

January 1998

DOD'S MOBILITY REQUIREMENTS

Value of Intratheater Lift Analyses Can Be Enhanced





**United States
General Accounting Office
Washington, D.C. 20548**

**National Security and
International Affairs Division**

B-277182

January 30, 1998

The Honorable Strom Thurmond
Chairman
The Honorable Carl Levin
Ranking Minority Member
Committee on Armed Services
United States Senate

As requested, we are providing you with the results of our review of the Department of Defense's 1996 Intratheater Lift Analysis. We reviewed the Department's analysis to determine whether (1) the analysis and recommendations in the study were appropriately linked, (2) the study considered all options in meeting the requirements for various lift assets, and (3) improvements could be made to enhance the study's value as a decision-making tool.

We are sending copies of this report to the Chairmen and Ranking Minority Members of the House and Senate Committees on Appropriations and the House National Security Committee; the Secretaries of Defense, the Army, and the Air Force; and the Director, Office of Management and Budget. We will also make copies available to others on request.

Please contact me at (202) 512-4841 if you or your staff have any questions concerning this report. Major contributors to this report are listed in appendix III.

A handwritten signature in cursive script that reads 'Louis J. Rodrigues'.

Louis J. Rodrigues
Director, Defense Acquisitions Issues

Executive Summary

Purpose

Operations Desert Shield and Desert Storm highlighted the need to quickly deliver combat forces and their support to theaters of operation other than Europe. To ensure that a sufficient amount of mobility assets would be available to support contingencies in the post-Cold War environment, Congress directed the Department of Defense (DOD) in fiscal year 1991 to assess both intertheater (from one theater of operations to another) and intratheater (within the same theater of operations) lift requirements and develop an integrated plan to meet them. In its 1992 Mobility Requirements Study and 1995 Mobility Requirements Study Bottom-Up Review Update, DOD addressed the intertheater portion of the directive. According to Joint Staff officials, the 1996 Intratheater Lift Analysis addressed the intratheater portion of the directive. DOD is planning to update this analysis as part of its 1999 Mobility Requirements Study.

Army officials told us that DOD plans to spend \$1.7 billion through fiscal year 2003 to implement the Army's tactical wheeled vehicle acquisition plan, as recommended in the Intratheater Lift Analysis. If the airlift recommendations in the analysis were implemented as well, another approximately \$2.7 billion (fiscal year 1996 dollars) could be spent. Because these recommendations are intended to serve as a basis for proposed intratheater lift acquisitions, the Chairman and Ranking Minority Member of the Senate Committee on Armed Services requested that GAO report on the results of the 1996 Intratheater Lift Analysis. Specifically, GAO determined whether (1) the analysis and recommendations in the study were appropriately linked, (2) the study considered all options in meeting the requirements for various lift assets, and (3) improvements could enhance the study's value as a decision-making tool.

Background

Members of the defense community agree that intratheater lift requirements are more difficult to establish than intertheater requirements. The type, amount, and timing of lift that will be needed within the theater of operations depend on the theater infrastructure and the course of the contingency, which can change rapidly. Five modes of intratheater transportation—airlift, highway, rail, coastal waterways, and pipeline—present several options for lift, all of which must be considered as the contingency progresses. For example, if outsize cargo—the largest items in the Army's inventory such as the M1 battle tank—need to be delivered by air, the availability of outsize-capable airlifters must be considered. The C-5 and the C-17 are the only airlifters capable of transporting outsize cargo. The Air Force plans to procure 120 C-17s. The final 80 aircraft are being procured under a June 1996 multiyear contract.

The C-130, with a smaller payload capacity, is the Air Force's primary intratheater airlifter.

The 1996 Intratheater Lift Analysis was led by the Joint Staff with support from other DOD agencies, the military services, and theater commands. The study assessed lift requirements for a nearly simultaneous Korea and Southwest Asia scenario. It also determined the mobility assets needed to move troops and equipment from the airfields and seaports in the theaters of operation to destination air bases, staging areas, and tactical assembly areas.

Results in Brief

The Intratheater Lift Analysis does not adequately fulfill the congressional directive to determine lift requirements and develop an integrated plan to meet them. The study contains recommendations that would cost billions of dollars to implement, but the study's analysis generally did not support these recommendations. The disconnect between the analysis and recommendations is especially evident in the information regarding tactical wheeled vehicles and outsize airlift capability.

In addition, the study's analysis did not incorporate several assets that can contribute significantly to the intratheater lift mission; as a result, the study's requirements and solutions may be overstated. The analysis did not consider (1) commercial vehicles provided by host nation support; (2) the use of the current and planned fleet of outsize-capable intertheater airlifters such as the C-5 and C-17; and (3) the extent to which Army watercraft could reduce the need for alternative sources of lift.

Furthermore, improvements could enhance the study's value to decisionmakers. These improvements include requirements stated as a range rather than as absolute numbers and tradeoff assessments based on the cost and capability of the various lift assets. A range would have better reflected the dynamic nature of intratheater requirements, and system tradeoff assessments would have provided choices based on cost and capability.

The 1999 Mobility Requirements Study and updated Intratheater Lift Analysis will afford DOD a good opportunity to address these issues and provide Congress with a basis for acquisition decision-making in future budget cycles.

Principal Findings

Intratheater Lift Analysis Contains Unsupported Recommendations

The Secretary of Defense's 1997 Annual Report to the President and the Congress cited the Intratheater Lift Analysis as a basis for DOD's future force structure and investment decisions. However, the study does not adequately fulfill congressional direction to determine intratheater lift requirements and establish an integrated plan to meet those requirements. The recommendations in the Intratheater Lift Analysis support the Army's current procurement plans but are not based on the requirements identified in the study. The disconnect occurred in some cases because of invalid assumptions, but in other cases the cause for the disconnect is unclear. Assumptions about the mission of the Heavy Equipment Transporter System, for example, did not reflect the way the Army plans to use this asset. As a result, the recommendation for the system's acquisition supports the Army's planned acquisitions but is not supported by the study. The Intratheater Lift Analysis also identified a requirement for 16 Palletized Load System companies but recommended that the Army continue its planned procurement of 32 companies. In addition, the study recommended that excess Heavy Equipment Transporter Systems and Palletized Load Systems, as well as host nation support, be used to offset shortfalls in other categories of tactical wheeled vehicles. However, the study did not include a cost-effectiveness analysis that assessed the relative cost and capabilities of using potential excesses to offset shortages.

The 442 C-130s currently in the fleet exceed the requirement identified in the Intratheater Lift Analysis for the Korea and Southwest Asia scenarios as well as other lift requirements generated by theater commanders outside of these scenarios. However, the study recommended that additional C-17s beyond the planned procurement of 120 (a squadron of 14, according to DOD officials) should be used to augment C-130 capability primarily by transporting outsize cargo. Although this recommendation is not currently a DOD acquisition objective, it has been supported by the Defense Science Board and theater commanders. The cost to implement the recommendation could be about \$2.7 billion (fiscal year 1996 dollars). The study's analysis, however, does not support the need to procure more than the planned 120 C-17s. The combat units relocated by the C-17 in the two scenarios were considered apart from the rest of the battle, and the time frames for delivery of the units were neither incorporated into the overall mobility scheme nor directly related to a specified intratheater lift

requirement. The Air Force has asserted that the currently planned procurement of 120 C-17s, along with the current C-130 fleet, will be sufficient to meet intratheater lift requirements as they arise.

Intratheater Lift Analysis Does Not Consider All Intratheater Lift Assets

Commercial vehicles provided by host nation support were not considered in the Intratheater Lift Analysis, although such support is cited throughout the study as a potential offset to U.S. mobility force structure. The theater commanders' current operation plans for the Korea and Southwest Asia scenarios rely extensively on host nation support to provide transportation of cargo, heavy tracked vehicles, and fuel within the theater. Host nation support was instrumental in transporting heavy tracked vehicles and other cargo during Operations Desert Shield and Desert Storm. Furthermore, the 1995 Mobility Requirements Study Bottom-Up Review Update, which identified the intertheater requirements for the same war-fighting scenario as the Intratheater Lift Analysis, assumed that commercial cargo trucks, fuel tankers, and heavy equipment transporters would be provided by the host nations. Such support would limit the amount of equipment that the United States would have to transport into the theater. The defense community is currently debating the appropriate level of host nation support to offset U.S. force structure, but agreements have not been reached. A study that considers U.S. intratheater requirements with and without host nation support offsets, as opposed to only one scenario with no host nation support, would provide decisionmakers with more flexibility as they consider acquisition plans.

The Intratheater Lift Analysis also did not consider the potential contribution of the C-5 airlifter. Air Mobility Command officials said that the C-5, although an intertheater asset, would be a candidate for intratheater lift of outsize cargo if destination airfields can accommodate the aircraft. The Command has surveyed 46 of the 67 airfields used in the Intratheater Lift Analysis to determine whether they are accessible to the C-5. The survey results show that the C-5 can land on 34, or 74 percent, of the 46 airfields. This number would likely be higher during a contingency, when airfields that have not yet been surveyed would be made available. The ability to rely on both the C-5 and the planned 120 C-17s to deliver outsize cargo as needed could increase flexibility and eliminate the need for additional large airlift capability dedicated to an intratheater role.

