replaced as well as augmented in consideration of the increasing tempo of chemical/biological training exercises.[22]

During the Gulf Crisis, it became apparent that nuclear-chemical-biological (NBC) defense materiel management readiness had not been maintained. Early ODS observations dictated that changes be considered with the "utmost seriousness."[23] Specific issues involved the reinstitution of required NBC readiness reporting for all combat and combat support units, and the institutionalization of a permanent central database of NBC materiel on hand, as well as in the late stages of development or procurement. The committee also recommended that the sale of NBC equipment to foreign nations be more carefully explored in consideration of the shelf life of the U.S. forces' supplies, resupply rates and production base/surge capability, and furthermore urged the institutionalization of critical considerations of NBC defense/contamination survivability in acquisition and planning review boards. In addition, AMCCOM top management suggested the use of defense agency or other centralized oversight of the total departmental NBC defense effort, considering all-service needs and single point responsibility. Furthermore, it was suggested that the scope of NBC training be increased in all services by funding increases to reduce unit out-of-pocket costs for training personnel in chemical defense. Computer simulations superimposed on chemical warfare situations on the exercise battlefield, the increased emphasis on senior officer chemical defense orientation, and exercises in all branches of the armed services, as well as embedding NBC training in professional military education was recommended.[24]

The availability of chemical protective equipment and its issue to local nationals and U.S. citizens working for the host country also became the subject of a submission deemed significant by the top cadre

of AMCCOM. Upon the evaluation of numerous foreign protective masks, the U.S. military made the judgement that many did not offer adequate protection, especially for children and bearded men, and that their use required continuous training to be effective. In consideration of this discovery, the suggestion was offered that a stock of M17 masks be maintained (after its replacement by the M40 series) for issue to local nationals and U.S. non-combatants in the theater of operations. The creation of a fund for a full and continuing evaluation of foreign chemical protective equipment so that appropriate and timely recommendations could be made to foreign governments, and a low threat, single use mask for non-combatants that could be quickly and properly used with little or no training also found support.[25]

The elimination of fratricide due to the mistaken engagement of allied aircraft with friendly vehicles and positions also became the subject of a submission designated significant. According to JULLS 52356-58715 (00173), in response to an urgent request from the U.S. Marine Corps, "innovative" U.S. Army Chemical Research, Development and Engineering Center (CRDEC) researchers developed a special marking round for use in SWA. The marines needed a projectile to mark terrain so that a Forward Air Coordinator could orchestrate close air support to minimize fratricide by creating a safe zone. CRDEC scientists accomplished this assignment in a mere nine days. From this experience AMCCOM officials noted that the understanding gained was that CRDEC, and other installations, could rapidly respond to requests from the field and that field units should not hesitate to submit requests for tactical assistance to research and development centers. Furthermore, the special marking round should be thoroughly studied for possible inclusion in the army inventory.[26]

It also came to the attention of authorities and became the subject of a significant submission that chemical detection items had not been properly inspected with regard to shelf life in the years prior to ODS. In order to prevent the unnecessary shortage of chemical detection kits that was experienced by some field units from reoccurring, the evaluation council recommended that periodic inspections be made to determine serviceability and reorders initiated within a three to six month timeframe prior to the materiel's shelf life expiration date.[27]

Also offered for further consideration, and marked "significant" was the need for biological detection equipment. It had been observed during the brief Gulf encounter that there were no specific requirements documents for biological detection samplers, and that although the XM2 sampler and SMART ticket biological detection devices had proven highly successful, they did not provide definitive proof of biological agents, but only offered indications of their presence. Definitive proof still required laboratory analysis. In addition, it was noted that the XM2 sampler should be employed with a three or four man team networked throughout the area of operations and that the development of the Point Biofluorescence Sensor (PBS) warranted pursuit.[28]

A further significant observation involved the FOX NBC reconnaisance vehicle. Fielded two years ahead of schedule, the FOX presented its users with some difficulties: an inaccurate inertial navigation system, an inability to determine wind direction, a profile frequently mistaken for that of the enemy, insufficient training time, the lack of FOX simulators for that training and a noncompatible radio system. With these problems corrected, the German-built FOX is expected to prove a valuable asset in future endeavors.[29]

The After Action Report included an additional six lessons learned generated by individuals specifically concerned with chemical and biological equipment. These involved specific items of chemical/biological equipment, technical documentation for surge equipment sent to SWA, chemical/biological hazard assessments, the deployment of developmental hardware to the desert and the possibility of psychologically-induced breathing problems by individuals using chemical protection equipment. Such lessons provide the impetus for chemical and biological efforts for the ensuing years and future endeavors.

In addition to the numerous observations concerning ammunition and chemical/biological issues, the After Action Report included six communication-oriented lessons. Of the six lessons, only one merited the designation "significant." That lesson noted that with the deployment of thousands of troops to SWA, a large number of support personnel had been tasked to follow. Due to the lack of alternatives, these personnel came to rely almost entirely on commercial telephone communications to connect to the major subordinate commands (MSCs), depots, and national inventory control points (NICPs) to resolve repair and supply issues. The well-maintained, sophisticated and Kingdominstalled telephone system of Saudi Arabia created a false sense of security. Had the host nation not been well equipped or had the communications center been successfully targeted by enemy military, terrorists, or long range artillery/missiles, the disruption could have been catastrophic.[30]

In addition to CONUS-SWA communication, LARs and QASAS (logistics assistance representatives and quality assurance specialists-ammunition surveillance) frequently required in country contacts. The near impossibility of these contacts resulted in CONUS Operations Centers becoming information relay stations between Saudi elements.

Upon consideration of these communication frailities, AMCCOM management recommended that in future engagements, LARs, logistic support teams, and QASAS be equipped with satellite telephones to permit direct down link to CONUS and LAR-to-LAR in theater, both voice and fax capable. The desired package would be a suitcase style portable unit that could be set up in a matter of 15-20 minutes and access CONUS and European dial tones. It was further recommended that several satellite telephones be provided with each unit. The packaging of communication services was deemed "essential" in theaters without a substantial telephone structure.[31]

Despite the designation of a single communications lesson as significant, other important information came from the desert. Communication officials generated observations concerning the constant revision of time-phased force deployment data (TPFDD), the need for a "smart" terminal capable of more rapid updating, the need for a direct line of communication to establish reporting procedures, and the poor flow of information between materiel and acquisition commands.

In the After Action Report's summary analysis of communication, a series of other issues were addressed. In order that communication might not be seized up during times of crisis, the use of "minimize" on the army message center system, the use of the voice conference call, and the use of the fax machine were suggested, with the notation that they had worked quite well in the recent conflagration. Indeed, the analysis noted, "communication during the Gulf Crisis was . . . a great asset" although the potential existed for it to be a "weak point."[32]

Equipment experts also submitted a number of suggestions for inclusion in AMCCOM's After Action Report. Of the ten lessons submitted, however, a mere two warranted a "significant." AMCCOM's Materiel Management team urged a rethinking of the standing policy, or lack thereof, concerning captured foreign materiel. They noted that captured foreign materiel was not thought of until after the fighting was over. Instead of utilizing Army Regulation 700-99 on the handling of this equipment, all levels wrote their own instructions on the materiel's disposition. Unfortunately, there was no coordination between levels. The lesson continued by noting that the end result of the lack of coordination was "chaos" as units redeployed with war trophies upon completion of hostilities without the proper documentation. The competition among museum representatives, units, and individuals for the control of captured Iraqi equipment as war trophies also caused consternation for materiel management personnel.[33]

Concluding that "being proactive and having a current AR (Army Regulation) addressing a scenario

far outweighs a reactive mode of operation," and that "coordination among levels of policy makers must take place in order to allow one good policy to be issued," Materiel Management personnel urged that the HQDA (Headquarters Department of the Army) revise and update its regulations concerning captured foreign materiel.[34]

Also of concern to AMCCOM's equipment experts was the lack of laser protection for Apache helicopter crews. Considering that the lasers of distant Apaches could easily damage the eyesight of crews and that laser-equipped enemy aircraft might also inflict injury, the failure to issue protective visors to deploying crews seemed derelict. As laser protective helmet visors caught up with crews in the deserts of SWA via the awarding of a sole source contract hurriedly prepared, a corrective action was not offered. Officials did warn, however, that AMCCOM must "prepare for battle, under all possible conditions, and especially for critical safety items . . . ."[35]

The remaining lessons generated by AMCCOM personnel in this field dealt with specific pieces of equipment (M102 tires, M16 series rifles, M1/IPM1/M1A1 recovery vehicles, etc.), fire protection equipment for port operations, the proper handling of equipment, depot maintenance plant equipment, the field evaluation of equipment, and the incorrect powder temperature corrective coefficient in the fire control computer.

Observations generated by individuals primarily concerned with force structure did not take a great deal of space in the After Action Report. Of the two lessons submitted by AMCCOM staff, neither received the designation "significant." It was observed, however, that in the interest of eliminating or at least reducing confusion concerning deployed units, the timeframe of deployment, and organizational relationships, changes needed to be made. Time-phased force deployment data (TPFDD), the primary data source, was not well understood and could be accessed from the Worldwide Military Command and Control System (WWMCCS) by only one individual at AMCCOM. In consideration of AMCCOM's stringent requirement to keep clearances to a minimum and the necessity of TPFDD users to possess a top secret clearance, the system came close to seizing. In order to prevent future problems, the top management of AMCCOM recommended the expansion of the clearance ceiling and the education of further individuals in the language of TPFDD and WWMCCS.[36]

Furthermore, defense ammunition directorate officials recommended that ammunition requirements for deployed units be more frequently and correctly updated using numerical force as the standard, not the presence of a threat to modify the requirements. Facing mild resistance from the Office of the Deputy Chief of Staff—Operations and Plans, AMCCOM officials urged a review of the "requirements computation methodology to insure logistics [were] given full consideration."[37]

Logistics assistance and the Logistics Assistance Office became the object of five submissions included in the After Action Report, two of which met the criteria for "significant." The most prominent of these lessons involved the quite difficult time LARs deploying to SWA had in obtaining the necessary level of support and communication. Regardless of home installation-CONUS, Europe, Korea—or assigned unit, LARs frequently had trouble arranging billeting, transportation, and communication. Due to the significant hindrances incurred, LARs had difficulty accomplishing their missions as well as communicating with CONUS. To alleviate such problems in future encounters, the Readiness Directorate suggested the creation of equipment/communication packages for LARs which would allow them to "communicate, survive and perform" in a deployment environment. The packages recommended could be contained in a maintenance van "fully uploaded with cots, tents, communications equipment, generators, light sets, first aid kits, tool, MREs (meals, ready to eat), NBC gear, etc."[38]

ARDEC (Ammunition Research, Development and Engineering Center) also contributed to the logistics assistance portion of the After Action Report. Their personnel observed that no formalized plans had been established prior to the start of Operation Desert Shield for the collection and transportation of captured foreign ammunition to CONUS. They also noted that at least two divergent, informal plans existed concerning the disposition of foreign ammunition. In order that the ensuing confusion might not occur in future engagements, ARDEC officials urged the identification of a single operational element to handle the responsibility for the collection, storage, and transportation of captured foreign ammunition of interest for exploitation purposes.[39]

Beyond these logistic issues denoted significant, lessons learned concerning ports and equipment accountability, the necessity of deploying advance individuals to ensure the proper establishment of plans, their coordination and execution, and the deployment of supply-oriented LARs rather than generically trained ones were included in the After Action Report.

The After Action Report also contained a number of submissions directed towards improving maintenance procedures in future deployments. Eleven lessons were included in the report, none, however, with the designation "significant." Yet the included observations provided food for thought: specific weapon system maintenance and maintenance problems incurred in a desert environment as well as materiel readiness technical manuals and their availability.

Six of nineteen submissions concerning mobilization and logistical planning received the "significant" designation. One involved the confusion that occurred with President Bush's callup of 200,000 National Guard and Army Reserve soldiers. At the time of the call-up, the Readiness Directorate (RD) received the task of determining equipment shortages in the called-up units. While in process RD discovered that similar actions had been tasked to the National Guard Bureau and the Continental United States Armies. The recommendation flowing from this experience was that greater efforts at coordination should be attempted in order that wasteful duplication might be avoided.[40]

Also suggested for re-evaluation was the AMC War Plan along with MOPES (Mobilization and Operations Planning and Execution System). According to Industrial Readiness personnel, the industrial base was not properly mobilized in support of ODS. Indeed, they noted, "the system established to transition to mobilization does not recognize that some MOPES actions should not be initiated if the base is not to be mobilized." Therefore, the Industrial Readiness community spent considerable time and effort initiating actions which were unnecessary, as well as redundant in nature, and confusing as to intent. In addition, directions contradicted one another as well as the published, pre-figured schedule and resulted in the generation of worthless data. To prevent such future confusion Industrial Readiness suggested an overhaul of the AMC War Plan along with MOPES "to develop a realistic, workable plan that makes sense."[41]

Preparation for Overseas Rotation/Movement (POR/POM) also became the subject of mobilization/ logistical planning lesson learned. Observers noted that during deployment the POM staff of Aberdeen Proving Ground (APG) had done a superb job of preparing civilian AMC personnel for travel to SWA, handling in excess of 200 individuals per week. Yet APG did suffer some problems with shortages. The lack of sufficient and properly sized desert camouflaged Battle Dress Uniforms (BDUs) as well as boots damaged morale and made for frustrated SWA-bound employees, as did APG's lack of authorization to issue weapons. In order to prevent such confusion and shortages from re-occurring, the Readiness Directorate (RD) made numerous suggestions: direct delivery of backordered clothing and boots to shorted individuals in the field, use of non-traditional imprest funds for local purchases, and the use of catalog suppliers (Sears, Cabalas, Gander Mountain, . . .) for boots for hard-to-fit civilians, making certain to utilize

the toll-free 1-800 numbers provided by most of these firms. The RD also recommended that AMC keep civilian deployee materiels on hand to rapidly resupply APG as necessary.[42]

One of the longest submissions included in AMCCOM's After Action Report concerned the role of the command in support of CONUS Replacement Centers (CRCs) at Forts Benning, Jackson and Knox. RD officials noted that the role of the CRC focused on processing individual soldiers and civilians as replacements to units and agencies already present in SWA. They also noted that CRC programs were tasked to provide appropriate clothing, chemical defense equipment, and weapons, including AMCCOM-managed materiel—rifles, pistols, and chemical protective equipment. Unfortunately, AMCCOM did not receive notification to execute support to the CRCs nor did the actual reserves held for the CRCs fully support processing requirements.[43]

From the experience RD personnel gathered the lesson that coordinated effort by HQDA, TRADOC (United States Army Training and Doctrine Command), AMC, and AMCCOM was required in peacetime to ensure sufficient support of CRCs during wartime. To ensure the coordination of future efforts, RD urged that AMCCOM and AMC work actively with HQDA and TRADOC in reconstituting CRC support in consideration of force modernization items, stockage of support items, and funding and authorization documentations.[44]

Also of concern to mobilization and logistical planning authorities and denoted "significant" but directed only towards AMCCOM, rather than the usual direction of significant lessons learned to AMC, was the observation that the skilled personnel needed to gear up for a crisis were not as readily available as previously indicated. The shortage of skilled machinists and machine tool operators became apparent at New York's Watervliet Arsenal. Working with the New York State Department of Labor, arsenal management learned that many of the hundreds of applicants for their openings did not possess the skills needed to perform satisfactorily. However, based upon earlier figures provided by the New York State Department of Labor, there should have been sufficient individuals in the labor pool to fill the positions. In consideration of this finding, AMCCOM officials determined that an updating of the mobilization table of distribution and allowances must occur, as well as the reexamination of skill requirements. Other installations were to be advised accordingly of the potential hazards of utilizing old information.[45]

Readiness ratings also became a concern of AMCCOM personnel. It appeared during ODS that units had the tendency to paint a very optimistic picture of their readiness, particularly in consideration of their equipment capabilities. Unfortunately, the commanders of questioned units frequently included stored equipment out of their direct control as being operations ready. The same problem occurred in consideration of personnel specialties and the presence of non-deployables in units scheduled for SWA. To avoid this difficulty in the future, it was recommended that commanders be required to clearly indicate the actual percentage of equipment not under their direct control, although including a status report of materiel in storage. And to verify the accuracy of readiness reports, it was recommended that periodic inspections should be conducted by independent agencies.[46]

Beyond observations designated "significant," an additional thirteen concerning mobilization and logistical planning were included in the After Action Report. They covered a variety of topics: the sufficiency of war reserves, CONUS Replacement Centers, their coordination, equipment, range of equipment supported and storage space, Class VII resupply, foreign intelligence during wartime, U.S. Marine Corps mobilization from ARDEC, and even the generation and collection of the official after action report.

