

2

AD-A254 272



IC

CTE

7 1992

C

D

Wartime Roles and Capabilities for the Unified Logistic Staffs

S. Craig Moore, James P. Stucker, John F. Schank

DEFENSE INFORMATION STATEMENT A
Approved for public release
Distribution Unlimited

92-23815



82 8 26 106

RAND

NATIONAL DEFENSE
RESEARCH INSTITUTE

The research described in this report was sponsored by the Joint Chiefs of Staff. The research was conducted in RAND's National Defense Research Institute, a federally funded research and development center supported by the Office of the Secretary of Defense and the Joint Chiefs of Staff, Contract No. MDA903-85-C-0030.

Library of Congress Cataloging in Publication Data

Moore, S. Craig, 1946-

Wartime roles and capabilities for the unified logistic
staffs / S. Craig Moore, James P. Stucker, John F. Schank.

p. cm.

"R-3716-JCS."

ISBN 0-8330-1037-9

1. United States—Armed Forces—Supplies and stores. 2. United
States—Armed Forces—Transportation. 3. United States—Armed
Forces—Combat sustainability. 4. Unified operations (Military
science) I. Stucker, J. P. II. Schank, J. III. RAND Corporation.
IV. Title.

UC23 1990-.M66 1990

355.4'22—dc20

90-33430

CIP

The RAND Publication Series: The Report is the principal publication documenting and transmitting RAND's major research findings and final research results. The RAND Note reports other outputs of sponsored research for general distribution. Publications of The RAND Corporation do not necessarily reflect the opinions or policies of the sponsors of RAND research.

R-3716-JCS

Wartime Roles and Capabilities for the Unified Logistic Staffs

S. Craig Moore, James P. Stucker, John F. Schank

DTIC QUALITY INSPECTED 8

February 1989

Prepared for the
Joint Chiefs of Staff

Accession For	
NTIS GRA&I	<input checked="" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	
By	
Distribution/	
Availability Codes	
Avail and/or	
Dist	Special
A-1	

RAND

PREFACE

Previous RAND research for the Air Force and the Army has established that improved "command and control" over logistic resources promises important increases in operational capability in wartime. For instance, the wartime availability rates of high-technology weapon systems can be raised dramatically by managing the maintenance and distribution of spare parts more flexibly and responsively. The Joint Staff asked RAND to identify the needs and opportunities for similar innovations within the unified commands.

This report summarizes the initial results of RAND's project entitled "Achieving Maximum Wartime Effectiveness from Available Joint and Combined Logistic Resources." This work, completed in May 1988, surveyed the needs and opportunities for improving the joint operational command and control of logistic resources in wartime, focusing on bulk fuels, conventional ammunition, and spare parts. Subsequent research has delineated specific principles and methods for improving the unified commands' assessment and management of ammunition resources in wartime and addressed new modeling approaches for strategic mobility analysis.

The research was carried out under the Acquisition and Support Policy Program, part of RAND's National Defense Research Institute, a federally funded research and development center for the Joint Staff and the Office of the Secretary of Defense.

The United States Pacific Command and its component headquarters provided the initial context for this review. Earlier visits by members of the authors' research team to the United States Central Command (USCENTCOM), United States European Command, United States Readiness Command (now disestablished), and Joint Deployment Agency (also disestablished)—though not focused especially on these same matters—and a subsequent visit to USCENTCOM led the authors to believe that the major observations and conclusions this report presents apply in large measure to the other U.S. unified commands as well.

This document should be of interest to logistic and operations planning staffs at the Joint Staff, unified commands, and their theater components.

SUMMARY

In peacetime, most of the attention of the joint and unified commands' logistic staffs (CINC/J-4s) goes to developing detailed operational plans, establishing agreements with host nations, planning and conducting exercises and war games, and, more recently, reviewing Services' budgets and programs. This work was completed in May 1988.

Only war-gaming and command-post exercises provide the opportunity for the staffs to practice the responsive logistic monitoring and management that will be necessitated by unpredictable wartime events—for example, losses of ammunition storage sites, decreased fuel-handling capacity, interrupted en-route resupply, unforeseen consumption and attrition rates, or operations in unfamiliar locations and terrains for varying periods of time. Unfortunately, probably because the detail and time necessary to "play logistics" realistically are so great and because logistic constraints could limit combat operations play so severely, logistics receives fairly short shrift in most games and exercises.

These facts and the traditional view of logistics as a Service function have left the theater logistic staffs inadequately equipped to support wartime operations. The staffs are relatively small, their data processing support is limited, and they receive limited information from their components. In wartime they will have to resort to ad hoc methods and interact with the Services in unpracticed ways. We fear they will not be able to ensure the supportability of theater forces under rapidly evolving conditions.

WARTIME CINC/J-4 ROLES

To help remedy this situation, we propose sharpened definitions of the theater logistic staffs' roles and responsibilities in wartime and recommend developing and implementing automated reporting and assessment systems specifically designed with those roles and the current staffing and funding realities in mind.

Currently, the wartime roles and responsibilities of the joint logistic staffs are not specified consistently and systematically. However, several types of duties are clearly in the province of the unified command. Just as the unified commander in chief (CINC) must task, coordinate, and oversee the operations of his component commands, so too must he—with the assistance of his logistic staff—task, coordinate, and

oversee at least some of their logistic functions, especially those relating to jointly used, handled, or maintained resources. Each CINC must also continually monitor the theater and worldwide status of certain *critical items*, the so-called warstoppers, regardless of which component owns or controls them.

Consequently, we deduce four distinct roles for the unified command logistic staffs:

1. Monitoring current and evolving theater logistic capabilities;
2. Coordinating logistic support with current and planned operations;
3. Advising the CINC about the supportability of proposed operations and courses of action;
4. Acting as the agent/advocate to nontheater logistic organizations.

Note that we do not recommend that the joint and unified staffs receive, maintain, and manipulate all the detailed logistic and operational data the components handle; this is neither necessary nor desirable. Logistic resource management should be kept in the Services' hands, and joint and unified staffs should remain relatively small. But these staffs do need information on certain joint and critical resources, and they need more information-handling capability than they currently possess if they are to fulfill their proper wartime roles adequately.

We recommend that the above roles be specified clearly in command and organizational documents, that the types of decisions necessary to fulfill these roles be delineated, and that the types of information necessary to inform that decisionmaking be specified. We suggest specifics toward these ends in this report, but these specifics need discussion and refinement by the joint community. Where agreement warrants, specific development and evaluation plans should be developed.

CURRENT CAPABILITIES TO FULFILL WARTIME ROLES

Our review of the current capabilities of the unified commands' logistic staffs with respect to three resource categories—namely, bulk fuels, conventional ammunition, and spare parts—reveals widely different capacities for fulfilling the four wartime roles.¹ Basing our opinions largely on observations at the United States Pacific Command (for

¹We selected these three resource categories because they represent quite diverse types of resources; each is coordinated by large, complex, and fairly distinct management and support operations structures; and joint organizations currently participate quite differently in the management and handling of these resources.

the three resource areas) and the United States Central Command (for ammunition), we find that the situation is relatively good with respect to bulk fuels. Existing information systems, management structures, and communications linkages contribute to the relative strengths in the bulk fuels area, including the CINC/J-4s' (1) visibility of the geographic distribution of fuels across the theater, of incoming resupply, and even of fuels stocks outside the theater; and (2) ability to manage the distribution of fuels actively (including the last-minute loading of fuels at U.S. ports, the redirection of en-route shipments, and the cross-leveling among fuels terminals within the theater). The major weakness in the fuels area is the CINC/J-4s' inability to estimate quickly the fuel requirements implied by an alternative course of combat action.

The CINC/J-4s' abilities to fulfill the wartime roles are lower in conventional ammunition and spare parts because in these areas the CINC/J-4s have less complete information and less current ability to influence the distribution or use of available assets. In fact, because spare parts currently receive negligible attention from the joint community, because there are so many of them, and because their management by the Services is so complex, we do not recommend that the joint staffs undertake the same wartime roles for them as for bulk fuels and conventional ammunition. The greatest opportunity for making near-term improvements in the unified commands' ability to monitor and manage joint and critical resources in wartime is in the area of conventional munitions.

RECOMMENDED DEVELOPMENTS

Table S.1 shows the technical developments we recommend to improve the CINC/J-4s' wartime functions; most of the developments relate to conventional ammunition. We suggest the first three developments, proposed for both bulk fuels and conventional ammunition, to improve the CINC/J-4s' ability to support role 3—advising on the supportability of proposed operations. The other two developments we recommend for ammunition deal with all four roles; the two we recommend for spare parts would improve the fulfillment of role 3 and role 1 (monitoring logistic capabilities), but additional developments, beginning with compilation of commonalities/interchangeabilities among the components' spare parts and repair capabilities, would be necessary to enable much greater fulfillment of roles 2 and 4.

Ultimately, the unified command staffs should be able to link supportability assessments across logistic resources, any one of which might render planned or proposed operations infeasible. This would require,

Table S.1

TECHNICAL DEVELOPMENTS FOR IMPROVING
CINC/J-4 WARTIME FUNCTIONS

Technical Development	Logistic Resource		
	Bulk Fuels	Conventional Ammunition	Spare Parts
Evaluate feasibility of meeting stated resource requirements	X	X	(a)
Estimate critical resource requirements for proposed operations or courses of action	X	X	(a)
Translate information on critical stocks and resupply into supportable operations	X	X	(a)
Incorporate/integrate information to make status summaries more meaningful	(a)	X	(a)
Compile cross-Service commonalities	(a)	X	(a)
Track system and mission availability rates	(a)	(a)	X
Assist in translating CINC's operations objectives into support goals for components	(a)	(a)	X

^aNot applicable.

first, evaluation of the CINC staffs' capabilities for monitoring and managing the theaters' distribution systems in wartime (considering the same roles we have identified here) and subsequent development of any improvements needed. (The theater distribution system and, to a degree, the distribution linkages back to the continental United States must be included because they both constrain and permit redistribution of logistic resources in response to changing operational needs.) Second, it would require developing an integrated evaluation framework—perhaps in the form of a computerized spreadsheet with different input and output sections tailored for Operations Directorate and CINC/J-4 staffs, joined by quantitative relationships linking operational activity levels and support resource quantities.

ACKNOWLEDGMENTS

We received substantial help in understanding the Services' and the Defense Logistics Agency's (DLA's) overall systems for providing and managing logistic support to U.S. forces abroad through many individuals. Contacts within the individual Services were coordinated by Mr. Donald Feeney, for the United States Army (USA); Lt. Col. Vince Canava, for the United States Air Force (USAF); Capt. E. A. McAlexander, for the Navy; and Lt. Col. Richard Yeoman, for the Marine Corps. Ms. Carole Martinson coordinated contacts with DLA.

Our guides, critics, and facilitators at the Joint Staff included Brig. Gen. William Hallin (USAF), Mr. Bill Boone, Col. William Smiley (USAF), Col. Karl Dahlen (USA), and Col. Ray Linville (USAF).

Special thanks go to members of the logistic and operations staffs at the United States Pacific Command (USPACOM) and its components' headquarters who introduced us to many of the wartime interactions between the unified command and the individual Services. The Logistics Directorate (J-4) at USPACOM is headed by REAR ADM. Hugh Webster; our attention there focused on the resources branch, headed by COL. Regis Dietrich (USA). Our interactions with the J-4 and component staffs were arranged by Maj. Bob Mitchell (USAF). The coordinators for our visits with the Army, Air Force, Navy, Marine Corps, and the Defense Fuel Region Pacific were, respectively, Mr. Raymond Chapman, Lt. Col. Jerry Clark, Lt. Comdr. Dave Brooks, Lt. Col. Dennis Bolten, and Comdr. L. A. VanRooy.

At the United States Central Commands our attention focused on the resources branch, headed by Col. R. E. Beck, Jr. (USAF). Interactions with J-4 personnel were arranged by Lt. Col. J. P. DiPierro (USAF).