Finally, even though the Intratheater Lift Analysis modeled the assets currently in the inventory, it did not consider that additional watercraft could offset requirements for other lift assets. The Army's logistics support

vessels and landing craft transport personnel and cargo from large strategic sealift ships to the shore and provide intratheater transport capability. Army watercraft were successfully used in Operations Desert Shield and Desert Storm and could be a significant means of transporting tracked vehicles, ammunition, and other cargo via coastal waterways in Korea and Southwest Asia. However, the study did not include any tradeoff or cost-effectiveness analyses to identify the benefits of additional watercraft. A separate watercraft study, completed in November 1996, found that theater commanders have not identified their intratheater requirements for watercraft. The role, capability, and requirements for Army watercraft, and potential tradeoffs with ground transportation assets, have not been determined.

Use of Ranges and Cost-Effectiveness Analysis Could Enhance Study's Value

Because intratheater requirements are subject to change based on the combat situation and theater infrastructure, requirements stated as ranges, rather than as absolute numbers, would better reflect the dynamic nature of intratheater lift. DOD's 1988 Worldwide Intratheater Mobility Study recommended that all future statements of intratheater mobility requirements be expressed in ranges when possible and that those requirements not expressed as ranges should be understood to be approximations. The Intratheater Lift Analysis, however, stated requirements as absolute numbers, which lessens the study's value as a management tool. A range of requirements would allow decisionmakers to consider different factors, such as the effect of damage to airfields or seaports, weather, or various threat scenarios, on the number and type of lift assets needed.

The Intratheater Lift Analysis also failed to conduct a tradeoff analysis among various lift assets based on cost-effectiveness, thereby limiting the information available to those making investment decisions within a sensitive budget environment. For example, the analysis identified excess Palletized Load Systems in the Army's acquisition objectives for fiscal year 2003 but recommended that the doctrine for the system be revised to allow the system to carry cargo other than ammunition so that it could alleviate shortfalls in 22.5-ton line haulers. The ammunition role was the sole mission on which the Palletized Load System originally was determined to be cost-effective, and a new cost-effectiveness analysis has not been done to justify the system's expanded role. A company of Palletized Load Systems costs about \$18.8 million (1996 dollars) compared with only \$9.5 million (1996 dollars) for a company of 22.5-ton line haulers, according to an analysis performed by the Tactical Wheeled Vehicles

Requirements Management Office. According to Joint Staff officials, limited tradeoff assessments were discussed in carrying out the Intratheater Lift Analysis, but these assessments did not consider cost and were not documented.

Recommendations

GAO recommends that the Secretary of Defense direct that the planned 1999 update of the Intratheater Lift Analysis

- link the study's recommendations to its analysis and include assumptions that consider current Army doctrine, if acquisition plans are to be based on the doctrine;
- consider host nation support as a means of accomplishing intratheater lift and ensure that host nation support assumptions are consistent with those in intertheater studies;
- include the potential contribution of the C-5 airlifter and planned fleet of 120 C-17s;
- reflect the role, capability, and requirements for Army watercraft in an intratheater role, including an analysis of the extent to which these assets can alleviate identified shortfalls in tactical wheeled vehicles;
- state intratheater requirements as ranges to reflect their dependence on the combat situation; and
- include cost-effectiveness analyses that examine tradeoffs among lift assets to reflect capability, cost, and requirements.

Agency Comments

In commenting on a draft of this report, DOD generally concurred with GAO's report and agreed to take into account GAO's recommendations in conducting its 1999 mobility study. However, DOD did not agree with GAO's finding that the recommendations of the Intratheater Lift Analysis are not supported by the study's analysis. DOD stated that the study used computationally-derived data, along with additional analysis and military judgment, to develop the study's recommendations. DOD cites service acquisition programs, input from theater commanders, and substitution of one type of intratheater asset for another as examples of the additional analysis considered in developing the requirements and recommendations in the Intratheater Lift Analysis. DOD points to the study's recommendation to use excess Heavy Equipment Transporter Systems in place of 34-ton line haulers as being based on service acquisition programs and theater commander input.

The Intratheater Lift Analysis does not link its requirements to its recommendations. Rather, its recommendations merely support the Army's acquisition plans with no explanation of the disconnect between those plans and the study's requirements. In discussing GAO's draft report, agency officials acknowledged that the Joint Staff had difficulty linking the Army's fiscal year 2003 acquisition program to the Intratheater Lift Analysis requirements and that, for this reason, the study's reliance on the acquisition program is not clearly explained. Furthermore, during GAO's review, Joint Staff officials asserted that the decisions reached by the study's working groups concerning, for example, tradeoff assessments and the airlift tactical unit moves analysis, were not documented. Without an explicit link in the Intratheater Lift Analysis between the study's requirements and recommendations, and without a means of reviewing the factors or additional analyses that led to the final recommendations in the study, GAO has no basis on which to concur that a link exists. Moreover, GAO questions the reliability and independence of a DOD requirements study that bases its requirements and recommendations on service acquisition programs without examining the disconnects between those programs and the study's own findings.

Concerning DOD's example, the number of Heavy Equipment Transporter Systems identified as a requirement in the Intratheater Lift Analysis is less than the number reflected in the study's recommendation. According to theater commanders' input to the study and GAO's discussions with Army officials, the Heavy Equipment Transporter System is not an effective or economical substitute for 34-ton line haulers. GAO agrees with DOD's statement that service acquisition programs were used to support the study's recommendations for Heavy Equipment Transporter Systems. It is this fact that leads GAO to conclude that the recommendations in the Intratheater Lift Analysis were not based on the requirements identified by the study's analysis, but rather were based on service acquisition programs that had already been established.

DOD's comments are addressed at the end of each chapter, and the complete text of DOD's comments is in appendix II.

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Abbreviations

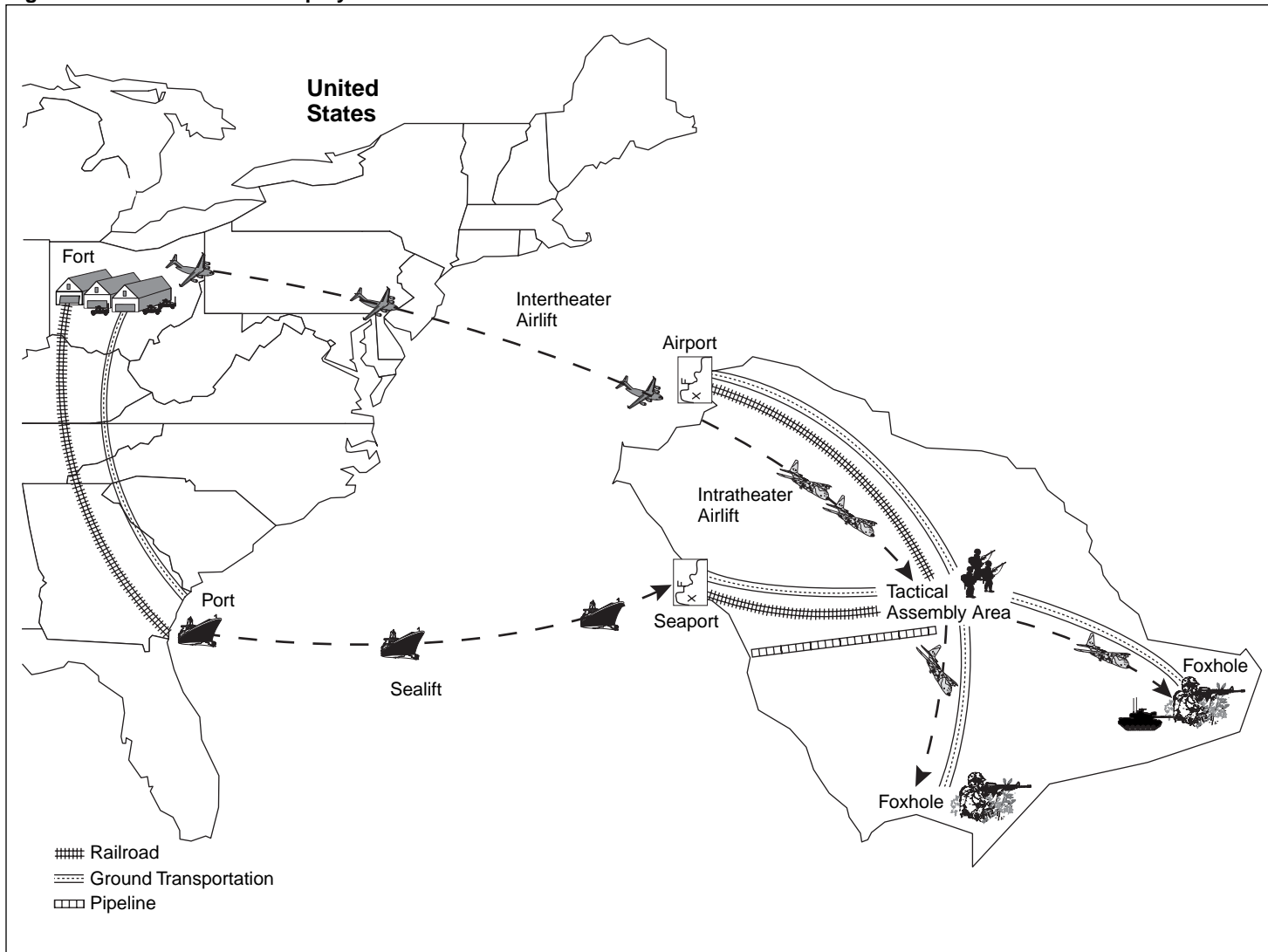
DOD	Department of Defense
GAO	General Accounting Office
HETS	Heavy Equipment Transporter System
HNS	Host Nation Support
ILA	Intratheater Lift Analysis
LCU-2000	Landing Craft, Utility-2000
PLS	Palletized Load System
SUMMITS	Scenario Unrestricted Mobility Model for Intratheater Simulation
TACWAR	Tactical Warfare Model

