DEPARTMENT OF THE ARMY
ARMY SCIENCE BOARD
OFFICE OF THE ASSISTANT SECRETARY
WASHINGTON, D.C. 20310-0103

28 February 1992

Lieutenant General Leon E. Salomon
Deputy Chief of Staff for
Logistics
Headquarters
Department of Army
Washington, DC 20310

Dear General Salomon:

In accordance with the Terms of Reference dated 27 March 1991, the final study report is herewith provided for the Army Science Board's Logistics and Sustainability Issue Group entitled, "Logistics Support and Strategic Deployment during Operation Desert Shield/Storm." We hope you find this study useful. The study chair and the Issue Group stand ready for any future discussion on this topic, if required.

Release or distribution of this study is at your discretion.

Sincerely,

Charles W Church

Charles Church
Acrting Executive Secretary
Army Science Board

Attachment

Copy furnished:
ASA(RDA)
SARD-ZT

George S -
Give me a short summary of this at a forthcoming staff mtg.
Leon
3/8

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Charles Church
Acting Executive Secretary
Army Science Board

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DEPARTMENT OF THE ARMY
ASSISTANT SECRETARY OF THE ARMY
RESEARCH, DEVELOPMENT AND ACQUISITION
WASHINGTON, D.C. 20310-0103

1991 STUDY

ARMY SCIENCE BOARD

FINAL REPORT

on

Logistics Support and Strategic Deployment during Operation Desert Shield/Storm

October 1991

afb

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Assistant Secretary of the Army for Research, Development and Acquisition tasked the Army Science Board to conduct an Ad Hoc Study on Logistics Support and Strategic Deployment during Operations Desert Shield/Storm.

(Continued on reverse)

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A panel of five Army Science Board members was formed to review and evaluate logistics procedures and technologies that have the potential to aid in solving the logistical challenges presented by Desert Shield/Storm and to evaluate which technologies could aid strategic deployment.

The panel held meetings at the Pentagon; U.S. Army Aviation Systems Command, St. Louis, MO; and the U.S. Transportation Command, Scott AFB, IL. Individual members visited the Strategic Logistics Agency, Ft. Belvoir, VA; PM Automated Retail Logistics Systems and TRADOC Analysis Command, Ft. Lee, VA; and the U.S. Army Engineer Waterway Experiment Station , Vicksburg, MS. The panel's efforts were synthesized into issues, findings and recommendations during a writing session in Crystal City, VA.

The study found seven issue areas and focused it attention on these issue areas, which are listed below:

1) Information Transfer
2) Planning
3) Asset Visibility
4) Training
5) Supply
6) Distribution of Materiel
7) Management and Organization

ABSTRACT

THE DCSLOG OF THE ARMY REQUESTED THE LOGISTICS AND SUSTAINABILITY ISSUE GROUP OF THE ARMY SCIENCE BOARD TO EVALUATE THE LOGISTICS ACTIVITIES OF DESERT SHIELD/STORM AND TO SUGGEST TECHNOLOGICAL SOLUTIONS TO PROBLEMS THAT WERE DISCOVERED. THE STUDY GROUP FOCUSED ON SEVEN ISSUE AREAS:

INFORMATION TRANSFER

PLANNING

ASSET VISIBILITY

TRAINING

SOURCES OF SUPPLY

DISTRIBUTION OF MATERIEL

MANAGEMENT AND ORGANIZATION

THE STUDY GROUP MADE A SERIES OF RECOMMENDATIONS ON EACH ISSUE. IN ADDITION, THE GROUP DEVELOPED A SCENARIO FOR A STRATEGIC DEPLOYMENT IN THE YEAR 2011 AND IDENTIFIED THOSE DOD CRITICAL TECHNOLOGIES THAT WOULD BE INSTRUMENTAL IN ENHANCING LOGISTICS ACTIVITIES.

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Section I

INTRODUCTION

This annotated briefing presents the results of an Army Science Board study entitled "Logistics Support and Strategic Deployment during Operation Desert Shield/Storm." The Terms of Reference of the study consisted of two broad questions. The first focused on procedures and technologies which have the potential to aid in solving the logistical challenges presented by Desert Shield/Storm. The second focused on strategic deployment, specifically technologies which could aid future strategic deployment.

Operation Desert Shield/Storm hinged on logistics. As such, it provided logisticians with insights into the future and reminders of the past. In successfully accomplishing its mission, the Army operated at substantial distances from the Continental United States (CONUS), forward deployed forces, and prepositioned stocks. It employed, for the first time, a new generation of systems in the context of a new war-fighting doctrine. It succeeded but in the presence of reasonably high levels of risk. Those high levels of risk were associated with strategic deployment and logistics support. The rapid response to the invasion of Kuwait consisted of deploying by air the 82nd Airborne Division, the 24th Mechanized Infantry Division, and the 101st Airmobile Division. Until the arrival by sea of the heavy equipment of the 24th Mechanized Infantry Division, these forces were vastly out-numbered and over-matched by Iraqi heavy forces. It took several months to deploy the VIIth Corps and other heavy units to facilitate the offensive operations which were successfully concluded in 100 hours of land warfare. The build-up of forces and combat operations stressed the logistics system which bent, but did not break. This might not have been the case if the Iraqis had been a more determined opponent or if the fighting had lasted longer than 100 hours.

The next war the Army fights will be different from Desert Shield/Storm. However, it is likely to be at a significant distance from CONUS; it is likely to involve a threat that has heavy armored forces, a modern air force, and possibly nuclear, chemical, and/or biological weapons. It will involve the employment of Air-Land Operational Doctrine. The theater of operations may not provide the modern sea and air ports nor the level of Host Nation support available in Saudi Arabia. Desert Shield/Storm thus did provide insights into the future, particularly in areas related to deployment and sustainment, i.e., logistics.

General Observations

Desert Shield/Storm was a logistician's war. Once forces could be put in place and adequately supplied, the outcome was not in doubt. Deploying and supporting those forces presented a significant challenge. The value of the all-volunteer Army was confirmed by the excellent performance of Army personnel in meeting that challenge.

Not only the Army, but also the Air Force and Navy "delivered the goods." One can argue that Desert Storm demonstrated the benefits of Goldwater-Nichols in insuring that the operation would be a joint operation efficiently executed. In fact, it was a coalition operation and it is a credit to the senior leadership of U.S. forces that the coalition worked.

It appears that the greatest problem faced by logisticians in Saudi Arabia was distribution - the movement of supplies, parts, etc. from the ports to the client units. While this problem was satisfactorily solved, it should be noted that the theater of operations provided many host nation, in-country assets. Seaports were modern and sufficient in number. The seaports had excellent facilities and adequate capacity. Roads, while not as numerous as might have been desired, were similarly modern. Open land was flat, although off-the-road movement was complicated by the desert terrain. Host nation support (communications, transport, POL supply, and maintenance services) was also excellent. Moreover, the Iraqis did not mount any meaningful operations against logistics operations.

The Army will not always be so fortunate in this regard and, in digesting the lessons learned from Desert Shield/Storm, the availability and vulnerability of in-country assets should be kept in mind. The course of Desert Shield/Storm would have been much different had these assets not been available.

General Observations...continued

At the same time, Desert Shield/Storm was providing insights into the future; it provided reminders of the past. Strategic sea and air lifts were a major problem. In-theater logistics, command, control, and communications suffered from lack of expertise and materiel support. Certain resources were scarce, including transportation assets; other resources turned out to be less useful than anticipated. Distribution was a challenge for a number of reasons. Major Commodity Commands had to adopt expedient solutions to solve problems with the industrial base associated with inventories of parts, subassemblies and assemblies, and with other classes of supply. All of these challenges were overcome; none would have surprised the logisticians of WWI, WWII, Korea, or Vietnam.

The Army met the logistic challenges of Desert Shield/Storm largely in the same way it met similar challenges in the past: it organized teams of competent people who adopted expedient and sometimes extraordinary procedures to accomplish their missions. Planners and executors employed a variety of decision support systems not available to their predecessors. (These, while important, generally did not represent the state-of-the-art.) Research and development facilities diagnosed problems, designed materiel solutions, and manufactured kits and subassemblies for field installation. Entire organizations were assembled and put to work to provide maintenance, supply, medical, and transportation services.