Personnel issues also found a place in the AMCCOM's After Action Report. And although individuals concerned with personnel matters generated numerous observations, of which 21 found inclusion in the

report, only one of these was deemed "significant." The significant lesson concerned the hiring authority for Operations Desert Shield and Desert Storm. Observers noted that certain installations, especially those required to ship ammunition, found themselves severely constrained in meeting shipping requirements for ODS by the Department of Defense hiring freeze. For example, Crane Army Ammunition Activity (CAAA) resorted to working employees in double and triple shifts as well as using white-collar personnel in shipping to meet its requirements. Although expedited, the procedures to obtain hiring authority did not come through fast enough to avoid jeopardizing mission performance. Personnel and Training Directorate officials recommended, in light of the significant problems incurred, that current and future hiring limitations should contain a provision for local commanders to unilaterally hire temporary employees to meet operation and mobilization requirements.[47]

Non-"significant" personnel submissions represented in the After Action Report covered a variety of issues: the shortage of trained personnel for bracing and blocking ammunition shipments, support offered to waiting families, casualty reporting, pay for deployed civilian personnel, the identification of support materiel and customers within the theater of operations, travel orders, staff relationships, the staffing of the AMCCOM Emergency Operations Center, the issue of weapons to LARs and other Department of the Army civilians in SWA, and the staffing of the Lessons Learned project.

In addition to the commentary generated concerning personnel issues, AMCCOM's After Action Report contained 30 lessons concerning procurement, production, and quality assurance. Of these, five warranted the designation "significant." "Red water," or environmentally hazardous water created in the explosives manufacturing process, became the focus of one such lesson. Observers noted that no known, established and approved plan existed for the disposal of "red water" in the event of a surge or mobilization order associated with a national crisis. And while the explosives, notably TNT, could have been produced with relative ease, the resulting "red water" would have been a "constraint without resolution" as no provision exists for disposal that has total Environmental Protection Agency (EPA) authorization. As the only known incineration technique for this material is continually fined by the EPA, commercial chemical producers are somewhat reluctant to undertake government contracts for explosives. In addition, the EPA does not perceive that environmental standards can be relaxed during wartime without direct order from the president. Thus, AMCCOM urged that the impact of current EPA laws on the production of critical explosives be brought to the attention of the Joint Chiefs of Staff, Congress, and President Bush.[48]

Regulatory relief also became a concern of procurement personnel and ultimately gained a "significant" notation in AMCCOM's After Action Report. Procurement and Production Policy Division personnel observed that regulations which serve the nation well in times of peace can be overly restrictive in times of conflict. They also noted that while AMCCOM took a proactive approach in gaining regulatory relief, AMC took a reactive stance, resulting in minuscule, incremental deviance allowances to regulations. Regardless, some alterations in regulatory policy did occur: Congressional notification within 20 hours was waived; the small purchases threshold for OCONUS rose to $100,000; and the processing time for after-the-fact justification and approvals (J&As) was extended. However, not all sought for relief became reality. For example, AMCCOM did not receive authority to continue work despite labor protests, to issue a moratorium on socioeconomic programs, or to waive equal employment opportunity clearances required from small business contractors. Noting that "the Department of Defense and the Congress are not going to change statutes and regulations for ODS-level conflicts," and that "we must rely on ourselves to develop solutions to our problems," the Procurement and Production Policy Division laid forth recommended actions in the face of Congressional recalcitrance. Among the recommended actions were the development of processes to expedite actions which higher authorities refused to waive, including imbedding clauses in future regulations and statutes providing for relief to be activated in a time of conflict and the pre-establishment, publication, and distribution to the contracting office a list of acceptable deviations, lowered

approval authorities, and eliminated requirements in the case of conflict. Surge alternatives in the case of less-than-all-out mobilizations, periodic review of contingency clauses and policies for surge operations, and the maintenance of a system which can efficiently shift to a high gear also found recommendation. Regardless of the problems which occurred with regulatory requirements though, the Policy Division noted that "AMCCOM reacted in an outstanding manner to a critical situation. AMC, higher headquarters, and the Congress should be apprised of the turmoil and wasted effort, as well as dangerous delays to procurement, which their inability to act more quickly created at the working level. Now is the time to preposition for the future."[49]

The Procurement Directorate's Major Weapons Systems Division submitted a quite similar notation for consideration. Personnel from that division noted that the entire range of mobilization planning needed rethinking "minus the present political restrictions, regulations and policies that have rendered it useless." In consideration of this, the office complained that in light of cost saving measures, its mission, as well as future missions, had been compromised as artificial production restrictions and equally artificial main supply routes ultimately increase costs, curtail surge abilities, and seriously impact a contractor's capability of meeting rapidly expedited requirements. In addition, State Department memorandum of understanding (MOU) further eroded the U.S. critical base components. The Department of Commerce inadvertently gave priority to foreign countries to procure charcoal filters for gas masks from the main U.S. supplier, to the detriment of the American forces. In consideration of the problems incurred, Major Weapons Systems recommended that all mobilization items and their critical components be procured exclusively from the U.S. or Canada and be made exempt from MOUs, unless otherwise coordinated, despite the cost. For as the Procurement Directorate's Major Weapons Systems Division office noted, "If the price of liberty is eternal vigilance, part of that price is mobilization."[50]

Small business goals also garnered the attention of procurement personnel and became the subject of a "significant" observation. Officials noted that AMCCOM attempted to meet its small business utilization goals in spite of ODS and the need to restrict competition to the current producer. On occasion this effort by AMCCOM resulted in delays in processing justifications and approvals/awards due to nonconcurrence by the Small Business Office. In order that unnecessary delays might be avoided on the occasion of future conflicts, procurement personnel recommended that clause 8(a) of the Small Business Goals directive be abandoned during wartime.[51]

Procurement personnel sought to modify the acquisition process in other ways as well. They noted that the acquisition process is predicated upon the assumption that the U.S. is at war, possibly on a global basis, with the Soviet Union or China. The reality, as noted, is that Panama, Grenada, and SWA are the types of conflicts this nation will face—short in duration but of high intensity. In such a war, reliance must be placed upon the established stockpile and the logistical pipeline. Thus the acquisition process must react using existing tools; i.e., there will not be time to to build up a workforce, or to have statutory or regulatory changes. Even in the nearly six month build-up to the Persian Gulf War, little or nothing occurred on the acquisition side of the logistics system to provide relief from peacetime restraints. Only after the actual hostilities began did higher headquarters become sensitive to the need to remove regulatory and statutory roadblocks, noted procurement personnel.[52]

In the Gulf crisis, procurement officials did their utmost to streamline and accelerate the acquisition process. Expanded delegations of authority in the areas of award approval, the use of unpriced contractual actions, and other review processes were initiated for the Head of Contracting Activity/Principal Assistant Responsible for Contracting approval where higher headquarters regulations permitted. Additionally, expedited processes were implemented to obtain formal review/approvals if the regulations precluded the delegation of authority and class documents were developed covering urgency statements, justifications

and approvals, and unpriced contractual actions. Most significantly, however, personnel were reallocated to high priority direct war-related activities which permitted the expeditious handling of the over 2,500 AMCCOM procurement work directives generated for ODS.[53]

Taking their cue from their obvious success in ODS, the personnel of procurement recommended that in preparation for future conflicts periodic reviews of contingency clauses and policies must be undertaken to ensure that they are up-to-date and supportable. Self-help must also be effected in times of crisis so that matters might be dealt with expeditiously, yet appropriately.[54]

Beyond the five submitted observations deemed significant concerning procurement, production, and quality assurance, an additional 25 were included in the After Action Report. These dealt with a variety of issues: the acquisition process, its streamlining and modification, procurement practices, the surge production program, production bases, and materiel release orders.[55]

Resource management personnel submitted seven of the lessons learned included in the After Action Report, five of which received the designation "significant." Comptroller personnel noted that the financial reporting requirements for ODS frequently changed and did not reflect use of standard Reports Control Symbol (RCS) formats established for emergency or contingency situations. Also, the implementation of non-standard financial reporting requirements imposed at AMC/Department of the Army/Department of Defense level, such as "Less Diverted Resources," and the failure to use established reporting procedures caused confusion and precluded the rapid assessment of resource situations. Nor did the implemented reporting requirements provide for the identification of "Offset Credits," which are estimated amounts that have been deferred or cancelled due to the current emergency and funding limitations. Additionally, scarce resources were strained in order to create, modify, and explain higher headquarters demands for new and revised requirements.[56]

In order that such problems might not reoccur, the comptroller's office urged that standard financial reporting requirements be implemented, recognized, and used at all levels to facilitate the management of scarce resources, that templates for standard personal computer software—Lotus 1-2-3, dBase, etc.—be developed to implement resource management, and that this be accomplished with appropriate celerity.[57] Summing its efforts and observations up quite succinctly, resource management personnel made the simple, boldface declaration: "A DEFINED STANDARD SYSTEM MUST BE IN PLACE READY TO PLUG IN!"[58]

The comptroller's office also made comment on, and submitted an observation concerning, the Civil War statute authorizing commanders in the field to pay for feed for the troops and forage for the horses and mules. Noting that the nature of the logistics support force had changed since the origination of RS 3732 Authority, the comptroller's office recommended that funding authorization documents (FADs) should be prepared which clearly indicate what costs might be properly incurred in the support of a modern army.[59]

The effort of the Comptroller of the Department of Defense to ferret out the actual cost of ODS also resulted in the submission of a comment deemed "significant." Considering that the guidance offered by the Comptroller of the Department of Defense sought to measure not only the obvious costs of the Gulf war such as materiel, machinery, wages, ammunition, etc., but also assistance-in-kind, realignments, reprogrammings and transfers connected to the war, AMCCOM's accountants were presented with the difficult task of measuring these costs. Should the costs be those of replacement or original acquisition? Should funds obligated during ODS but not actually incurred be included? How should depot maintenance be tallied?[60]

In the computation of these figures, AMCCOM comptrollers came to the realization that higher echelon guidance and policy concerning costs of ODS concentrated on current costs and obligations and that locally generated figures would also concentrate on these figures while ignoring those for previously obligated funds until Congress required a tabulation.[61]

For future engagements, AMCCOM's comptrollers recommended that a more suitable method of estimating, collecting, and reporting costs for assets expended and costs accrued in contingency operations, as well as operational expenses, be devised. Additionally, AMCCOM's comptrollers urged the revision of not only the Army Field Manual (FM 14-6) Resource Management Operations, but also of the AMC/AMCCOM Mobilization and Operations Planning and Execution System (MOPES) and the Army Mobilization and Operations Planning System (AMOPS). The new systems should be formulated to implement a better means of understanding, collecting, and reporting costs for the nontheater logistics support force, appraising operational, as well as investment expenses, and the operating costs for forces in the field.[62]

Also the subject of a "significant" observation was the tracking of costs for ODS. AMC established requirements to report all obligations in support of the Gulf crisis against Management Decision Package (MDEP) code VKWT as well as Functional Cost Account (FCA) code 9999 The comptroller's office observed that it appeared redundant to collect the costs of ODS against two data elements in the accounting system. This seemed especially so in consideration of the fact that by using the MDEP code, specific accountability for intensively managed weapon systems support was lost. While recognizing that the use of separate codes could significantly increase the number of job orders as well as processing time required in the Standard Operations and Maintenance Army Research and Development Systems (SOMARDS), AMCCOM comptrollers also acknowledged the imperativeness of AMC retaining visibility for the resources devoted to weapon systems management. Thus, AMCCOM officials recommended that the AMC Deputy Chief of Staff for Resource Management along with the Comptroller of the Army, Defense Finance and Accounting Service, and functional major subordinate commands develop and implement unique accounting project codes that would permit collection of costs to weapons system management as well as contingency operations.[63]

The final "significant" submission connected with resource management contained within the After Action Report specifically involved resource management within AMC. Comptrollers observed that during ODS AMCCOM received numerous requests for obligations and cost data. Redundant reporting elements, conflicting requirements and guidance, as well as diverse data transmission requirements from different staff elements imposed a taxing burden on resource management staff assets at the MSC level. While much of the information requested was similar, disturbing parameter variations made a single response impossible and further hindered the system, as did the requirement for multiple copies in a "MINIMIZE" communication state.[64]

From this experience, AMCCOM officials gathered that decentralized resource management does not necessarily promote efficient operations. Conflicting guidance and multiple reporting requirements imposed an onerous burden on subordinate activities; separate channels of communication for resource issues additionally hindered a unified command position. To limit the problem in the future, AMCCOM comptrollers urged the centralization of resource management within AMC by the Commanding General to improve communication and interaction among appropriation managers, the use of standardized automated reporting procedures, and the implementation of appropriate policies and procedures.[65]

Beyond the resource management observations deemed "significant," two others appeared in AMCCOM's After Action Report. One involved the separation of wartime requirements and obligations from

those of peacetime and the development of a tracking system for those requirements. The remaining lesson focused upon budgetary requirements and the necessity of accelerating programs during times of emergency.