Introduction

In the National Defense Authorization Act for Fiscal Year 1991, Congress directed the Department of Defense (DOD) to determine intertheater (from one theater of operations to another) and intratheater (within a theater of operations) mobility requirements for the armed forces and develop an integrated plan to meet those requirements. DOD assessed its intertheater requirements in the 1992 Mobility Requirements Study. This study was updated in 1995 based on the results of the 1993 Bottom-Up Review. According to Joint Staff officials, intratheater requirements were addressed in the July 1996 Intratheater Lift Analysis (ILA), which was DOD's first published intratheater lift requirements study since the 1988 Worldwide Intratheater Mobility Study. The ILA was sponsored by the Joint Staff, with representatives from the Office of the Secretary of Defense for Program Analysis and Evaluation, military services, U.S. Central Command, U.S. Forces Korea, U.S. Pacific Command, and U.S. Transportation Command. At the time of our review, the ILA had not been submitted to Congress.

Historically, DOD has focused on intertheater lift requirements because intratheater lift requirements are more difficult to establish. The time-phased force deployment data process, which sets out the mode and timing of transportation of each unit, typically concentrates on the intertheater leg of the deployment. Intratheater lift requirements depend more on the combat situation and the theater concept of operations, which may not be known until the start of hostilities and are always subject to change. Intertheater lift transports troops, equipment, and supplies from U.S. airfields and seaports or prepositioned locations to the airfields and seaports in the theater of operations. The intratheater lift phase transports the troops and equipment from these airfields and seaports to the tactical assembly areas and foxholes in the theater. Figure 1.1 illustrates "fort-to-foxhole" deployment.

Figure 1.1: Fort-to-Foxhole Deployment



The Secretary of Defense's 1997 Annual Report to the President and the Congress states that the mobility objectives identified in the updated 1995 Mobility Requirements Study and the 1996 ILA will guide future force structure and investment decisions. Officials from the Joint Staff and the Office of the Secretary of Defense for Program Analysis and Evaluation said that the ILA is the official DOD study that the military services should use in developing their procurement plans for intratheater lift assets. The

Army plans to spend about \$1.7 billion through fiscal year 2003 to implement the ILA's recommendations for tactical wheeled vehicles; if the airlift recommendations were implemented as well, another approximately \$2.7 billion (fiscal year 1996 dollars) could be spent.

According to Joint Staff officials, a new Mobility Requirements Study is expected to be completed in 1999. That study is expected to incorporate the Quadrennial Defense Review scenarios and force structure,¹ include an update to the ILA, and examine intertheater and intratheater lift requirements simultaneously rather than separately.

Modes of Intratheater Lift

Five alternate modes of transportation—airlift, highway, coastal waterway, rail, and pipeline—present several options for intratheater lift. The availability of these options depends on the combat situation and theater infrastructure. For example, if the 176 bridges and 11 tunnels between Pusan and Seoul, South Korea are damaged or destroyed or if the bridges cannot accommodate heavy tracked vehicles, such as main battle tanks, alternative modes of transportation must be arranged.

Airlift enables immediate positioning and delivery of unit equipment and sustainment, but it is costly and provides limited cargo capacity. The C-130 airlifter is the primary aircraft used for intratheater lift. Large intertheater airlifters, such as the C-17 and C-5, can also be used for intratheater lift if a larger payload capacity or the transport of outsize cargo—the largest items in the Army's inventory—is needed and airfields can accommodate the aircraft.

Tactical wheeled vehicles are key to (1) moving units to assembly areas in the theater of operations in preparation for combat and (2) sustaining forces with supplies essential for successful operations. The tactical wheeled vehicles included in the ILA were the Heavy Equipment Transporter System (HETS), the Palletized Load System (PLS), 5,000- and 7,500-gallon fuel tankers, and 22.5- and 34-ton line haulers. The Army's watercraft fleet consists of 245 craft that transport cargo and combat vehicles from ship to shore or to locations in the theater of operations via intracoastal waterways. The Logistics Support Vessel can accommodate

¹In May 1997, DOD issued the Quadrennial Defense Review, its fourth comprehensive review of the military since the end of the Cold War. This review, required by the Military Force Structure Review Act in the National Defense Authorization Act for Fiscal Year 1997, examined U.S. defense needs from 1997 to 2015. The Quadrennial Defense Review continued to base force structure requirements on nearly simultaneous scenarios in Korea and Southwest Asia, but it also noted that the demand for smaller contingency operations is expected to remain high over the next 15 to 20 years. A limited mobility analysis, focusing on intertheater lift requirements, was done for the study.

24 M1 main battle tanks and has the capacity to carry 2,000 tons. Rail, an important mode of transport in Korea, can alleviate some highway transportation requirements, according to the ILA. Appendix I shows some intratheater lift assets.

ILA Methodology

The war-fighting requirements on which the ILA was based were established in the updated 1995 Mobility Requirements Study. That study, which formed the basis for DOD's current intertheater lift program, developed a requirement that would accomplish, with moderate risk, U.S. objectives established by the Joint Staff's Tactical Warfare model (TACWAR) for a nearly simultaneous Korea and Southwest Asia scenario.² The study assessed intertheater lift requirements to deliver combat and support forces to airfields and seaports in the two theaters of operations. The 1995 study, however, did not address the intratheater lift requirements needed to transport the units to their final destinations within the theaters.

The ILA, through the Scenario Unrestricted Mobility Model for Intratheater Simulation (SUMMITS), modeled the intratheater lift—including airlift, tactical wheeled vehicles, Army watercraft, and rail—needed to transport the troops and equipment from the airfields and seaports and prepositioning sites in the theater to destination air bases, staging areas, and tactical assembly areas.³ SUMMITS considers required delivery date, payload, rate of movement, loading and unloading times, and the available transportation assets and network capabilities; examines every feasible path from origin to destination; and selects the fastest path through the network, subject to user-defined mode selection rules. For example, the mode selection rules direct that airlift, which is more expensive than ground transportation, is to be used only if ground transportation would be late and airlift would result in an improvement of at least 24 hours.

²Developed by the Joint Staff for a North Atlantic Treaty Organization-Warsaw Pact conflict, TACWAR is a theater-level combat model that examines the interaction of strategic and tactical forces in a conventional and chemical environment. TACWAR is a deterministic model; that is, for a given set of input data, the model provides an associated set of output results. TACWAR has recently been criticized by the National Defense Panel, appointed to review the Quadrennial Defense Review, and the Air Force Chief of Staff for failing to account for the contributions of military activity beyond force-on-force direct attack scenarios. A new model, planned to be fully operational by 2001, is expected to better represent future warfare.

³SUMMITS is an intratheater deployment simulation model that quantifies the lift needed to deliver a specified force to its final destination in the theater of operations and then to sustain that force. The model moves commodities, such as ammunition, bulk fuel, unit equipment, and personnel through an interconnected network of air routes, roads, pipeline, railroads, and coastal waterways.

Objectives, Scope, and Methodology

Because its recommendations are intended to serve as the basis for proposed DOD acquisitions, the Chairman and Ranking Minority Member of the Senate Committee on Armed Services requested that we report on the results of the 1996 ILA. Specifically, we determined whether (1) the analysis and recommendations in the study were appropriately linked, (2) the study considered all options in meeting the requirements for various lift assets, and (3) improvements could enhance the study's value as a decision-making tool. To determine whether the ILA's analysis and recommendations were appropriately linked, we reviewed the ILA, its Catalogues of Data and Assumptions, and other information supporting the study; theater command input to the ILA; Army and Air Force doctrine and procurement plans for tactical wheeled vehicles and airlifters; information on intratheater mobility in Operations Desert Shield and Desert Storm and Operation Joint Endeavor; the 1997 and 1998 Air Mobility Master Plans; RAND's 1997 Documented Briefing, "Should C-17s Be Used To Carry In-Theater Cargo During Major Deployments?"; and other relevant documents. We reviewed our prior reports on Operations Desert Shield and Desert Storm, PLS, HETS, and C-17. We visited the tactical wheeled vehicles training facility at Fort Eustis, Virginia. We discussed the ILA's assumptions, analysis, and recommendations with officials from the following organizations:

- Joint Staff, Washington, D.C.;
- Office of the Assistant Secretary of Defense for Strategy and Requirements, Washington, D.C.;
- Office of the Under Secretary of Defense for Policy for Program Analysis and Evaluation, Washington, D.C.;
- U.S. Central Command, MacDill Air Force Base, Florida;
- U.S. Forces Korea;
- U.S. Pacific Command, Camp H. M. Smith, Hawaii;
- U.S. Transportation Command, Scott Air Force Base, Illinois;
- Air Force Headquarters, Washington, D.C.;
- Air Combat Command, Langley Air Force Base, Virginia;
- Air Mobility Command, Scott Air Force Base, Illinois;
- Army Headquarters, Washington, D.C.;
- Army Training and Doctrine Command, Fort Monroe, Virginia;
- Army Combined Arms Support Command, Fort Lee, Virginia;
- Army Tactical Wheeled Vehicles Requirements Management Office, Fort Eustis, Virginia; and
- Boeing Corporation (formerly McDonnell Douglas Corporation), Rosslyn, Virginia.