Our colleague David Kassing provided important help in our first visit to USPACOM, and he and John Bondanella provided helpful reviews of an earlier version of this document.

CONTENTS

PREFACE	iii
SUMMARY	v
ACKNOWLEDGMENTS	ix
FIGURES AND TABLES	xiii
GLOSSARY	xv
Section	
I. INTRODUCTION	1
II. THE WARTIME ROLES AND RESPONSIBILITIES OF THE THEATER UNIFIED LOGISTIC STAFFS	4
Organizational Setting and Relationships	4
Categories of Decisionmaking and Command Authorities	7
CINC/J-4 Wartime Roles and Responsibilities	9
Information Necessary to Accomplish Wartime Roles ...	14
III. BULK FUELS: CURRENT SITUATION AND POTENTIAL IMPROVEMENTS	21
The Major Bulk Fuels	21
Managing the Fuels Cycle	24
Fulfillment of CINC/J-4 Wartime Roles	27
Potential Developments for Bulk Fuels	30
IV. CONVENTIONAL AMMUNITION: CURRENT SITUATION AND POTENTIAL IMPROVEMENTS	34
Ammunition and Its Management	34
CINC/J-4 Wartime Role Fulfillment	37
Potential Developments for Munitions	40
V. SPARE PARTS: CURRENT SITUATION AND POTENTIAL IMPROVEMENTS	44
The Spare Parts and Repair Domain	44

Spare Parts Organizations and Allocation	
Mechanisms	47
Fulfillment of the CINC/J-4 Wartime Roles	49
Potential Developments	52
VI. SUMMARY AND RECOMMENDATIONS	56
REFERENCES	63

FIGURES

2.1.	Primary communications relationships	6
6.1.	Conceptual elements of a spreadsheet relating planned (or proposed) operations and logistic supportability	61

TABLES

S.1.	Technical developments for improving CINC/J-4 wartime functions	viii
2.1.	Information necessary to fulfill CINC/J-4 wartime roles . . .	20
3.1.	Defense fuels supply center bulk petroleum status	22
3.2.	Retail fuels consumption, fiscal year 1987	23
3.3.	J-4 information needs and availabilities for bulk fuels, by wartime role	31
4.1.	J-4 information needs and availabilities for conventional ammunition, by wartime role	39
5.1.	Counts of secondary items, by type, commonality, and Service	46
5.2.	CINC/J-4 information availabilities for critical spares and repairs, by wartime role	51
6.1.	Qualitative assessments of CINC/J-4s' current ability to fulfill suggested wartime roles	57
6.2.	CINC/J-4 information needs in three logistic resource areas	58
6.3.	Technical developments necessary to improve CINC/J-4 wartime functions	60

GLOSSARY

ACP	ammunition control point
ADS	ammunition distribution system
ALC	air logistics center
AMCCOM	Armament, Munitions, and Chemical Command (Army)
AOR	area of responsibility
ARG	ammunition requirements generator
ARMS	ammunition reporting management system
ASP	ammunition supply point
CAIMS	conventional ammunition information management system (Navy)
CAS	combat ammunition system (Air Force)
CIL	critical item list
CINC	commander in chief
CINC/J-3	Operations Directorate in a unified theater command
CINC/J-4	Logistics Directorate in a unified theater command
COA	course of action
COCO	contractor-owned and contractor-operated
CONUS	continental United States
CSA	corps storage area
DEFCON	defense condition
DEIS	defense energy information system
DFAMS	defense fuel activity management system
DFR	defense fuel region
DFSC	Defense Fuels Supply Center
DFSP	defense fuel storage points
DLA	Defense Logistics Agency
DMAS	defense materiel allotment system
DoD	Department of Defense
DOE	Department of Energy
DOS	days of supply
DRIVE	distribution and repair in variable environments (Air Force)
EPSF	expense time per sortie factor
FMC	fully mission-capable
GUARDS	general unified ammunition reporting data system
ICP	inventory control point
IMP	inventory management plan (fuels)
J-3	Operations Directorate

J-4	Logistics Directorate
J-5	Plans Directorate
JCS	Joint Chiefs of Staff
JMPAB	Joint Materiel Priorities and Allocation Board
JOPES	joint operational planning and execution system
JOPS	joint operational planning system
JP4	Jet fuel 4
JP5	Jet fuel 5
JP8	Jet fuel 8
JPO	Joint Petroleum Office
JS	Joint Staff
LCE	logistics capability estimator
LOE	level of effort
LRC	logistic readiness center
LRT	logistic readiness team
LRU	line-replaceable unit
MAARS	marine ammunition accounting and reporting system
MAC	Military Airlift Command
MIPR	military interdepartmental purchase request
MPS	maritime prepositioned ship
MRG	movement requirements generator
MRO	materiel release order
MSC	Military Sealift Command
MTMC	Military Traffic Management Command
NATO	North Atlantic Treaty Organization
NCA	National Command Authority
NCAA	nonnuclear consumables annual analysis
NFMC	not fully mission-capable
NMCS	not mission-capable due to the lack of supply
NNOR	nonnuclear ordnance
OJCS	Organization of the Joint Chiefs of Staff
OPLAN	operational plan
OSD	Office of the Secretary of Defense
PC&S	posts, camps, and stations
PCB	printed circuit board
PMC	partially mission-capable
POE	port of embarkation
POL	petroleum, oil, and lubricants
POLCAP	POL capability report
POR	percent of requirement
PPBS	planning, programming, and budgeting system
PWRM	prepositioned war reserve materiel
PWRS	prepositioned wartime reserve stocks

REPOL	petroleum damage and deficiency report
SA-ALC	San Antonio Air Logistics Center (Air Force)
SAAS	standard Army ammunition system
SAPO	Subarea Petroleum Office
SCP	service control point (fuels)
SHAPE	Supreme Headquarters, Allied Powers Europe
SIDATH	source identification and ordering authorization (fuels)
SITREP	situation report
SMCA	single manager of conventional ammunition
SORTS	status of resources and training system
SPCCA	single point for control of conventional ammunition (Navy)
SRU	shop-replaceable unit
STAMP	standard ammunition package (Air Force)
TO	threat-oriented or target-oriented
TPFDD	time-phased force deployment data
TSA	theater storage area
UNAAF	<i>Unified Action Armed Forces</i> (JCS Publication 2)
USA	United States Army
USAF	United States Air Force
USCENTCOM	United States Central Command
USEUCOM	United States European Command
USPACOM	United States Pacific Command
USREDCOM	United States Readiness Command
USTRANSCOM	United States Transportation Command
WAARS	wartime aircraft activity reporting system
WARS	worldwide ammunition reporting system (Army)
WRM	war reserve materiel
WRSK	war readiness spares kits

I. INTRODUCTION

The commander in chief (CINC) of a U.S. unified command develops strategies for and oversees the development of operational plans (OPLANs) to employ and sustain the U.S. military forces in his theater or geographic area of responsibility (AOR). This requires the CINC and his staff to engage in mobilization and deployment planning and to participate in the Department of Defense's (DoD's) planning, programming, and budgeting system (PPBS). They work to assure that adequate combat and support resources can become available in the theater quickly enough and long enough to make possible the implementation of current operational concepts and constituent employment plans.

The CINC receives his guidance—in terms of broad objectives for his AOR, operational constraints, desired relationships with allies, and force and support resource limitations—from the National Command Authority (NCA).¹ The CINC has operational command over the Army, Air Force, Navy, and Marine Corps forces in his AOR. In war-time, his forces may come under the command of a commander of U.S. and allied forces.

Providing logistic support for forces—in the form of food, fuel, ammunition, transport, spare parts, repair, and so on—is considered a Service responsibility. Thus, for example, the U.S. Army must support its forces wherever they fight in the world. Each Service has large-scale organizational elements devoted to providing logistic support—for example, maintenance depots, munitions arsenals, shipyards, and transportation and materiel control centers. But providing logistic support also involves many entities outside the individual Services, including

- Other Services that provide common materiels or services;
- The United States Transportation Command (USTRANSCOM) and its components: the Army's Military Traffic Management Command (MTMC), the Navy's Military Sealift Command (MSC), and the Air Force's Military Airlift Command (MAC), all of which handle and move forces, support elements, and materiel to the theater;

¹The CINCs are linked through the Joint Chiefs of Staff (JCS) to the NCA, which consists of the president and the secretary of defense.

- The Defense Logistics Agency (DLA), which provides many items common to more than one Service—notably, fuels (through the Defense Fuels Supply Center [DFSC]);
- Allies who may provide facilities, transport, materiel handling, repair, or storage (often for prepositioned war reserve materiel [PWRM]);
- The U.S. unified commands, responsible for establishing logistically supportable operational strategies and plans for their AORs.

In peacetime, most of a unified CINC's logistic staff's time is spent in planning or revising OPLANs, coordinating PWRM requirements, establishing agreements with host nations, determining whether the Services' proposed budgets include the elements of logistic support required by the theater's combat plans, and planning and conducting exercises and war games. These are all large, complex, and important endeavors. In fact, they are so large and complex that they leave the logistic staffs with inadequate opportunity to develop and practice the extensive adaptations that wartime will require.

One of the few things certain about war is that unexpected things happen. For example, the enemy may choose to fight in unexpected places or ways; some weapons may prove more effective than expected, while others less so; more of some types of operations/missions may be necessary than expected; resources may be consumed at unexpected rates; allies may prove more effective or less reliable than expected; stored resources (for example, fuel or ammunition reserves) may be lost; and carriers and resupply cargos may be delayed or lost. Such events require flexibility and rapid, integrated adaptability, both in planning and conducting combat operations and in planning and providing logistic support.

Unfortunately, exercises and war games conducted in peacetime usually provide little opportunity to practice the responsive logistic resource management wartime requires. This probably results from the fact that "playing logistics" realistically (1) would require substantially more detail, labor, and (probably) elapsed time; and (2) could insert limitations of such significance that the exercise of operational procedures and the practice of tactical decisionmaking would be affected severely.

This study reports an initial review of the interactions planned or potentially needed in wartime between the CINC's logistic staff and (1) the CINC's operations planning staff, and (2) the Services' theater components' logistic staffs. Because we believe that effective and efficient means for monitoring and assessing logistic capability at the unified command level must rely on the Services' systems, the review

began with a survey of the Services' and DLA's broad systems for providing and managing logistic support to the forces abroad in wartime. We then examined the decisionmaking that occurs at the unified command level in wartime, considering both operations and logistics and emphasizing the translation of information about one into meaningful and useful terms for the other.² The review focused on three types of support resources: bulk fuels, conventional ammunition, and spare parts. These three resources are quite diverse; each is coordinated by a large, complex, and fairly distinct management and support operations structure; and joint organizations currently participate quite differently in the management and handling of these resources.

The next section introduces four roles that appear appropriate for the CINCs' logistic staffs to fulfill in wartime—roles they cannot fulfill completely today. The following three sections consider bulk fuels, conventional ammunition, and spare parts, respectively. Each section reviews the system through which the logistic resource is provided, the CINC logistic staff's current ability to fulfill its wartime roles for that resource, and the potential developments that could enable greater fulfillment of those roles. A summary of our findings and recommendations concludes the report.

²The United States Pacific Command (USPACOM) and its component headquarters, all near Honolulu, Hawaii, provided the initial context for this review. Earlier visits by members of our research team to the United States Central Command (USCENTCOM), United States European Command (USEUCOM), United States Readiness Command (USREDCOM; now disestablished), and Joint Deployment Agency (JDA; also disestablished)—though not focused especially on these same matters—and a subsequent visit to USCENTCOM led us to believe that the major observations drawn from the review at USPACOM apply in large measure to other U.S. unified commands.

II. THE WARTIME ROLES AND RESPONSIBILITIES OF THE THEATER UNIFIED LOGISTIC STAFFS

Before we outline the four wartime roles for the CINCs' logistic staffs, we describe these staffs' organizational environment and some inconsistencies among interpretations of their responsibilities. Recognizing these inconsistencies clarifies the need for a well-conceived delineation of wartime roles. The roles themselves, along with the information they require, provide a framework for assessing the joint logistic staffs' capabilities and for identifying potential improvements for the three resource areas subsequent sections address.