Thirty-six supply-oriented observations were included in the AMCCOM After Action Report, two with the designation "significant." One lesson deemed significant concerned the materiel release process in emergency situations. Materiel Management noted that no procedure existed whereby the time required to obtain a materiel release order (MRO) could be reduced. As it stood during ODS, the MRO process was time consuming and involved numerous offices. Approval at the command level was always required, with conditional releases needing approval from the four-star level. Ninety days could be consumed in the process, frequently followed by transportation delays. While HQ, AMC did provide some relief, further measures appeared warranted to AMCCOM's materiel personnel. Indeed, they recommended that the MRO process requirement be lessened by a documentary amendment providing relief in emergency situations so that all but necessary staffing might be eliminated and that approval authority might be delegated to the lowest level possible.[66]

Additionally, materiel management personnel submitted that during the initial stages of ODS no centrally accessible document existed which identified deploying units and deployment schedules. And even though the requisitions/validations system contained authorization and asset information, its validity became suspect due to the volume of requisitions received and the knowledge that items were being transferred among units.[67]

In discussions it became apparent that the problem occurred with the flood of requisitions which inundated MSCs when the initial deployment to SWA began. Units submitted requisitions for items they did not need and freely used the SWA priority and project codes, and just as freely sought unnecessarily expedited delivery dates. In some cases the requisitioning units did not even have orders to deploy. Yet lacking a reliable means of validating the requisitions but desirous of fulfilling the needs of the soldier in the sand, item managers released stocks and then attempted the validation process. These requisition validations often resulted in the return of stocks to the depot and ultimately a decline in exaggerated materiel orders.[68]

Thus supply personnel concluded that the traditional batch processing used to update asset and authorization files ran too slowly and became cumbersome during mobilization. And in order that MSCs might function efficiently and accurately, the need for a real or near-real time system, as opposed to a cyclically updated one—weekly, monthly, or bimonthly—was sought. Thus, the materiel management team of AMCCOM recommended that AMC develop a real, or near-real, time asset and authorization file capable of interfacing with the time-phased force deployment data file and any other asset distribution file, including direct input by TRADOC and FORSCOM (United States Army Training and Doctrine Command/ United States Army Forces Command) of items being redistributed within their commands. Materiel Management recommended that HQ AMC initiate the effort with HQDA input and involvement due to the multi-command nature of the implementation.[69]

Taken individually the thirty-four remaining supply-oriented submissions did not warrant AMCCOM's "significant" rating. Yet, taken as a whole, the remaining lessons could warrant scarcely less. As noted in the summary analysis portion of the After Action Report, "the most significant supply lessons learned dealt with the absence of a functioning retail supply system, particularly during the early stages of ODS." Contributing to this overall deficiency was the mid-stream status of the replacement process of the Standard Army Intermediate Level Supply (SAILS) system by the Standard Army Retail Supply System (SARSS). As a result, accountability and visibility of assets received in SWA became practically non-existent. Visibility

was further hampered by the pirating of materiel on a first come rather than requisition basis. This ultimately resulted in an excessive number of requisitions as units continually reordered what had not been received.[70] The various work-arounds utilized in circumventing this problem resulted in a variety of lessons learned: push packages, telephone and datafax requisitions, "priority" code abuse, supply discipline, Desert Express, etc.

Remaining observations developed in conjunction with supply, but not warranting the designation "significant" involved the validation and visibility of supplies as well as the use of Prepositioned Materiel Configured to Unit Sets (POMCUS).

The United States Army's Total Package Fielding (TPF) program also warranted space in the After Action Report. Six lessons learned submitted in conjunction with the program were included in the report; none, however, earned the designation "significant." Regardless, the emergency fielding of new equipment did cause HQ, AMCCOM concern. When equipment was fielded without the benefit of a fielding team, AMCCOM frequently was unable to locate the materiel upon its arrival in theater. As a result, units could not locate materiel in a timely fashion and duplicate shipments were required to correct instances of end items received without necessary support equipment. Individuals involved in Integrated Logistics Support urged the creation of procedures and controls to ensure that during future operations of the ODS nature, limited resources were not wasted in an effort just to get the latest equipment in theater but without the proper support.[71]

Beyond issues of supply and total package fielding, the After Action Report included submissions concerning transportation. The report contained thirty of the observations generated involving transportation issues, only two of which carried the designation "significant." One involved the use of containerized ammunition. USADACS (United States Army Defense Ammunition Center and School) officials observed that in theater port congestion could be reduced by the increased utilization of containerized ammunition shipments. Containerized ammunition, the observers noted, could be removed immediately upon offloading to storage areas. The containers could also be beneficially used to aid retrograde. In consideration of this observation, USADACS personnel urged that they be allowed to perform an assessment of containerization capability.[72]

The conclusions drawn from the study suggested that containerizing ammunition resulted in excessive costs when compared to the use of MILVANs (military vans), and that alternative freight containers needed to be developed for future activities, and perhaps tested in the retrograde from SWA.[73]

A second "significant" transportation lesson drawn from ODS involved the initial lack of a single focal point for ammunition ship planning and the resultant inefficiencies, delay and lack of visibility by the Military Traffic Management Command (MTMC) over all ammunition moving to port. A heavy depot workload contributed to MTMC's inability to maintain separate Export Traffic Release Requests (ETRR) for each item. AMCCOM's Transportation Directorate took note of the difficulties experienced by MTMC and urged the use of its "Fast Release" system to track ammunition ships and shipments. By using the Defense Standard Ammunition Computer System (DSACS), transportation modules automated assistance was provided and management report capability enhanced. The ship messages generated provided complete visibility over what each vessel was to carry, with reports sent to MTMC, customer services, the Commander in Chief, depots, plants, ports, and SWA. The enhanced visibility provided support for prioritization decisions, flexibility for necessary diversions, and preparation for reception and onward transportation. The modified structure was applied to AMCCOM and Single Manager for Conventional Ammunition (SMCA) shipments only.[74]

From this experience, AMCCOM's transportation managers identified the need for a single focal point for all ammunition ship planning actions using a single system, perhaps the "Fast Release" one. MTMC endorsed the proposal and the Transportation Command (TRANSCOM) designated AMCCOM as the single focal point for ammunition ship planning upon discovery of its efforts. The system will provide for both enhanced movement control and total visibility over all ammunition and missile shipments, both SMCA and non-SMCA, and will be used for peacetime as well as contingency, mobilization, and wartime requirements.[75]

Other observations included in AMCCOM's After Action Report focusing on transportation involved the ammunition basic load (ABL), ammunition visibility, documentation, the host utilization of space, and depot, as well as port, facilities.

Three of the submitted and included observations involving weapons received the designation "significant" in the final draft of AMCCOM's Operation Desert Shield/Storm After Action Report. Concerning weapons, AMCCOM's personnel noted that existing design processes did not always place adequate emphasis on assuring that life cycle requirements—safety, reliability, availability, storability—could be met for desert storage and operational use conditions. While ODS was a success and ammunition did perform well, long-term storage under desert conditions would have exacted a high toll on performance and storability had the war continued at great length. Developmental emphasis had been placed too firmly on fighting a western European battle against the forces of the Soviet Union rather than in the deserts of southwestern Asia.[76]

Accelerated testing and modeling techniques revealed a number of potentially dangerous problems. Glue joints on combustible cartridge cases were found to be drastically affected by high temperatures and humidity with resulting reduced availability. Further, extensive exposure to open storage could reduce the reliability of LX14 shape charge warheads, cause premature activation of glass battery ampules, and reduce the reliable life of M577 mechanical time fuzes due to lubricant dissipation. Also, ballistic computers utilizing "off-the-shelf" hardware appeared to perform reliably up to 129 degrees Fahrenheit. However, there were some algorithm errors for extreme propellant temperatures resulting in unreliable ballistic solutions.[77]

Furthermore, studies of the M74 detected a safety hazard in high temperature and humidity conditions, as well as reduced electronic clock accuracy. The sand and dust of the Saudi desert also caused problems with weapons systems and requires further testing and field user feedback. Affected weapons systems include the M9 pistol, the M1911 pistol, the M14 rifle, the M249 machine gun, the M60 machine gun, and the M2 machine gun.[78]

In consideration of these issues, AMCCOM personnel recommended that the design and development processes be modified to emphasize the life cycle requirements that must be met for desert storage and operation.[79]

Further, weaponry personnel noted that ODS had overwhelmingly proven the value of management by weapon system. The keystone to AMCCOM support for ODS became the existence of an organized, trained, and experienced team for operationally critical ammunition items and weapon systems. The system provided the ability to quickly react to user issues and problems as well as offering the visibility requisite for the command to provide direction, redirect resources and immediately respond to inquiries and taskers by higher authorities. The system also facilitated communication between weapon-responsible commands, as well as between LARs in the field and HQ, AMCCOM.[80]

In a note of self-congratulations, AMCCOM's weapons system personnel reiterated the success of weapon systems management not only during development, production, and fielding of systems, but especially during a wartime scenario where rapid adjustments and reactions are required in order to maintain high operational readiness, regardless of operational constraints and the environment. Indeed, the recommended action concerning weapon system management simply stated, "maintain current systems."[81]

The final "significant" weapon-oriented observation included in the After Action Report concerned the accidental discharge of an 84mm:M136 (AT4). A cocked AT4 accidentally discharged when a corporal attempted to improperly safe the weapon. While no lives were lost in the ensuing explosion, 14 soldiers were injured when the AT4 projectile went through a tent, struck a single soldier, bounced past a portable shower unit and entered a second tent where it struck a ruck sack containing a Claymore mine and other assorted ammunition before detonating. The insight gained concerning this accident was simple according to Defense Ammunition Directorate personnel. They noted, "If instructions, either in training or as decals on weapons, can be misinterpreted, they will be."[82]

In order to prevent future incidents, the directorate recommended more intense safety training, improved and clarified safety decals, the emphasis in training on safing weapons, not just firing them.[83]

Further submissions concerned with weapons, but not designated "significant," primarily involved specific weapon maintenance issues in a desert environment, and life cycle requirements for desert storage.

Approximately seventy observations which appeared in the initial listing for AMCCOM's required report did not appear in the final iteration of that document. (Others had been cut from individual directorate office submissions, but do not survive for analysis.) The elimination of the required commentary occurred for a number of reasons: duplication, lack of applicability, the obviousness of the lesson, consolidation with other lessons, the need for further exploration and the declaration of illegality. Some observations were apparently eliminated from the final draft of the After Action Report due to their local nature as well as the possibility of consolidation. For example, material submitted by the Hawthorne Army Ammunition Plant dealt with the facility's somewhat isolated Nevada location and its difficulty in obtaining sufficient commercial carriers to support the high priority shipments required by ODS. Hawthorne also had difficulty outloading large numbers of vehicles with requisitioned ammunition. The difficulty stemmed from inadequate numbers of experienced supervisors, blockers, and bracers, insufficient internal rail structures and crowded loading conditions.[84] As the problems with Hawthorne's outloading capacity seemingly appeared to AMCCOM officials to be a localized one, the submitted lessons were jointly deleted upon the decision that direct action should be taken and a missing, larger-scoped summation generated for inclusion in the final JULLS report.

Beyond Hawthorne's local issues, other material found internal resolution rather than spots in the After Action Report. Thus a "smart" terminal capable of rapidly analyzing time-phased force deployment data was ordered, received, and installed at AMCCOM as recommended, and the Iowa Army Ammunition Plant gained control over its outbound transportation via the institution of stricter dead-head mileage rules and more resolute attention to priorities and required delivery dates. Independence, Missouri's Lake City Army Ammunition Plant prepared a construction project to meet mobilization-oriented MILVAN shortages, and Indiana's Crane Army Ammunition Activity undertook to build up a supply of MILVANs and commercial containers.[85]

Other submissions were cut due to their lack of applicability. Thus submitted lessons concerning the

foreign production of United States ammunition, the proper manner to support borrowed weaponry despite its return, and the need to conduct an already completed study were eliminated.[86] The Executive Council also eliminated repetitive observation files and those with a seemingly over-obvious message. Thus, submissions which encouraged the clear and concise formulation of procedures and guidance, the handling of matters expeditiously, an effort at up-front coordination, and honest communication were cut from the final Operation Desert Shield/Storm After Action Report as apparently being too general or too obvious.[87]

In addition to the deletion of these lessons, the overview committee also struck down the proposal that the 4.2" M329A2, HE, cartridge be used in combination with the M732 proximity fuze. Although the combination had worked well in Operation Desert Storm, members of the Defense Munitions Directorate noted that an 1989 Act of Congress prohibited this action.[88] The Executive Council also disagreed with the United States Army Armament Research, Development and Engineering Center's (ARDEC) desire to make M128 GEMSS mine dispenser readiness availability a factor in the report cards of those units equipped with the device. Despite the fact that a high percentage of the M128 dispensers deployed in Europe were not operational when the decision came to field them in support of ODS and that ARDEC engineers declared it obvious that there had been no sense of urgency in maintaining the dispensers in operational condition, the reviewers apparently did not believe the suggested action warranted.[89]

Several other proposed lessons "disappeared" between the first draft of the report and the finished After Action Report. While some were simply combined to form broader-based lessons as in the missing ones directed to arise from Hawthorne Army Ammunition Plant's problems and the need for clear directions in the bracing and blocking of ammunition, the final disposition of several submitted observations remains in question.[90] While apparently forwarded to AMC as required by AMCCOM's compliance with 10 October 1989's AR 11-33, they do not appear in the After Action Report.[91] These submissions vary from support arrangements for the M12A1 decontamination apparatus and the servicability of the mask, cannister, and filter elements of chemical defense equipment to the availability of qualified quality assurance personnel and the contact team of the Fort Riley M109 self-propelled howitzers. Observations concerning the availability of publications in support of ODS, the total package fielding schedule and the need to utilize the United Nations/performance oriented packaging markings when ammunition shipments directed toward SWA were filled also disappeared from AMCCOM's final report. Other disappearing commentary dealt with the need to review and update AMCCOM's mobilizing temporary duty assignments (TDA) to prevent future delays in facilitating callups as well as mobilizing the foreign intelligence office.

While these observations dropped from the system after being forwarded to AMC for inclusion at the After Action Report, a small number of lessons fell to the simple "delete per Executive Council meeting of . . . ."[92] The reasons did not always appear obvious.

Not since World War II had the United States mobilized so many men or so much materiel in the name of war. And while the continual, vigiliant training conducted in dread of war had been helpful in support of ODS, the experience was not without its problems, frailties, and disappointments. From these less than halcyon moments, observations were gathered, notes were perhaps taken, analyses were made, and lessons were learned. And beyond the containment of the forces of Saddam Hussein along with the preservation of Kuwaiti integrity, these garnered lessons were the most important outcome of the war. Indeed, Army Chief of Staff GEN Gordon R. Sullivan has noted that the lessons learned program, in the form of after-action reviews, is "one of the most important training innovations ever."[93] For only with the honest appraisal and consideration of the shortcomings experienced in one endeavor can soldiers, as well as administrators, learn and improve their future performance.

If broad categories may be drawn from the observations gathered during Operations Desert Shield and Desert Storm, and if the lessons extracted are appropriately applied, future endeavors will find an army better prepared for whatever climate it finds the necessity of engagement. With the declining threat from the Soviet Union, the nation must prepare for warfare not in western Europe as anticipated and prepared for, but rather for small, highly intense conflicts around the world. Men and materiel must be ready for any scenario, backed by research and development.

Similarly, the nation must devote more energy to training and equipping for a battle fraught with the potential for nuclearbiological-chemical combat. While these factors did not appear to be great threats during the period of a bipolar world, their use possibility has risen greatly in the new world order and must be prepared for accordingly. Soldiers and civilians must have equipment which is not only safe, but comfortable in a variety of climatic conditions.

A further broad category which demands attention is that of communication. For as noted in the After Action Report, "Communication during the Gulf Crisis was both a great asset and a potential weak point."[94] AMCCOM relied upon commercial telephone lines and datafax resources to communicate not only in country, but also out of country. Had the system failed due to overload, terrorism, direct Iraqi attack, or friendly fire, the effect might have been disastrous. In order to prevent such over-reliance in future endeavors, AMCCOM, as well as higher headquarters, must develop a transportable communication package for their personnel.

Along with better communication support, LARs, QASAS, and SCRs (senior command representatives) need physical support that they did not receive in SWA. These civilians, for efficacious future action, must receive adequate billeting, clothing, transportation, and authority or their mission may be severely impaired. The creation of a containerized support package maintained within a van gained support as ODS wound down.

A further broad category of observations that will assuredly alter future endeavors is that of regulatory relief. AMCCOM personnel felt stymied during ODS by both statutory and regulatory restrictions guiding socioeconomic programs, competition requirements, and environmental protection, as well as other factors. AMCCOM, and others, must be able to respond in times of emergency without hindering delays.