The Army can take steps to avoid many of the logistics challenges presented by Desert Shield/Storm. First, it can provide better training to the personnel who plan and execute the logistics functions of major operations. Second, it can realistically resource logistics commands and logistics units with personnel, materiel, and inventories of parts and supplies. Third, it can exploit technologies: some available now, others available in the future. These technologies will reduce demand, facilitate command and control, and increase capacity. Logistics remain a constraint. It can be turned into an asset.

PANEL ACTIVITIES

DATE AND LOCATION	TOPIC	ORGANIZATION
18 April 1991 - Pentagon	Conflict of Interest	General Counsel
	AMC Support to Operation Desert Shield	HQ AMC
	Strategic Mobility in Operation Desert Shield	ODCSLOG
	Logistics Overview of Operation Desert Shield	ODCSLOG
	Supply and Maintenance in Operation Desert Shield	ODCSLOG
19 April 1991 - St. Louis, MO	Aviation Logistics in Operation Desert Shield	HQ AVSCOM
19 April 1991 - Scott AFB, IL	Deployment and Redeployment	HQ TRANSCOM
7 May 1991 - Ft. Lee, VA	Logistics Automation	PM ARLS, CASCOM
13 June 1991 - Ft. Belvoir, VA	SLA Initiatives	SLA
27 June 1991 - Pentagon	JOPES	J-7, Joint Staff
	Sealift Support to Operation Desert Shield	MSC
	Artificial Intelligence	OAIAE, USMA
	Rand Studies	Rand Aroyo
28 June 1991 - Pentagon	MITLA and Bar Code Technology	SLA
8-9 August 1991 - Vicksburg, MS	U.S. Army Engineer Waterway Experiment Station	COE
27-28 August 1991 - Crystal City, VA	Writing Session	
11 September 1991 - Warren, MI	Tank Automotive Logistics in Operation Desert Shield	HQ TACOM
8 October 1991	Field Logistics	724th Support Battalion

Contributors

Army Science Board Logistics and Sustainability Issue Group

"Logistics Support and Strategic Deployment During Operations Desert Shield/Storm"

COL William S. Crowder - Strategic Mobility	HQDA
Mr. Jack Kem - Supply and Maintenance	HQDA
LTC John Revelle - Desert Storm Logistics Overview	HQDA
Mr.. Ronald L. Treusdall - AMC Support	HQ USAMC
MG Donald Williamson - Aviation Logistics Support	USAAVSCOM
COL Fortunato - Desert Storm Overview	USTRANSCOM
LTC Hassell - Global Transportation Network	USTRANSCOM
MAJ John Schorch - JOPES	Joint Staff
COL Richard Fields - Sealift	Military Sealift Command
Mr. John Halliday - Sustainability and Support	Rand Army Arroyo Center
Mr. Dave Kassing - Strategic Deployment	Rand Army Arroyo Center
MAJ Robert Richberg - Artificial Intelligence	Office of Artificial Intelligence Analysis and Evaluation
MAJ Mark Henderson - Strategic Mobility Vision	HQDA
COL Charles Chase - MITLA and Bar Code Technology	HQDA
LTC James Beling - Communications in SWA	HQDA
LTC Bob Balog - JOPES	Joint Staff

ISSUES/RECOMMENDATIONS

INFORMATION TRANSFER

POOR IN-THEATER COMMUNICATIONS, ABOVE DIVISION LEVEL, WAS A MAJOR CONTRIBUTING FACTOR IN CAUSING THE ARMY'S LOGISTICS SYSTEM TO OPERATE AT LESS THAN FULL EFFICIENCY.

INFORMATION TRANSFER

Availability and location of communications capabilities in support of logistics users was a major cause of the information transfer issue. Increased logistics workload and errors associated with manual off-line processing of requisitions below Division level were directly related to the availability of adequate communications. Marginal implementation of evolving logistics doctrine in support of Air-Land Battle probably exacerbated the communications problem.

INFORMATION TRANSFER

FINDINGS:

- **Communications support to logistics operations in Saudi Arabia was inadequate, in part, because communication doctrine has not been updated to be consistent with current Air-Land Battle doctrine**

- **The time-phased deployment of communication units, above Division level, was not consistent with emerging logistics-related communications requirements**

- **Adequate logistics-related communications capabilities/systems did not exist outside of major urban areas**

- **Lack of communications capability to support automation below the Division level forced units to transfer logistics information via specially developed and hand-carried diskettes which was slow and time-consuming**

INFORMATION TRANSFER

FINDINGS:

- Lack of deployment policy for automation caused many computers to be shipped by sea, arriving after troops
- Poor communications support of logistics automation resulted in transaction backlogs/excessive processing time and multiple requisitions for the same items
- Manual/off-line processing of requisitions caused lost requisitions, poor status tracking, and sporadic financial obligation definition

INFORMATION TRANSFER

DISCUSSION:

The inability of logisticians to adequately service users was caused in large part by the inability of the communication system to fully deploy consistent with the deployment of combat forces. This issue was not a major one for users/providers located in areas where the indigenous communication system was robust. However, major problems were experienced in areas not supported by the local system. The communication system in these areas was inadequate, resulting in an impedance of information transfer. Additionally, when major units began to maneuver in a land battle context, the problem was compounded by the inability to rely on the local system and also because of the marginal implementation of Air-Land Battle logistics doctrine. Apparently, logistics units, particularly those above Division level, were not adequately trained or prepared for the rapid decentralized operational activity, because adequate training for this type of operation had not been provided.

The assumption that the rear area communication system would be available to logistics users did not prove valid because of the deployment sequences of communication units. Many logistics units which did not have adequate deployment planning, shipped computers by sea, causing delays as air transported logistics units awaited their computers. The inability of the communication system to adequately service logistics users caused slow processing and unnecessary backlogs. Also, the inability to perform logistics translations automatically, caused reduced information visibility, status tracking, and financial obligations. Later in this report, issues more relevant to logistics organization shortcomings will be specifically addressed.

The discussion of these logistics unit/system shortages should not obscure the more primary causes of the information transfer issue, which were: communications and doctrine.

INFORMATION TRANSFER

RECOMMENDATIONS:

- Strengthen communications doctrine for Air-Land Battle operations in support of logistics activities, particularly above Corps level
- Accelerate the in-process CTASC-II/DAAS fielding, and in the long-term, develop new MSE and STAMIS communications software and hardware
- Put command emphasis and controls on requisition procedures and procure dependable, upgraded communications/computers to eliminate off-line processing of requisitions
- Give deployment of automation hardware a high priority

INFORMATION TRANSFER

RECOMMENDATIONS:

- Deploy communications units that provide support to logistics organization earlier on the Time-Phased Force Deployment List (TPFDL)
- Give consideration to logistics-related communications units when combat-to-combat service support decisions are made as part of the TPFDL process to insure that adequate communications support is provided logistics users
- Consider developing a dedicated logistics communication system or possibly logistics support "packages"
- Consider leasing commercial satellites to link CONUS with in-country COSCOM computer network

INFORMATION TRANSFER

Logistics units and their related communication support units should receive training using realistic scenarios similar to those utilized by combat units at the National Training Centers. Given the intensive reliance of logistics forces on the Army area communications system, the deployment of these assets must be consistent with the deployment of logistics forces. Serious consideration must be given to the establishment of a dedicated Logistics Communication System similar to the Air Defense Communications System. Assumptions that MSE will solve the current shortfall should be analytically validated since the ability of MSE to service logistics users in an Air-Land Battle context is suspect for two reasons: distances involved and node saturation. As a minimum, the linkage of specific communications units and associated logistics users should be made for deployment planning with specific "packages" being defined. Further, it is recommended that a system for commercial computers, similar to the Civil Reserve Air Fleet (CRAF) for aircraft, be considered. Such a system might improve logistics capability.

PLANNING

THE NEED TO PUT HEAVY FORCES IN PLACE AS SOON AS POSSIBLE PLACED CONSIDERABLE STRESS ON THE DEPLOYMENT OF LOGISTICS FORCES.