ORGANIZATIONAL SETTING AND RELATIONSHIPS

The Logistics Directorate (J-4) is just one of the CINC's staff elements. Other directorates nominally include Personnel (J-1), Intelligence (J-2), Operations (J-3), Plans (J-5), and Command, Control, and Communications Systems (J-6).¹ We are especially interested in the J-4's interactions with the J-3 staff, who, in wartime, augmented by the J-5 staff, monitor the progress of combat operations and help the CINC develop alternative courses of action (COAs), adjusting to changed circumstances in the theater or to guidance from the NCA.

In wartime, the unified commands operate "command centers" and "operational planning teams" to meld the disparate information that comes through the various directorates. These centers and teams keep the CINC apprised of the status of forces and resources; they also take the lead in conceiving and evaluating different strategies and operations for pursuing the theater's overall war. The staff members representing the CINC/J-4 in such groups are supported by a logistic readiness center (LRC) or logistic readiness team (LRT) containing specialists in various "functional areas"—for example, fuels, ammunition, engineering, supply, sealift, airlift, or medical care. Each directorate prepares a daily (or more frequent) briefing for the CINC that summarizes status, new information, recommendations, and actions needed. The CINC/J-4's briefings typically show the approximate quantities of

¹To distinguish directorates at the unified commands from their counterpart at the Joint Staff (JS) level (previously the Organization of the Joint Chiefs of Staff [OJCS]), we designate the former as CINC/J-4, for example, and the latter as JS/J-4.

resources available (often measured in days of supply [DOS]) and current or impending problems (for example, restricted storage or material-handling capacities).²

A side-by-side working relationship between the CINC/J-3 and the CINC/J-4 is intended to ensure that logistic problems that might jeopardize planned or potential alternative operations become known promptly to operations planners.

The CINC/J-4 receives from the components in the theater regular reports of support resource status and problems, which it summarizes in its reports to the CINC. The CINC/J-4 also communicates with the components' logistic organizations in less formally structured ways, especially when trying to answer specific questions from the CINC, CINC/J-3, or JS/J-4 about availability of resources, feasibility of COAs, and so on. In the management of bulk fuels, the CINC/J-4 (via its Joint Petroleum Office [JPO]) also communicates directly with DLA's DFSC, defense fuel regions (DFRs), MSC, pipeline operators, and Subarea Petroleum Offices (SAPOs).

Communication exists between the operations and logistic staffs *within* the unified, component, Service, and JS levels. But *between* organization levels the communications are between like organizations. For example, the CINC/J-4 communicates with component and JS logistic staffs, but not with component or JS operations staffs.

Figure 2.1 displays the principal communication linkages of importance here: the unified commands' connections to their components and to the Joint Staff. The figure also indicates the existence, in certain cases, of joint task forces and allied staffs. Although joint task forces are often assembled for special purposes (for example, the attempted rescue of hostages from Iran in 1980, the seizure of control in Granada in 1983, and the protection of Kuwaiti oil tankers in the Persian Gulf in 1988), they are frequently overseen directly by the National Command Authority (the president and the secretary of defense, assisted by the National Security Council and the Joint Chiefs of Staff), essentially bypassing the unified commands. Joint task forces are temporary entities, however, and, because their operations are generally of limited scope and duration, they create relatively limited stress for U.S. logistic support systems and resources.³ Relationships between U.S. unified commands and allied

²Similar command centers and LRCs operate at the component headquarters within the theater, stateside at the Services' headquarters, and at the JS.

³This does not diminish the importance of joint task forces, whose logistic communication needs are being addressed in other studies. See, for example, Joint Tactical Command, Control, and Communications Agency, *Joint Tactical C3 Architecture for Combat Service Support: Requirements for Effective Inter-Service Coordination*, JTC3A Publication 8008, Fort Monmouth, N.J., October 1987.

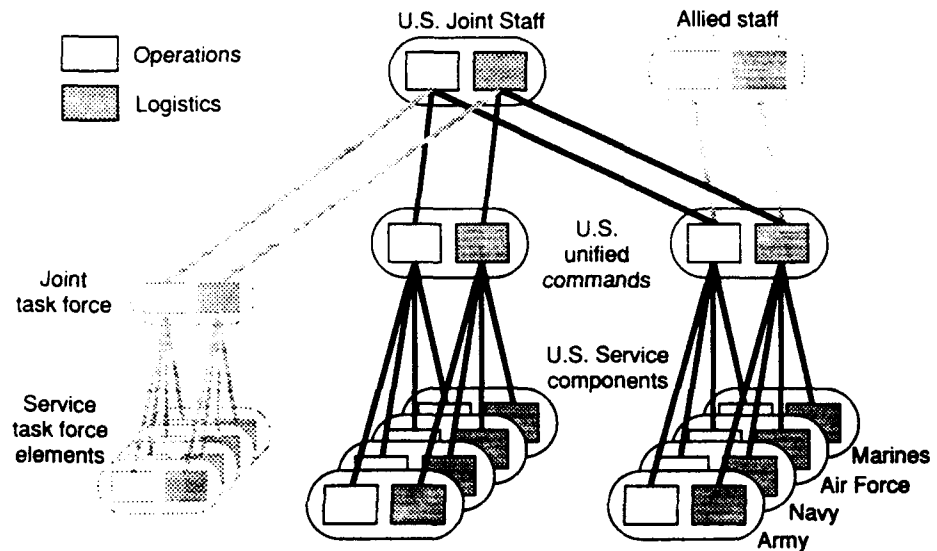


Fig. 2.1—Primary communications relationships

commands (for example, between USEUCOM and NATO's Supreme Headquarters, Allied Powers Europe [SHAPE]) are also considered only tangentially here. Contingencies that require U.S. combined operations with allies are more likely to be large scale and to stress logistic systems and resources, of course, but the interrelationships with allies are peculiar to each alliance and subject to specific agreements. Thus, we view both joint task forces and relationships with allies as special cases, too idiosyncratic to provide much insight into the general wartime roles and capabilities appropriate for unified commands' logistic staffs. Although many of the decisions and much of the associated information would be similar in these other organizational settings, our review considers primarily the canonical situation of U.S. unilateral prosecution of war using joint forces (that is, from more than one Service) in one or more theaters under the direction of unified commanders.

CATEGORIES OF DECISIONMAKING AND COMMAND AUTHORITIES

The CINC holds *operational command* over forces and operations in his AOR, both in peacetime and wartime. This puts him unequivocally in charge. He directs the distribution and use of his forces, and is in charge of strategies and employment plans. Operational command (equivalently, operational control) is officially defined as follows:

[T]hose functions of command involving the composition of subordinate forces, the assignment of tasks, the designation of objectives, and the authoritative direction necessary to accomplish the mission.⁴

Of course, CINCs work closely with their component commanders in considering changes in strategies and COAs, and the NCA must be consulted about *major* changes. Examples of the kinds of decisions CINCs might make in their direction of *operations* include changes in the timing, location, or intensity of combat operations and changes in the allocation of operational responsibilities between components—for example, assigning the destruction of enemy port operations in an area to Navy aviation instead of to the Air Force.

The CINCs' authority over logistics is *directive authority*. The *Unified Action Armed Forces (UNAAF)* includes the following description of the CINCs' authority and control over logistics:

Under conditions short of crisis or war, the CINC is authorized to exercise directive authority within his command in the field of logistics *TO ENSURE EFFECTIVE EXECUTION* of approved operational plans, *EFFECTIVENESS* and economy *IN OPERATIONS* and the prevention or elimination of unnecessary duplication of facilities and overlapping of functions among the Service component commands. *IN CRISIS ACTION OR WARTIME CONDITIONS* and where critical situations make diversion of the normal logistic process necessary, *THIS AUTHORITY IS EXPANDED TO AUTHORIZE COMMANDERS TO USE ALL FACILITIES AND LOGISTIC RESOURCES AVAILABLE AS NECESSARY FOR THE ACCOMPLISHMENT OF THEIR OPERATIONAL MISSIONS*. . . . Implementation and execution of logistic functions remain the responsibility of the Services and the Service component commander.⁵

The emphasized portions of this passage (the capitalization and italics are ours) leave little room for doubt: In wartime, the CINC may con-

⁴Joint Chiefs of Staff, *Dictionary of Military and Associated Terms*, Publication 1, January 1986, p. 258.

⁵Joint Chiefs of Staff, *Unified Action Armed Forces*, Publication 2, August 1986, pp. 3-57.

trol the distribution and use of logistic resources as well as combat forces.

Nevertheless, prevailing thought and practice consider the CINCs' authority over logistics quite limited. Several documented passages illustrate this view: The National Defense University's *Guidebook for Exercise of Authority* states:

The various Service logistic support systems will be operated by the respective Service component commanders in accordance with Departmental instructions, subject to the directive or coordinating authority of the joint force commander. Service component commanders advise the joint force commander of planning for significant changes in logistic support, including base adjustments, sufficiently early for the joint force commander to express his views.⁶

Neither the guidebook nor JCS Publication 1 defines *directive authority*, but both define *coordinating authority* in nearly the same terms:

The commander . . . has the authority to require consultation between the agencies involved . . . , but does not have the authority to compel agreement.⁷

Because this is the prevailing view, both in formal documentation and, especially, in unwritten practice, we should not be surprised if the unified commands have relatively weak capabilities for managing logistic resources or even for monitoring logistic capabilities. To emphasize the degree to which CINCs have been expected to manage operations but *not logistics*, consider the following:

[T]he commander himself remains aware of his general logistic endurance and reach as well as any limiting factors and takes appropriate action to coordinate tactical requirements with logistic capabilities.⁸

Thus, delineating what the CINC/J-4s *should* be able to do in wartime is quite important.⁹

⁶National Defense University, *Guidebook for Exercise of Authority*, August 1986, pp. 7-8.

⁷JCS, *Dictionary*, p. 92.

⁸National Defense University, *Guidebook*, p. 9.

⁹We note in passing the existence of a similar problem in delineating allied commands' appropriate roles in managing logistic resources in wartime. While allied commanders would control combat forces, logistic support would remain "a national responsibility," just as it remains "a Service responsibility" for U.S. unified operations. (See, for example, *NATO Logistics Handbook*, Senior NATO Logisticians' Conference, Secretariat, NATO Headquarters, Brussels, June 1989, p. 22.)

CINC/J-4 WARTIME ROLES AND RESPONSIBILITIES

Just as the unified commander must task, coordinate, and oversee the operations of his component commands, so too must he—with the assistance of his logistic staff—task, coordinate, and oversee at least some of their logistic functions, especially those relating to jointly used, delivered, or maintained resources. He must also continually monitor the status of numerous critical items—the so-called warstoppers—regardless of which component owns or controls them. The CINC/J-4 is the commander's instrument for doing these things, it is his principal source of assistance for evaluating the supportability of rapidly changing operational plans and candidate COAs, and it provides his connection to component and continental U.S. (CONUS) logistic organizations.

The *UNAAF* distinguishes unified commands' and components' responsibilities generically within individual functional areas—for example, fuels, engineering, supply, and medical—without establishing a common thread of overall CINC/J-4 responsibilities or the information needed to fulfill those responsibilities. Based largely on our interviews with operations and logistics staffs at unified and component levels, we discern four relatively distinct roles the CINC/J-4 staff should be able to fulfill in wartime.

We believe that important improvements in understanding, interactions, and wartime operational capabilities will be fostered by a more careful delineation of (1) the CINC/J-4's wartime roles and responsibilities, (2) the types of decisions that must be made in fulfilling them, and (3) the information necessary to inform the decisionmaking. This subsection and the next offer a starting point for such a delineation. This subsection describes and distinguishes the four roles we discern, including the types of decisions they include.¹⁰ The next subsection discusses the types of information necessary to fulfill the different roles. The four roles are

1. Monitoring current and evolving theater logistic capabilities;
2. Coordinating logistic support with current and planned operations;
3. Advising the CINC about the supportability of proposed operations and COAs;
4. Acting as the CINC's agent/advocate to nontheater logistic organizations.