Perhaps the most significant category of information to be generated by the ODS experience, however, involves the absence of a functioning retail supply system. Caught in mid-stream replacement of the Standard Army Intermediate Level Supply (SAILS) system by the Standard Army Retail Supply System (SARSS), the visibility and accountability of assets received in SWA was practically nonexistent. The system's failure resulted in units taking ordered materiel that was not their own simply to ensure a supply, the build-up of requisitions as units reordered that which was not being received, and work-arounds to resolve the problems engendered.

These observations provide challenges to future training so that those who remember the past are not condemned to repeat it. George Santayana should be pleased.

NOTES

[1]MAJ Donald Wolff, chief of data base management at CALL, "Center for Army Lessons Learned," Soldiers May 1991, p. 28.

[2] MAJ Anne Godsey, CALL data base manager, "Center for Army Lessons Learned," Soldiers, May 1991, p. 28.

[3] MAJ Rich Bogdan, Jr., CALL chief executive officer, "Center for Army Lessons Learned," Soldiers, May 1991, p. 30.

[4]Message (U), CDRAMC to AIG 12113, Subject: Operation Desert Shield Lessons Learned, 151715Z November 1990.

[5]Operation Desert Shield/Storm After Action Report, June 1991, iv-1. Hereafter cited as After Action Report, iv-1.

[6]United States Armament, Munitions and Chemical Command, Lessons Learned Task Force, 7 May 1991, 1.

[7]Operation Desert Shield/Storm After Action Report, Figure II-1, II-3.

[8]*Ibid.*

[9]*Ibid.*, II-2.

[10]Lessons Learned, 11162-02466 (00037) (U), HQ, AMCCOM, Title: Technical Publications for Unique Climatic Conditions, 11 November 1990.

[11]Lessons Learned, 11162-52602 (00038) (U), AMSMC-QAL, Title:Information Related to AMCCOM Equipment Operation in Adverse Conditions, 11 November 1990.

[12]Lessons Learned, 12730-21506 (00056) (U), USADACS, Title:Availability of Logistics Documentation, 26 November 1990.

[13]Lessons Learned, 52256-57232 (00158) (U), AMSMC-QAN, Title: True Climatic Conditions, 20 May 1991.

[14]Lessons Learned, 52952-41644 (00201) (U), ARDEC, SMCAR-AST, Title: Ammunition Interchangability, 23 May 1991.

[15]Lessons Learned, 61227-74231 (00237) (U), AMCCOM-SWA, Title: Accountability of Class C, 11 June 1991.

[16]Operation Desert Shield/Storm After Action Report, Summary Analysis—"Ammunition".

[17]Lessons Learned, 11156-81427 (00028) (U), CRDEC, Title: Simple, Transportable Collective Protection, 11 November 1990.

[18]Lessons Learned, 11159-50402 (00034) (U), CRDEC, Title: Vehicle Collective Protection/Cooling, 11 November 1990.

[19]Lessons Learned, 11157-40472 (00029) (U), CRDEC, Title: Realistic and Timely Intelligence, 11 November 1990.

[20]Lessons Learned, 11157-95540 (00030) (U), CRDEC, Title: Chemical Protective Equipment, 11 November 1990.

[21]Lessons Learned, 11157-95540 (00032) (U), HQ, AMCCOM, Title: Protective Masks Preventive Maintenance Checks and Services (PMCS), 11 November 1990.

[22]Lessons Learned, 11159-81578 (00035) (U), CRDEC, Title: Miscellaneous Consumable CB Defense Equipment, 11 November 1990.

[23]Lessons Learned, 11160-08074 (00036) (U), CRDEC, Title: Chemical/Biological Defense Materiel Management, 11 November 1990.

[24]*Ibid.*

[25]Lessons Learned, 32138-07116 (00084) (U), CRDEC, SMCCR-OC, Title: Chemical Protective Equipment (CPE) for Non-Combatants, 14 March 1991.

[26]Lessons Learned, 52356-58715 (00173) (U), AMSMC-RT, Title: Special Artillery Marking Round for Friendly Troop Positions, 23 May 1991.

[27]Lessons Learned, 52359-34842 (00176) (U), AMSMC-QA, Title: Shelf Life of Chemical Detection Items, 23 May 1991.

[28]Lessons Learned, 60563-59509 (00222) (U), CRDEC, SMCCR-DD, Title: Biological Detection Equipment, 23 May 1991.

[29]Lessons Learned, 61236-40384 (00247) (U), CPDEC, PM NCBDS AMCPM, Title: Fox NBCRS Operations in SWA, 12 June 1991.

[30]Lessons Learned, 52357-67995 (00174) (U), AMSMC-RD, Title: Commercial Telephone Communication Dependency, LAR, 23 May 1991.

[31]*Ibid.*

[32]Operation Desert Shield/Storm After Action Report, Summary Analysis—"Communication".

[33]Lessons Learned, 50233-99344 (00117) (U), AMSMC-MM, Title: Handling of Captured Foreign Materiel, 1 May 1991.

[34]*Ibid.*

[35]Lessons Learned, 52255-19852 (00157) (U), AMSMC-QAL, Title: Laser Protection for Apache Helicopter Crews, 20 May 1991.

[36]Lessons Learned, 91847-80204 (00003) (U), AMCCOM, Title: Identification of Deploying Units, 29 August 1990.

[37]Lessons Learned, 60468-67213 (00217) (U), AMSMC-DS, Title: Ammunition Requirements, 23 May 1991.

[38]Lessons Learned, 52358-71848 (00175) (U), AMSMC-RD, Title: LAR Deployment, Communication, Transportation, Life Support, 23 May 1991.

[39]Lessons Learned, 53143-09305 (00212) (U), ARDEC SMCAR-FSM, Title: Foreign Ammunition Exploitation Program, 23 May 1991.

[40]Lessons Learned, 91847-40536 (00002) (U), AMCCOM, Title: Determining Unit Shortages, 12 September 1990.

[41]Lessons Learned, 32136-04853 (00081) (U), AMSMC-IR, Title: AMC War Plan and MOPES, 21 March 1991.

[42]Lessons Learned, 52242-46234 (00150) (U), AMSMC-RD, Title: Preparation for Overseas Rotation/ Movement (POR/M)-ODS, 17 May 1991.

[43]Lessons Learned, 52350-31933 (00171) (U), AMSMC-RD, Title: AMCCOM Equipment Support for CONUS Replacement Centers (CRC) OPS Project, 23 May 1991.

[44]*Ibid.*

[45]Lessons Learned, 53048-32685 (00209) (U), WVA SMCWV-PCP-R, Title: Skills Needed, 23 May 1991.

[46]Lessons Learned, 60533-71672 (00220) (U), AMSMC-RDA, Title: Readiness Rating, 23 May 1991.

[47]Lessons Learned, 52359-69829 (00177) (U), AMSMC-PT, Title: Hiring Authority for Operation Desert Storm, 23 May 1991.

[48]Lessons Learned, 40944-10412 (00100) (U), AMSMC-PDJ, Title: Environmental Constraints on "Red Water", 5 April 1991.

[49]Lessons Learned, 52361-37989 (00179) (U), AMSMC-PPC, Title: Regulatory Relief, 23 May 1991.

[50]Lessons Learned, 52447-17232 (00181) (U), AMSMC-PCW, Title: Mobilization, 23 May 1991.

[51]Lessons Learned, 52832-79304 (00188) (U), AMSMC-PT M, Title: Small Business 8(a) Goals, 23 May 1991.

[52]Lessons Learned, 52833-20592 (00189) (U), AMSMC-PPC, Title: Modification of Acquisition Process, 23 May 1991.

[53]*Ibid.*

[54]*Ibid.*

[55] *Ibid.*

[56] Lessons Learned, 00438-93789 (00008) (U), AMSMC-CP, Title: Financial Reporting Requirements, 4 October 1990.

[57] *Ibid.*

[58] Operation Desert Shield/Storm After Action Report, Summary Analysis—"Resource Management".

[59] Lessons Learned, 01969-89422 (00009) (U), AMSMC-PC, Title: RS 3732 Authority, 19 October 1990.

[60] Lessons Learned, 50827-57627 (00135) (U), AMSMC-CP, Title: Costs, 1 May 1991.

[61] *Ibid.*

[62] *Ibid.*

[63] Lessons Learned, 50828-84121 (00136) (U), AMSMC-CP, Title: Tracking Costs by MDEP, 1 May 1991.

[64] Lessons Learned, 50829-36745 (00137) (U), AMSMC-CP, Title: Resource Management Operations within AMC, 1 May 1991.

[65] *Ibid.*

[66] Lessons Learned, 52254-35311 (00156) (U), AMSMC-QAL, Title: Materiel Release Process during Emergency Operations, 20 May 1991.

[67] Lessons Learned, 52360-16406 (00178) (U), AMSMC-MM, Title: Identification and Prioritizing of Deploying Units, 23 May 1991.

[68] *Ibid.*

[69] *Ibid.*

[70] Operation Desert Shield/Storm After Action Report, Summary Analysis—"Supply".

[71] Operation Desert Shield/Storm After Action Report, Summary Analysis—"Total Package Fielding".

[72] Lessons Learned, 12750-29983 (00060) (U), USADACS, Title: Containerized Ammo Shipments, 26 November 1990.

[73] *Ibid.*

[74] Lessons Learned, 52348-94169 (00170) (U), AMSMC-TM, Title: Single DOD Focal Point for Ammunition Ship Planning, 20 May 1991.

[75] *Ibid.*

[76]Lessons Learned, 52258-59226 (00159) (U), AMSMC-QAN, Title: Life Cycle Requirements for Desert Storage and Operational Use Conditions, 20 May 1991.

[77]*Ibid.*

[78]*Ibid.*

[79]*Ibid.*

[80]Lessons Learned, 52353-76942 (00172) (U), AMSMC-AS, Title: Weapons Systems Management, 20 May 1991.

[81]*Ibid.*

[82]Lessons Learned, 52961-33513 (00203) (U), ARDEC AMSMC-DSM, Title: Launcher and Cartridge, 84mm: M136 (At4), Accidental Discharge, 23 May 1991.

[83]*Ibid.*

[84]Draft of Lessons Learned, 11150-31186 (00020) (U), Hawthorne AAP, Title: Commercial Carrier Availability to Support High Priority Shipments, 11 November 1990; 51760-07135 (00143) (U), Hawthorne AAP, Title: Installation Shipping Capacity, 17 May 1991; 51762-57546 (00145) (U), Hawthorne AAP, Title: Expanding Installation Outloading Capabilities, 17 May 1991; 51763-72082 (00146) (U), Hawthorne AAP, Title: Lack of Rail in South Magazine Area, 17 May 1991; and 51764-31577 (00147) (U), Hawthorne AAP, Title: Lack of Commercial Transportation Assets, 17 May 1991.

[85]*Ibid.*, 92864-28496 (00007) (U), AMCCOM, Title: Time-Phased Force Deployment Data (TPFDD) Accessibility, 28 September 1990; 11151-29612 (00022) (U), Iowa AAP, Title: Outbound Transportation, 11 November 1990; 60568-21076 (00223) (U), Lake City AAP, Title: MILVAN Handling Facility, 23 May 1991; 6073474498 (00229) (U), Crane AAA, Title: MILVAN/Commercial Containers, 11 June 1991. Although the drafters of the Lessons Learned estimated that the "smart" terminal would be in place within five years, it was actually installed within a single year. See Lessons Learned, 92864-28496 (00007) (U), AMCCOM, Title: Time-Phased Force Deployment Data (TPFDD) Accessibility, 28 September 1990.

[86]Draft of Lessons Learned, 52951-01271 (00200) (U), ARDEC SMCARAST, Title: World Ammunition Production Data Base, 23 May 1991; 61135-16862 (00231) (U), AMSMC-LSP, Title: Shoulder Launched Multi-Purpose Assault Weapon (SMAW), 11 June 1991; 52968-52883 (00207) (U), ARDEC AMSMC-LSA, Title: Shortage of Replacement/Spare Parts, 23 May 1991.

[87]*Ibid.*, 92863-71412 (00006) (U), AMCCOM, Title: HQ, AMCCOM Surge Production Program, 28 September 1991; 41019-15724 (00106) (U), AMSMC-CA, Title: Obligation Reporting, 10 April 1991; 52342-89983 (00167) (U), LHAAP SMCLO-XC, Title: Ammo Plant MILVAN Loading Capability, 20 May 1991; 52468-61649 (00183) (U), AMSMC-RDP, Title: Segregation of ODS Suppon Funds, 23 May 1991; 52827-48372 (00184) (U), AMSMC-PPM, Title: Desert Storm Budget, 23 May 1991; 52830-33551 (00186) (U), AMSMC-SP, Title: Federal Acquisition Regulation (FAR), 23 May 1991; 52957-93815 (00202) (U), ARDEC SMCAR-ASF, Title: Return of Captured Enemy Equipment, 23 May 1991; 52966-33121 (00204) (U), AMSMC-LSL, Title: M109 Howitzer Parts Shortages, 23 May 1991; 52969-31520 (00208) (U), WVA SMCWVPP, Title: Chief, Purchasing and Contracting Division, 23 May 1991; 60537-15237 (00221) (U), CRDEC SMCCR-OPA, Title: Use of the M687 Binary Round for Prototype Day/Night Marking and

Illumination, 23 May 1991; 60629-79642 (00224) (U), AMSMC-DS, Title: Receipt of Sustainment Requirements from DA, 23 May 1991; 61234-13251 (00242) (U), AMCCOM-SWA, Title: Lack of Movement Control (MCT) Support as TSAs, 11 June 1991; 62769-80722 (00262) (U), CRDEC PM-AMMOLOG, Title: Acceleration of Ammunition Surveillance Information, 21 June 1991, 70950-74923 (00270) (U), ARDEC, Title: AMCCOM Materiel Release Coordinator, 21 June 1991; and 91855-16051 (00004) (U), AMSMC-PD, Title: Problem Areas in Price and Availability (P&A), 29 August 1990; 91855-68456 (00005) (U), AMCCOM, Title: PM Mortars, 24 August 1990; 31427-84563 (00080) (U), AMSMC-LS, Title: Fielding of Non-Standard Equipment for Operation Desert Storm, 11 March 1991; 53049-39262 (00210) (U), WVA SMCWV-IN, Title: Public Affairs Office, 23 May 1991; 61228-23087 (00239) (U), AMCCOM-SWA, Title: Combat Units Attempting to Attain Excessive Amount of Supplies under UBL (Unit Basic Load) Authority, 11 June 1991; 61288-58157 (00240) (U), AMCCOM-SWA, Title: Theater Ammo Units Tasked to Provide Direct Support to Kuwait City, 11 June 1991; 61234-41378 (00243) (U), AMCCOM-SWA, Title: Conflicting Instructions-Redeployment/Retrograde Procedures, 11 June 1991; 61235-93851 (00246) (U), Picatinny, Title: Climatic Conditions, 12 June 1991; 70225-36882 (00263) (U), ARDEC, Title: Enhanced Performance through Improved Coordination and Communication, 21 June 1991; and 70926-18248 (00267) (U), ARDEC, Title: Projectile 155mm Artillery Delivered Expendable Jammer (AD/EXJAM) XM867, 21 June 1991.

[88] *Ibid.*, 60633-64823 (00228) (U), SMCAR-FSS-DM, Title: M329A2, HE Cartridge/M732 Proximity Fuze, 6 June 1991.

[89] *Ibid.*, 60456-50833 (00213) (U), ARDEC SMCAR-FSM, Title: M128 GEMSS Mine Dispenser, 23 May 1991.