PLANNING

DISCUSSION:

The need to deploy credible combat forces during Desert Storm is recognized and appreciated. Consideration must be given to insuring that logistics force capability is deployed at levels consistent with logistics requirements of the in-country heavy forces.

Related force planning discussions such as theater stockage level for ammunition and major force deployments and their effects on the logistics system must also be recognized.

PLANNING

FINDINGS:

- Joint Operational Planning and Execution System (JOPES) is weak in the following areas:
  - User Friendliness
  - Flexibility to respond to questions
  - Improved logistic system interfaces
  - Support to senior high-level decision makers
  - Minimize labor-intensive operations
- Deployment of force was not balanced in terms of combat, combat service, and combat service support categories
- Major decisions to accelerate deployment and change stockage levels severely impacted on the in-theater logistics system
- Ongoing contingency logistics planning scenarios for Iraq/Saudi operations were not evident

PLANNING

The Joint Operational Planning and Execution System (JOPES) appeared to work with some exceptions. This is not to say that JOPES did not receive criticism from some officials surveyed in this study. At the same time, it was fully appreciated that JOPES is an evolving system and a major improvement over predecessor systems. Almost all respondents indicated that JOPES' terminals are difficult to use and that the system is rigid in its ability to answer questions. JOPES' ability to develop excursions on alternative force packages/timing actions was also considered in need of improvement. While it is recognized that this capability is not required for all users, given their roles in the deployment problem, it was considered valid for an "excursion" generating capability for senior planners. In fairness, JOPES' improvements may well be planned for the future, unbeknownst to the panel which did not have the time or resources to perform a detailed analyses of the JOPES' system architecture.

The study did observe that the deployment sequencing of logistics forces and associated communications capability was not without difficulty. This is not to denigrate the absolute requirement to deploy appropriate heavy forces as speedily as possible. However, in the planning of the operation, it was observed from most respondents that the in-country logistics capability did not evolve consistent with requirements being placed on it by Army forces. Further, the ultimate impact actions of major planning decisions did not appear to be appreciated in terms of their effects on the logistics system. For example, when the decision was made to deploy the VIIth Corps from Europe, two significant outcomes occurred to the logistics system. First, deploying logistics forces in many cases were delayed because the transportation system was applying its capability to moving the VIIth Corps. Secondly, as units already in Saudi noted this event and its possible effect, they placed unnatural demands on the system for supplies that would suffice until the delayed logistic support would arrive. The resulting effect was substantial and produced an artificial demand on the logistics system which could have been possibly alleviated if planning considerations had been given to the effects of the VIIth Corps deployment.

The study also observed that scenarios upon which base planning logistics could have been based were not evident for an Iraq/Saudi contingency. Further noted was the absence of scenarios for other potential trouble spots in the world. The fact that no TPFDL existed for some time early in Desert Shield was probably due to the lack of specific scenario information.

PLANNING

RECOMMENDATIONS:

- **Approach JCS to improve JOPES in the following ways:**

- **User Friendliness**	- Increase usage; daily operations - Hierarchical menu organized data bases - Improve application software
- **Flexibility to Answer Questions**	- Faster TPFDL development - More timely transportation feasibility estimation
- **Improved Logistics System Interfaces**	- Fast, easy access to movement readiness and logistical data
- **Support to Senior High-Level Decision Makers**	- Compare courses of action - Aggregate critical information - Improve system response time
- **Minimize Labor Intensive Operations**	- Field new WAM work stations - Train JOPES users - Insert modern technologies

PLANNING

RECOMMENDATIONS:

- Insure balanced in-country force exists
- Major decisions to accelerate deployment of major formations (e.g., VIIth U.S. Corps) or increase ammunition daily rates of theater stocking levels must be accompanied by analyses/plans to identify the effect of these decisions on logistics forces and capability assumptions
- Logistics planners should develop, on a routine basis, scenarios/data bases for potential application of U.S. forces worldwide
- Contingency planning for high-cost or long-lead time items should be developed by logistics planners

PLANNING

The study team recommends that improvements be made to JOPES in the near term. This recommendation is made in recognition that, if another Desert Shield/Storm deployment is made before these improvements are made, similar JOPES related problems will occur.

Further, it is recommended that contingency planning activities reflect the necessity for a balance between combat, combat service, and combat service support forces.

Finally, the development of scenarios for worldwide contingencies should be accelerated. This work could be country-specific or regional, depending on resources available. Data bases, indigenous capability, and requirements could also be generated. This would facilitate the planning for high cost or long lead items which may or may not be relevant to the specific scenarios.

ASSET VISIBILITY

LACK OF ASSET VISIBILITY, IN-THEATER, RESULTED IN ERRATIC AND LIMITED DISTRIBUTION OF, AND EXCESSIVE RE-REQUISITIONING OF SUPPLIES AND EQUIPMENT.

ASSET VISIBILITY

DISCUSSION:

The movement of a spare part or an end item from the United States to a combat unit in the Gulf followed a long trail that passed through several nodes and utilized several modes of transportation. Typically, a spare part would be picked and packaged at a depot, shipped by truck to be consolidated in a container at a second depot, and then moved to a port. Loading of containers on a ship was a decision of the ship's Captain, a decision based on consideration of shipping safety and efficiency with little consideration given to tactical schemes or logistics priorities. This scenario was also true for major end items where shipping criteria dictated ship loading, and unit integrity was lost. Once the ship was off-loaded at the Gulf port, there was little ability to identify contents of shipping containers or the requesting units. There was no true inventory control in the sense that any agency knew what was on the ground, where it was, and to whom it belonged. This resulted in the infamous "iron mountain" of containers within the theater. Failure to receive spare parts in a timely manner caused units to place serial requisitions for the same item and swamp the supply system. This lack of asset visibility and inability to control the priority of shipments created the need for the "Desert Express". In one sense, this operation was a true success as critical items were delivered to the theater in a timely and efficient (if expensive) manner. On the other hand, a purist might argue that "Desert Express" was a failure in that it signaled that the supply system was unable to function as planned.

The Army has long recognized the need for total asset visibility and has been working on solutions to this problem. Ideally, one would like to know that part "A" was placed in container "Y" and was shipped to port "P" on truck "T" on Julian date "ZZZ". The Captain loaded container "Y" on his ship so that it would be off-loaded first at the receiving port "R" as this container had a priority higher than any other container on that ship. At the receiving port, the supply organizations knew what was in container "Y" and immediately shipped part "A" to the requisitioning unit. The Army does not have the procedures or technology in hand to implement this scenario. However, technology is imminent to accomplish many of the goals of total asset visibility. The Strategic Logistics Agency should be alert to the numerous commercial developments and, as rapidly as possible, get the new technology into the hands of troops for field trials and experimentation.

ASSET VISIBILITY

FINDINGS:

- Shipments in containers were difficult to track
- Inability to control loading priority of cargo on ships and rail reduced visibility
- Lack of asset visibility at in-theater ports resulted in multiple requisitions for some supplies
- Existing technology would make monitoring and control of inventory (containerized or other) automatic and immediate
- Lack of asset visibility resulted in expensive "Desert Express" shipping and mountains of excess supplies at ports
- Existing procedures for inventory control are not "real time"
- Contents of Sea Van container shipments received in-theater were inadequately identified

ASSET VISIBILITY

RECOMMENDATIONS:

- **Acquire modern inventory control devices which will increase visibility (e.g., SAVI Tytag Tracking System) and the automation support to exploit that visibility**

- **Encourage early technology transfer from SLA to the commodity commands**

TRAINING

LOGISTICS TRAINING MUST BE IMPROVED TO SUPPORT FUTURE STRATEGIC DEPLOYMENTS.

TRAINING

DISCUSSION:

Training was an obvious and often recognized factor in the successes of Desert Storm. The training was not limited to combat soldiers and units but encompassed the training for all of the combat support and combat service support soldiers and units as well.

We found universal praise for the technical skills of the individual soldiers. Welders, mechanics, truck drivers, medics, and other support personnel knew their jobs and performed in a commendable manner. This was true if the individual was from an active unit or Reserve/National Guard unit. This is a credit to the Army training system. The use of part task trainers and skill testing for promotion undoubtedly contributed to this individual facility. One might also hypothesize that many Reserve/Guard soldiers were doing a job in the Army that closely corresponded to their civilian occupation. Certainly, it is reasonable to expect members of a Reserve/Guard Hospital Unit to be recruited from civilian health care workers. In any event, individual skills were rarely lacking.