¹⁰Sections III-V will make clear that the CINC/J-4s could fulfill these roles only partially—and in many ways relatively ineffectively—if war were to occur in the near future.

Role 1: Monitoring Current and Evolving Theater Logistic Capabilities

Currently, CINC/J-4s spend considerable time during exercises practicing this role. Role 1 involves collecting information from the components, extracting and summarizing the most crucial information, and passing it to the CINC and to the Joint Staff. This status information helps the CINC and his operations staff answer the question, Are current operations in jeopardy because of logistic limitations?

The task in role 1 is to collect, consolidate, interpret, and explain data about current and upcoming logistic status in the theater, relating those data insofar as possible to current and planned operations. The a priori uncertainties about wartime—for example, uncertainties about combat location, timing, and intensity; about weapons effectiveness; and about combatant attrition and material loss rates—make this role absolutely fundamental.

Role 2: Coordinating Logistic Support with Current and Planned Operations

Where role 1 “only” requires CINC/J-4s to track whether unfolding logistic capabilities can still support current and near-term OPLANS, this role involves the CINC/J-4s in *matching* support with requirements. Unfolding circumstances will change both the operations to be supported and the condition and distribution of the supporting logistic resources.

In helping the CINC coordinate operations in his theater, the CINC/J-4 has the unique perspective to integrate information about and to oversee resources that are (1) used by more than one component (for example, fuel, food, many ammunition items, certain spare parts, and repair capabilities), (2) used for more than one component (especially transport, storage and material handling, and repair resources and capacities), or (3) judged particularly critical to successful operations, even if they are owned and used by only a single component (for example, certain high-technology munitions or end items). The CINC/J-4 must continually understand the current and impending availability of such resources and be able to take quick action to alter the use/allocation of limited assets to ensure the best possible logistic support for upcoming operations.

Concerning the first class of joint resources (those joint in use) the phrase CINC/J-4 staff members use most often to characterize this role is “cross-leveling”—that is, directing the movement of logistic resources from one component or one geographic area to another

within the theater. For the second class of joint resources (those joint in production) the task of assigning priorities is only slightly different. Here the CINC and his staff must tell a component whose material to move first or which items to repair first. Examples of the types of decisions to be made in this role include

- Adjusting priorities for shipments of resources into or within the theater;
- Directing in-place or incoming resources from one part of the theater to another or from one component to another;
- Directing one component to store, handle, repair, or move materiel for another, or to do it sooner.

Even without coordination or assistance by the CINC/J-4s, the components would almost certainly share some of their supply and repair resources in wartime, making ad hoc arrangements that depend on proximity, current requirements, and unsystematic knowledge of each others' resources ("I'll trade you some batteries for some electrolyte"). However, limitations in total resources, and in the components' visibility and understanding of each others' resources, argue for the CINC's coordinating, prioritizing, and adjudicating such activities for a limited set of critical resources. This is the wartime role that relates most closely to the CINC's "directive authority" over logistics.

Role 3: Advising the CINC about the Supportability of Proposed Operations and Courses of Action

Almost inevitably, changing conditions require that joint commanders revise their operational strategies, schedules, and tactics as a conflict progresses. They need rapid assessments of the logistic supportability of the alternative COAs they might identify.

Currently, this role is filled almost exclusively by the components. The CINC first outlines one or more alternative COAs. The component commanders and their operations staffs then break down each broad COA into more detailed parts, identify the specific operations necessary, and lay out the location, scale, intensity, and timing of the operations. From these, the component logistic staffs estimate the resource requirements, assess the risks and logistic advantages and disadvantages, and compare the supportability of alternative COAs.

This approach, from the unified command's perspective, has at least two problems: The CINC/J-4 currently is in a poor position to either

(1) corroborate or question the components' logistic assessments,¹¹ or (2) provide its own *preliminary* assessments before the components are queried. At times, the CINC or his operations staff needs to consider COAs' *gross* feasibility without triggering the components' extensive assessments—for example, in order to reduce the likelihood of security leaks, reduce the burden on the components' logistic staffs, or even preclude disturbances in the components about mission responsibilities that only *might* be considered in greater detail.¹²

The CINC/J-4s could play this role at two levels: (1) assessing whether the logistic resource requirements that components identify as being required by a COA can be met, or (2) estimating the resource requirements themselves and then assessing the feasibility of meeting them. The first level could involve two kinds of assessments—one to confirm the components' stated resource requirements and another to confirm the feasibility of satisfying those requirements *simultaneously* (for example, the latter assessment could reveal when intratheater lift or materiel-handling capacities would be exceeded by the components' *collective* materiel movement requirements). Assessments of the latter type would be useful even if assessments of the former type were not performed at the CINC/J-4 level. At the second level, the CINC/J-4 would conduct the entire supportability assessment, although undoubtedly at a coarser level.

For both levels, we reemphasize that the CINC/J-4's evaluations or estimates would be developed in less detail than the components use. At the first level, the need is to determine whether the components' stated requirements could be met, especially considering any cross-Service logistic assistance that might help and any inter-Service logistic conflicts that might hinder. At the second level, the need is to ascertain which COAs are probably feasible, which are probably infeasible, and which must be evaluated in more detail by the components.

¹¹In a recent USPACOM war game, for example, the CINC/J-4 could not produce timely data or analysis assuring the CINC that his components' positive assessments of the supportability of a specific COA were correct. The CINC rejected the COA. With more information and improved analytical capabilities, the CINC/J-4 could have contributed more positively to the CINC's decision.

¹²Even at the Joint Staff level, this sort of "hot planning" and assessment is frequently necessary *before* the unified commands, Services, or components are engaged.

Role 4: Acting as the CINC's Agent/Advocate to Nontheater Logistic Organizations

This role requires the CINC/J-4s to report theater logistic status to the Joint Staff, request resources beyond those allocated to the theater, oversee priorities conveyed to supporting organizations (role 2 also requires this), oversee adjustments to the time-phased force deployment data (TPFDD), coordinate U.S. logistic transactions/relationships with allies, and coordinate logistic transactions with other U.S. unified commands. The CINC/J-4s also answer questions from the JS about quantities (and timeliness) of available assets.

Examples of the types of decisions to be made in fulfilling this role during wartime include the following:

- Do current or impending circumstances in the theater warrant special requests for additional logistic resources (for example, more of an expensive, high-technology munition)?
- Should adjustments be made in the priorities for resupply that the components are conveying to supporting organizations? (For example, should the Army component's current highest-priority requirements receive greater priority for materiel handling and shipment into or within the theater than the Air Force component's current highest priority requirements?)
- Should resources be requested from or provided to allies?

The Joint Staff will be consulted about most decisions of the third type, and also about obtaining resources from or providing resources to other U.S. unified commands. This report primarily focuses on matters of *joint* logistics, not *combined* logistics, so the first two questions are of greater immediate interest.

With respect to materiel management—except for bulk fuels—the wartime activities planned by the CINC/J-4s in support of this role consist primarily of compiling and forwarding to the Joint Staff the reports it receives from the components. The components manage their own resupply of nonfuel materiel—for example, through their depots, DLA, MSC, and MAC. For bulk fuels, the JPO manages the requisitions (slate) and wholesale distribution in the theater. Outside of bulk fuels management, the CINC/J-4s become involved in interactions with CONUS-supporting organizations only when a component requests help—that is, when a component asks the CINC to “weigh in” to help it receive higher priority for materiel or lift resources.

The unified commands' participation in managing within-theater transport and materiel handling also falls under this role. In most cases, intratheater distribution involves working with host nations to

coordinate access to handling, storage, and transport resources—including, for example, ports, vehicles, roadways, and workers. Although our review concentrated on the fuels, ammunition, and spare parts categories of logistic resources, expected limitations in wartime transport/handling capacity or availability were brought to our attention repeatedly. Such limitations could limit the availability of virtually all other logistic resources in wartime. Thus, we recommend that a review be undertaken of the joint staffs' ability to monitor and manage the theater distribution systems in wartime.¹³

INFORMATION NECESSARY TO ACCOMPLISH WARTIME ROLES

The preceding discussion implies that the CINC/J-4s need particular types of information, and much of the information will be rapidly dynamic in wartime, reflecting *unexpected changes in operations and support requirements* (for example, in types, quantities, timing, and locations) and in the availability of resources (stockpiles, movement and handling capacities, and incoming resupplies) to meet those requirements. Key questions—ones we do not presume to answer precisely at this stage—are, What additional information should the CINC/J-4s receive and maintain? In what detail? How frequently? In what formats? How should the information be organized, manipulated, and displayed? The answers to these questions will vary among the different categories of logistic resources and need to be worked out carefully between the unified commands and their components.

Nevertheless, we outline here the broad *types* of information necessary to fulfill the four roles. Sections III-V will then consider the roles and information in the context of individual logistic resource categories and describe potential developments that could exploit the information to support decisionmaking at the unified command level.

For emphasis, we repeat our conviction that information of the types described here should not duplicate at the CINC/J-4s the detail and volume of logistic data the components use; to do so would be expensive and counterproductive. A preferable course is to identify appropriate aggregations of information that enable the CINC/J-4 to fulfill its roles while carefully limiting the data and computational burdens the

¹³The review should parallel those in Secs. III-V for fuels, ammunition, and spare parts, dealing with all four of the CINC/J-4's wartime roles and the associated information requirements. The emphasis should fall on the wartime command and control of physical distribution resources, not on the adequacy of any specified set of those resources. Unavoidably, this review would spill over into matters of *combined* logistics and relationships with host nations.

CINC/J-4 would bear. Several dimensions in which aggregations should be sought include

- Time (for example, considering multiday increments instead of daily increments);
- Geographic area (for example, subdividing a theater into ten or so areas instead of hundreds);
- Organizational level (for example, considering regiments instead of battalions, or air wings instead of squadrons);
- Combat operations (for example, opening particular sealanes instead of destroying numbers of enemy ships or submarines);
- Materiel categories (for example, considering, say, five categories of level-of-effort [LOE] munitions instead of dozens of individual munitions).

The CINC/J-4s already receive and maintain *some* information of the types outlined below, and we emphasize that important improvements in CINC/J-4 capabilities could be achieved without incorporating *all* the information delineated here.

Now let us consider information of three broad types: information about planned operations, about the relationships between operations and logistic resources, and about logistics.

Information about Planned Operations

Information about planned operations would be necessary to estimate logistic resource requirements as part of evaluating, even preliminarily, the feasibility of alternative COAs (role 3). Such information obviously must distinguish the components and the geographic subdivisions of the theater. And at levels of detail still to be determined, it should describe the types of operations, the scale on which they would be conducted, their intensity, and the associated timing.

The CINC/J-4s could use similar information about *current* plans in acting as the CINC's agent/advocate to nontheater logistic organizations (role 4).¹⁴ The purpose would be to make requests for additional resources as compelling as possible by tying them directly to operations required by the CINC's and components' combat plans.

For the CINC/J-4s to translate information about logistic resource availability and requirements into insights about elements of current operations plans that may be in jeopardy (as part of role 1), they would

¹⁴The information needed for this purpose is less comprehensive but more detailed than that for role 3. In fact, we expect that the components, when they ask a CINC/J-4 to act in their behalf, already provide the CINC/J-4s with information appropriate for this purpose.

also need the information about *currently planned* operations, not just about alternative COAs.

Finally, the CINC/J-4 should also understand the CINC's priorities for the different operations comprising the current plan. This would be useful in fulfilling role 2—coordinating logistic support with upcoming operations. If several operations were to proceed with the knowledge that logistic resources might not meet all requirements, the CINC/J-4 could be the arbiter to allocate the shortages. Obviously this should be done in accordance with the CINC's strategic objectives. The CINC's priorities would also be useful in assembling requests for additional materiel as part of role 4.