[90] *Ibid.*, 51760-07135 (00143) (U), Hawthorne AAP, Title: Installation Shipping Capability, 17 May 1991; 51762-57546 (00145) (U), Hawthorne AAP, Title: Expanding Installation Outloading Capabilities, 17 May 1991; 51764-31577 (00147) (U), Hawthorne AAP, Title: Lack of Commercial Transportation Assets, 17 May 1991; 61724-76282 (00250) (U), Picatinny, Title: Shipment of Ammunition Basic Load, 21 June 1991; 61830-81896 (00252) (U), CRDEC, PM-AMMOLOGMCPM, Title: Compliance with 49 CRF and Transportation Exemption (DOT-E) 3498, 21 June 1991; and 6191933860 (00253) (U), CRDEC, PM NBCDS AMCPM, Title: Ammunition Blocking and Bracing Requirements, 12 June 1991.

[91] *Ibid.*, 11158-26677 (00031) (U), HQ, AMCCOM, Title: M12A1 Decontamination Apparatus, 11 November 1990; 11159-15508 (00033) (U), HQ, AMCCOM, Title: Serviceability of Masks, Canisters, and Filter Elements, 11 November 1991; 11166-61358 (00048) (U), McAlester AAP, Title: Personnel, 11 November 1991; 20435-73902 (00064) (U), AMSMC-MA, Title: M109 Self-Propelled Howitzers Located at Ft. Riley, KS, M109 Contact Team, 30 November 1990; 21049-57344 (00065) (U), AMSMC-MA, Title: Publications for Operation Desert Shield, 7 December 1990; 10238-59483 (00071) (U), CRDEC, Title: Total Package Fielding Schedule, 2 January 1990 (1991?); 10239-94659 (00072) (U), McAlester AAP, Title: UN/Performance Oriented Packaging Markings, 2 January 1990 (1991?); 32143-47105 (00091) (U), AMSMC-PT, Title: AMCCOM Individual Mobilization Augmentee (IMA) Callup, 19 March 1991; 50350-50684 (00132) (U), AMSMC-SI, Title: Wartime Mobilization of the Foreign Inteiligence Office, 1 May 1991; 52241-18626 (00149) (U), AMSMCRD, Title: Deployment, Weapons, Equipment, and Reimbursement, 17 May 1991; and 52263-25554 (00163) (U), AMSMC-QAW, Title: Shelf Life of Chemical Detection Items, 20 May 1991.

[92] *Ibid.*, 52241-18626 (00149) (U), AMSMC-RD, Title: Deployment, Weapons, Equipment, and Reimbursement, 17 May 1991; 60631-11045 (00225) (U), SMCAR-ISQ-F, Title: Unsolicited Donations from the American People, 6 June 1991; 61135-09068 (00230) (U), CRDEC AMCPM-SK, Title: Fog Oil for Large Area Smoke Generation, 6 June 1991; 61151-73102 (00235) (U), AMCCOM-SWA, Title: Reception of Unit,

11 June 1991; 61224-39856 (C0236) (U), AMCCOM-SWA, Title: TACCS for DISPERS Management, 11 June 1991; and 61230-05671 (00241) (U), AMCCOM-SWA, Title: Downloading of Corp Weapon Systems, 11 June 1991.

[93]GEN Gordon R. Sullivan, "A Trained and Ready Army: The Way Ahead," Military Review, November 1991, p. 6.

[94]Operation Desert Shield/Storm After Action Report, Summary Analysis—"Communication".

Chapter Seven

Concluding Commentary on AMCCOM's Role in Operations Desert Shield and Desert Storm

On the evening of 27 February 1991, President George Bush addressed not only America, but the world as well, from the Oval Office of the White House. With the world's full attention, he announced:

> America and the world drew a line in the sand. We declared that the aggression against Kuwait would not stand, and tonight, America and the world have kept their word.[1]
>
> Kuwait is liberated. Iraq's army is defeated. Our military objectives are met . . . . (This) is a time of pride in our troops. . . . And soon we will open wide our arms to welcome back home to America our magnificent fighting forces.[2]

Beyond announcing the suspension of offensive combat operations in Iraq and Kuwait, President Bush also laid down the requirements that the defeated Saddam Hussein would have to meet for the suspension of hostilities to become a permanent cease-fire. The conditions specified that Iraq must immediately release all prisoners of war (POWs), third-country nationals, Kuwaiti detainees and the remains of those killed. Furthermore, President Bush ordered that the Iraqi government disclose the location of all deployed land and sea mines. Additionally, he disclosed that before the temporary cease-fire could be considered permanent that Iraq must agree to comply with all United Nations resolutions, including rescission of the annexation of Kuwait and payment of compensation for damages caused by its aggression. The Iraqis were also called upon to designate military commanders to meet with a coalition delegation within 48 hours to arrange for military aspects of the cease-fire.[3]

Heading the coalition delegation, GEN H. Norman Schwarzkopf, United States Army, met with senior Iraqi military representatives in a tent beside the gravel runway at Safwan, Iraq, on Sunday, 3 March 1991. Emerging from the two-hour session, GEN Schwarzkopf reported that both sides had agreed on all matters discussed. Within hours of the meeting, the Iraqis released ten POWs, including six Americans. The remainder of the POWs held by Saddam Hussein were freed over the course of the next four days. The process of releasing the over 100,000 Iraqis who had surrendered to coalition forces was also begun with dispatch.[4]

Ironing out the details of the formal cease-fire agreement at the United Nations took another month. That mission was accomplished on 3 April, 1991, with Saddam Hussein pronouncing his acceptance on 6 April, and the official cease-fire being proclaimed on 10 April. Included within the United Nations agreement was the authorization of a 1,440-member observer team to oversee the newly created demilitarized zone separating Kuwait and Iraq.[5]

Even as the two delegations were meeting in Safwan, Iraq, Islamic fundamentalists in the southern Iraqi city of Basra were rising in revolt against the rule of Saddam Hussein. The arrival of thousands of Iraqi troops and vehicles driven out the Kuwaiti desert by the Desert Storm blitzkrieg added to the chaos and confusion in the nation's second largest city. The arriving remnants of the Iraqi Republican Guard, many apparently still loyal to Saddam Hussein, turned their few remaining tanks and guns on the rebels and in a few days crushed the revolt in Basra and nearly a dozen other southern cities. Thousands of rebels

escaped, fleeing southward toward the American-occupied regions of southern Iraq. Similar uprisings were underway in the predominantly Kurdish regions of northern Iraq, near the borders with Turkey and Iran. In these instances, Hussein unleashed his remaining helicopter gunships against the lightly armed Kurds, and again it took only a few days to turn nearly a million rebels into refugees, fleeing to the mountainous regions along the Turkish and Iranian borders. In the melee, Operation Desert Storm (ODS), born of Operation Desert Shield, became Operation Provide Comfort as approximately 13,000 coalition military personnel, including about 9,000 American soldiers, turned their full attention upon providing food, shelter and medical care to the refugees.[6]

While the uprisings continued in the nation of Iraq, and coalition warriors struggled to "provide comfort," the foremost thought in the minds of most Americans, and the troops deployed to the desert in particular, was a simple, "When do we go home?" President Bush provided the first hint that U.S. troops would soon be returning when he addressed Congress just three days after the 3 March 1991 Safwan agreements. To the joint session, the president pronounced:

> Soon our troops will begin the march we've all been waiting for -- their march home. I have directed Secretary (of Defense Richard B.) Cheney to begin the immediate return of American combat units from the Gulf. Less than two hours from now, the first planeload of American soldiers will lift off from Saudi Arabia, headed for the U.S.A. That plane will carry men and women of the 24th Mechanized Infantry Division bound for Fort Stewart, Georgia. This is just the beginning of a steady flow of American troops coming home.[7]

With that initiative, the redeployment of U.S. forces became the next major effort of USCENTCOM (United States Central Command). Within just a few days, a daily average of 5,000 troops was being airlifted back to the United States. Those not engaged in monitoring the cease-fire in Iraq and Kuwait or providing comfort to refugees turned their attention to the repair, cleanup, repacking and loading of the mountains of supplies and equipment which had taken seven months to deliver. As the Association of the United States Army's Special Report The U.S. Army in Operation Desert Storm observed, "Not even the oldest soldier in Desert Storm had ever witnessed a 30-mile square ammunition supply point like the one established in Saudi Arabia."[8]

Quoting President George Bush's 27 February 1991 address to the nation, MG Paul L. Greenberg, commander of the United States Army Armament, Munitions and Chemical Command, could note with pride that, "No small part of the success of Operations Desert Shield and Desert Storm [lay] with the employees of . . . AMCCOM." Not only had the command's employees worked diligently to ensure that American troops had received the equipment, munitions and supplies needed to maintain superiority in the desert, but many had volunteered to travel to Southwest Asia (SWA) personally. Following a listing of AMCCOM's major accomplishments during the deployment, including the output of assorted army ammunition plants (AAPs), the filling of 210,300 requisitions valued at $6.62 billion, the shipment of more than 453,000 short tons of ammunition to support the troops in SWA, the refurbishing of hundreds of thousands of chemical protective masks, and the development and shipment of over 78,000 copies of three technical manuals covering armament, munitions and chemical defense equipment, MG Greenberg could offer, "By working together you have brought hope and encouragement to our young men and women in the field. Your efforts have made the victory in the Persian Gulf a total success."[9]

MG Greenberg's comments on AMCCOM contributions to the victory in the desert, due to their

format, touch but the tip of the sand dune. During Operations Desert Shield and Desert Storm, AMCCOM employed 17,934 civilian employees and 633 military personnel. During the deployment, the command was authorized to hire 1,035 temporary employees in support of the operation. Approximately 700 temporary employees, scattered amongst the various locations under the hegemony of AMCCOM, were actually hired. Installations utilizing temporary employees included McAlester Army Ammunition Plant, McAlester, OK; Crane Army Ammunition Activity, Crane, IN; Pine Bluff Arsenal, Pine Bluff, AR; Rock Island Arsenal, Rock Island, IL; U.S. Army Armament Research, Development and Engineering Center (ARDEC), Picatinny Arsenal, NJ; U.S. Army Chemical Research, Development and Engineering Center (CRDEC), Aberdeen Proving Ground, MD; and a few selected headquarters elements, Rock Island, IL. During the war, the command deployed over 240 military and civilian employees to the desert. Additionally, military Individual Mobilization Augmentees (IMAs) were activated to predetermined positions on the AMCCOM Mobilization Table of Distributions and Allowances (TDA). A total of one hundred forty-one reservists were activated. They filled mobilization TDA positions at HQ, AMCCOM, CRDEC, Pine Bluff Arsenal, and McAlester Army Ammunition Plant. Of the total activated, five served their nation in SWA.[10]

The personnel of AMCCOM and its subordinate units had been further augmented during ODS by the authorization it received to buyback 132 civilian positions it had lost in the August 1990 reduction-in-force. All told, the civilian workload undertaken by AMCCOM and its subordinates in support of ODS from 6 August 1990 through 28 February 1991 constituted 1,619,552 hours with a concommitant expenditure of $52 million.[11]

Working together, AMCCOM's personnel administered 508,100 materiel requisitions in support of Operations Desert Shield and Desert Storm. Prior to the onset of the deployment, its offices had filled an average of 50,000 requisitions per month, but with the deployment this number rose to approximately 73,000 requisitions per month. AMCCOM's Procurement Directorate accelerated 149 actions, 53 contracts, 96 purchase orders, and awarded 503 contracts in support of ODS. Consequently the directorate administered a total of 1,434 procurement requirements during the war at a dollar value of $895,169,286. Many of these actions were executed with little or no additional cost to the government, or accordingly, the taxpayer, as they represented accelerations, not unbudgeted purchases. By the war's conclusion, AMCCOM had shipped $97 million worth of Class II supplies (individual equipment), and $356 million worth of Class IX supplies (repair parts). Such efforts contributed mightily to the iron mountain of materiel shipped to SWA by AMCCOM.[12]

Major items shipped by AMCCOM to SWA in support of Operations Desert Shield and Desert Storm by AMCCOM included the following:[13]

MAJOR ITEM	QUANTITY
M240 machine gun	1,792
M240C machine gun	381
M60 machine gun	1,076
M60D machine gun	150
MT tripod M122	793
M249 machine gun	929
M2 machine gun, flex	372
M3 tripod	569
M2 machine gun, fixed	277
M85 machine gun	228
MK19 grenade machine gun	395
M9, 9mm pistol	10,770

MAJOR ITEM	QUANTITY
M1911A1, 45 caliber pistol	9,254
38 caliber, 4" barrel revolver	490
38 caliber, 2" barrel revolver	90
M3A1 45 caliber submachine gun	316
M1200 12 gauge shotgun	203
Pyrotechnic AN-M8 pistol, without mount	36
M16A1 rifle	45,896
M16A2 rifle	9,420
M203 grenade launcher	1,183
M24 sniper weapon system	180
M21 sniper rifle	5
M41 armament subsystem	28
M24 armament subsystem	13
M23 armament subsystem	17
M130 general dispenser	454
M197 20mm machine gun	13
M230 30mm automatic gun	19
M24A1 4.2" mortar	11
M29A1 81mm mortar	6
M224 60mm mortar	7
M23 computer ballistics	35
M252 81mm mortar	81
M67 90mm recoilless rifle	31
M12A1 decontaminating apparatus	282
M17 lightweight decontaminating apparatus	600
M87 gas particulate filter unit	15
M56 gas particulate filter unit	10
M59 gas particulate filter unit	25
M10 protective entrance	20
M12 protective entrance	2
M20 simplified collective protection equipment	348
M51 shelter system	46
M9A1 gas mask	1,202
M43 aircraft mask	680
M24 aircraft gas mask	3,962
M25A1 tank gas mask	27,585
M17 series field gas mask	314,585
M3A41/M157 smoke generators	99
M239/M250/M243/M257/M259 smoke grenade launchers	1,462
M841 chemical agent alarm (CAA)	4,529
M140 test set	35
M81 simulator	342
chemical agent monitor (CAM)	66
mine clearing line charger (MICLIC) launchers	34
mine clearing line charger (MICLIC) trailers	34
M33A1 disperser	22
Canadian chemical agent monitors	500
battery servicing shelter mounted shop set	6

MAJOR ITEM	QUANTITY
fire control mechanic tool kit	17
field ordnance tool set	4
automotive maintenance tool kit #2	5
aircraft armament repairman tool kit	42
small arms repair shelter mounted shop set	2
automotive maintenance tool kit #1	22
field maintenance machine shop	2
canvas and glass repair, shelter mounted shop set	10
spare parts storage shop set	29
special weapons tool kit	3
engineer air assault tool kit	18
artillery repair shop, shelter mounted	3
artillery shop set, field maintenance	4
tracked vehicle maintenance shop set	2
electronic systems maintenance tool set	8
electronic maintenance tool kit	8
instrument and fire control tool kit	5
robot explosive ordnance device	28
M122 firing device	36
lathe engine	19
welding machine	35
torch outfit	21
power hacksaw	2
MK36 tool set, explosive ordnance device	15
MK37 tool set, explosive ordnance device	20
container cavity	15
lathe brake drum	9
steam cleaner	109
tool outfit hydraulic test and repair kits	6
electrical repair shop set, semi-trailer mounted	6
tool set, injection explosive MK MODS	8
tool set, fiberscope, MK 1, MOD 0	34
shop equipment. general purpose kits	2
shop equipment, contact maintenance kits	405
back-up computer system, general	90
shop equipment, organizational repair kit	20
back-up computer system, special	42
M102 howitzer	8
M163A1 self-propelled VADS	3
M65 periscope	52
telescope	39
M109A2 howitzer	3
M109A3 howitzer	3
M578 recovery vehicle	10
M198 howitzer	1
M138 mine dispenser (flipper)	114
M2A2 aiming circle	174
M90 radar chronograph	49