To determine whether the ILA considered all options in meeting the requirements for various lift assets, including host nation support, the C-5, and Army watercraft, we reviewed the ILA and its supporting Catalogues of Data and Assumptions; DOD's 1997 Quadrennial Defense Review; theater commands' operation plans for Southwest Asia and Korea; DOD documents concerning host nation support in Operations Desert Shield and Desert Storm; the DOD Inspector General's 1997 report on host nation support in Southwest Asia; the Air Mobility Command's May 1997 Airfield Suitability and Restrictions Report; Air Force and contractor documents concerning C-5 operations and capabilities; the Logistics Management Institute's November 1996 report, "Joint Logistics Over The Shore Causeway Systems and Support;" the November 1996 Army Watercraft Master Plan; and other documents. We obtained information on the potential contribution of these lift assets from officials at the Joint Staff; theater commands; the Office of the Under Secretary of Defense for Policy for Program Analysis and Evaluation; the U.S. Transportation Command; Army Headquarters; the Army Training and Doctrine Command; the Army Combined Arms Support Command; the Air Combat Command; the Air Mobility Command; and Lockheed Martin Corporation, Crystal City, Virginia. We also toured the Army watercraft docked at Fort Eustis.

To determine whether improvements could enhance the study's value as a decision-making tool, we reviewed the 1988 Worldwide Intratheater Mobility Study, 1992 Mobility Requirements Study, 1995 Mobility Requirements Study Bottom-Up Review Update, and the 1996 Defense Science Board Task Force Report on Strategic Mobility. We also reviewed the theater commands' input into the ILA, information on tactical wheeled vehicle cost and capability from the Tactical Wheeled Vehicle Requirements Management Office, and our prior reports on the 1992 and 1995 Mobility Requirements Studies. We obtained additional information from the Joint Staff; the Office of the Under Secretary of Defense for Policy for Program Analysis and Evaluation; the Office of the Assistant Secretary of Defense for Strategy and Requirements; Air Force Headquarters; Air Force Studies and Analyses Agency; Air Combat Command; Air Mobility Command; Army Headquarters; and Army Combined Arms Support Command.

We did not assess the validity of the requirements or objectives identified in the fiscal year 2003 Total Army Analysis and did not independently verify the computer-generated data from the SUMMITS or TACWAR models. Our analysis focused on the decisions that were justified based on the

output of these models. Our assessment of whether the outputs were properly used did not require a determination as to the accuracy of the models and the data they produce. We evaluated the links between the ILA's recommendations and the requirements generated by the models.

We performed our review between September 1996 and November 1997 in accordance with generally accepted government auditing standards.

ILA Recommendations Are Not Based on the Study's Analysis

The ILA contains several recommendations that are not based on requirements developed by the study's analysis. In some cases, this disconnect appears to be the result of invalid assumptions. For example, assumptions about how the Army would use HETS were not consistent with Army doctrine. In other cases, the cause of the disconnect is unclear. Further, the recommendations for tactical wheeled vehicles supported the Army's planned acquisition objectives, but the study's analysis would have resulted in a different recommendation for most types of tactical wheeled vehicles (e.g., the PLS and the 34-ton line hauler). Finally, the ILA found that the current C-130 fleet is more than sufficient to meet airlift requirements but recommended that an additional squadron of C-17s, beyond the planned procurement of 120 aircraft, should be used for intratheater lift, particularly for outsize cargo. This recommendation is not supported by the analysis in the study.

Tactical Wheeled Vehicle Recommendations Are Not Based on the Study's Requirements

The tactical wheeled vehicle acquisition plan recommended by the ILA does not reflect the requirements determined by the study's analysis. The ILA recommended that the Army continue with its tactical wheeled vehicle acquisition objectives based on the biennial Total Army Analysis for fiscal year 2003,¹ even though the ILA requirements differed significantly from that analysis. The ILA recommended that shortfalls in some types of tactical wheeled vehicles be alleviated either by host nation support or tradeoffs with other types of excess vehicles. However, because the ILA requirements differ significantly from the Army's acquisition objectives, the excesses asserted in the ILA may not actually exist. Further, the ILA did not consider tactical wheeled vehicle host nation support (the treatment of host nation support is discussed in ch. 3) or include a cost-effectiveness analysis of the tradeoffs among various types of vehicles. Table 2.1 shows the ILA requirements (number of companies) and recommendations for tactical wheeled vehicles. Appendix I shows the number of assets in each company.

¹We did not assess the requirements or objectives of this Army-generated analysis and thus cannot comment on their validity.

**Chapter 2
ILA Recommendations Are Not Based on
the Study's Analysis**

Table 2.1: ILA Requirements and Recommendations

Asset	ILA requirement^a	ILA recommendation^b
HETS	4 companies	The ILA recommended supporting the Army's doctrinal requirement of 18 companies and using HETS to offset a shortfall in 34-ton line haulers. (The study identified excess HETS capability.)
5,000-gallon fuel tanker	12 companies	The ILA recommended 12 companies as the absolute minimum. (The Army's acquisition objective is 43 companies.)
7,500-gallon fuel tanker	41 companies	The ILA recommended 41 companies as the absolute minimum. (The Army's acquisition objective is 48 companies.)
PLS	16 companies	The ILA recommended that the Army's acquisition objective of 32 companies be continued and that the PLS doctrine be changed so that the additional capability could alleviate the 22.5-ton line hauler shortfall.
22.5-ton line hauler	54 companies	The ILA recommended continuing the Army's acquisition program of 33 companies but stated that 54 companies should be the minimum. Additional PLS capability could be used to alleviate the shortfall.
34-ton line hauler	87 companies	The ILA recommended 87 companies as an objective and that the Army's acquisition objective of 49 companies be continued. (These companies are already on hand.) The study recommended using HETS, 7,500-gallon fuel tanker tractors, and host nation support to offset the shortfall.

^aThe ILA refers to the requirements as "workloads."

^bThe Army acquisition objective is for fiscal year 2003.

HETS Assumptions Are Not Consistent With Army Doctrine

The ILA's recommendation for the procurement of HETS is not consistent with the requirement identified in the study. The ILA requirement is for 4 HETS companies, but the recommendation supports the Army's plan to buy 18 companies. The ILA did not model the use of HETS according to current Army doctrine and thus derived a much lower HETS requirement than the Army's analysis. The ILA Catalogue of Data and Assumptions states that HETS were used to transport tracked vehicles only when the vehicles' time to self-deploy would exceed the time required to load them on a HETS, transport them, and unload them. According to Army officials, however, under current Army doctrine, battle tanks do not self-deploy

unless the distance to be traversed is 3 miles or less. This mission was added in 1991, before which time HETS only evacuated tanks from the battlefield. The Army's objective of 18 HETS companies reflects the Army's plan to procure enough HETS to relocate a heavy brigade and its support in a single lift. Another reason for ILA's lower HETS requirement is that the study assumed a steady, even flow of heavy equipment arrivals by sea, with no surges as a result of weather or chance.

Fuel Tanker Requirements
Are Not Accurate

The ILA identified a need for fewer 5,000-gallon fuel tankers than the Army plans to procure, but it recommended that the Army's acquisition program be continued. The ILA acknowledges that its 5,000-gallon fuel tanker requirements are understated. According to Joint Staff and Army officials, one reason for the inaccuracy is that the ILA did not factor in fuel requirements for the tankers or the additional cargo line haulers that the analysis showed were needed to meet requirements. Another reason for the difference between the Army and ILA estimates is that the TACWAR battle on which the ILA was based was fought at a low-to-moderate intensity level. If the level of intensity had been higher, fuel requirements would have been greater.