Relationships between Operations and Logistic Resource Requirements

Information about the rates at which logistic resources are used, together with information about planned or potential operations, would enable the CINC to estimate logistic resource requirements. Currently, the Services compile extensive sets of "planning factors" (primarily used in deliberate planning) that the components expect to use in wartime to generate detailed logistic resource requirements. Two innovations are needed to make a similar capability (but at a more aggregated level) available to the CINC/J-4s. The first would be important to the components as well: to incorporate into the planning factors the unfolding wartime experience about resource consumption rates. The second would be particularly important for the CINC/J-4s: to find suitable aggregate descriptors of operations, suitable aggregate categories of logistic resources, and corresponding aggregate consumption rates to link the two.

As we noted previously, estimating logistic resource requirements is a major activity primarily in fulfilling role 3. One might think that because weighing in the CINC in role 4 is so serious a matter, the CINC/J-4 should confirm through its own calculations that additional resources are required for the operations planned. We believe this is unnecessary, however, because the appropriate requirements calculations would be more detailed (because the requests probably will be for individual materiel items) than is necessary for other CINC/J-4 purposes; a simple review of the component's calculations should suffice.

Although we emphasize here using operations/logistics relationships to estimate logistic resource requirements, we note the potential for using them in the opposite direction: to translate information about available logistic resources into information about the operations they could support. This would be important if the monitoring of current and evolving theater logistic capabilities (role 1) were carried to the

point of identifying elements of planned operations that were jeopardized because of logistic resource limitations.

Information about Logistic Resources

Several different types of logistic information would be needed to fulfill the four wartime CINC/J-4 roles. The CINC/J-4s already receive information of some of these types, but often in aggregations too broad to enable fulfillment of the roles.

Required Resources. This is the resource consumption anticipated for either the current plan or for alternative COAs. Requirements information is needed in one form or another for each of the four wartime roles. The requirements can be calculated either by the components or by the CINC/J-4s. (If the CINC/J-4s calculate requirements, of course, we expect them to use more aggregate categories of resources.) Because of inherent uncertainties about resource consumption, "requirements" must often be recalculated frequently and quickly.¹⁵

In wartime, the components' forward elements (for example, battle groups and air wings) would estimate their resource requirements frequently so they could call forward what they needed. Currently, these are the requirements the component headquarters expect to compile, aggregate, and forward routinely to the CINC/J-4s. But the headquarters themselves would estimate the resource requirements for potential alternative COAs. Of course, time permitting, they could consult with forward commanders about the specific tactics and operations that would make up the COAs. As we indicated above, the CINC/J-4s need a less detailed capability for calculating logistic resource requirements.

As we noted previously, requirements information should be broken down by component and region within the theater—plus, of course, by type of resource and time period.

Available Stocks. Information about the availability of joint and/or critical logistic resources is also needed for each of the four wartime roles, but in some cases more comprehensive and more detailed information is necessary. The detail for information about resource stocks must match that for resource requirements—that is, distinguishing components, regions, resource types, and (because requirements vary over time) time periods. The need for distinguishing time periods makes including information about logistic resources that are en route, either within the theater or coming into the theater, necessary. En-

¹⁵We noted earlier several types of uncertainty that will make recalculating requirements necessary—for example, unexpected effectiveness of U.S. weapons or the enemy's weapons, altered tactics, and changes in the location, timing, and scale of engagements.

route stocks that are "close enough" can go toward meeting some of the anticipated resource requirements.

This "full" breakout of stockage information—that is, on-hand (by type, component, and region) and en route (by type, component, and within-theater or incoming) is necessary for monitoring theater logistic capabilities (role 1), coordinating support with upcoming operations (role 2), and advising the CINC about the supportability of proposed COAs (role 3). But aggregations by type and component only often suffice for acting as the CINC's agent/advocate to nontheater logistic organizations (role 4). This greater aggregation would suffice when endorsing a Navy component's request for more Harpoon missiles, for example, but not for ordering ("slating") specific quantities of fuels to be delivered to particular terminals on particular schedules.

Stockage information is obviously dynamic in wartime. Stocks, too, are affected by important uncertainties—for example, manufacturing flaws, degradation in storage, or damage or loss resulting from enemy attacks.

Cross-Service Commonalities. This information tells the compatibilities or interchangeabilities among the components' logistic resources—for example, all four Services use 30-millimeter (-mm) ammunition rounds; Marine Corps aircraft can use JP4, JP5, or JP8 jet fuel; and both Navy and Air Force F-4s use the same radar antenna (which may be repaired in the theater only by the Air Force).

Such information is necessary for all four CINC/J-4 wartime roles. It identifies the *potential* for one Service to help out another.

The task of identifying and tabulating cross-Service commonalities can range from simple to complex, depending on the logistic resource under consideration. For example, only a few types of bulk fuel exist, and the Defense Fuels Supply Center and the Joint Petroleum Offices already know which of the Services use each type. The same is true for subsistence, personal, and medical items (for example); although more types of items exist, the DLA knows the Services' commonalities. But we know of no similar source for comprehensive information about cross-Service commonalities in ammunition (especially considering ammunition components), spare parts, or repair capabilities, for instance.

Unlike the information about resource requirements and stocks, information about cross-Service commonalities remains relatively constant over time. Essentially, it changes only when new equipment or supply items enter the inventory or when old ones are phased out. Thus, this information does not require regular compilation in wartime. We recommend that this information about resource commonalities be both compiled and *used* in peacetime, letting the Services practice cross-Service resource sharing in day-to-day operations (to whatever

extent, probably a very limited one, logistic resource shortfalls occur in peacetime) and in war games and exercises.

Facilities and Capacities. This information reflects the components' storage and handling (throughput) capabilities for different types of materiel and the relevant repair capabilities. These capabilities also vary over time, being affected by consumption rates, enemy actions, and equipment failures and repairs, for example.

Much of the facility and capacity information relates primarily to the ability to move logistic resources within the theater and to receive stocks from outside the theater. Accordingly, this information is important for all four CINC/J-4 roles—even, in the case of fuels, acting as the CINC's agent/advocate to nontheater logistic organizations (role 4). Information about repair capabilities can also be useful for all four roles.

Transport Capabilities. Transport is the complement of materiel storage and handling capabilities in physical distribution systems. Information about the timeliness and amounts of transport capacity availability is also needed for all four wartime roles, enabling the CINC/J-4s to ascertain whether logistic resources could be delivered when and where needed to support currently planned or proposed operations or COAs.

Transport capabilities, too, are subject to substantial uncertainties in wartime—for example, resulting from breakdowns and enemy actions. And they must be distinguished by their flexibilities (indicating the types of cargo they can carry), ranges, and speeds, for instance.

Summary of Information Needs

Table 2.1 summarizes the types of information we feel are appropriate for fulfilling the CINC/J-4s' four wartime roles. We see this table as a *starting point*, helping to stimulate consideration within the joint community of (1) activities and information appropriate for the CINC/J-4s, (2) sources for the information (which could easily vary from one situation to another), and (3) methods for collecting, handling, and displaying the information.

As noted, information that seems to be "the same" in the table can come from different sources, depending on the role or the level to which a role is being fulfilled. For example, for evaluating the supportability of proposed plans or COAs (role 3), information about "planned" operations might come from either the CINC/J-3 or from the components, and information about required resources might come from either the CINC/J-4 or from the components.

The next three sections will use the roles and information described above to provide a framework for assessing the joint logistic staffs' wartime capabilities and for identifying potential improvements for three resource areas: bulk fuels, conventional ammunition, and spare

Table 2.1
INFORMATION NECESSARY TO FULFILL CINC/J-4 WARTIME ROLES

	Role 1: Monitoring Logistic Capabilities	Role 2: Coordinating Logistic Support	Role 3: Evaluating Proposed Plans	Role 4: Advocating Theater Needs
Planned operations				
By component & region				
Type	(a)	(a)	X	X
Scale	(a)	(a)	X	X
Intensity	(a)	(a)	X	X
CINC's priorities	(a)	X	(a)	X
Relationships between operations and required logistic resources	(a)	(a)	X	X
Logistic information				
Required resources (anticipated consumption)				
By component	X	X	X	X
By region	X	X	X	(a)
Available stocks				
In theater				
By component	X	X	X	X
By region	X	X	X	(a)
En route	X	X	X	(a)
En route to theater				
By component	X	X	X	X
Cross-Service commonalities	X	X	X	X
Facilities and capacities	X	X	X	X
Transport capabilities	X	X	X	X

NOTE: Information is needed by time periods—for example, (a) by 5-day increments over a 60-day planning horizon, (b) by 1-day increments over a 10-day planning horizon, or (c) by increments of different lengths.

^aNot applicable.

parts. Each section reviews the system through which the logistic resource is provided¹⁶ and the CINC logistic staff's current ability to fulfill its wartime roles for that resource. Each section concludes with a short list of potential developments that could permit greater fulfillment of those roles.

¹⁶Readers familiar with the management of these commodities can readily skip these introductory sections.

III. BULK FUELS: CURRENT SITUATION AND POTENTIAL IMPROVEMENTS

To a large extent, fuels are joint resources.¹ Gasoline, jet and missile fuels, fuel oils, and lubricants are used by all the Services and by most U.S. allies. And, like many other common items such as food and medicine, fuels for U.S. military use are provided by a single agency. The Defense Fuels Supply Center in Alexandria, Virginia, has the worldwide mission of buying and distributing fuels used by the armed forces and by specified federal agencies.

The military fuel cycle begins with estimating future requirements by designated units of all the Services. In peacetime those estimates are consolidated at the petroleum control points of the individual Services and then passed on to the DFSC, where they are consolidated further and where all resulting contracts with oil-industry suppliers are authorized. The suppliers eventually deliver the fuels to defense fuel storage points (DFSPs, usually at U.S. military installations) located around the world. There, the DFSC takes possession, tests the fuels to be sure they meet government specifications, and then arranges for their distribution to the Services' operating units.

This section begins with a brief introduction to bulk fuels (supply class III) and then describes how the Services determine their fuel requirements, how the DFSC orders fuels, and how the DFSC, the Military Sealift Command, and the Services manage fuels distribution. It then discusses the responsibilities and capabilities of the CINC's staff—in this case, the Joint Petroleum Office, for bulk fuels, and that office's ability to fulfill the wartime roles we described in Sec. II. The section closes with our suggestions for improvements in the JPO's capabilities.

THE MAJOR BULK FUELS

Although the Services consume, and the DFSC procures, a large variety of petroleum products, most money and attention is given to the "bulk" items. Bulk petroleum, oil, and lubricants (POL) consists of petroleum products normally transported by pipeline, rail tank car, tank truck, barge, or ocean tanker and stored in containers or tanks

¹Readers familiar with the management of bulk fuels can proceed directly to the subsection "Fulfillment of CINC/J-4 Wartime Roles."

having a capacity of more than 55 gallons. Most common fuels—such as motor gasoline, jet, and diesel fuels—fall into this category. Most bulk fuels are liquid, handled in large volumes, and flammable. Packaged POL products, on the other hand, are petroleum products that are transported, stored, and issued in containers with capacities of 55 gallons or less.² Packaged POL is distributed by the same military general supply system that handles subsistence items and spare parts.

As Table 3.1 shows, bulk POL consists mainly of jet fuels (JP4 for the Air Force and JP5 for the Navy) and distillates (diesel fuels for vehicles and ships). Residuals (heating fuels), motor gasoline, and JP8 (which will eventually replace JP4 for most noncarrier-based military jet operations) comprise most of the rest.

Wholesale fuels are owned by the DFSC and consist of in-transit and stored peacetime fuels, as well as prepositioned wartime stocks. Table 3.1 shows that the DFSC wholesale inventory parallels the annual purchases, consisting mainly of jet fuels and distillates. Notice too, however, that JP8 is being phased into use; its proportion in the

Table 3.1

DEFENSE FUELS SUPPLY CENTER BULK PETROLEUM STATUS
(Fiscal year 1987)

Product	Purchases (Millions of barrels)	Ending Inventory	
		Quantity (Millions of barrels)	Value (Millions of dollars)
Motor gasolines	3	3	91
Aviation gasolines	(a)	(a)	1
Jet fuel 4	94	23	589
Jet fuel 5	29	17	467
Jet fuel 8	10	14	357
Distillates	30	23	629
Residuals	4	2	42
Lube oils	(a)	(a)	4
Total	170	82	2180

SOURCE: Defense Logistics Agency, *Defense Fuels Supply Center Fact Book—Fiscal Year 1987*.