Major systems supported by AMCCOM during ODS, primarily with items manufactured at the command's Rock Island Arsenal, Rock Island, IL, facility, included the M102 105mm towed howitzer, the M198 155mm towed howitzer, the M109 155mm self-propelled howitzer and M110 8" self-propelled howitzer. Additionally, AMCCOM supported the M167A1 towed Vulcan, the M12 decontaminating unit, and the M163A1 self-propelled Vulcan. Parts supplied to the forces in SWA in support of these major weapon systems included recoil rails, replenishers, recuperators, obturator pads, and spacers to prevent inadvertent damage to the army's newly designed M864 white phosphorous smoke projectile and M825A1 projectile, containing small multiple bomblets. Without the spacers, the projectiles rattled dangerously in the howitzers' storage bustles.[14]

Aiding HQ, AMCCOM in supporting the deployed troops were its three arsenals: Pine Bluff Arsenal, Pine Bluff, AR; Rock Island Arsenal, Rock Island, IL; and Watervliet Arsenal, Watervliet, NY. As noted, Rock Island Arsenal served primarily as a job lot shop during the war, providing numerous spare parts, as well as spacers for the effort. Additionally, its staffers assembled and shipped quantities of tool kits and shop sets, as well as painted deploying National Guard unit vehicles the appropriate desert camouflage CARC (chemical agent resistant coating). Pine Bluff Arsenal refurbished tens of thousands of chemical defense masks both at their Arkansas site and at a Dhahran, Saudi Arabia, facility. Additionally, Pine Bluff Arsenal provided contact teams to travel into the desert to refurbish the masks, and build the confidence of units that could not travel to Dhahran. Pine Bluff Arsenal also aided the cause of liberty in SWA by its increased production of 81mm smoke-generating red phosphorous mortar rounds designed to screen or mask soldiers' activities. And, of course, Watervliet Arsenal had provided crucial boring and welding input on the creation of the infamous "bunker-buster" that helped to bring the war to a successful close.[15]

Also helping to bring the Persian Gulf War to a successful conclusion was the designation of AMCCOM as the single focal point for ammunition ship planning. While AMCCOM's bureaucratic predecessor had been declared the Single Manager for Conventional Ammunition (SMCA) in 1977 when the army assumed control of all the nation's ammunition facilities, it was not until the opening of Operation Desert Shield that AMCCOM's responsibilities expanded to include ammunition ship planning.[16]

The designation came about after a significant amount of chaos in the initial days of ODS. During the opening stage of the operation, some ammunition shipments were "free flowing" into the ports without the prior knowledge of the Military Traffic Management Command (MTMC) through Export Traffic Release Requests (ETRRs). Noting that heavy depot workloads contributed to a backlog of delayed ETRRs, resulting in inefficiencies, delays and a distinct lack of visibility over all ammunition moving to port, AMCCOM proposed a solution. The command proposed that by using a single data system, its "Fast Release" structure, some of the confusion could be eliminated and the servicemember more effectively served. Persuaded by the argument, MTMC endorsed AMCCOM's proposal and TRANSCOM (United States Army Transportation Command) designated AMCCOM as the single focal point for ammunition ship planning.[17]

Using the Fast Release system, AMCCOM made tentative plans for 60 ammunition carrying vessels to leave the continental United States (CONUS) in support of the territorial integrity of Kuwait and Saudi Arabia. Of the planned vessels, 24 were intended to support the needs of the army, in terms of SMCA, with the transport of 222.5 thousand short tons. Twenty-two vessels were intended to carry 226.4 thousand short tons for the use of the air force, and 14 ships were scheduled to move 117 thousand short tons for the Marine Corps. Yet before all scheduled vessels could depart CONUS, or even be loaded, Operation Desert Storm had ground to a close. By the war's conclusion, however, only 49 of the planned 60 vessels had been loaded and otherwise prepared for transit to SWA. Of the prepared vessels, 23 were loaded with

army ammunition, 17 with air force conventional ammunition, and nine with Marine Corps ammunition. The loaded vessels carried an ammunition total of 477,000 short tons. A total of 44 ships actually sailed toward SWA under the suzerainty of AMCCOM during ODS. Of the vessels actually leaving CONUS ports, 23 carried army ammunition, 12 bore air force supplies, and nine transported Marine Crops conventional ammunition. The total tonnage of ammunition the vessels bore was 434,000 short tons. The remaining ammunition provided to Americans and coalition members in the desert was supplied from facilities based outside the continental United States (OCONUS).[18]

During the course of Operations Desert Shield and Desert Storm, the command directed shipments of ammunition to the desert totaling $4 billion. This included 274,000 short tons of bombs, 245,000 short tons of artillery, 34,000 tons of small arms ammunition, 36,000 tons of mortar, tank, and navy gun munitions, and an assortment of 31,000 additional tons. The total shipments directed by AMCCOM constituted 620,000 tons. And while this tonnage includes that shipped from OCONUS facilities, it does not include the approximately 60,000 short tons of assorted Class V (ammunition) stores carried on three Marine Corps Near Term Prepositioned Fleet (NTPF) vessels—the *Green Island*, the *Green Harbor*, and the *Austral Rainbow*.[19]

Aiding AMCCOM in supplying America's fighting men and women, as well as many coalition members, with ammunition were its thirteen government-owned, contractor-operated (GOCO) army ammunition plants (AAPs) and two government-owned, government-operated (GOGO) facilities. Falling into the former category are: Hawthorne Army Ammunition Plant, Hawthorne, NV; Holston Army Ammunition Plant, Kingsport, TN; Indiana Army Ammunition Plant, Charlestown, IN; Iowa Army Ammunition Plant, Middletown, IA; Kansas Army Ammunition Plant, Parsons, KS; Lake City Army Ammunition Plant, Independence, MO; Lone Star Army Ammunition Plant, Texarkana, TX; Longhorn Army Ammunition Plant, Marshall, TX; Louisiana Army Ammunition Plant, Shreveport, LA; Milan Army Ammunition Plant, Milan, TN; Radford Army Ammunition Plant, Radford, VA; Scranton Army Ammunition Plant, Scranton, PA; and Sunflower Army Ammunition Plant, DeSoto, KS. GOGO facilities include McAlester Army Ammunition Plant, McAlester, OK, and Crane Army Ammunition Activity, Crane, IN.[20]

Several of the plants were cited in the official after action report for their extraordinary accomplishments in support of Operations Desert Shield and Desert Storm. Crane Army Ammunition Activity, for example, received commendation for their modification of 1,500 linear demolition charges, the delivery of 7,050 short tons of ammunition in a seven day period, and the loading of 52 railcars and 66 trucks in 23 days. Loading 258 trucks and 138 railcars in a week, as well as moving from a single work shift to a three shift rotation covering a 24 hour, seven day per week schedule, and shipping 65 short tons of ammunition in a mere 90 days earned Hawthorne AAP notice. Indiana AAP earned notice as well for its accomplishments during ODS. During the war, the plant shipped 235,000 propelling charges. Additionally, it loaded 63 MILVANs (military vans) and 15 railcars in a single, arduous week.[21]

Iowa AAP, working from Middletown, IA, despite a brief work stoppage, shipped 8,500 short tons of tank ammunition, mines, demolitions, and missile warheads, constituting 80 railcars and 190 truck loads, during the deployment. Kansas AAP produced over 10,000 155mm projectiles for shipment to SWA during the war, and at one frenetic point loaded 77 trucks with ammunition in a five day period. Lake City AAP received notice in the after action report for shipping over 320,000,000 rounds of small arms ammunition during the war. Also receiving notice was Lone Star AAP for shipping 60 railcars of munitions over the Christmas holiday.[22]

AMCCOM's top cadre also observed the diligence of Louisiana AAP in the after action report. That facility produced 2.75mm rockets as fast as rocket motors were received from the vendor, and conducted

the first ever ammunition container shipment for United States Army requirements. Additionally, Milan AAP shipped over 30,000 short tons of ammunition during the deployment, and loaded 105 MILVANs and 24 trucks in a single week. Also gaining the attention of the command were the efforts of the Mississippi AAP. During the deployment the plant shipped over 60 shot tons of support equipment to American servicemembers and assisted in moving over 110 MILVANs in a ten day period.[23]

In addition to arranging for the creation and transportation of nearly all of the conventional ammunition used by American servicemembers, and much of that used by coalition members as well, AMCCOM provided copies of over 600 different technical publications to deployed or deploying units. AMCCOM personnel prepared over 865,000 pages of extant, technical information for use in the Persian Gulf.[24]

Furthermore, at the onset of Operation Desert Shield, AMCCOM realized that its armament, munitions and chemical defense equipment would be severely tested in the environment of the Persian Gulf. It also recognized that troops deployed there would need to be alerted to the best manner in which to use and maintain the materiel. The command, therefore, assembled a team and developed three technical manuals: Armament, Chemical Defense Equipment, and Ammunition. Information for the manuals was gathered from users and experts worldwide and then documented in pocket-sized, desert-camouflaged manuals that could be used as a quick reference for soldiers serving in SWA. The manuals spelled out, in layman's language, protective measures which needed to be taken to minimize the damaging effects of high temperatures, high humidity, sand, and dust. The manuals also identified operation and maintenance limitations in the severe SWA climate, and spelled out ways to compensate for the limitations.[25]

Printed in numerous editions, at least four of the chemical defensive equipment manual, and two of the ammunition and armament booklets, a total of over 78,000 copies, constituting several million pages, were published and distributed to the deploying troops. The first set was airlifted in October 1990 to forces already in the desert. AMCCOM subsequently shipped manuals to units preparing for travel to SWA and to the various mobilization station sites in CONUS. Soldiers responded to the manuals with appreciation, and, more importantly, use. Requests for additional copies arrived at HQ, AMCCOM almost daily. With reference to the manuals during a briefing to his battalion commanders, the commander of the 75th Field Artillery noted that if his soldiers had not read the booklet on ammunition they should do so for it was one of the best pieces of information he had seen on the topic in years.[26]

Other substantial efforts by AMCCOM during the deployment to the desert included the emergency fabrication of a wheel extension parts package for the M102 howitzer by its Maintenance Directorate's Maintenance Operations and Procedure (MOP) Branch. In the early stages of the deployment, the 101st Airborne Division reported that their M102s bogged down in the soft sand. They felt that larger, wider tires on the howitzer carriage would remedy the problem. However, once the larger tires had been added to the carriage, the increased width interfered with the proper use of the hand brakes on the wheels. Mr. Jerry Ward, chief of the MOP shop, and his crew responded to the problem with a wheel extension kit. A metal spacer placed on the axle provided the necessary extension for proper clearance between the tire and hand brake. Upon their completion, fifty-five extension kits were immediately shipped to the desert.[27]

Further proof of AMCCOM's skill, as well as preparation for any situation which might arise, came in the form of weapons system management. The value of weapons system management within AMCCOM was repeatedly demonstrated during ODS. An organized, trained, and experienced team, headed by a weapons system manager, for operationally critical ammunition items and weapon systems was a keystone to AMCCOM support to ODS. Because this organizational structure existed, logistic and technical requirements emanating from the operational forces received through the Emergency Operations Center

were immediately routed for action to the appropriate weapon systems manager. The ability to quickly concentrate functional expertise on logistical and technical issues enabled AMCCOM to maintain exceptionally high technical Operational Readiness (OR) rates for mission materiel. Not only did weapon system management provide the ability to quickly react to user issues and problems, it also provided the necessary visibility for the command staff to quickly assess its own overall pulse, provide direction, redirect resources, and immediately respond to inquiries by higher authorities. The system also facilitated communication between weapon-responsible commands, as well as between LARs (logistics assistance representatives) in the field and HQ, AMCCOM.[28]

Despite the successful role played by AMCCOM in supporting weapons systems, shipping ammunition, refurbishing gas masks, building spacers, contributing to the fabrication of the bunkerbuster, scheduling vessels, acquiring materiel, filling requisitions, and preparing manuals, problems did, of course, occur for the command in the frenetic months of Operations Desert Shield and Desert Storm. Chief among the problems, and the one which beset the entire military structure not simply AMCCOM, was the inability to properly track materiel sent to the desert due to the absence of a functioning retail supply system, particularly in the early months of the deployment. A prime contribution to this deficiency derived from the fact that the Standard Army Intermediate Level Supply (SAILS) system was in the process of being replaced by the Standard Army Retail Supply System (SARRS). As a result, accountability and visibility of assets received in SWA was initially practically nonexistent and in some cases materiel was taken by units on a first come basis. This resulted in an excessive number of requisitions as units continually ordered that which was not received, and, in turn, placed undue stresses upon the efforts of AMCCOM personnel. Various work-arounds were developed to resolve this situation. These included push packages, push shipments of specific items, and telephone/fax requisitions worked through LAR channels.[29]

Contributing to the difficulty of properly supplying soldiers and civilians in SWA was the absence of established supply and distribution facilities. In a mature theater, supply and distribution facilities are in place to ensure an unimpeded flow of supplies to the requisitioner. This situation cannot exist when combat troops are the first deployees to a possible combat area, as in SWA. As a result, supply personnel had problems identifying and subsequently locating materiel which had been received. In some cases, it was diverted to, or by, customers who had not requisitioned it. In other cases, it simply went to a holding area. Command representatives spent many hours in these areas searching for AMCCOM items and locating customers. In the mean time, customers who knew their stocks were in country "somewhere" submitted new requisitions for the same requirement as it was deemed more expedient than trying to find a shipment. As an antidote, AMCCOM staffers recommended that in future deployments the attempt be made to place supply personnel more rapidly in the theater of operations and to assure that a number of the LARs sent to the theater had also received specialized supply-oriented training.[30]

However, in the future, LARs, supply-oriented or otherwise, need better support mechanisms. Based upon their experiences in the deserts, LARs as well as numerous others, recommended that if at all possible, better channels of communication be implemented before future deployments were undertaken. Indeed, that the strained communications system had held up as well as it had was deemed little less than a miracle and noted as a "potential weak point" that might have proven disastrous had the Kingdom of Saudi Arabia not had a relatively substantial commercial telephone system in place. Yet despite the Kingdom's significant internal telephone structure, an Operation Desert Shield/Storm After Action Report observation warned against relying upon a host nation's telephone system. Doing so created a false sense of security and relative ease of operation although initial struggles with MCI trunk lines caused difficulties and forced an expansion to other carriers. An aftertaste of the potential for confusion with the delicate telephone structure occurred when the commercial circuits went down on 15 May 1991. Likewise, had the staging areas been elsewhere, e.g., Turkey, Jordan, Syria, Iran, the luxury of a sophisticated commercial telephone

system would not have been available to resolve deployment and supply issues. If the communication system had been successfully targeted by enemy military, terrorists, or long range artillery/missiles, the disruption could have been extremely serious.[31]

For LARs, the potential frailties of the Kingdom's telephone structure were twofold. Not only were their numerous contacts with the major subordinate commands (MSCs), depots, and the national inventory control points (NICPs) concerning the resolution of repair parts and supply issues conducted on a system whose central focus could easily have been destroyed, but the placement of the telephones was problematic as well. The desert environment with its widely dispersed population and nomadic peoples did not promote the placement of telephone booths which LARs, isolated in enclaves with their units, could readily access. Upon return to CONUS, LARs reported traveling up to 70 kilometers to use a standard telephone hook-up. Some LARs were provided with AT&T credit cards for use in contacting AMCCOM and other mission-oriented centers. Mobile telephones could be utilized in the selected regions of SWA which were in range of a communications satellite. Additionally, the satellite communications as well as AT&T lines were only useful in making contacts outside the Kingdom of Saudi Arabia. Local lines connecting points within the SWA were nearly nonexistent. In some cases, HQ, AMCCOM served as an informational relay station between Saudi elements.[32]