PLS Recommendation Is
Not Supported

The ILA's recommendation to continue the Army's plan to procure 32 PLS companies is not based on the ILA's requirement of 16 companies. Rather than recommend a reduced number of PLS to reflect the requirements, the ILA recommended that the Army continue toward its acquisition objective and use the surplus PLS to help alleviate the 22.5-ton line hauler shortfalls. However, on the basis of a cost and operational effectiveness analysis, the cost-effectiveness of the PLS was determined only for an ammunition role. Further analysis has not been done to determine the cost-effectiveness of the PLS in a cargo-carrying role. One PLS costs about \$391,000 (1996 dollars) compared with \$158,000 (1996 dollars) for one 22.5-ton line hauler, according to an analysis by the Tactical Wheeled Vehicle Requirements Management Office. Because alternative uses for the PLS have not been assessed for cost-effectiveness, the ILA's recommendation for the PLS is premature and not supported by analysis.

Line Hauler
Recommendations Are Not
Consistent

The ILA identifies a minimum requirement for 54 22.5-ton line hauler companies but also supports the Army's acquisition objective of 33 companies. The ILA states that excess PLS assets can help alleviate this

shortfall. However, the PLS mission would have to be changed, and a cost-effectiveness analysis for such a change has not been done.

The ILA also identified a large shortfall in the 34-ton line haulers, but the Army believes enough of these assets are already in its inventory and therefore does not plan to procure any more. The ILA recommends 87 of these companies as an objective but supports the Army's plan not to procure any additional trucks, stating that shortfalls can be offset with excess HETS assets, 7,500-gallon fuel tanker tractors (the same tractor used with the 34-ton line hauler), and host nation support. None of these options, however, were modeled.

Recommendation for Additional Airlift Is Not Supported

The number of C-130s in the fleet exceeds the number that the ILA identified as a requirement for the Korea and Southwest Asia scenarios.² To determine the number of additional C-130s that would be needed worldwide for contingencies unrelated to these scenarios, the Joint Staff surveyed the theater commanders. Even with their additional requirement, the C-130 fleet still exceeds the number needed for intratheater lift. However, on the basis of analyses by the Air Force Studies and Analyses Agency, the ILA recommended using additional C-17s beyond the planned procurement of 120 (a squadron of 14, according to DOD officials) to augment the C-130s by providing outsize cargo capability. This recommendation has been supported by the Defense Science Board Task Force on Strategic Mobility (in a 1996 report) and by theater commanders. The Air Force analyses, however, do not support this recommendation because they only demonstrated that the C-17 could move cargo more quickly than the C-130 under certain circumstances. No intratheater requirement was established based on the C-17's contribution to meeting TACWAR timelines, and the relative cost-effectiveness of the two aircraft was not taken into account.

The Air Force is not currently planning to acquire more than the planned 120 C-17s so that a squadron could be dedicated to an intratheater role. An Air Force document shows that no C-17s are allocated solely for intratheater lift but that the U.S. Transportation Command would continue to support the intratheater lift needs of war-fighting commanders, as demonstrated in Operation Joint Endeavor in Bosnia. RAND's National Defense Research Institute evaluated intratheater concepts of operations

²As of fiscal year 1997, the Air Force had 442 C-130s in its fleet. This number does not include the additional aircraft used for training and as backup for aircraft undergoing maintenance.

for the planned C-17 fleet of 120 aircraft. In a 1997 Documented Briefing,³ RAND identified the advantages of using the C-17 in an intratheater role and concluded that about one squadron of C-17s could be used effectively in each of the two theaters of operation. These C-17s would be part of the planned procurement of 120 aircraft and would be based in the theater, unavailable to fly intertheater missions. RAND acknowledged that deploying these C-17s as intratheater assets would slow the flow of intertheater cargo, but stated that this effect would be offset by the improved intratheater deliveries afforded by the C-17. DOD officials commented that, during the halting phase, a delay in the strategic airlift flow may not be acceptable. RAND also determined that fewer C-17s would need to be dedicated to the theater if some C-17s arriving in the theater were delayed to perform intratheater missions and then re-entered the intertheater airlift flow. According to RAND, this concept could allow nondedicated C-17s to fly most of the missions that would otherwise require theater-assigned C-17s.

Further Analysis of Potential C-17 Role Is Warranted

In support of the ILA, the Air Force Studies and Analyses Agency used its own models, along with SUMMITS, to determine the number of C-130s needed to meet TACWAR requirements after the addition of a squadron of C-17s beyond the 120 planned aircraft. The analysis found that about 50 percent more cargo could be delivered with only two-thirds as many sorties. However, because the C-130 fleet was more than sufficient to deliver the ILA workload, the faster deliveries resulting from the addition of C-17s were not necessary to meet the TACWAR battle requirements.

The ILA also stated that, on the basis of its capability to deliver bulk cargo,⁴ every additional C-17 could replace three C-130s. However, the ratio of three C-130s to one C-17 does not take into account either cost or the reduced flexibility that would be provided to a theater commander who may need three C-130s for multiple deliveries rather than one C-17 for a single delivery.

Finally, dedicating a squadron of large airlifters, such as the C-17, for intratheater use could be an inefficient use of the asset. Intratheater missions typically involve small loads. In Operations Desert Shield and Desert Storm, for example, the average C-130 load was only 3.2 tons per sortie, although the C-130 can carry 17 tons. During the three peaks in the airlift operation—August and September 1990 and February 1991—the

³“Should C-17s Be Used To Carry In-Theater Cargo During Major Deployments?” RAND, 1997.

⁴Bulk, or palletized, cargo includes ammunition, supplies, and food.

average C-130 load was 3.5 tons per sortie, which is only 5 percent of the C-17's 65-ton cargo-carrying capacity.

The Air Force stated that more analysis is needed before a definitive conclusion on the intratheater contribution of C-17s can be reached. The ILA notes that, due to SUMMITS' limited ability to model airlift, C-17 and C-130 capability tradeoffs warrant further analysis. The Air Force Studies and Analyses Agency had planned to complete a more detailed study of C-17 and C-130 capability in September 1996, but, according to an Air Force official, that study has been delayed indefinitely.

**Unit Relocation Analysis
Used Questionable
Assumptions and Was Not
Tied to the TACWAR
Requirement**

The Air Force also performed an analysis of the advantages and necessity of the C-17 in theater airlift operations by identifying ways the C-17 could augment the C-130 in conducting specific unit relocations in the theater. This analysis was conducted outside of the SUMMITS and TACWAR models because the TACWAR battle plan does not relocate specific units once they have arrived at their target destinations. An ILA working group determined the units that should be relocated to specific airfields based on how the move could improve the theater commander's tactical advantage. On the basis of these discussions, the Air Force modeled 11 different unit moves, including Patriot batteries, Multiple Launch Rocket System battalions, and the 101st Air Assault Division.

The Air Force analysis showed that, if a squadron of C-17s were dedicated to the theater, the selected units could be delivered to their destinations more rapidly than they could by the C-130. However, because the time frames in the analysis were not directly related to a specified requirement in the TACWAR battle plan, the benefit of the units' earlier availability was not measured. For example, even if the analysis showed that a Patriot battery could reach its destination 3 days earlier on the C-17 than it would by other means, the analysis did not assess the effect of this unit's move on the rest of the battle. In addition, the analysis did not assess the ripple effect of earlier delivery of the selected units on other units because the analysis was intended only to examine how the C-17 could speed the arrival of the 11 selected units.

Further, the C-17 unit relocation analysis assumed that the aircraft could land on 18 planned fields. However, according to the May 1997 Air Mobility Command Airfield Suitability and Restrictions Report,⁵ only 9 of

⁵This report is updated quarterly and includes factors such as airfield dimensions, obstructions, lights, and other potential limitations to airlifter use.

the 18 airfields have been surveyed for airlift operation suitability, and only 7 have been determined to be suitable for use by the C-17. The remaining two airfields have not been assessed for C-17 operations.

Conclusions

The ILA does not adequately fulfill congressional direction to develop intratheater lift requirements and establish an integrated plan to meet them because the study's recommendations are not supported by the analysis. The ILA's tactical wheeled vehicle recommendations, even though they support the Army's acquisition objectives, are not consistent with the requirements identified in the ILA. In addition, some ILA assumptions are either not consistent with Army doctrine or are invalid for other reasons. These discrepancies call into question the basis for the study's recommendations. Due to the inconsistencies between the ILA requirements and the Army's acquisition objectives, for example, excess HETS and fuel tanker tractor assets may not actually exist. In addition, the ILA's recommendation to use another squadron of C-17s, beyond the planned procurement of 120 aircraft, for intratheater lift is not based on sound analysis. The ILA did not establish a relationship between the use of the C-17 in a dedicated intratheater role and the rest of the battle, so the effect of the faster C-17 deliveries was not measured. Furthermore, even though the Air Force's analysis assumed that the C-17 would be able to use all of the airfields identified by the ILA working group, there is no guarantee that they would be accessible to the C-17. The updated ILA, planned as part of the 1999 Mobility Requirements Study, will provide a good opportunity for DOD to reconsider the basis for intratheater lift requirements and ensure that they are linked appropriately to the study's analysis.

Recommendations

We recommend that the Secretary of Defense direct that the 1999 ILA update (1) link the study's recommendations to its analysis and (2) include assumptions that consider current Army doctrine when acquisition plans are based on the doctrine.