²Some special products are stored in 500-gallon, collapsible containers but are still considered "packaged" products. See James L. H. Thomson III, *A Look at the Corps Level Bulk POL Supply System*, Defense Logistics Systems Information Exchange 48588A, June 1980.

end-of-year inventory is some three times greater than its proportion of use over the full year.

Table 3.1 shows DFSC transactions and inventories, reflecting the wholesale portion of the bulk fuels system. Table 3.2 shows the distribution of (retail) fuels consumption. It details retail POL consumption for fiscal year 1987 and confirms several of the statements made previously: JP4 is consumed mainly by the Air Force, JP5 is used primarily for jet operations from carriers, and distillates are consumed mainly as shipboard fuels. These three uses accounted for 89 percent of all retail consumption in 1987.³

The Navy has two columns in Table 3.2. The "Navy" column reports fuels delivered through one of the DFSC supply points or terminals. The "Ship" column reports fuels delivered directly from refineries or commercial storage sites to ships at sea via MSC or contract tankers; this is often termed consol delivery.

Table 3.2

RETAIL FUELS CONSUMPTION, FISCAL YEAR 1987
(Millions of barrels)

Product	Air Force	Navy	Ship	Army	Marines	Other	Total
Motor gasoline	1.0	0.7	(a)	1.9	0.1	(a)	3.8
Aviation gasoline	(a)	(a)	(a)	0.1	(a)	(a)	0.1
Jet fuel 4	88.5	0.5	(a)	2.9	0.1	(a)	92.1
Jet fuel 5	1.6	15.1	4.1	0.1	3.0	(a)	24.0
Jet fuel 8	4.0	(a)	(a)	(a)	(a)	(a)	4.1
Distillates	3.4	2.0	24.3	4.4	0.3	0.1	34.4
Residuals	(a)	1.5	0.5	(a)	(a)	(a)	2.0
Fuel oils	1.5	2.4	(a)	4.3	0.5	(a)	8.8
Reclaimed fuel oil	(a)	0.4	(a)	(a)	(a)	(a)	0.4
Total	100.0	22.6	28.9	13.7	4.0	0.1	169.7
Percent	59	13	17	8	2	0	100

SOURCE: Defense Logistics Agency, *Defense Fuels Supply Center, Fact Book—Fiscal Year 1987*.

^aConsumption of less than 0.5 million gallons in fiscal year 1987.

³The distribution of the retail inventory as of September 30, 1986, was similar to the consumption distribution for the year. The overall year-ending inventory amounted to some 17 percent of the year's total consumption.

MANAGING THE FUELS CYCLE

We will summarize how requirements are generated, how those requirements are consolidated and the DFSC procures the fuel, and how the fuels are then distributed and stored.

How Requirements Are Generated

The Services typically use similar methods and models to estimate wartime fuel requirements and peacetime fuel requirements, but the procedures, timing, and organizations differ. We will review the peacetime process first.

Requirements for Peacetime Operations. Each Service, through its service control point (SCP), projects annual (fiscal) fuel requirements and submits them to the DFSC as military interdepartmental purchase requests (MIPRs). The MIPRs normally cover the following fiscal year for each location (post, base, or station), plus any additional requirements for special exercises, initial tank fills, and building up of Service-owned inventories.⁴

The Air Force serves as a good example: The SCP for the Air Force is "Detachment 29"—an extension of the Directorate of Energy Management, San Antonio Air Logistics Center (SA-ALC)—which is collocated with the DFSC at Cameron Station, Virginia. It serves as the direct link between the DFSC and Air Force in determining petroleum requirements. In determining fuel requirements, Detachment 29 relies primarily on information contained in the Air Force's five-year plan and in the "D022" report from SA-ALC. The five-year plan details projected aircraft flying hours for each mission, design, and series aircraft in the Air Force's inventory. The D022 report integrates data and information from the monthly fuels management data report, the monthly sales analysis report, general ledger information from the Air Force Accounting and Finance Center in Denver, Colorado, and inventory status information from the defense energy information system-I (DEIS-I).

Those sources provide information on past activities, past consumption, and planned activities. Detachment 29 specifically examines each base's past two years' fuel consumption and then, considering significant, projected changes in flying hours and aircraft assignments reflected in the five-year plan, projects the estimated aviation fuel needs for each base. After the projections are passed to the

⁴J. D. Richardson, Jr., and C. F. Stocky, *Aviation Fuel Forecasting at Base Level Using Programmed Air Force Flying Activities*, AFIT/GLM/LSM/84S-61, Air Force Institute of Technology, September 1984.

appropriate major command's Energy Management Division for validation, they are consolidated and submitted to the DFSC.

Requirements for Wartime Operations. Planning for war focuses on estimating bulk-fuel requirements for various OPLANS, COAs, and contingency plans.

Wartime fuel requirements are typically estimated by "war planners," with the assistance of the SCPs for fuels. For example, in the Air Force the planners are in the "XP" community of the major commands. These planners compute unit requirements, measured in days of supply, using computations based on the estimated number of sorties to be flown per day, estimated gallons of fuel necessary per sortie, and estimated number of days for the operation. The output then represents the estimated amount of fuel needed to support the planned operations.

An important element of war planning is the establishment of prepositioned wartime reserve stocks (PWRS). The Services expect wartime fuel requirements to be met through a combination of normal peacetime stocks, prepositioned wartime reserve stocks, and planned wartime resupply. Because the peacetime stocks typically can cover only several days of wartime operations, the PWRS and the initial resupply are very important.

Prepositioned wartime fuel stocks are usually sized according to the most stringent current OPLAN. In the Air Force, for example, using information from the wartime aircraft activity reporting system (WAARS), analysts look at all the different OPLANS. They identify sortie requirements by 5-day periods for each OPLAN and pick the single most stringent period. They divide that level (sum) by five to get a sortie/day factor. Then they assume that that flying level (and fuel requirement) will hold for the entire planning period. Finally, they compute the resource requirements for fuel, for the consequent size of fuel storage and handling facilities, and for fuel-handling and management personnel. The PWRS are funded and stocked during peacetime for use during wartime.

Selecting Suppliers and Contracting

After each Service has projected its upcoming fuel requirements and submitted them to the DFSC as military interdepartmental purchase requests, the DFSC uses the MIPRs as the basis for soliciting bids and issuing contracts between commercial refineries or storage facilities and the defense fuel regions and DFSPs. Delivery contracts are often established by the DFR after the DFSC negotiates a contract. Fuel contracts generally allow drawing 12 months' supply in 7 months, if necessary, so some surge capacity is available for emergencies.

After the contracts have been awarded, the DFRs and DFSPs are notified; in turn, they issue source identification and ordering authorizations (SIDATHs) to the bases in their geographic areas. The SIDATHs notify each base or military activity of the quantity and petroleum contract source(s) that will be used for resupply.⁵ Some operating units in particular locations are allowed to order directly from local sources.

The Distribution of Bulk Fuels

Distribution, as we will describe it, includes the computation of *short-term* requirements, especially important in wartime. After operating bases and units receive their SIDATHs (determined in part from annual requirements computed centrally by the Services), they compute their individual shorter-term requirements and forward these (in operating theaters) to the appropriate Joint Petroleum Office or Subarea Petroleum Office. In peacetime, these requests are forwarded each month and cover that month plus the next four months by 10-day period and by location. During wartime, they cover 60 days of operations and are updated daily.

The JPOs/SAPOs receive the short-term requirements and consolidate them for resupply by submitting slates (how much, when, and where needed) to the DFSC, which in turn coordinates with suppliers (refineries) and deliverers (MSC) to send appropriate quantities to wholesale terminals or at-sea locations as determined by the slates. The DFSC accomplishes this by establishing cargos in appropriate sizes from available suppliers; the MSC then nominates vessels to carry the cargos to meet the required delivery dates. Should the DFSC be destroyed, the JPO is capable of taking over for the DFSC in its area.

The fuel is then distributed in two stages: a wholesale stage managed by the DFSC, DFRs, and MSC (and overseen in operating theaters by the JPOs); and a retail stage managed by one or more of the Services.

Wholesale Distribution. Most fuels regions and theaters of operation feature two general types of wholesale distribution schemes: those going directly to users, and those going through terminals.

Posts, camps, and stations (PC&Ss) often purchase fuels from local, commercial suppliers. This happens mostly in the CONUS, but also in some overseas locations. Service units in Hawaii procure PC&S items directly, as do some units in Japan—mostly heating fuels and motor

⁵Richardson and Stocky, *Aviation Fuel Forecasting*.

gasoline. And, as mentioned above, consol is the direct delivery of fuel to ships at sea, bypassing theater terminals.⁶

Most deliveries into a region, however, are to terminal facilities. For example, there are six SAPOs in the Pacific area, each responsible for storing wholesale fuel stocks and operating a number of fuel terminals.⁷ All these terminals and storage sites are owned and operated either by one of the Services or by a contractor. The DFSC does not fund such activities. Military construction funds finance new facilities and major repairs.

Wholesale delivery of fuel to terminals in the theaters can be by commercial or MSC ocean tankers, rail or truck tankers, or pipeline.

Retail Distribution. Withdrawals from theater terminals and storage sites by the Services represent retail transactions. This distribution occurs in various ways. Often it is direct—many Navy ships refuel directly from Navy-operated terminals, as in Pearl Harbor and Subic Bay. Sometimes it is by truck or local tanker, as on and among the Hawaiian and Japanese islands. Sometimes it involves large integrated road/rail/pipeline networks, as in Europe and in the Army-operated distribution system in Korea. And sometimes it uses shuttle ships to deliver fuel to Navy supply ships operating with convoys and task units.⁸ Retail distribution is often the responsibility of the individual Services, but, as noted above, many joint and cross-Service activities occur. The Navy handles most retail activities for the Marines.

FULFILLMENT OF CINC/J-4 WARTIME ROLES

The Joint Petroleum Office of a theater manages the bulk petroleum support of forces within the theater to ensure that fuel (of the necessary quality) is received at the right place, at the right time, and in appropriate

⁶Two related forms of direct delivery are called "into-plane" and "bunker contract." At some commercial airports (Pango Pango, on the route from Hawaii to Australia, for example) military airplanes need to refuel, but there is no military facility nearby. These planes purchase fuel from commercial facilities but obtain it at a bulk rate by charging to a DFR or DFSC account used by all the military planes that refuel there. The MAC has a similar contract for fuel at the Honolulu airport. A bunker contract describes the same type of operation for ships. Note too that a single MSC tanker may conduct both consol operations and deliveries to terminals.

⁷The Pacific DFR also has property administration and management responsibilities for more than 5.8 million barrels of DoD fuel stored in seven contractor-owned and contractor-operated (COCO) fuel terminals in Japan, Singapore, and Guam. See L. A. Van Rooy, Jr., "Defense Fuel Region Pacific: Management of Commercial Fuel Supply Support," *The Navy Supply Corps Newsletter*, July/August 1987, pp. 21-22.

⁸Note that this is retail delivery as opposed to consol or wholesale delivery direct from refineries or commercial storage sites.

quantities.⁹ The JPO is responsible for all types of fuel, but mainly worries about the major fuels for ships, airplanes, and land vehicles.

Fuels Visibility at the Joint Petroleum Office

As we noted above, during wartime, operating bases and units report their individual short-term requirements to the nearest Subarea Petroleum Office daily. These requests cover the next 60 days, by 10-day period, for each location. The JPO receives the short-term requirements from the SAPOs and consolidates them for resupply through the submission of slates to the DFSC.