The integration of individuals into small units such as Platoons and Companies was also a success. However, larger logistics units operations were not initially as successful. Logistic units in Desert Shield were required to operate under stressful situations for prolonged periods. Commanders and staff were required to control and coordinate complex operations. Many combat commanders attributed much of their success to the National Training Center experience There was no NTC analog for the logistics units. Particularly for the Reserve forces, and to a lesser extent for active logistics units, there was little prior opportunity to operate as a Battalion or larger sized unit under near combat conditions. As a result, the larger logistics units climbed the learning curve on the floor of the Saudi Arabia desert. By March, most units were functioning credibly. However, the learning process had been difficult.

We did not find as much interest and enthusiasm for computer assisted training using models and simulation within the logistics community as we did within the combat arms community. As an example, we found no "LOGNET" that would be a counterpart to "SIMNET". Technology now exists to develop meaningful training for logistics units using a combination of computer models and simulations.

TRAINING

FINDINGS:

- Individual skills were excellent
- Logistics units functioned well as small units (Platoons, Companies)
- The commanders and staffs of the larger non-Divisional logistics units were slower to exploit the full capability of subordinate units
- Stressful, sustained logistic activity has not been created in training environments for unit staffs of Battalion and larger sized units
- Logistics training models/simulations are not as advanced or available as are combat training models/simulations

TRAINING

RECOMMENDATIONS:

- **Develop computer models/simulations to train commanders and staffs of Battalion and larger sized logistics units**

- **Develop "NTC" like realistic training for senior logistics commanders and their staffs**

SUPPLY

THE SOURCES OF SUPPLY WITHIN CONUS MUST BE MAINTAINED.

SUPPLY

DISCUSSION:

Central to any strategic deployment is a logistics base and source of supply within the United States. Desert Shield/Storm was the first large scale test of the CONUS logistics base since Vietnam. The results were a credit to dedicated Army soldiers, civilians, and supporting contractors. Our purpose in this issue is to note several areas that would result in marginal improvements in future deployments.

We were briefed that some units arrived at CONUS ports lacking ASL/PLL. In addition, the environment and tempo of operations within the Gulf area resulted in a somewhat different set of ASL/PLL than was necessary within CONUS. Both of these factors led to early demands on the supply system to fill ASL/PLL. At the time, the supply system was immature and fragile. The requisitions to fill ASL/PLL were partially responsible for overwhelming the system. We discussed in an earlier section the problem of asset visibility that resulted in the loss of ASL/PLL within theater and in shipping. These mishaps exacerbated the ASL/PLL problem. The lesson learned is an old one - ASL/PLL should be complete at all times.

The Army has entered a "high tech" era since Vietnam. Designers routinely use metallurgy techniques, composites, electronic devices, and the like that were unheard of 20, or even 10 years ago. Manufacturing has become global. The source of supply for raw materials and even some manufacturing processes and manufactured products lie in countries that, while they may be friendly or semi-friendly today, may well be enemies tomorrow.

Parts, even if manufactured in the United States, may require a lead time of many months. These factors lead to increasing difficulty for logisticians in meeting surge requirements.

There are no easy answers to this problem. AVSCOM has suggested that, in the future, PM's will need to stock unusual or scarce raw materials to furnish to contractors during hostilities. PM's may also need to stock semi-finished parts or finished parts to meet surge requirements. There may be a possibility of shared manufacturing facilities using a variety of computer integrated manufacturing techniques. These could be GOCO facilities open to Army contractors on an as-needed basis. The data bases for production would be a derivative from the Computer Aided Acquisition and Logistics System (CALS) initiative.

SUPPLY

DISCUSSION:

The Army is beginning to embrace the concepts of Total Quality Management (TQM). Two tenants of TQM are to emphasize quality rather than cost and to develop a long term partnership relationship with a small number of suppliers rather than an arms length relationship with a larger number of low cost bidders. Obviously the TQM contract philosophy will require some change in Army procurement practices. However, the TQM approach would offer an opportunity to meet surge requirements as the supplier should have a "hot" line and a close working relation with the PM's.

We were led to believe that, in general, the depot system functioned well. However, there was some bottlenecking at the New Cumberland Depot with preparation of material for shipping. Augmentation of depot forces with contractor and/or automation may also prove beneficial to the depot force.

Afloat prepositioning is, of course, not truly a CONUS based source of supply. However, it is analogous in that it is an extra-theater source of supply. Our impression is that afloat supplies paid large benefits. Although this is an expensive and difficult way to stock supplies, it seems apparent that the Army will need to use more afloat depots in the future. The afloat materiel can be augmented with prepositioned ground based supplies in some parts of the world.

Desert Shield/Storm was a paradoxical operation. It would be hard to select a theater further from the United States, with a harsher environment, a less well developed land line of communication, and a smaller pool of indigenous labor. On the other hand, it would be equally difficult to find finer port facilities, more adequate airfields, or an enemy that would allow the United States six or more months to position and arm the force. One must conclude that logistic planners and operators will face a more difficult task in any future deployment.

SUPPLY

FINDINGS:

- Some units deployed with incomplete ASL/PLL
- Strategic logistics planning for critical items of supply did not appear to occur
- Depot throughput was a limiting factor
- Afloat prepositioning, while expensive and difficult, paid large benefits
- Future deployments will place heavier demands on logistics planners

SUPPLY

RECOMMENDATIONS:

- Develop contingency plans for high-cost, long-lead time items
- Augment CONUS depots with reserve forces, contractor support and/or automated packaging systems
- Preposition Army materiel afloat and on the ground

DISTRIBUTION OF MATERIEL

THE DISTRIBUTION SYSTEM WAS INADEQUATELY RESOURCED.

DISTRIBUTION OF MATERIEL

DISCUSSION:

The panel defined the distribution system as the totality of vehicle, ship, and air transport within the United States, Europe, and the Gulf area.

There were any number of firsts accomplished during Desert Shield/Storm. Among these were the first exercise of the Civil Reserve Air Fleet (CRAF), the activation of roll-on roll-off (RORO) ships from standby status, and the coordinating role played by the U.S. Transportation Command. All of these were eminently successful. The lower level coordination and cooperation among Army, Air Force, and Navy transportation units also went very well. These efforts were a result of the professionalism and dedication of the logisticians within the system.

The RORO's clearly demonstrated they were the vessel of choice for shipping heavy equipment from theater to theater. The only regret is that there were insufficient RORO's. An Army decision to support legislation to increase the number of fast sealift ships with RORO capability would be well justified by the experiences of the Gulf War. Similarly, the CRAF airplanes proved effective for long hauls of light material. The Gulf War occurred at a time when the civilian aviation industry was economically in the doldrums. One might speculate how willing the airlines might be to make aircraft available if the traffic load was high.

There were mixed reviews on the effectiveness of the German Rail System. A movement to the west through ports on the Atlantic was certainly the antitheses of years of planning for an eastern move that was largely ground-based using the combat unit's organic transportation ability. Some of the initial confusion in Europe may have been a cultural adjustment to overcome this mind set. The movement of the heavy Divisions out of Germany can largely be counted a success. In any event, the necessity of host nation support agreements was again emphasized.

DISTRIBUTION OF MATERIEL

The port and airfield facilities within Saudi Arabia were exceptional. The highway system was quite limited. The Army had made a conscious decision to reduce logistics units to improve the "tooth to tail" ratio. A lesson learned from this decision was the cut in heavy truck transport was too great. In addition, the tactical scheme called for moving tanks and other tracked vehicles hundreds of miles across country using wheeled heavy equipment transporters. The logistics and combat units were not resourced to handle these demands. The Saudi government was able to partially overcome this shortfall with a great variety of foreign heavy equipment transport and native drivers. However, a careful analysis needs to be made to determine the need for Heavy Equipment Transporters (HET's) within the Division and Corps units. In addition, there is some sense that the combat Divisions lack both HEMTT's and water trucks. The total amount of material handling equipment (forklifts, cranes, etc.) was insufficient to adequately handle the flow of materiel.