In consideration of this frailty, AMCCOM's Readiness Directorate, at the close of the war, recommended that LARs and other logistics support teams be equipped with satellite telephone communications to permit direct down-links to CONUS and LAR-to-LAR in theater, as well as permitting datafax capabilities. The recommended package was a suitcase style, portable unit that could be set up in 15-20 minutes and access CONUS/European dial tones. AMCCOM's Readiness Directorate noted that such units would be "essential" in theaters with limited or no telephone communications. Several devices were recommended for each deployed unit.[33]

Other LAR issues involved the proper level of support. Transportation also provided the LARs, and accordingly AMCCOM, with a myriad of problems, primarily obtaining it. LARs returning to the United States following their deployment commented without fail on the difficulty obtaining efficacious transportation in SWA. And as the units in need of support were frequently a great distance from one another—up to 150 miles in some cases—efficacious transportation was a necessity.[34]

LARs were not automatically provided military transportation and initially had to seek rental vehicles, at government expense, on their own. According to one returning civilian, fees for four-wheel drive rental vehicles ranged from $3,000 to $4,500 during the height of ODS, although automobiles were available at lesser fees. Rental vehicles of any sort were hard to come by; hundreds of reporters, as well as other individuals on the scene, were vying for the limited supply. Only when civilians traveled close to Iraq, and the deadline for Hussein's withdrawal from Kuwait approached, were government civilians offered the opportunity to travel in military vehicles.[35]

Beyond the issues of communication and transportation was the matter of basic life support. When AMCCOM's Senior Command Representative (SCR) and LAR Supervisor Mr. Terry Spurrier returned CONUS, he noted that it was not realistic to expect the troops supported by a LAR to take responsibility for that individual in terms of billeting, communication, transportation, food, etc. Indeed, he commented that during hostilities "warfighters have enough to concern themselves with," and that the role of a LAR should not hinder operations.[36]

In consideration of the need for LARs not to be a hindrance to soldiers in the field, and also for them to effectively accomplish their mission, AMCCOM's Readiness Directorate recommended the creation of

LAR Support Packages (LSPs). In the recommended format, such support packages would be fully uploaded expandable mobile maintenance vans, or perhaps simple maintenance vans and would ideally contain cots, tents, communications equipment (datafax, computers, radios, etc.), generators, light sets, first aid kits, tools, MREs (meals, ready to eat), bottled water, NBC (nuclear, biological, chemical) gear, etc. (Some individuals urged that LSPs also include a weapon.) Constantly maintained and periodically checked, the vehicles would be shipped when LARs deployed and provide the individual with both living quarters and an amply appointed work site, and ultimately make the LAR both self-supporting and self-contained. Each deploying LAR would ideally be provided his or her own four-wheel drive vehicle to facilitate the accomplishment of their mission. In troubled economic times, the development of such vehicles remains questionable.[37]

Further difficulties arose in AMCCOM's effort to properly provide for America's deployed servicemembers and their supporting civilian staff in the realm of procurement. Regulations which served the United States well during peacetime were discovered to be overly restrictive in times of conflict. AMCCOM personnel felt stymied during ODS by both the statutory and regulatory restrictions which guided socioeconomic programs, competition requirements, and environmental protection, as well as other factors. HQ, AMCCOM needed immediate relief which, due to AMC's insistence upon specific examples of regulations and processes causing delays, were not forthcoming. Instead, the command obtained permission for incremental deviations to procurement regulations as ODS progressed, resulting in inefficiency and confusion. Accordingly, AMCCOM's procurement personnel recommended that as the Department of Defense and the Congress of the United States had not gone out of their way during the war to change statutes and regulations concerning the acquisition process, that the command must take the burden upon itself to effect relief. Plans have been outlined to bring relief in the areas of justifications and approvals (J&As), delegations of authority, statute and regulatory provisions, surge production, etc.[38]

Yet despite the problems and pitfalls encountered in supplying American servicemembers half a world away with the accouterments of war, AMCCOM fulfilled its mission, and delivered the ammunition, weapons, chemical defensive equipment, and spare parts to the right place at the right time. According to AMCCOM's Commander, Major General Paul L. Greenberg, the credit for this success must go to the individual AMCCOM employees whose dedication to duty, patriotism, and support of the men and women of the United States Armed Forces made possible a difficult task. It was the "welders, machinists, painters, item managers, stock clerks, food service workers, warehousers, temporary hires, and volunteers . . . who pulled together to accomplish and support this great military victory."[39]

Also making possible the victory was the very fact of AMCCOM's existence. As an anonymous author in December 1991's AMC News observed:

> You can't do what was done with Kelly Girls. The requisite structure didn't suddenly spring up overnight. It's only because the system was already in place, only because so many of the needed parts and supplies were already on hand, only because the military and industry were already working together as partners, and only because an incredible number of ordinary folks did an extraordinary job that an operation of this magnitude could be carried out with unprecedented speed and effectiveness.[40]

The AMCCOM slogan declares "Firepower--Make the Difference'. And during Operations Desert Shield and Desert Storm, it most certainly did.

NOTES

[1]Memorandum to "All AMCCOM Employees" (U), MG Paul L. Greenberg, AMSMC-CG, Subject: Support to Operation Desert Shield/Desert Storm, 19 March 1991.

[2]Quoted in Association of the United States Army, The U.S. Army in Operation Desert Storm: An Overview (Arlington, Virginia: Association of the United States Army, 1991), 21.

[3]*Ibid.*

[4]*Ibid.*; Mark S.R. Suchecki, "Arsenal reveals its role in bunkerbusting bomb," (newspaper article without name, date, or page) notes that the super-penetrating, bunker-busting bombs developed in part by AMCCOM's Watervliet Arsenal, Watervliet, NY, had apparently reached the upper echelon of the Iraqi military leadership. He drew this inference from the relatively low rank of Iraqi military officers who attended the capitulation meeting with GEN Schwarzkopf at the war's conclusion. An interesting, informative discussion of the psychological aspects of preparing the negotiation site at Safwan is presented by LTC Peter S. Kindsvatter, "VII Corps in the Gulf War: Post-Cease-Fire Operations," Military Review, June 1992, 2-19.

[5]Association of the United States Army, The U.S. Army in Operation Desert Storm: An Overview (Arlington, Virginia: Association of the United States Army, 1991), 21.

[6]*Ibid.*, 22.

[7]Quoted in *Ibid.*

[8]*Ibid.*

[9]Memorandum to "All AMCCOM Employees" (U), MG Paul L. Greenberg, AMSMC-CG, Subject: Support to Operation Desert Shield/Desert Storm, 19 March 1991.

[10]Operation Desert Shield/Storm After Action Report, Executive Summary, I-1, 4; United States Army Armament, Munitions and Chemical Command, "Logistic Issues and Lessons Learned from Operation Desert Storm (ODS) and Southwest Asia (SWA)," n.d., n.p.

[11]Operation Desert Shield/Storm After Action Report, Executive Summary, I-4, 9.

[12]United States Army Armament, Munitions and Chemical Command, "Logistic Issues and Lessons Learned from Operation Desert Storm (ODS) and Southwest Asia (SWA)," n.d., n.p.; Operation Desert Shield/Storm After Action Report, Executive Summary, I-10.

[13]*Ibid.*, I-10, 11, 12, 13.

[14]United States Army Armament, Munitions and Chemical Command, "Logistic Issues and Lessons Learned from Operation Desert Storm (ODS) and Southwest Asia (SWA)," n.d., n.p.; memorandum (U), M.F. Montford, SMCRI-DL, for AMSMC-IN, Subject: Desert Storm/Desert Santa, 6 March 1991; Information Paper (U), SMCRIDL, Subject: AMCCOM Commander's Conference, 5 March 1991, 1 March 1991; and statistics presented by Mr. Ronald E. Sikorski, SMCRI-AP, at FMA meeting, 5 February 1991; and Thomas J. Slattery, AMSMC-HO, "M864 and M825A1 Spacers." This paper is a brief assessment of Rock

Island Arsenal's production of spacers and served as a feeder report for this volume, as well as his own concerning the role of the arsenal in Operations Desert Shield and Desert Storm.

[15]See Chapter Three: Production and Procurement for a more detailed discussion of the production efforts of AMCCOM's arsenal elements during Operations Desert Shield and Desert Storm.

[16]United States Army Armament, Munitions and Chemical Command, Army Ammunition Plants and Activities, AMCCOMP 360-3, February 1990; Operation Desert Shield/Storm After Action Report, Lessons Learned 52348-94169 (00170) (U), AMSMC-TM, Title: Single DOD Focal Point for Ammunition Ship Planning, 20 May 1991.

[17]*Ibid.*

[18]Viewgraph (U), AMSMC-TM, Title: CONUS Ammunition Ships Planned and Executed by AMCCOM, n.d.

[19]United States Army Armament, Munitions and Chemical Command, "Logistic Issues and Lessons Learned from Operation Desert Storm (ODS) and Southwest Asia (SWA)," n.d., n.p.; Operation Desert Shield/Storm After Action Report, Summary Analysis-"Ammunition".

[20]United States Army Armament, Munitions and Chemical Command, AMCCOM Facts, AMCCOMP 5-1, 1 October 1991.

[21]Operation Desert Shield/Storm After Action Report, Executive Summary, I-8.

[22]*Ibid.*

[23]*Ibid.*

[24]United States Army Armament, Munitions and Chemical Command, "Logistic Issues and Lessons Learned from Operation Desert Storm (ODS) and Southwest Asia (SWA)," n.d., n.p..

[25]*Ibid.*, Alfred N. Bradley, deputy, for LTC Melvin A. Miller, Acting Director, Readiness, to GEN William G.T. Tuttle, AMC-CG, Subject: Data Call for Command and General Staff College Briefing, 28 February 1991, 18-19;

[26]*Ibid.* See also the assorted editions of the manuals. Operation Desert Shield Materiel Readiness: Ammunition, AMCCOM TM 9-1300-DS-1, September 1990 and AMCCOM TM 9-1000-DS-1; Operation Desert Shield Materiel Readiness: Armament, AMCCOM TM 9-1000-DS-3, 12 October 1990 and AMCCOM TM 9-1000-DS-3, 21 November 1990; Operation Desert Shield Materiel Readiness: Chemical Defensive Equipment, AMCCOM TM 9-1000-DS-2, 21 September 1990, AMCCOM TM 9-1000-DS-2, 28 September 1990; AMCCOM TM 9-1000-DS-2, 3 October 1990, and AMCCOM TM 9-1000-262-DS, January 1991.

[27]Ray Gall, "Desert Shield keeps MOP Shop on the hop," Target, November 1990, 5; "Good News," a computer mail service bulletin produced during ODS, point 47.

[28]Lessons Learned 52353-76942 (00172) (U), AMSMC-AS, Title: Weapons System Management, 20 May 1991.

[29]Operation Desert Shield/Storm After Action Report, Summary Analysis—"Supply".

[30]*Ibid.*; Lessons Learned, 40943-30100 (00099) (U), AMSMC-MMP, Title: ODS Frustration of Shipments, 5 April 1991; Lessons Learned 61235-53789 (00245) (U), AMSMC-RDL, Title: Supply Logistics Assistance Representatives (LAR) in Southwest Asia (SWA), 12 June 1991.

[31]*Ibid.*; Summary Analysis—"Communication"; and Lessons Learned, 52357-67995 (00174) (U), AMSMC-RD, Title: Commercial Telephone Communication Dependency, LAR, 23 May 1991.

[32]Interview, H.P. LePore, AMSMC-HO, with D. Rogers, AMSMC-RD, 1 November 1991; Lessons Learned, 52357-67995 (00174) (U), AMSMCRD, Title: Commercial Telephone Communication Dependency, LAR, 23 May 1991.

[33]*Ibid.*

[34]Interview, H.P. LePore, AMSMC-HO, with Steve Lovely, Rich Albrecht, Rick Relfe, Jim Wagner, and Dick Thissen, SMAC-AV, 4 April 1991; Rogers Intvw., 1 November 1991; and Interview H.P. LePore, AMSMC-HO, T. Spurrier, AMSMC-RD, 19 February 1991.

[35]*Ibid.*

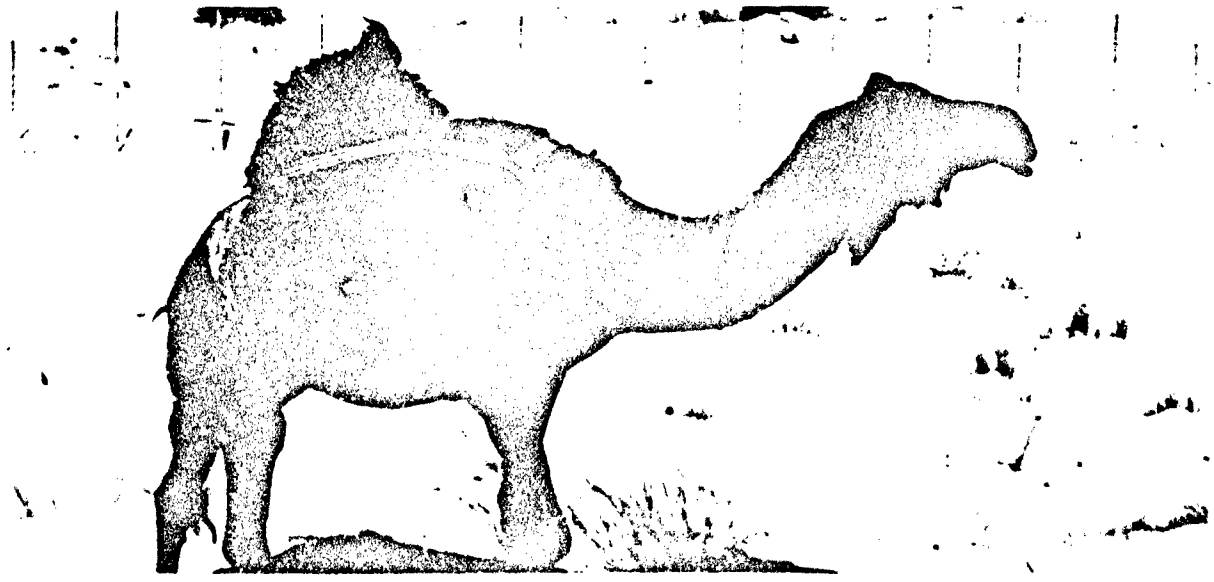
[36]Spurrier Intvw., 19 February 1991.

[37]Operation Desert Shield/Storm After Action Report, Summary Analysis—"Logistics Assistance/LAO"; Lessons Learned, 5235871848 (00175) (U), AMSMC-RD, Title: LAR Deployment, Communication Transportation, Life Support, 23 May 1991; Rogers Intvw., 1 November 1991.

[38]Lessons Learned, 52361-37989 (00179) (U), AMSMC-PPC, Title: Regulatory Relief, 23 May 1991.