Several reports provide the basis for fuels visibility. First is the petroleum, oil, and lubricants capabilities report (POLCAP), which is submitted annually in peacetime from subregional commanders¹⁰ to their theater CINCs,¹¹ and then from the CINCs' JPOs to the OJCS, DFSC, and others.¹² Should defense condition (DEFCON) 3 be declared, the POLCAP will be updated immediately and then reported daily. It contains information on (1) POL distribution concepts and constraints, (2) current consumption and projected increases if a numbered OPLAN should be implemented, (3) product availability (including civilian, host nation, and PWRS), (4) the status of handling equipment, facilities, ocean terminals, and pipelines, (5) an assessment of general POL capability to support forces at planned operating levels on a current and a sustained basis, and (6) an assessment of the local capability to support additional unprogrammed forces.

When DEFCON 1 is declared, the POLCAP is replaced by the petroleum damage and deficiency report (REPOL). This report is submitted daily through the same channels and contains information on (1) facility damage, (2) product status and deficiencies (including inventory, capacity, and requirements, in both barrels and DOS, by period), (3) status of damaged POL discharge ports, and (4) a general summary of the effect of product deficiencies on planned operations over the next 60 days in sufficient detail to allow the CINC to view the overall theater impact.

⁹The USPACOM Joint Petroleum Office consists of the branch chief and one person each for operations, plans, tanker scheduling, and quality surveillance. These personnel are supplemented in wartime by reservists.

¹⁰The information originates at the terminals and SAPOs, which are generally distributed regionally in a way that correlates with the CINC's war-fighting organizational structure.

¹¹See, for example, USCINCPACINST 4020.5N, 4224, January 28, 1985.

¹²Joint Chiefs of Staff, *Joint Reporting Structure*, Publication 6, Vol. 2, Part 13, Change 2, March 22, 1982.

Several other fuel reports are also important in wartime. The DFSC operates an automated data system, the defense fuel activity management system (DFAMS), that is used to monitor fuel levels at all storage sites. The DFSC also keeps an inventory management plan (IMP) that tracks peacetime usage and wartime reserves for fuel storage points throughout the world. The IMP reports terminal capacity by type: (1) unobtainable capacity, (2) PWRS, (3) peacetime operating stocks, and (4) unassigned ullage. This information is all available to the JPO.¹³

These reports also provide the JPOs with information on fuel stocks and flows outside their region: Because all the JPOs receive the DFAMS and IMP reports, they can judge their relative needs and problems.

Current Capabilities

To provide timely and independent support to the CINC's planning and execution activities, the JPO must monitor the fuel needs, stocks, and prospects of the Services and the specialized commands. It must be able to estimate, at least crudely, the fuel necessary to support proposed operations. It must know which fuels can be used by different Services (and in different areas), as well as the availability of and time required for intratheater and into-theater deliveries.

The JPO staff must support the CINC in these areas during wartime, during crisis and low-level conflicts, and during peacetime. During wartime, the JPO needs these capabilities to support planned operations in consonance with the Service components, to react to uncertainties (losses, opportunities), and to assist in planning altered/advanced operations. During low-level conflicts, it must provide quick responses in planning and reacting to contingencies of all types. And finally, during peacetime, the JPO needs to practice its wartime functions during exercises and war games. Again, however, we do not envision the JPO infringing on the Services' planning responsibilities; the Services have the detailed knowledge, information, and capabilities to do the better job. But the JPO must be able to evaluate the Services' plans and to provide quick-reaction estimates of feasibility to the CINC.

Our observation, based mainly on visits to USPACOM, is that J-4 staffs currently are not adequately prepared to accomplish all these roles and tasks. They seem to have an adequate grasp of the evolving

¹³In fact, it is information generated by the terminals and SAPOs, and accumulated by the JPO, that makes up most of the DFAMS and IMP reports.

supply of fuels for their theaters, and they can usually evaluate whether inventories and scheduled resupply will be sufficient to meet "stated" requirements,¹⁴ but they appear to have little capability for estimating or evaluating those fuel requirements.

Table 3.3 contains our evaluation of the information currently provided to the JPOs to support their wartime roles. In this table, an *OK* indicates that a data item is needed to allow the JPO to fulfill a particular role and that the JPO currently receives, or is scheduled to receive during wartime, information adequate to satisfy that need. *Need* indicates that the JPO needs the information but does not currently have (easy) access to it. *Needs more* indicates that some information of this type is present (or that plans for its provision in wartime exist), but that more is needed to enable the JPOs to fulfill that wartime role.

The bottom row of Table 3.3 indicates how fully we believe the JPOs could fulfill the four wartime roles. The most serious shortfall is the JPOs' inability to estimate quickly the amounts of fuel that would be necessary to support altered courses of action.

As the table shows, we believe that the JPO probably has or will have access to the inventory and supply information needed to carry out all four wartime roles. And the JPO should have easy access to the CINC's plans and priorities. It does not, however, have algorithms to transform operational plans into corresponding fuels amounts (or vice versa), and it does not currently have enough information on force structures to compute even crude requirements.

POTENTIAL DEVELOPMENTS FOR BULK FUELS

All the information discussed above should become available to theater JPOs (and to many others) in great detail when the joint operational planning and execution system (JOPES) is implemented. Indeed, a "POL analysis prototype" already exists that apparently can handle most conceivable data and analysis needs.¹⁵ The JOPES and

¹⁴The USPACOM's JPO has a spreadsheet called EXEWS (designed and created by its own staff) that it uses to identify distribution allocations and schedules to meet stated requirements for bulk fuels. Apparently, JPO staff members repeatedly adjust allocations and schedules within the spreadsheet and review the effects on meeting the stated requirements. A series of adjustments is often necessary before a feasible and efficient distribution plan is derived. Depending on the frequency, difficulty, and practicality of this trial-and-error procedure in wartime, it may be useful to embed the spreadsheet's evaluation capability within a systematic, rule-based procedure (for example, using principles of expert systems or mathematical optimization) to hasten the identification of preferred distribution plans.

¹⁵W. H. Cook et al., *JOPES POL Analysis Process: Development of POL Analysis Prototype*, Systems Research and Applications Corporation, Arlington, Va., January 1987.

Table 3.3

J-4 INFORMATION NEEDS AND AVAILABILITIES FOR BULK FUELS,
BY WARTIME ROLE

	Role 1: Monitoring Logistic Capabilities	Role 2: Coordinating Logistic Support	Role 3: Evaluating Proposed Plans	Role 4: Advocating Theater Needs
Planned operations				
By component & region				
Type	(a)	(a)	Need	Need
Scale	(a)	(a)	Need	Need
Intensity	(a)	(a)	Need	Need
CINC's priorities	(a)	Need	(a)	Need
Relationships between operations and required logistic resources				
	(a)	(a)	Need	Need
Logistic information				
Required fuels (anticipated consumption)				
By component	OK	OK	OK	OK
By region	OK	OK	OK	(a)
Available stocks				
In theater				
By component	OK	OK	OK	OK
By region	OK	OK	OK	(a)
En route	OK	OK	OK	(a)
En route to theater				
By component	OK	OK	OK	OK
Cross-Service commonalities	OK	OK	OK	OK
Facilities and capacities	OK	OK	OK	OK
Transport capabilities	Need more	Need more	Need more	Need more
J-4's capability for performing role				
	Good	Good	Poor	Good

^aNot applicable.

the POL analysis routines may not be implemented soon, however, and we believe the theater staffs' capabilities should be improved in the interim. We also suggest that, on the requirements side at least, the JPOs and the unified planning staffs do not need all the detailed information JOPES will provide from Service-level files. Instead, they need

more aggregate information, along with some simple microcomputer-sized analysis procedures so they can

- Perform credibility checks on the fuel requirements and capabilities estimated in detail by the Services;
- Monitor and coordinate plans presented by the Services to ensure that theater assets (the fuels themselves, along with fuels transport, handling, and storage resources) are earmarked only once and that commonalities and possible joint economies or efficiencies are exploited;
- Provide the CINC with rough, quick answers to his "what if?" questions.

The JPO can have access to operational information and priorities developed in other directorates of the CINC's staff. Its main independent need is for information and algorithms so that it can at least roughly estimate consumption rates under alternative courses of action and, conversely, translate fuels stocks and resupply into ranges of supportable operations. This capability should be combined with an enhanced capability for tracking stocks in transit to increase greatly the JPO's ability to fulfill the third wartime role: advising the CINC about the supportability of proposed operations or COAs. As Sec. II noted, a major challenge in such a development would be identifying suitable aggregations for considering forces, operations, organizations, and time. Little would be gained by simply providing the JPOs with precisely the same, detailed procedures the components use. Indeed, the limited staffing and computerized support available at the JPOs would probably preclude the use of such detailed procedures.

Section VI discusses briefly a potential structure for a generic spreadsheet program that would have input and output sections tailored separately for operations and logistic interests. A range of supportable operations could be traced out either by trial and error—for example, by raising the sizes, intensities, or durations of operations until fuels resource limitations prevent further increases—or by incorporating computerized procedures for doing the same thing. (A combination of the manual, trial-and-error method and an automated method would probably be preferable to either alone.)

Other possible developments theater-level personnel have suggested to us deal with fuel transport into and within the theater and with war games and exercises.

When shipments are made from the CONUS to foreign terminals and storage facilities, the DFSC and MSC inform the JPO of the quantities of fuel en route and the likely arrival times. But after the fuel is

embarked, the JPO has no knowledge of the progress the ships are making, whether they have been sunk, or even which side of the Panama Canal they might be on.

The USPACOM JPO, in particular, indicated that it would like to have information about commercial ships' off-loading capabilities. It is also concerned that no one seems to be tracking the supply of crude oil *into* the United States and military-supplying refineries in wartime. It worries that war will force the DoD to "steal" tankers from all sources, that many ships will be damaged or sunk, and that some supply sources will be cut off. All in all, there could be less (perhaps little) crude flowing into the refineries, and thus little refined product would be coming out.¹⁶

Finally, the JPOs, like most other logistic support offices, feel somewhat left out during training exercises and war games. The JPO staff is on station but typically has only limited interactions with operations personnel. Generally, it is simply told which operations are going to happen and what the associated fuels requirements are; only occasionally is it asked whether actions are supportable or not.¹⁷ Rationing usually isn't played either, nor are interactions with organizations or nations (allies or otherwise) outside the region.

¹⁶The Department of Energy (DOE) is responsible for tracking the incoming supply of crude oils available to refineries. The DoD and DOE may have to coordinate the use of tankers in wartime for transporting crude and refined petroleum products.

¹⁷As we noted above, USPACOM already has a specialized microcomputer spreadsheet program and trial-and-error methods it could use for evaluating the feasibility of meeting stated fuels requirements. (It uses this capability now for adjusting fuels movement schedules during games and exercises.) It should be possible to combine such a computerized evaluation capability with today's manual, objective-seeking logic into an enhanced computerized method for more rapidly assessing the feasibility of meeting a set of stated (and dynamic) fuels requirements. Such an enhanced capability would improve the JPOs' abilities to fulfill all four wartime roles Sec. II outlines and would be an integral component of the spreadsheet arrangement we outline in Sec. VI.

IV. CONVENTIONAL AMMUNITION: CURRENT SITUATION AND POTENTIAL IMPROVEMENTS

As for the other resource categories, we begin this section with a brief overview of the conventional¹ ammunition commodity (supply class V) and the major organizations involved in its provision and management.

AMMUNITION AND ITS MANAGEMENT²

Ammunition is the "point of the U.S. military sword." It is the instrument that does the enemy physical harm.

Somewhat paralleling bulk fuels, special handling is required for some types of ammunition (for example, some explosives must be handled and stored separately), and very large amounts of materiel are required by the combatants. As a class of supply, however, it is quite different from fuels. Hundreds of kinds of conventional munitions exist, ranging from bullets to high-technology torpedoes and missiles. Some munitions are self-contained ("wooden") rounds; others come in pieces and must be assembled from components. Some have different configurations depending on the platform that fires them. (For example, Harpoon missiles can be launched from ships, aircraft, or submarines. And sabots³ can be used to fire some projectiles from different-caliber weapons.)