The short characterization of the distribution system is "what there was, was effective; need more of it."

DISTRIBUTION OF MATERIEL

FINDINGS:

- All modes of transportation were effective, but not sufficient
- Coordination among the Army, Air Force, and Navy major transportation Commands worked well
- Sufficient materiel handling equipment was not available

DISTRIBUTION OF MATERIEL

RECOMMENDATIONS:

- The Army should support legislation to provide a larger increase of the number of Fast Sealift Ships (FSS) with RORO capabilities
- A greater number of HET's, HEMTT's, and water trucks should be allocated to the Division level units

MANAGEMENT/ORGANIZATION

DESERT STORM-LIKE CONTINGENCIES DEMAND ADAPTIVE MANAGEMENT CONCEPTS.

MANAGEMENT/ORGANIZATION

DISCUSSION:

"The best laid plans of mice and men often go astray."

We had earlier emphasized the necessity of careful planning to assure the success of strategic deployments. However careful this planning is, there can be no expectation that every contingency or outcome will be anticipated. Therefore, adaptive command and leadership and management techniques are needed.

During Vietnam, the Project Management (PM) organizations were not as mature as they are now; thus, Desert Shield/Storm was the first test of the efficacy of the PM's. The panel visited AVSCOM and TACOM and found refreshing innovative approaches to difficult logistics problems. Contract maintenance support was quickly brought to bear to supplement organic Army maintenance activities. AMC and PM civilians were moved into the field and worked side-by-side with uniformed maintenance personnel. Contrary to "doctrine", a depot-type maintenance activity was established very near the area of combat. Needed spare parts were quickly acquired within the United States and moved to Charleston for delivery by the "Desert Express" to the theater. The PM and his/her high level staff were personally involved in assuring support to the combat units. The availability of combat assets such as tanks and helicopters was remarkable, even more remarkable when one realizes these high rates were accomplished in a harsh and difficult environment. Perhaps the strongest perspective that one gains from the PM offices was that each and every individual felt a deep responsibility to keep his /her weapon system up and operating. This was the key to the success in the desert.

The Army has considered making the PM a true "womb to tomb" life-cycle manager with total responsibility for acquisition, provisioning, maintenance, and disposal of a weapon system. In effect, the PM would partially supplant the depot system. In light of Desert Shield/Storm, this concept appears to have a great deal of merit.

MANAGEMENT/ORGANIZATION

DISCUSSION:

The study group did not exhaustively examine the organization of logistics units within the Divisions and at Corps and echelons above Corps level. In addition, our impression of unit effectiveness may well be colored by the problems that larger logistics units had in accomplishing effective training (as noted in the earlier section). It is our impression that Divisional logistics units, while they may be marginally improved, are soundly designed and should remain essentially status quo. If improvement in logistics capability is to come from organizational redesign, it will most likely come from reorganizing units above the Division level.

The Army Science Board Study Group, perforce, has a strong bias toward technology and, in this particular case, toward analysis. There are a number of extant operation research methods that were not fully utilized and that would appear to have had the potential to benefit DCSLOG in planning and executing the Desert Shield/Storm mission. Moreover, logistics, in the future, will have a stronger and stronger dependence on computers, data bases, modelling and simulation, and technology. DCSLOG does not have, in house, the analytical capability to adequately exploit this potential. We would suggest the creation of a small (2 or 3 officers) operations research cell within DCSLOG. This would not be additional to the present TDA, but would be created by designating 2 or 3 positions as requiring an additional skill identifier as an operations research analyst. The role of this cell would be to conduct quick analyses for the DCSLOG, to frame substantive issues for analytical agencies such as CAA, to follow technology particularly in the area of computers and optimization algorithms, and to focus the efforts of the Strategic Logistics Agency.

MANAGEMENT/ORGANIZATION

DISCUSSION:

We have emphasized throughout this study our respect and admiration for the superb performance of the logistics community during the Gulf War. We particularly reflect on our visits to AVSCOM and TACOM to gather data on actions taken to support aviation, armored, and automotive systems. In both of these installations, the professionalism of the Army's logisticians, uniformed and civilian, was evident and worthy of commendation. Desert Storm was a contingency operation. TPFDL's did not exist in detail, nor were the initial defensive deployment or the subsequent offensive operation anticipated in August 1990. Nonetheless, the personnel of AVSCOM and TACOM met the challenge. In essence, they adapted existing plans and procedures, quickly acted to overcome shortfalls of which they were aware, and responded with procedural and materiel fixes to problems that arose in theater. The Army and DOD should not lose sight of the critical role played by these trained personnel in making the logistics system work. No future contingency will arise or evolve exactly as considered to operational plans prepared in anticipation of future operations. Technology can make it easier for these people to do their job; it can improve the responsiveness and quality of their products, but it cannot replace them. This is true, not just of the logisticians in AMC, but also for their counterparts in other units, other commands, and other activities. Competent, well trained professionals are a necessary component of any present or future logistics system.

MANAGEMENT/ORGANIZATION

FINDINGS:

- Contract maintenance support worked well and was critical
- The Army created what amounted to a depot, organizationally and geographically close to user
- Desert Storm demonstrated PM's important role in providing supply and maintenance support to weapons system
- DCSLOG does not have a strong analytical capability
- Trained, competent personnel are the present and future key to logistics success

MANAGEMENT/ORGANIZATION

RECOMMENDATIONS:

- Ensure contract maintenance is available to support future contingencies
- Ensure a deployable depot capability is available
- Create a small OR cell within DCSLOG

THE FUTURE

This section presents a fictionalized account of a deployment in the year 2011 with an emphasis on technology assistance that could be available. One significant aspect is that most of this technology will come about because of industry participation and interest. DCSLOG's main activity will be to monitor the developments within the civilian sector and assure early introduction into the Army system. Other technology such as insensitive ammunition will obviously come about only through Army R&D programs. DCSLOG needs to play an active role in this arena to insure that projects critical to the logistics community receive a fair share of attention and resources.

In addition, we feel that Desert Shield/Storm has signaled a need for greater use of knowledge representation technology, particularly for command and control, transportation planning, inventory control, and maintenance.

Command and control posed a significant challenge to logisticians in Operation Desert Shield/Storm, specifically in planning and executing logistics operations. The technologies which support such activities are usually categorized as decision support technologies. Significant advances have been made in these technologies during the past 10 years which are closely tied to the availability of inexpensive computational capacity, memory, and data base management software. The use of these technologies in Desert Shield/Storm was not even. On one hand, TRANSCOM appears to have utilized state-of-the-art mathematical programming in planning both short-term and long-term transportation operations and in responding to contingencies. On the other hand, from the outset, DA staff officers did not have a range of tools available, and employed spreadsheet and PERT packages at relatively low levels of sophistication.

THE FUTURE...continued

Transportation planning, inventory control, and maintenance are examples of areas in which significant state-of-the-art advances have been made. The size and complexity of the problems that can be solved has enormously increased. The availability of computational capacity and large scale data bases has made it possible to solve the problems in real time. Linear and non-linear programming are the key disciplines in these technologies; they are extensively applied in the private sector in air, sea, rail, and road transportation. Real time analysis capabilities, coupled with real time or near real time data base management, has significantly increased the application of these techniques to inventory control and management. Changes in demand can be identified and adjustments in supply made on a day-to-day basis in large and complex retail and manufacturing enterprises. Centralized and decentralized management information systems exist which keep track of locations and status of entities and activities. Decision support packages identify problems and generate alternative solutions.

The Army should make greater use of these technologies. It should exploit advances in management information systems to keep track of resource status and availability. It should exploit advances in decision support technology to develop and evaluate alternatives in planning. Appropriate packages should be made available to logisticians at all levels, recognizing that the greatest need may exist for those planners who operate at theater Army levels and above.

LOGISTICAL ACTIVITIES DURING STRATEGIC DEPLOYMENT:
A Futurist View

The year is 2011.