Agency Comments

DOD concurred with our recommendations. DOD noted that, although study assumptions are generally based on military service doctrine, DOD must be free to analyze changes to that doctrine in the interest of enhancing joint capability. However, DOD did not agree with our finding that the ILA's recommendations are not supported by the study's analysis. DOD stated that the study used computationally derived data, along with additional

analysis and military judgment, to develop its recommendations. DOD cites service acquisition programs, input from theater commanders, and substitution of one type of intratheater asset for another as examples of the additional analysis considered in developing the requirements and recommendations in the ILA. DOD points to the study's recommendation to use excess HETS in place of 34-ton line haulers as being based on service acquisition programs and theater commander input.

The ILA does not link its requirements to its recommendations. Rather, its recommendations merely support the Army's acquisition plans with no explanation of the disconnect between those plans and the study's requirements. In discussing our draft report, agency officials acknowledged that the Joint Staff had difficulty linking the Army's fiscal year 2003 acquisition program to the ILA requirements and that, for this reason, the study's reliance on the acquisition program is not clearly explained. Furthermore, Joint Staff officials told us during our review that the decisions reached by ILA working groups concerning tradeoff assessments and the airlift tactical unit moves analysis were not documented. Without an explicit link in the ILA between the study's requirements and recommendations, and without a means of reviewing the factors or additional analyses that led to the final recommendations in the study, we have no basis on which to concur that a link exists. Moreover, we question the reliability and independence of a DOD requirements study that bases its requirements and recommendations on service acquisition programs without examining the disconnects between those programs and the study's own findings.

Concerning DOD's example, the number of HETS identified as a requirement in the ILA is less than the number reflected in the study's recommendation. According to theater commanders' input to the study and our discussions with Army officials, the HETS is not an effective or economical substitute for 34-ton line haulers. We agree with DOD's statement that service acquisition programs were used to support the study's recommendations for HETS. It is this fact that leads us to conclude that the recommendations in the ILA were not based on the requirements identified by the study's analysis, but rather were based on service acquisition programs that had already been established.

ILA Did Not Include the Potential Contribution of Some Lift Assets

The ILA did not incorporate the potential contribution of several lift assets that could assist in meeting intratheater lift requirements. Specifically, the ILA did not include (1) the potential contribution of host nation-provided tactical wheeled vehicles, (2) the ability of the C-5s currently in the inventory and the planned fleet of 120 C-17s to meet outsize intratheater airlift requirements as needed, and (3) the potential for Army watercraft to supplant tactical wheeled vehicle requirements. As a result, the study's requirements and solutions may be overstated.

Host Nation Support Can Significantly Contribute to Intratheater Lift

Host nation support (HNS) is the civil or military assistance provided by a nation to foreign forces within its territory during peacetime, crisis, or war based on agreements mutually concluded between the nations. In Operations Desert Shield and Desert Storm, HNS included commercial cargo line haulers, fuel tankers, personnel transporters, and HETS. Of the 1,404 HETS used in the Persian Gulf conflict, 333 were provided by Saudi Arabia. DOD reported that support from host and other nations during the conflict was critical and that it gave the United States the flexibility to deploy substantial amounts of combat power early in the contingency—when the risks were the greatest—while reducing the amount of tactical wheeled vehicles that needed to be deployed from the United States.

The 1995 Mobility Requirements Study Bottom-Up Review Update, based on the same TACWAR battle as the ILA, assumed that HNS in Southwest Asia and Korea would include commercial cargo line haulers, fuel tankers, and HETS. However, the potential HNS tactical wheeled vehicle contribution to intratheater lift was not modeled in the ILA. Thus, ILA assumptions are inconsistent with the assumptions made in the updated 1995 Mobility Requirements Study. According to the ILA, HNS was not modeled because of a lack of signed agreements with some of the host nations. In addition, theater commanders wanted the ILA to model a worst case scenario without any HNS offsetting U.S. force structure. The ILA, however, notes repeatedly that HNS has the potential to reduce some of the reported lift shortfalls in several categories of tactical wheeled vehicles. HNS would also limit the amount of equipment required to be moved into the theater. Because it did not reflect HNS, the ILA depicted the worst case scenario as the only scenario for intratheater lift.

The theater commanders' operation plans portray HNS as very important, if not critical, to the successful outcome of wars in Southwest Asia and Korea. Even the lack of formal HNS agreements in Southwest Asia does not

limit the operation plans' expectations of substantial HNS. The Southwest Asia operation plans assume that HNS will be available in either the amounts received during Operations Desert Shield and Desert Storm or in amounts negotiated and approved bilaterally between the host nations and the United States. The plans note that outsourcing logistical requirements within the theater of operations may completely preclude the need to deploy some logistical assets or units from the United States. The operation plans for a war in Korea state that U.S. Pacific Command forces can expect to receive significant wartime HNS from the Republic of Korea. The United States negotiated a wartime HNS agreement with the Republic of Korea in 1991. Cargo transportation was one of the components of this agreement, which also included medical, bulk fuel transport, maintenance, engineering, and ammunition support.

The key factors in making HNS successful are availability of the right numbers of assets when and where they would be needed and the commitment of host nation drivers and other equipment operators to perform their assigned missions. Members of the defense community, including the military services, theater commanders, the Joint Staff, and the Office of the Secretary of Defense, are debating the extent to which HNS should offset U.S. force requirements. This debate is not likely to be resolved in the near future.

Intertheater Airlifters Can Help Meet Outsize Intratheater Requirements

The current intertheater airlift fleet includes the C-5 and C-17, which are capable of carrying outsize cargo. The C-5 Galaxy is the Air Mobility Command's largest intertheater airlifter, with the capacity to carry 89 tons of cargo and 36 pallets, and the smaller C-17 is capable of carrying 65 tons of cargo and 18 pallets. Although the C-5 and C-17 are intertheater lift assets, they can also be used for intratheater lift if warranted, assuming that airfields can accommodate them. However, the ILA did not model the potential contribution of the C-5 and considered the planned 120 C-17s as an offset to the C-130 fleet only in Southwest Asia. Use of the existing airlift fleet for intratheater missions as needed could increase flexibility and decrease the need to procure additional outsize airlift capability. Although the C-5 and C-17 are primarily intertheater airlifters, the ability to divert them for intratheater missions is recognized in Air Force operational documents.

The Air Force has highlighted the C-17's ability to deliver outsize cargo to small, austere airfields as a key factor in its dual role as an intertheater and intratheater airlifter. Small, austere airfields usually have a short

runway and are limited in one or a combination of the following factors: taxiway systems, ramp space, security, materiel handling equipment, aircraft servicing, navigation aids, weather observing sensors, and communications. If delivering outsize cargo to small, austere airfields is necessary, the C-17 would likely be needed. However, if the airfields could accommodate the C-5, it could accomplish the mission. For example, the C-5 can quickly facilitate unit relocations. A Patriot battalion requires only 9 C-5 sorties compared with 15 sorties for the C-17.

Of the 67 airfields in the ILA, 46 have been surveyed by the Air Mobility Command and are listed in its Airfield Suitability and Restrictions Report. Analysis of the 46 airfields common to the ILA and the Airfield Suitability and Restrictions Report showed that 34 airfields, or 74 percent, are suitable for all types of airlifters, including the C-5. In Korea, the C-5 can use 70 percent of the airfields, and in Southwest Asia, the C-5 can use 77 percent of the airfields. Further, the number of airfields available to the C-5 would likely be higher during a contingency, since other airfields that have not been surveyed would be available at that time.

Potential Contribution of Army Watercraft Was Not Determined

Due to their cargo capacity and demonstrated multiple mission capability, Army watercraft could be used for intratheater transportation and could reduce the need for reliance on rail, tactical wheeled vehicles, and HNS. However, the ILA did not identify a requirement for Army watercraft and deferred a recommendation on these assets pending a planned study by the Logistics Management Institute. That study, issued in November 1996 (4 months after the ILA), found uncertainty among planners at the theater commands about the capability and availability of watercraft for intratheater operations. The Army has developed a long-range fleet management plan that includes an acquisition strategy to procure more watercraft, but the role and capability of watercraft to help meet intratheater requirements have not been addressed at the joint level.

At the end of fiscal year 1997, the Army had 245 watercraft in its fleet, according to an Army official. Some of these watercraft, such as the Logistics Support Vessel and the Landing Craft, Utility-2000 (LCU-2000), provide intratheater movement of equipment, cargo, and combat vehicles and transport cargo from ship to shore. The Logistics Support Vessel can self-deploy anywhere in the world to provide intratheater transport of large quantities of cargo, tracked and wheeled vehicles, and equipment. These vessels provided intratheater transport during Operations Desert Shield and Desert Storm. The LCU-2000 can perform tactical resupply

missions to remote or underdeveloped coastlines and inland waterways. During Operation Uphold Democracy in Haiti, this vessel transported about 38,548 tons of equipment and supplies to fishing villages that had small piers or ramps.