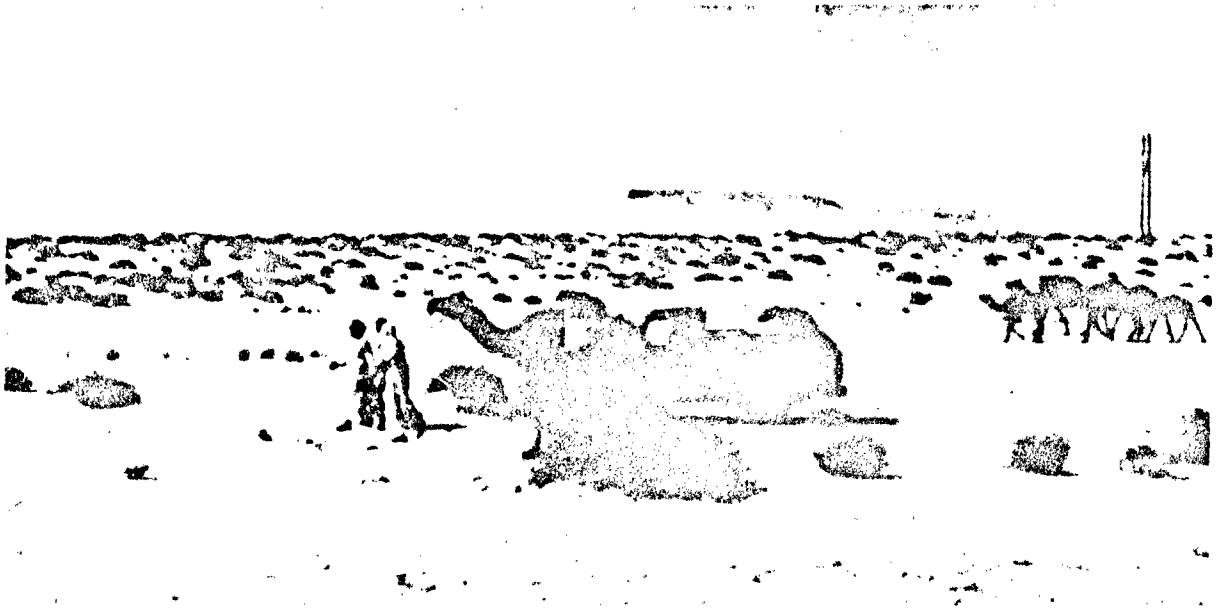
[39]Operation Desert Shield/Storm After Action Report, Commander's Assessment, v-6.

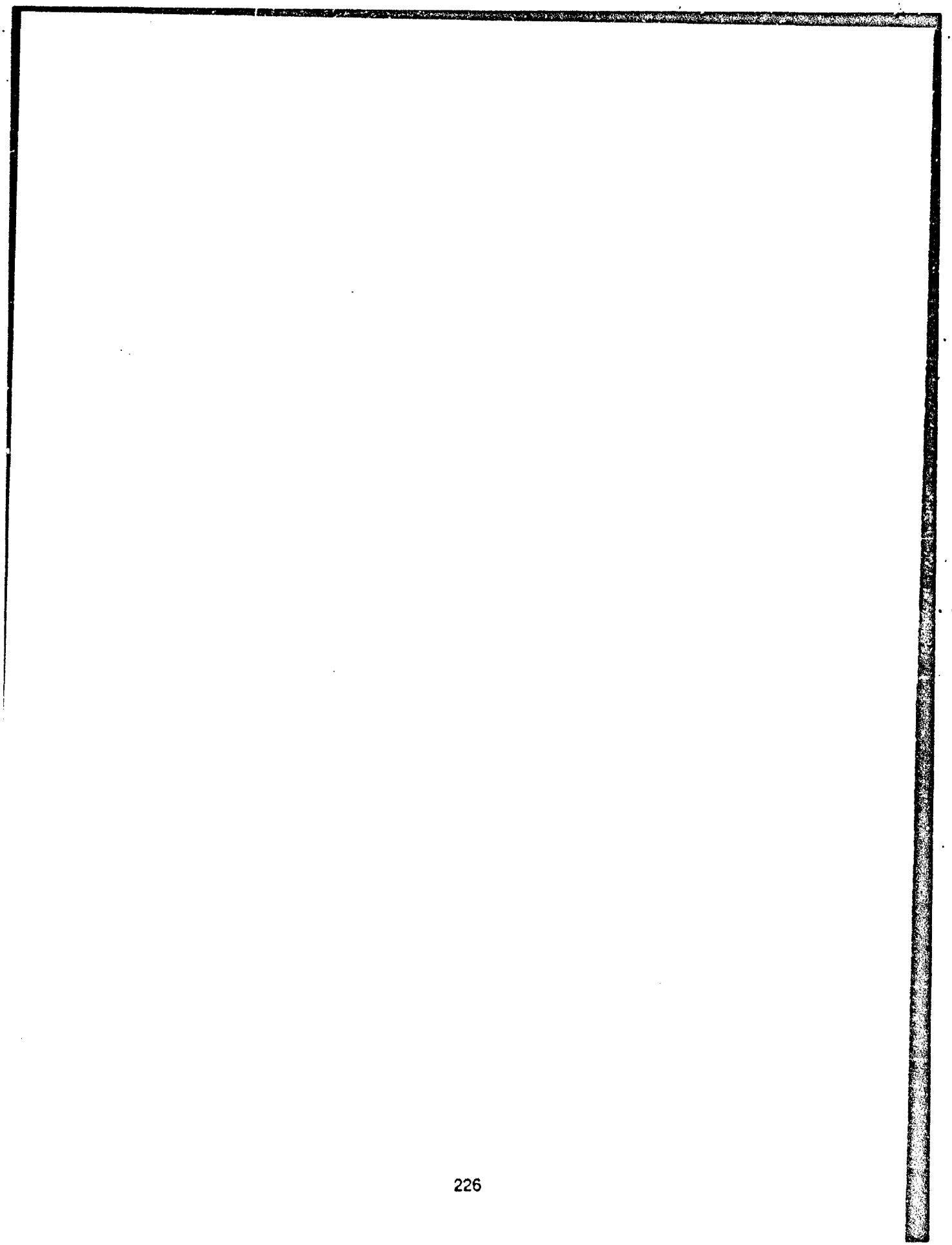
[40]"War and Pieces: The Logistics Story of Desert Storm," AMC News, December 1991, 5.



An abundance of oil reserves has served Southwest Asia well. The region's abundance of camels and blowing sand, however, could contribute mightily to its downfall. In an effort to control these natural resources, some SWA nations have configured cinder piles to limit the power of the wind, and erected fences, as well as fitted camels with contraceptive harnesses, to limit the herds of wild dromedaries

LARs and OASAS, as well as other deploying American servicemembers and civilians, could not help but notice the wondrous juxtaposition of the new and the old in Southwest Asia. Bedouins wandered the desert with their herds of camels as they had from time immemorial, yet shared the sands with speeding pick up trucks, power lines, and pumping oil wells





GLOSSARY

AAA	army ammunition activity
AAP	army ammunition plant
ABL	ammunition basic load
ACS	Army Community Services
ADPE	automatic data processing equipment
AFARS	Army Federal Acquisition Regulation Supplement
AFR	Air Force Regulation
AIN	ammunition information notice
ALLMIS	Army Lessons Learned Management Information System
AMC	United States Army Materiel Command
AMCCOM	United States Army Armament, Munitions and Chemical Command
AMCRM	Army Materiel Command Resource Management
AMOPS	Army Mobilization and Planning System
AMSMC	Army Materiel, Subordinate to the Major Command
AOR	area of responsibility
AP	acquisition plans
APDS	armor-piercing, discarding sabot
APG	Aberdeen Proving Ground
APOE	aerial ports of embarkation
AR	army regulation
ARCENT	United States Army Central Command
ARDEC	United States Army Armament, Research, Development, and Engineering Center
ASG	United States Army Support Group
ASIS	Ammunition Surveillance Information System
ASP	ammunition supply point
ATCMD	advance transportation and control movement documents
AVSCOM	United States Army Aviation Systems Command
AWOL	absent without leave
BDU	battle dress uniform
BII	basic issue items
BLU	bomb, live unit
BRAC	base realignment and closure
CAA	chemical alarm agents
CAAA	Crane Army Ammunition Activity
CADS	Containerized Ammunition Distribution System
CALL	Center for Army Lessons Learned
CAM	chemical agent monitor
CARC	chemical agent resistant coating
CCSS	Commodity Command Standard System
CDE	chemical and biological defense equipment
CECOM	United States Army Communications and Electronics Command

CINC	commander in chief
CONUS	continental United States
COPS	contingency plans report
COSIS	care of supplies in storage
CP	comptroller
CPO	Office of Civilian Personnel
CPP	central processing point
CRAF	civil reserve air fleet
CRC	CONUS replacement center
CRDEC	United States Army Chemical Research, Development and Engineering Center
CRF	Code of Federal Regulations
CSRS	Civil Service Retirement System
CSS	combat support services
DA	Department of the Army
DARCOM	United States Army Development and Readiness Command
DD	Department of Defense
DEFCON	defense condition
DESCOM	United States Army Depot System Command
DFAR	Defense Federal Acquisition Regulation
DMMC	division materiel management center
DMZ	demilitarized zone
DOD	Department of Defense
DODAAC	Department of Defense Activity Addressing Code
DODIC	Department of Defense Identification Code
DOT	Department of Transportation
DOT-E	Department of Transportation-Exemption
DP	Deputy for Procurement and Production
DR	Desert Shield/Storm routine
DSACS	Defense Standard Ammunition Computer System
DSM	director of supply maintenance
DTS	Defense Transportation System
DU	Desert Shield/Storm urgent
DX	Desert Shield/Storm high priority
ECG	electrocardiogram
EEO	equal employment opportunity
EOC	Emergency Operations Center
EOD	explosive ordnance disposal
EPA	Environmental Protection Agency
ETRR	export traffic release request
FAC	Forward Air Command
FAD	funding authorization document
FAR	Federal Acquisition Regulation
FAT	first article test

FCA	functional cost account
FEGLI	Federal Employee Group Life Insurance
FERS	Federal Employee Retirement System
FLSA	Fair Labor Standards Act
FM	field manual
FMS	foreign military sales
FORSCOM	United States Army Forces Command
FPD	foreign post differential
GBU	glide bomb unit
GMG	grenade machine gun
GOCO	government-owned, contractor-operated
GOGO	government-owned, government-operated
GSA	General Services Administration
GS/GM	general service/general management
HCA	head of contracting authority
HE	high explosive
HEDP	high explosive, dual purpose
HERD	high explosive research and development
HET	heavy equipment transporter
HIV	human immunodeficiency virus
HMMWV	high-mobility, multi-purpose wheeled vehicle
HQ	headquarters
HQDA	Headquarters, Department of the Army
IMA	individual mobilization augmentee
IPT	initial production test
IRR	individual ready reserve
ISSAA	United States Army Information Systems Selection and Agency
J&A	justification and approval
JCS	joint chief of staff
JULLS	Joint Universal Lessons Learned System
KKMC	King Khalid Military City
LAO	Logistics Assistance Office
LAP	load, assemble, pack
LAR	logistics assistance representative
LASH	lighter aboard ship
LAT	lot acceptance test
LCAAP	Lake City Army Ammunition Plant

LPV	laser protective visor
LRIP	low rate initial production
LSP	LAR support package
MAC	Military Airlift Command
MCC	movement control center
MDEP	management decision package
MICLIC	mine clearing line charge
MILSTAMP	military standard transportation and movement procedures
MILVAN	military van
MMC	materiel management center
MMP	master mobilization plan
MOB	mobilization
MOBEX	mobilization exercises
MOBTDA	mobilization table of distributions and allowances
MOP	maintenance operations and procedures
MOPES	Mobilization and Operations Planning and Execution System
MOPP	mission-oriented position posture
MOTSU	military ocean terminal-Sunny Point
MOU	memorandum of understanding
MRE	meal, ready to eat
MRO	materiel release order
MSA	Mine Safety Appliances
MSC	major subordinate command
MSR	main supply route
MTF	mechanical time fuzes
MTMC	Military Traffic Management Command
NATO	North Atlantic Treaty Organization
NBC	nuclear, biological, chemical
NEW	net explosive weight
NICP	national inventory control point
NM	nanometer
NIMSC	non-consumable items materiel support code
NMCM	non-mission capable maintenance
NTPF	near term prepositioned fleet
NWS	naval weapons station
OCONUS	outside the continental United States
ODCSLOG	Office of the Deputy Chief of Staff for Logistics
ODS	Operation Desert Shield/Storm
OFCCP	Office of Federal Contract Compliance Programs
OJT	on the job training
OMMCS	Ordnance Missile and Munitions Center and School
OPEC	Oil Producing Exporting Countries
OPLAN	operations plan

OR	operational readiness
P&A	price and availability
PARC	principal assistant responsible for contracting
PASS	Procurement Aging and Staging System
PBS	point biofluorescence sensor
PC	Procurement Directorate
PCO	procuring contracting officer
PCS	permanent change of station
PIBD	point initiating, base detonating
PIVADS	Product Improved Vulcan Air Defense System
PL	public law
PM	project/program/product manager
PMCS	preventive maintenance checks and services
POMCUS	prepositioned materiel configured to unit sets
POR/POM	preparation for overseas rotation/mobilization
POW	prisoner of war
PREPO	prepositioned
PWD	procurement/work directive
QASAS	quality assurance specialist-ammunition surveillance
QPL	qualified products list
RCS	reports control symbol
RD	Readiness Directorate
RDD	required delivery date
RDL	Readiness Directorate, Logistics Assistance Division
REPSHIP	report of shipment
RFK	Richardson, Flory, Kops
RIA	Rock Island Arsenal
RIF	reduction in force
RRT	round removal tool
RSI	rationalization; standardization; interoperability
SAAS	Standard Army Ammunition System
SADARM	simulated research and destroy armor
SAILS	Standard Army Intermediate Level Supply (system)
SANG	Saudi Arabian National Guard
SARDA	Secretary of the Army, Research, Development and Acquisition
SARSS	Standard Army Retail Supply System
SAW	squad automatic weapon
SBA	Small Business Administration
SBR	small box respirator
SCR	senior command representative
SCRAM	self-contained respiratory assist mechanism

SITREP	situation report
SMCA	Single Manager for Conventional Ammunition
SOMARDS	Standard Operations and Maintenance Army Research and Development System
SOP	standard operating procedure
SPOE	sea ports of embarkation
SP-PRI	special priority designator
SWA	Southwest Asia
TACCS	Tactical Army Combat Service Support Computer System
TACOM	United States Army Tank Automotive Command
T&E	testing and evaluation
TAP	toxicological agent protection
TAT	to accompany troops
TCMD	transportation control and management document
TCN	transportation control number
TDA	temporary duty assignment
TDP	technical data package
TDY	temporary duty
TECOM	United States Army Testing and Evaluation Command
TMDE	test, measurement, and diagnostic equipment
TO&E	table of organization and equipment
TPF	total package fielding
TPFDP	time-phased force deployment plan
TRADOC	United States Army Training and Doctrine Command
TRANSCOM	United States Army Transportation Command
TSA	theater storage area
UBL	unit basic load
UCA	unpriced contractual action
UN/POP	United Nations performance oriented packaging
USADACS	United States Army Defense Ammunition Center and School
USAIS	United States Army Information Service
USAREUR	United States Army Europe
USC	United States Code
USCENTCOM	United States Central Command
VADS	Vulcan Air Defense System
WALLP	Wartime Army Lessons Learned System
WARS	Worldwide Ammunition Reporting System
WP	white phosphorous
WWMCCS	Worldwide Military Command and Control System
YPG	Yuma Proving Ground