The Treaty of Vidalia in 2000 had drastically altered the political boundaries in South America. Boundaries were recast to recognize ethnic groupings, particularly groupings of the original Indian inhabitants. Three of the countries created in northeastern South America were Tribnia, Ocmulgee, and Altamaha.

Altamaha has recently invaded Tribnia and unilaterally annexed a part of the country which Altamaha claimed to be part of the ancient Altamaha tribal lands.

The Altamaha Army has a veritable potpourri of equipment. Some of it is fairly modern, having been supplied by unscrupulous arms merchants from South Africa, North Korea, and China. Altamaha also has some 1980 vintage equipment supplied by the United States during a brief alliance in the late 1990's. The equipment is not well maintained.

In spite of this hodgepodge of equipment, the Altamaha's are a formidable foe. The spirit of the Army is determined by tribal allegiances, religious fanaticism, fierce loyalty to "El Lieder", and incredible individual combat feats fueled by mind altering drugs. The invasion of Tribnia was marked by a level of savagery unequalled in modern warfare.

The Prime Minister of Tribnia, Che Rhee, has asked President Adams of the Untied States to commit a military force to restore the boundaries of the Treaty of Vidalia. President Adams has acceded to this request as Tribnia has been a stable bastion of democracy in the area. In addition, Tribnia has a large supply of yttrium, an element that is indispensable for the magnetic levitation rail line being built between Dallas, Houston, and San Antonio. Therefore, President Adams has directed General Rock to commit the South Looking Rapid Deployment Force (SLRDF).

A Futurist View... page 2

General Rock met with his J-3 and developed a tactical concept of operations. He read this concept into a computer that used an array of voice recognition, pattern recognition, parallel processing, knowledge representation, neural networks, and data base manipulation techniques to automatically develop a tentative TPFDL. General Rock's planning staff massaged the tentative TPFDL to produce a final list that was transmitted to the planning staffs and commanders involved. In addition, a computer generated operations scenario was transmitted to the SIMNET and LOGNET facilities as an aid to planning and mission rehearsal.

To support planned operations in Tribnia, the President called up elements of the Guard and Reserves; among these elements were units which filled out the Corps Support Command. All of these units, distributed over the continental United States, participated in a CPX which took place within two days of the call-up using the distributed logistics simulation - LOGNET. The CPX reinforced understanding of the concept of operation. It identified unforeseen demands for special maintenance of decontamination equipment and resulted in additional units being deployed. It also permitted work-arounds to be developed for several distribution problems. The CPX was put together smoothly and quickly. All units, down to company level at their home stations, had been using these simulators in their annual training programs. Company commanders, Battalion, and Corps support group commanders and their staffs had high degrees of readiness and were used to working with the staffs of the Divisions and non-Divisional combat units they supported.

Although it was not obvious to General Rock, the computer processing did not take place in the Pentagon, but occurred at Todd Enterprises. This is a computer "utility". Todd Enterprises guaranteed the Army a computer operating speed equal to the 90th percentile of the speed of current computers in any year. As a result, the sophisticated Army programs were run at 100 terra flops. This stringent contract requirement has resulted in Todd Enterprises upgrading their computer equipment almost yearly. However, as the Army was only one of many customers, the computer capacity was furnished economically to the Army. Encryption assured safeguarding of any classified information.

A Futurist View... page 3

An invaluable planning aid for the logistics planners was the P.A. Scene. This was a sophisticated Geographic Information System (GIS). It was a very user-friendly system that gave the planner high quality displays of port area, transportation networks, off road trafficability, water supply, and other information so necessary for the campaign. Logistic planners were able to use this GIS and the computer simulation of the tactical battle plan to develop a new set of ASL and PLL for each unit planned for the deployment. The new ASL and PLL were a recognition that the environment, the nature of the combat activity, and the tempo of operations would be far different than that experienced by the units in CONUS. The new ASL and PLL were furnished to deploying units prior to their leaving their home stations.

One of the SLRDF units alerted for the operation was the 21st Air Envelopment Division at Fort Hood. The deployment of this Division was a model for the deployment of the rest of the force. As an example, all of the Division's equipment fit into the standard 8x8x40 shipping container. This was a result of the Army recognition that the standard shipping container was here to stay. This led to a concentrated effort to "lighten the load" by the use of ceramics, composites, and plastics. Strap on armor for the armored gun system and telescoping gun tubes solved problems of weight and geometry. The Army's insensitive ammunition programs had resulted in projectiles, fuzes, and propellants that could be safely loaded into containers without any special provisions. Many soldiers at Fort Hood were equipped with exto-skeletal arrays and could easily and quickly move loads up to 500 pounds. In addition, robots were used for stock picking and loading of containers.

The Division's tactical concept and logistics requirements were run through a computer optimization program that developed a safe and efficient ship loading plan that also guaranteed tactical integrity.

The Division used the results of this plan to dispatch the standard containers to the port of Houston using autonomous vehicles. These vehicles were equipped with collision avoiding radar, terrain following data bases, and other sensors that allowed the vehicles to move to the port of Houston without human intervention.

The Military Transportation Command had a long established contract with the port to use two berths in time of deployment. Logistic exercises in the past had used these provisions so it was a readily accepted procedure.

A Futurist View... page 4

Roll-On Roll-Off (RORO) ships from the reserve fleet arrived in Houston on schedule. Little had changed with these ships since the 1980's. Improvements in hull design and boundary layer effect treatments had resulted in marginal improvements in speed. Diesel and turbine power plants had materially increased the reliability. Each RORO carried two surface effect lighters for over-the-shore operations.

The main port in Tribnia was Crib Ends. It was not adequate for the total Division off-load. Therefore, the Army had to bring in an Elevated Causeway System and, subsequently, the Navy emplaced a Rapidly Deployable Port, a set of barges that could be set in place with jacking columns. In addition, the Army had an underwater pipeline for POL off-loading. This was operated simultaneously with an extensive Logistics Over-The-Shore (LOTS) operation. The LOTS simulation and planning model that had been completed in 1993 analyzed parameters such as underwater topography, adjacent headlands, wave approach, winds, and wave hind casts to suggest several desirable beaches for LOTS operations. The beach at Playa del Tarter best supported the tactical plan and was chose by the J-3 and J-4 for the LOTS operation.

A rapidly employable break-water ameliorated waves from Sea-state 3 to Sea-state 2 allowing uninterrupted LOTS operations. This, coupled with the Hi Seas COTS, a loading platform affixed to the RORO's, greatly improved the efficiency of the surface effects lighters.

Rough terrain fork lifts moved the containers from the lighters to the Army's on-off road mover. This mover had electrical drive at all wheels, centrally variable tire pressure, large radial tires with an aggressive tire design, and an improved suspension system that made for rapid and effective travel both on and off highway. A sand grid expedient road allowed movement in and around the beach area. The trucks, in addition to their inherent off road capability, had a terrain decision aiding monitor. The Global Positioning System (GPS) down link placed an icon to locate the truck, and graphical presentations from the Condensed Army Mobility System (CAMS) showed the driver the best routes to his destination. In addition, the Army had instituted an integrated approach to cross-country driving. This system's approach which included vehicle design, an integrated navigation system, decision aiding graphical presentations, and specialized cross-country driving training had led to an off-the-road mobility that was unparalleled in the Army's history.

A Futurist View... page 5

The trucks looked far different than the trucks of the '90's as the Army had designed most vehicles for ease of decontamination following a chemical or biological attack.

The navigation system on board each truck allowed tracking each truck after it left the port. Each container on a truck was bar coded and had an implanted smart chip. In addition, virtually all of the shipped items had implanted smart chips. These chips served as identification of the item and also as the item's log book. This capability finally gave the Army total asset visibility.

On board navigation systems and GPS provided more than just total asset visibility. Company commanders, Battalion headquarters, Corps support group headquarters, and the COSCOM itself had a near real-time picture of the logistics battlefield. Commanders at all levels used decision support modules to plan and execute combat service support operations. They were able to anticipate requirements and respond efficiently. Contingencies were recognized and fixes found; fixes which, when necessary, made best use of all of the assets and soldiers in the COSCOM.