Army watercraft employment is phased to meet the theater commanders' requirements to offload combat and support forces during major regional contingencies. During the first 3 weeks of a conflict, Army watercraft operations would focus on port operations and offloading combat and support equipment from prepositioned ships and large strategic sealift ships. After the first 3 weeks, watercraft would continue port operations and begin to transition to sustainment operations, which include establishing intracoastal main supply routes and transporting equipment and cargo to forward areas in the theater. During Operations Desert Shield and Desert Storm, for example, watercraft delivered main battle tanks, ammunition, and other cargo to several locations on the Persian Gulf coast. Thus, although the port operations are the key mission for Army watercraft during the first part of a contingency, watercraft can contribute significantly to intratheater lift missions during later phases.

In several cases, the ILA demonstrated how Army watercraft could be used to offset reliance on rail, tactical wheeled vehicles, and HNS by repositioning forces in the theater of operations and moving tanks prepositioned on land to tactical assembly areas. However, the ILA did not recommend that these potential offsets be implemented, and the contribution of watercraft to intratheater lift was not reflected in the ILA's recommendations for tactical wheeled vehicles as part of a tradeoff analysis.

The Logistics Management Institute study evaluated the role of watercraft for logistics-over-the-shore and intracoastal main supply route operations in the Korea and Southwest Asia scenarios. The study did not establish an intracoastal transportation requirement, however, because of a lack of data from theater commanders regarding the types and amounts of cargo and equipment that could be transported on watercraft. The study recommended that the Joint Staff provide theater command planners the analytical tools to match intratheater lift requirements with intracoastal transportation capability.

Conclusions

Because several potentially significant contributions to intratheater lift were not thoroughly considered in the study, the requirements in the ILA may be overstated. Given the experience of Operations Desert Shield and Desert Storm, the inclusion of HNS in the theater commanders' operation plans, and the fact that the 1995 Mobility Requirements Study update assumed HNS would be available, it is unreasonable to exclude HNS from the analysis. A more flexible mobility study that reflected requirements with and without HNS would better assist decisionmakers in determining the effects of HNS on U.S. mobility requirements. U.S. Central Command officials agree, acknowledging that requirements stated with and without HNS would have added flexibility to the ILA. In addition, the C-5s and the planned fleet of C-17s could be considered as needed if an outsize intratheater airlift requirement is identified. Use of these airlifters would ensure that the potential contributions of DOD's current assets are fully taken into account. Finally, Army watercraft has the potential to reduce reliance on tactical wheeled vehicles and HNS, but a requirement for these assets that reflects their intratheater role has yet to be defined. The potential contributions of tactical wheeled vehicle HNS, the current outsize-capable airlift fleet, and Army watercraft to meeting intratheater lift requirements warrant incorporation into the 1999 ILA update.

Recommendations

We recommend that the Secretary of Defense direct that the 1999 updated ILA (1) consider HNS as a means of accomplishing intratheater lift and ensure that HNS assumptions are consistent with those in intertheater lift studies; (2) include the potential contribution of the C-5 airlifter and planned fleet of 120 C-17s; and (3) reflect the role, capability, and requirements for Army watercraft in an intratheater role, including an analysis of the extent to which these assets can alleviate identified shortfalls in tactical wheeled vehicles.

Agency Comments

DOD concurred with our recommendations and added that, as the potential intratheater role of the C-17 and C-5 are investigated, an analysis should be done to assess the impact on the warfight of taking these assets out of the intertheater airlift flow. We agree that such an analysis would be an important part of future studies that consider the use of these airlifters in an intratheater role.

Opportunities Exist to Improve Study's Value as a Decision-Making Tool

Intratheater lift requirements depend on the course of the battle and theater infrastructure and thus are difficult to quantify. However, because the ILA requirements and solutions were stated as absolute numbers rather than ranges, the study does not reflect the dynamic and often unpredictable nature of intratheater lift requirements. In addition, the ILA did not include a cost-effectiveness analysis to assess tradeoffs between various lift alternatives. Such an assessment would provide decisionmakers with information needed to make investment decisions in a sensitive budget environment.

Lift Requirements Were Not Stated as Ranges

The 1995 updated Mobility Requirements Study determined lift requirements through an iterative modeling process that examined various war-fighting and mobility schemes. However, the ILA did not use an iterative modeling process to determine requirements, which precluded the ILA from stating lift asset requirements and solutions as ranges. Rather, the ILA stated the requirements and solutions as absolute numbers. Given the dependence of intratheater lift requirements on the course of the battle and the theater infrastructure, requirements stated as ranges would provide a more accurate depiction of the dynamic intratheater situation. It would also allow decisionmakers the flexibility to determine the type and quantity of lift assets needed to meet requirements while accounting for such factors as potential enemy actions to disrupt airfields and seaports, chemical or biological warfare, weather, HNS, and various threat scenarios.

DOD's 1988 Worldwide Intratheater Mobility Study noted that intratheater mobility requirement statements are extremely dependent on the theater concept of operations. The study recommended that all intratheater mobility requirements be expressed as ranges when possible and that those requirements not expressed as ranges be understood as approximations. The 1996 Report of the Defense Science Board Task Force on Strategic Mobility noted that the deployment phase most subject to disruption by the adversary is the intratheater movement of troops and equipment to their final destinations.

DOD officials said that the ILA could not express requirements as ranges because SUMMITS would have had to be rerun with a different input requirement. The officials told us that only one concept of operations was available—the TACWAR battle established for the 1995 updated Mobility Requirements Study. They stated that expressing the ILA requirements as ranges could have required amending the TACWAR battle timelines after the 1995 study had been completed and that this option was not seriously

considered. The officials said, however, that SUMMITS and TACWAR are capable of interacting and that iterations can be modeled.

Cost-Effectiveness Analysis Is Needed to Assess Tradeoffs Between Lift Assets

The 1995 updated Mobility Requirements Study, which is the basis for DOD's procurement strategy for intertheater lift assets, included a cost-effectiveness analysis that assessed tradeoffs between various intertheater lift assets. The study developed a set of options consisting of possible additions to current airlift, sealift, and afloat prepositioning programs. Life-cycle cost estimates were developed for each option, and cost was a factor in the analysis leading to the final recommendations. However, a cost-effectiveness analysis that examined tradeoffs between the assets was not done to support the ILA recommendations. According to Joint Staff officials, limited tradeoff assessments were discussed as part of the ILA, but these assessments did not include cost and were not documented.

The ILA states that the study's workloads for the 34- and 22.5-ton line haulers can be met by other means, such as excess HETS or PLS. However, tradeoff assessments were not made to determine whether these alternatives would be cost-effective uses of the HETS or PLS. The ILA identified a requirement for fewer HETS and PLS than the Army's acquisition objectives for fiscal year 2003, but the study did not recommend that the Army procure fewer of these expensive assets. As of January 1996, each HETS cost \$414,000 compared with \$118,000 for the 34-ton line hauler, according to the Tactical Wheeled Vehicle Requirements Management Office's Catalog of U.S. Army Tactical Wheeled Vehicles. Army officials noted that the HETS would provide excess capacity in a line-haul role. In addition, even though a PLS company can carry 17 percent more cargo, it costs almost twice as much as the 22.5-ton line hauler. A PLS company costs \$18.8 million (1996 dollars) compared with \$9.5 million (1996 dollars) for a company of 22.5-ton line haulers, according to an analysis performed by the Requirements Management Office. DOD officials noted, however, that the PLS can self-load and unload containers, thereby requiring fewer personnel than the 22.5-ton line hauler.

In addition, a cost-effectiveness analysis was not conducted on the ILA's proposed use of a squadron of 14 C-17s, beyond the planned procurement of 120 aircraft, for intratheater lift. Since the C-130 fleet is more than sufficient to meet requirements, according to the ILA, and outsize airlift capability exists with the planned procurement of C-17s and the current fleet of C-5s, it is important for a recommendation to procure additional

C-17s beyond the currently planned 120 aircraft to be based on an analysis that includes cost-effectiveness as a criterion. In addition, a tradeoff assessment has not been conducted to consider the extent to which C-130s could be retired if additional C-17s were procured for intratheater lift.¹

Conclusions

The value of DOD's future lift studies as decision-making tools can be strengthened if they state intratheater requirements and solutions as ranges rather than as absolute numbers to reflect the uncertainty associated with predicting lift requirements within the theater of operations. An iterative process resulting in requirements ranges may have shown, for example, that allied forces would not lose key objectives or incur additional casualties under a range of intratheater delivery schemes that required fewer lift assets to accomplish. Since the planned 1999 Mobility Requirements Study and ILA update are expected to be conducted simultaneously, concerns about changing the TACWAR battle by establishing a requirements range should be alleviated. Furthermore, if future mobility studies are to be the basis for the services' acquisition plans, it would be prudent to determine the appropriate type and number of mobility assets to procure based on a tradeoff analysis of the capability and cost-effectiveness of different options. Tradeoff assessments of the lift alternatives considered in the study would provide decisionmakers the flexibility to take into account competing investment options within a constrained budget. The 1999 updated ILA will provide an opportunity to address these concerns so that decisionmakers can have a more substantive basis on which to determine DOD acquisition strategies.

Recommendations

We recommend that the Secretary of Defense direct that the 1999 updated ILA

- determine intratheater requirements and solutions as ranges to reflect their dependence on the combat situation and
- include a cost-effectiveness assessment of the alternatives considered in the study that examines tradeoffs among the lift assets to reflect capability, cost, and requirements.