Most supplies were heat shrink wrapped. Some supplies were placed in containers with cushioning "peanuts". The Army had discovered a process to make the "peanuts" from fertilizer material. After the supplies were unloaded, the Civil Affairs section made the fertilizer available to the local farmers. The Altamaha Indians spoke an obscure and difficult dialect. However, voice recognition miniaturized computers worn by all soldiers allowed instant translation and gave the American soldier the ability to easily communicate with the natives.

Major systems had built-in automatic test equipment. This gave the operators and mechanics an instantaneous read-out of defective parts and needed preventive maintenance services. Mechanics simply talked into their computers to initiate a requisition. Voice recognition translated this into all the information necessary to cause a part to be shipped to the unit. Requisitions were consolidated at the country level. Although logisticians were major users of satellite transmissions, all supply messages were transmitted by burst transmission so that total satellite time was not overwhelming.

A Futurist View... page 6

In the 1990's, the Army had made project/program managers truly responsible for womb-to-tomb management of end items. As a consequence, requisitions were routed directly to the PM office. The PM's in the '90's had enthusiastically adopted Total Quality Management. This had resulted in a longer time relationship with fewer suppliers and an attitude of partnership rather than an adversarial stand-off situation. Most of the surge requirements were easily met. One key to meeting the surge was an Army decision in the 1990's to stockpile critical raw materials. A second key was to establish shared manufacturing facilities. These were GOCO centers of Flexible Manufacturing Systems (FMS's) and computer driven machine tools and were an outgrowth of the Defense Machine Tool Depot. The digital data bases that were required as part of the Computer Aided Acquisition and Logistics System (CALS) project resulted in machine tapes that allowed rapid production of replacement parts.

The PM's used the C-17's of TRANSCOM, as well as commercial carriers going into the main airport of Ocmulgee to move parts to Tribnia. Nearly all of the PM's established contractor operated special repair facilities in Ocmulgee.

At the local level, support troops had supplies of composites and powdered metals. Using these as raw materials and a PC as a driver to lay down the matrix, mechanics were able to fabricate many spare parts on the spot.

Much of the water in Tribnia was polluted. Army microbiologists quickly developed "bugs" that were able to turn the brackish water into potable water.

Another innovation in Tribnia was the "safe" POL program. A gasoline storage bladder was hit by an Altamaha mortar. There was a small self-extinguishing fire, but no catastrophic explosion occurred.

The combat operations in Tribnia were mercifully short with minimal casualties on both sides. General Rock's after action comments noted that at no time was the tactical operation constrained by the logistic support. But, as LTG Craddock, the theater logistics Commander said, "It was a piece of cake."

DOD CRITICAL TECHNOLOGIES AND LOGISTICS ACTIVITIES

In 1990, DOD created a listing of Critical Technologies. The Table on the following page is an assessment of the Panel's views on the possible impact of these Technologies on Logistics activities. DCSLOG should monitor those Technologies that will significantly impact on Logistic activities.

Defense Critical Technologies and Logistics

TECHNOLOGY	IMPACT ON LOGISTICS
COMPOSITE MATERIALS	++
SEMICONDUCTOR MATERIALS & MICROELECTRONIC CIRCUITS	+
SUPERCONDUCTORS	0
MACHINE INTELLIGENCE AND ROBOTICS	++
SOFTWARE PRODUCIBILITY	+
PHOTONICS	0
PARALLEL COMPUTER ARCHITECTURES	+
DATA FUSION	++
SIGNAL PROCESSING	++
PASSIVE SENSORS	0
SENSITIVE RADARS	0
SIMULATION AND MODELING	++
COMPUTATIONAL FLUID DYNAMICS	0
BIOTECHNOLOGY MATERIALS & PROCESSES	+
AIR-BREATHING PROPULSION	0
HIGH ENERGY DENSITY MATERIALS	0
HYPERVELOCITY PROJECTILES	0
PULSED POWER	0
SIGNATURE CONTROL	0
WEAPON SYSTEM ENVIRONMENT	0

KEY: ++ Possible high impact on logistical activities
+ Likely moderate impact on logistical activities
0 Little foreseeable impact on logistic activities

TECHNOLOGIES TAKEN FROM DOD, CRITICAL TECHNOLOGIES PLAN, 15 MARCH 1990

ACKNOWLEDGEMENTS

The Panel would like to express its appreciation and admiration for the members of the logistics community who accomplished such Herculean tasks during DESERT SHIELD/STORM. The dedication, professionalism, and love of country exhibited by these soldiers was exemplary. We particularly thank those who were willing to take time from their busy schedules to share their experiences with this Panel.

We were inspired by our study sponsor, Mr. Joe Cribbins of the Office of the Deputy Chief of Logistics, Department of the Army, who, in his 51st year of Federal Service, retains the enthusiasm and energy of a 17 year old. It was our privilege to work with Mr. Cribbins on this study.

The influence and guidance of Mr. Cribbins was also instrumental in assuring excellent support from CPT(P) Brian Craddock, our DA Staff Assistant. His efficiency in arranging our meetings, his written contributions to this study,and his mature reflections on logistics matters were instrumental in getting us on the right track and keeping us there once we got started.

Our administrative support came from three sources. The main support came from three superb and patient women at Smiths Industries: Mrs. Joan Bresnan, Miss Terri Strauss, and Ms. Cynthia Shabazz. We also were assisted by personnel from Mr. Cribbins' office, as well as the secretarial staff from the School of Engineering at Mercer University. To all of these people, we say Thank You for a job well done!

REFERENCES

In the course of its study, the panel received a number of briefings pertaining to Operations Desert Shield and Storm. These briefings produced a sizable library of handout and reference material which have been used in the development of this report. Some of these materials are useful as reference data and are summarized below.

Logistics Support Operation Desert Shield/Storm

This briefing provides an overview of the logistical aspects of the operation. The briefing details the deployment timeliness, force structure, and logistics support unit alignment on the battlefield. The briefing presents a tonnage over time depiction of the arrival of key classes of supply in theater.

Supply and Maintenance in Operation Desert Storm

This briefing provides a summary of operational readiness, modernization, maintenance, and supply operations during Operation Desert Storm. The briefing highlights some of the critical logistics issues, to include: the shortage of trucks, tires, barrier material, and chemical defense capability and the effort to develop anti-fratricide materiel and procedures.

AVSCOM Southwest Asia Briefing

This briefing details AVSCOM support to aviation forces deployed during Operation Desert Storm. The briefing presents the initiatives that AVSCOM developed and employed to provide timely support. It discusses the aviation support structure and efforts to position wholesale stocks in theater.

Desert Shield/Storm/Sortie Military Sealift Command Support

This briefing discusses the efforts of the Military Sealift Command to support the deployment and sustainment of units in Southwest Asia. The briefing summarizes the successes and challenges of the Military Sealift Command and thé Ready Reserve Fleet. It summarizes the tons of cargo deployed by surface and the quantity of ships required to support the operation.

References (continued)

The Army Strategic Mobility Vision

This briefing describes the DCSLOG vision of future Army strategic deployment requirements to support contingency operations. The briefing considers lessons learned from the Desert Storm experience and the reduced force structure of the Army of the mid-1990's.

Joint Operation Planning and Execution System (JOPES)

This briefing outlines the JOPES, its purpose and capabilities, and describes the efforts underway to expand the system.

Operation Desert Storm Logistics Automation Issues/Initiatives

The briefing details the lessons learned during the deployment of logistics automation systems to Southwest Asia. It outlines the impact of the issues and the solution that was developed to counter the problem.

CSS Analytical Tools

This briefing discusses the computer models that the TRADOC Analysis Command employs to perform quantitative study logistics operations. The briefing details the capability and output of each of the models.

CONFLICT OF INTEREST STATEMENT

By letter of 12 April 1991, the Administrative Officer of the ASB furnished the Panel Chairman a copy of a memorandum from the ASB Ethics Counselor stating that a review of the Terms of Reference and the membership list had identified no apparent conflicts of interest (Appendix C). It was requested, however, that continuing attention be given to the matter of potential conflicts, and that Panel reports should include (or be accompanied by) a statement by the Panel Chair "either describing conflicts that have become apparent as a result of the Panel's recommendations, or confirmation that there were no conflicts identified."

It is hereby confirmed that no conflicts of interest have been identified.

Allen F Grum

Allen F. Grum

10 Feb 92

APPENDICES

A. Tasking Letter

B. Membership

C. Conflict of Interest Review Text

APPENDIX A

TASKING LETTER

DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
WASHINGTON, DC 20310-0103

27 MAR 1991

Dr. Duane A. Adams
Associate Dean
School of Computer Science
Carnegie Mellon University
Pittsburgh, Pennsylvania 15213

Dear Dr. Adams:

Request you appoint members of the Army Science Board (ASB) to conduct a study for the Logistics and Sustainability Issue Group entitled "Logistics Support and Strategic Deployment during Operation Desert Shield/Storm." The study should address, as a minimum, the Terms of Reference (TOR) described below; however, the study group should consider the TOR as a guideline and not be inhibited from considering other issues regarding logistics and sustainability during Desert Shield/Storm that it deems important to the study. Modifications to the TOR must be coordinated with the ASB Office.

I. Terms of Reference

a. Which procedures and technologies have the potential to aid in solving logistical challenges presented by Desert Shield/Storm?

(1) What Headquarters Department of Army (HQDA), Army Material Command (AMC) and locally devised procedures were used to alleviate the logistical problems in Desert Shield/Storm and what was the effectiveness of these procedures?

(2) Which technologies were most effective in countering the logistical challenges? Specific concerns are the logistical challenges caused by the heat and sand of the desert environment.

b. What technologies could aid strategic deployment?

(1) What was the effectiveness of the strategic deployment technologies employed in Desert Shield/Storm? In particular, what was the effectiveness of the utilization of available modes of transportation (e.g., surface vessel by type, strategic air, self-deployment)?

(2) Identify the areas where existing strategic deployment technologies were not employed, were under-utilized, or could have been employed more effectively, taking into account the impact of the mission, time constraints, available resources, available means of transportation, the existing force structure and the deployed force structure.

(3) Which mature or nearly mature technologies, that have not been fully developed, offer potential for significant near-term (0-5 years) gains and which offer potential for significant long-term (>5 years) gains in strategic deployment capability?

II. Study Support

The Study Sponsor will be Mr. Joseph P. Cribbins, Special Assistant to the Deputy Chief of Staff for Logistics. The Staff Assistant will be Captain Brian M. Craddock, Office of the Deputy Chief of Staff for Logistics.

III. Schedule

The Study Panel shall begin its work immediately and submit the final report of its findings and recommendations by 30 September 1991. As a first step, the Study Chairman should prepare a study plan and present that plan to the Sponsor and the Executive Secretary of the Army Science Board.

IV. Special Provisions

It is not expected that the inquiry will go into any "particular matters" within the meaning of Section 208, Title 18, of the United States Code.

Sincerely,

Stephen K. Conver
Assistant Secretary of the Army
(Research, Development and Acquisition)

13 March 1991

TENTATIVE PARTICIPANTS LIST

Army Science Board
Logistics and Sustainability Issue Group Study
on
Logistics Support and Strategic Deployment During
Operation Desert Shield/Desert Storm

STUDY CHAIR
Dr. Allen F. Grum
Chairman
Industrial and Systems Engineering Department
Mercer University
1400 Coleman Avenue
Macon, GA 31207
912-752-2453

VICE CHAIR
Mr. H. Wayne Pacine
Telecommunications Management Specialist
General Services Administration
7980 Boeing Court
Vienna, VA 22182-3988
703-760-7721

MEMBERS

Dr. William Peter Cherry
Vice President, Technical Programs
P.O. Box 1506
Vector Research, Inc.
Ann Arbor, MI 48106
313-973-9210

Mr. John J. Todd
Military Marketing - North America
Smiths Ind., Aerospace & Defense Systems
1225 Jefferson Davis Hwy
Suite 402
Arlington, VA 22202
703-920-7640

Dr. Elizabeth J. Rock
Professor of Chemistry
Department of Chemistry
Wellesley College
Wellesley, MA 02181
617-235-0320 X3045

SPONSOR

Mr. Joseph P. Cribbins
Special Assistant to the Deputy Chief of Staff for Logistics
The Pentagon, DALO-ZD
Room 1E572
Washington, DC 20310-0103
703-697-0487

STAFF ASSISTANT

CPT Brian M. Craddock
Office of the Deputy Chief of Staff for Logistics
The Pentagon, DALO-AV
Room 1E572
Washington, DC 20310-0103
703-697-0487

APPENDIX B

MEMBERSHIP

Membership
Army Science Board Panel on
LOGISTICS SUPPORT AND STRATEGIC DEPLOYMENT DURING OPERATION DESERT SHIELD/STORM

STUDY CHAIR

Dr. Allen F. Grum
Chairman, Industrial & Systems Engineering Department
Mercer University

VICE CHAIR

Mr. Wayne Pacine
General Services Administration

Dr. William P. Cherry
Vice President, Technical Programs
Vector Research, Inc.

Dr. Elizabeth J. Rock
Department of Chemistry
Wellesley College

Mr. John J. Todd
Vice President, Military Business
Smiths Industries

APPENDIX C

CONFLICT OF INTEREST REVIEW TEXT

DEPARTMENT OF THE ARMY
ARMY SCIENCE BOARD
OFFICE OF THE ASSISTANT SECRETARY
WASHINGTON, D.C. 20310-0103

12 April 1991

Dr. Allen F. Grum
Chairman
Industrial and Systems Engineering
Department
Mercer University
1400 Coleman Avenue
Macon, Georgia 31207

Dear Dr. Grum:

As you know, the Army Science Board has a procedure whereby the Office of the General Counsel (OGC) reviews all Terms of Reference and associated participants for appearance of or actual conflicts of interest. This process has been accomplished for the ASB Study on "Logistics Support and Strategic Deployment During Operation Desert Shield/Desert Storm." Attached for your information and retention is a copy of a memorandum from Mr. Ernest Willcher, ASB Ethics Counselor, dated 9 April 1991 stating his findings.

Your attention is called to the two additional steps outlined in paragraph three of the attached memorandum:

a. First, the members of the panel should be requested to notify the Army Science Board's Executive Secretary whenever their individual or collective efforts become more specific and they then perceive the possibility of a conflict with any of their interests.

b. Second, the panel's report should include or be accompanied by a statement either describing any conflicts of interests that have become reasonably apparent as a result of the panel's recommendations or confirming that there are no such conflicts. Mr. Willcher's office is always available to provide assistance in connection with these two steps.

Your continued compliance with these procedures is appreciated.

Sincerely,

Sally A. Warner
Administrative Officer
Army Science Board

Attachment

DEPARTMENT OF THE ARMY
OFFICE OF THE GENERAL COUNSEL
WASHINGTON, DC 20310-0104

9 April 1991

MEMORANDUM FOR ADMINISTRATIVE OFFICER,
ARMY SCIENCE BOARD

SUBJECT: Conflict of Interest

This responds to your 1 April 1991, memorandum, subject as above, concerning the study on "Logistics Support and Strategic Deployment During Operation Desert Shield/Storm." We have reviewed the terms of reference and participants' list, and we concluded that none of the panel members presently have apparent conflicts of interests. However, in light of their employment and financial interests, the members should pay particular attention to the suggestions in the last paragraph of this memorandum.

Our conclusion is based on application of the following test: Whether the matters before the panel are sufficiently specific as to lead to reasonable anticipation of personal financial interest in them. Applying this test, we consider the results of the panel's endeavors to be highly speculative, given the broad nature of the terms of reference before the panel. Accordingly, we cannot now reasonably anticipate that some advantage will accrue to any particular entity listed by the members.

To help assure the continued absence of any appearance of conflicts of interests, we suggest that two additional steps be taken. First, the members of the panel should be requested to notify the Army Science Board's Executive Secretary whenever their individual or collective efforts become more specific and they then perceive the possibility of a conflict with any of their interests. Second, the panel's report should include or be accompanied by a statement either describing any conflicts of interests that have become reasonably apparent as a result of the panel's

recommendations or confirming that there are no such conflicts. Our office is always available to provide assistance in connection with these two steps.

The participants' files are returned herewith.

Ernest M. Willcher
Attorney Advisor

Attachments