¹RAND's 1997 Documented Briefing noted that outsize cargo items that require a C-17 for air transport could be delivered over roads if their delivery dates allowed. RAND noted that the lack of a tradeoff assessment that considered alternative modes of transportation was a limitation of its analysis.

Agency Comments

DOD concurred with our recommendation concerning requirements ranges. DOD stated that cost-effectiveness analysis would be accomplished if appropriate and that DOD has in place an acquisition process that considers cost-effectiveness when making programmatic decisions. DOD officials explained that detailed cost-effectiveness analyses would significantly expand the time frame and cost of mobility studies. Our recommendation is directed at system tradeoff analyses that would provide decisionmakers information on the relative costs and capabilities of systems in light of identified requirements. The ILA made programmatic recommendations that included, to an extent, tradeoffs among lift assets. We believe that cost-effectiveness should be a part of a requirements study that makes acquisition recommendations.

Intratheater Lift Assets

Airlifters, tactical wheeled vehicles, and watercraft are all used for intratheater lift. The following sections provide information these assets.

Airlifters

The C-130 Hercules is the Air Force's primary intratheater airlifter. It can carry 6 pallets and 17 tons of cargo and accommodate 90 passengers. The C-17 Globemaster, being produced by the Boeing Corporation, can carry 18 pallets and 65 tons of cargo and accommodate 102 passengers. The C-5 Galaxy can be loaded with 36 pallets and can carry 89 tons of cargo and 73 passengers. Figures I.1 through I.3 show the C-130, C-17, and C-5 airlifters, respectively.

Figure I.1: C-130 Hercules



Source: Lockheed Martin Corporation.

Figure I.2: C-17 Globemaster



Source: Boeing Corporation (formerly McDonnell Douglas Corporation).

Figure I.3: C-5 Galaxy



Source: Air Force.

Tactical Wheeled Vehicles

The primary mission of the Heavy Equipment Transporter System is to (1) deliver main battle tanks to forward assembly areas fully fueled, armed, and ready for combat and (2) evacuate tanks from the battlefield. The tank's crew rides in the cab of the system. The Palletized Load System consists of a truck, trailer, and removable cargo beds. It is used by artillery, ordnance, and transportation units to move ammunition to and from transfer points. The 7,500-gallon fuel tanker and the 34-ton line hauler use the same tractor and transport fuel and cargo, respectively, from ports to corps supply points, which are located farthest from the

**Appendix I
Intratheater Lift Assets**

battle front. The 5,000-gallon fuel tanker and the 22.5-ton line hauler also use the same tractor and operate primarily in the division and brigade areas, which are closer to the battle front where roads are generally less developed. Table I.1 shows the number of tactical wheeled vehicles per company.

Table I.1: Number of Tactical Wheeled Vehicles Per Company

System	Number per Company
Heavy Equipment Transporter System	96 trucks and 96 trailers
Palletized Load System	48 trucks and 48 trailers
22.5-ton line hauler	60 tractors and 120 trailers
34-ton line hauler	60 tractors and 120 trailers
5,000-gallon fuel tanker	60 tractors and 60 5,000-gallon tankers
7,500-gallon fuel tanker	60 tractors and 60 7,500-gallon tankers

Figures I.4 through I.6 show the Heavy Equipment Transporter System, the Palletized Load System, and the 34-ton line hauler, respectively.

Figure I.4: Heavy Equipment Transporter System



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Intratheater Lift Assets

Figure I.5: Palletized Load System



Source: Army.

Figure I.6: 34-Ton Line Hauler



Source: Army.

Army Watercraft

The Logistics Support Vessel has the capacity to carry 2,000 tons and accommodate 24 M1 main battle tanks or 25 20-foot containers (50 if they are double-stacked). Each Landing Craft, Utility-2000 has the capacity to carry 350 tons and accommodate 5 M1 main battle tanks or 12 20-foot containers (24 if double-stacked). Figures I.7 through I.9 show the Logistics Support Vessel and the Landing Craft, Utility-2000.

Figure I.7: Logistics Support Vessel



Source: Army.

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Intratheater Lift Assets

Figure I.8: Logistics Support Vessel Unloading Trucks



Source: Army.

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Figure I.9: Landing Craft, Utility-2000



Source: Army.

Comments From the Department of Defense



PROGRAM ANALYSIS
AND EVALUATION

OFFICE OF THE SECRETARY OF DEFENSE
1800 DEFENSE PENTAGON
WASHINGTON, D. C. 20301-1800



January 12, 1998

Mr. Louis J. Rodrigues
Director, Defense Acquisition Issues
National Security and International Affairs Division
U.S. General Accounting Office
Washington, DC 20548

Dear Mr. Rodrigues:

This is the Department of Defense (DoD) response to the General Accounting Office (GAO) draft report, "DOD's MOBILITY REQUIREMENTS: Value of Intratheater Lift Analyses Can Be Enhanced," dated November 19, 1997 (GAO code 707262, OSD case 1496).

The Department generally concurs with the report. The Department's process to determine and assess intratheater mobility requirements is less mature than the comparable process used to define intratheater mobility requirements. The recommendations of the GAO report will assist in the maturation process and will be considered prior to initiation of the next departmental intratheater lift analysis.

The Department does not agree with the report's assertion that the recommendations of the 1996 *Intratheater Lift Analysis* (ILA) were not supported by the analysis. In general, computationally-derived data provide valuable inputs in identifying requirements, but are not the sole basis for determining requirements or how requirements are satisfied. In particular, the ILA used computationally-derived data to estimate intratheater workloads needed to support the two Major Theater War (MTW) defense strategy. Additional analysis and military judgment were applied to the quantitative results in developing the study's recommendations. The additional analyses included consideration of CINC inputs, service acquisition programs and associated rationale, and other reasonable means to meet workloads, such as substitution (e.g., use a capability that is already budgeted for to offset shortfalls in workloads of a similar required capability). For example, workloads were estimated for 34-ton common-user tactical wheeled vehicles. Based on the application of service acquisition programs and CINC inputs, the ILA recommended substituting underutilized (scenario dependent) heavy equipment transporters (HETS) to move containers and other cargo to offset the projected shortfall of 34-ton trucks. Thus, the Department believes that the ILA recommendations were appropriately linked and supported by analysis based on computationally-derived data tempered by military judgment.



Appendix II
Comments From the Department of Defense

The Department appreciates the opportunity to comment on the draft GAO report. Detailed comments in response on the report's recommendations are enclosed. Technical comments were provided separately to the GAO staff.

Sincerely,



Robert R. Soule
Acting Director
Program Analysis and Evaluation

Enclosure

GAO DRAFT REPORT - DATED 19 NOVEMBER 1997
(GAO CODE 707262, OSD CASE 1496)

“DOD MOBILITY REQUIREMENTS: VALUE OF INTRATHEATER LIFT
ANALYSES CAN BE ENHANCED”

DOD COMMENTS ON THE GAO RECOMMENDATIONS

- RECOMMENDATION 1: The GAO recommended that the Secretary of Defense direct that the 1999 Intratheater Lift Analysis (ILA) update (1) link the study’s recommendations to its analysis and (2) include assumptions that consider current Army doctrine when acquisition plans are based on the doctrine. (p.7, p. 25/GAO Draft Report)

Now on pp. 7 and 25.

DOD RESPONSE: Concur. While study assumptions are generally based on current Service doctrine, the Department must be free to challenge Service doctrine and to analyze changes to enhance joint capability.

- RECOMMENDATION 2: The GAO also recommended that the Secretary of Defense direct that the 1999 updated ILA: (1) consider host nation support (HNS) as a means of accomplishing intra-theater lift and ensure that HNS assumptions are consistent with those in inter-theater lift studies; (2) include the potential contributions of the C-5 airlifter and planned fleet of 120 C-17s; and (3) reflect the role, capability and requirements for Army watercraft in an intra-theater role, including an analysis of the extent to which these assets can alleviate identified shortfalls in tactical wheeled vehicles.(p.7, pp. 31-32/GAO Draft Report).

Now on pp. 7 and 31.

DOD RESPONSE: Concur. The potential employment of C-5s and C-17s in an intratheater role should be investigated. However, a warfighting analysis must be conducted to determine the risk to the warfight should the intratheater use result in the degradation in the strategic flow of forces to theater.

- RECOMMENDATION 3: The GAO further recommended that the Secretary of Defense direct that the 1999 ILA: (1) determine intra-theater requirements and solutions as ranges to reflect their dependence on the combat situation; and (2) include a cost-effectiveness assessment of the alternatives considered in the study that examines tradeoffs among the lift assets to reflect capability, cost, and requirements. (p. 7,p. 36/GAO Draft Report)

Now on pp. 7 and 34.

DOD RESPONSE: Concur. We agree that the variability in requirements based on varying combat situations and outcomes should be examined. The inclusion of a cost-effectiveness analysis will be accomplished if appropriate. The Department has, in place, an acquisition process that considers cost effectiveness when making programmatic decisions.

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