Complex munitions require periodic maintenance—for example, to incorporate upgrades or to ensure that guidance systems are properly calibrated. All munitions are subject to performance degradation over time. Many munitions are used in common by the Services, while others are unique to one Service.⁴ Most munitions have uses for which

¹Munitions are "conventional" if they are not nuclear, biological, or chemical weapons.

²Readers familiar with the conventional ammunition commodity and its management can proceed directly to the subsection "CINC/J-4 Wartime Role Fulfillment."

³A sabot (or shoe) is a lightweight carrier in which a subcaliber projectile is centered to permit firing from a larger caliber weapon. The carrier fills the bore of the weapon from which the projectile is fired; it is normally discarded a short distance from the muzzle.

⁴Of the 64 munitions items reported by at least one unified command as "critical items" in 1986, 35 were used by more than one Service, and 3 of the 12 threat-oriented items were used by more than one Service. Further, 9 of the 35 were common between the Navy and the Air Force; 24 of the 35 were common between the Army and the Marine Corps. (Office of the Assistant Secretary of Defense for Acquisition and Logistics.)

they are "best," but other munitions can often be substituted for the preferred ones. "Preferred" munitions typically offer greater accuracy, lethality, or range, thus providing greater effectiveness, efficiency, and safety in their delivery.

Munitions are typically categorized as either level-of-effort or threat-oriented (TO).⁵ In both peacetime and wartime, the available supplies of LOE munitions are typically measured in terms of days of supply, reflecting how long current stockpiles would last under expected expenditure rates; and available supplies of TO munitions are measured in terms of percent of requirement (POR), reflecting the remaining fraction of the *objective* stockpile—that is, the fraction of the number of weapons originally estimated to be *required* to destroy a fixed number of targets.

The system for bringing ammunition to the U.S. combatants in a theater of operations is managed differently from the one for fuels. Conventional ammunition originates with either the single manager for conventional ammunition (SMCA)⁶ or a Service's own munitions acquisition organization. Stocks of ammunition may be stored at numerous echelons between the procuring/producing organizations and the combat units—including Service-specific sites in the CONUS and in the theaters of operations (for example, maritime prepositioned ships [MPSs], Army theater storage areas [TSAs], or corps storage areas [CSAs]). Depending on geography and inter-Service arrangements, common-user munitions might stay in the Army's hands as far forward as ammunition supply points (ASPs), where they are drawn by other Services. But in many cases the Services manage the entire forward movement of their munitions, from the point of either a direct procurement or a materiel release order (MRO) to the SMCA.

Each Service has a centralized ammunition control point (ACP) with worldwide responsibility. For example, the Air Force's ACP is at

⁵*Threat-oriented* implies that a weapon is tailored to counter an active enemy weapon system (for example, large surface ships or air defense aircraft), and the number of such enemy weapon systems is known, at least approximately. There are also target-oriented (TO) munitions that are designed for *fixed* enemy targets such as radar sites, command bunkers, or bridges; the number of such targets in a geographic area is also known, again perhaps approximately. For the purposes of this discussion, we lump threat-oriented and target-oriented munitions together because they are intended to destroy known numbers of targets. Level-of-effort munitions are more general-purpose weapons, and the requirements for them are generally calculated on the basis of expenditure rates, not considering finite numbers of targets.

⁶The SMCA, headquartered in Rock Island, Illinois, is part of the Army's Armament, Munitions, and Chemical Command (AMCCOM). It manages the acquisition, production, and wholesale storage of most munitions used by more than one Service. In fiscal year 1988, this amounts to approximately half of the Army's expenditures for conventional explosives, over a fifth of the Air Force's, and about a sixth of those for the Navy and Marine Corps combined.

Ogden air logistics center (ALC), Utah, and the Navy's (the single point for control of conventional ammunition [SPCCA]) is in Mechanicsburg, Pennsylvania. The ACPs handle interactions between their Services and the SMCA, and they coordinate the distribution of available ammunition among CONUS storage locations and the major operating commands. They work with the MTMC to arrange transport to their Services' CONUS storage locations and to ports of embarkation (POEs). In wartime, they provide or obtain munitions in response to requisitions from theater components. The MAC and (primarily) MSC provide intertheater transport, which is coordinated by Service ACPs in the theaters. The Services' theater ACPs also coordinate storage and ammunition transport within the theaters.

Within the theaters, the ammunition supply systems are "pull" systems: ammo doesn't move forward unless it's called forward. It can be called forward from the next higher source of supply, via requisition, by virtually any Service organizational echelon in the theater. However, the Services have some preconfigured ammunition packages (for example, the Air Force's standard ammunition packages (STAMPs) and the Army's operations projects) that move to the theaters without requisition—as do munitions loads specified in OPLAN TPFDDs—so ammunition supply to the theaters is at least partially a "push" system.

When the theater components' combined requirements for munitions exceed supplies, available resources are allocated by the Joint Materiel Priorities and Allocation Board (JMPAB), whether in peacetime or wartime. The JMPAB convenes at the JS level; its members include representatives from all Services.

Each Service has its own information system(s) for monitoring and managing ammunition. The Army's is the standard army ammunition system (SAAS), which feeds information to its worldwide ammunition reporting system (WARS). The Navy's is the conventional ammunition information management system (CAIMS). The Air Force uses the ammunition reporting management system (ARMS, but better known as the D-15/D-078 system) and is beginning to implement an improved system called the combat ammunition system (CAS). And the Marine Corps' is the marine ammunition accounting and reporting system (MAARS). These systems, to somewhat different degrees, inform theater components' staffs of the availability of munitions within the theater. Worldwide visibility is available in some cases, but not necessarily to theater components. The *joint* system for providing visibility of ammunition resources worldwide is the general unified ammunition reporting data system (GUARDS).

In peacetime, munitions requirements are determined through extensive requirements analysis processes—long, slow efforts in the PPBS

cycle that involve negotiation and compromise (for example, the Navy's nonnuclear ordnance requirements [NNOR] process or the Air Force's nonnuclear consumables annual analysis [NCAA] process). But for wartime or crisis-planning situations, as is the case for fuels, the theater elements have planning factors (for example, expenditures per sortie factors, EPSFs) they can use fairly quickly to estimate ammunition requirements for planned or potential operations. In wartime those requirements are calculated by the forward elements (for example, battle groups, brigades, or air wings)—that is, by the fighters, not by the supporting organizations.

CINC/J-4 WARTIME ROLE FULFILLMENT

Except for the peacetime role of allocating enemy targets to Services (which drives the requirements determination process for TO munitions) and the JMPAB's wartime role of allocating scarce munitions across competing theaters and Services, the unified commands and the Joint Staff have little involvement in munitions management.

In war games, the CINC/J-4s collect information from their components about perhaps 200 selected munitions resources daily. They summarize and report this information to their CINCs and the Joint Staff. However, no "standard" setup for collecting, summarizing, analyzing, or reporting munitions information exists at the unified command level. For example, USPACOM's J-4 uses a self-developed LOTUS spreadsheet to display munitions information collected from the components. Its output contains a section for each component. The report's column headings are:

- Munition type;
- Requirement (for TO munitions);
- DOS metric (for LOE munitions, this is the amount required per day);
- Beginning on hand;
- Received;
- Expended;
- Lost;
- Ending on hand;
- Number of DOS (for LOE munitions);
- Percent of requirement (for TO munitions).

This reflects recent years' improvements, now reporting the *counts* (rounds) of munitions items instead of the gross tonnages of munitions in more aggregate categories. Nevertheless, several problems remain

that seriously limit the usefulness of the information compiled. Some especially prominent problems include the following:

- For each component, the data are aggregated across the theater, so the CINC/J-4 can't tell how closely the geographic distribution of stocks matches the distribution of anticipated consumption.
- The CINC/J-4 has very limited information about which munitions can be used by more than one Service, so even if it could see that shortfalls were jeopardizing a component's operations in some part of the theater, it might not be able to tell that another component could help out.
- The DOS figures are based on assumptions about force employments, combat intensities, and expenditure rates that the CINC/J-4 doesn't see, so it can't check the accuracy (even approximately) of the sustainability estimates.
- The POR figures *don't reflect changes in the "requirement" as the war proceeds*. They simply reflect the proportion of the original stockpile objective that remains.⁷
- Information about incoming resupply is limited, so the CINC/J-4 may not be able to tell whether current or impending shortfalls might be alleviated without requiring adjustments in operating plans or hasty relocation of munitions to areas of special need. (The amount of information available to the CINC/J-4s about incoming munitions apparently varies among theaters.)
- The CINC/J-4 has no ready access to information that tells which munitions are especially important for different missions or that relates munitions consumption to force operations, so it can't point out operations that might be in jeopardy or tell whether alternative courses of action would be supportable. The operations staff must make these judgments on its own.

Following the patterns of Tables 2.1 and 3.3, Table 4.1 summarizes the availability of and the needs for additional information about ammunition at the CINC/J-4s, based principally on our understandings from USCENTCOM and USPACOM. The information available

⁷During wartime, if a TO munition was more effective than expected so that expenditure of, say, 40 percent of the stockpile destroyed 50 percent of the required targets, then, conceptually, the remaining stockpile might be judged *more* adequate than the stockpile as it stood on D-day. We recognize that in many cases ascertaining very accurately how many targets remain of any particular type would be very difficult. Nevertheless, even a crude estimate might provide a more meaningful denominator than the current method's use of the original stockpile objective.

Table 4.1

J-4 INFORMATION NEEDS AND AVAILABILITIES FOR
CONVENTIONAL AMMUNITION, BY WARTIME ROLE

	Role 1: Monitoring Logistic Capabilities	Role 2: Coordinating Logistic Support	Role 3: Evaluating Proposed Plans	Role 4: Advocating Theater Needs
Planned operations				
By component and region				
Type	(a)	(a)	Need	Need
Scale	(a)	(a)	Need	Need
Intensity	(a)	(a)	Need	Need
CINC's priorities	(a)	Need	(a)	Need
Relationships between operations and required logistic resources				
	(a)	(a)	Need	Need
Logistic information				
Required resources (anticipated consumption)				
By component	Need more	Need more	Need more	OK
By region	Need	Need	Need	(a)
Available stocks				
In theater				
By component	OK	OK	OK	OK
By region	Need	Need	Need	(a)
En route	Need	Need	Need	(a)
En route to theater				
By component	Need	Need	Need	Need
Cross-Service commonalities	Need more	Need more	Need more	Need more
Facilities and capacities	Need	Need	Need	Need
Transport capabilities	Need	Need	Need	Need
J-4's capability for performing role				
	Poor	Poor	Poor	Fair

^aNot applicable.

about the components' anticipated munitions consumption is aggregated component-wide and is reflected in DOS figures whose calculations use numerous assumptions the CINC/J-4 doesn't know. And the information available about cross-Service ammunition commonalities includes only munitions common between the Navy and Air Force.

As the table shows, the available information about munitions falls far short of that deemed necessary for any of the four wartime roles.

Without knowing the geographic distribution of ammunition stocks or requirements, the only role the CINC/J-4 can fulfill to a very useful degree is role 4, acting as an agent or advocate for the theater, primarily in requesting resources beyond those already allocated to the theater.

POTENTIAL DEVELOPMENTS FOR MUNITIONS

The CINC/J-4 staffs obviously need more and different information about munitions in and en route to the theater. They also need corresponding analysis and projection capabilities.

Enhanced Information

At a minimum, the components' munitions stocks and anticipated consumption should be distinguished across geographic subdivisions of the theater, not simply theaterwide. This could reveal to the CINC and the CINC/J-3 areas where there may be flexibility to undertake a more ambitious strategy or areas where ammo-conserving operations should be planned. It might enable the CINC/J-4s to identify situations in which reallocations of ammunition across geographic subdivisions or Service boundaries (or both) might be more effective or efficient than awaiting replenishment from a Service whose forces in an area are especially short of ammunition.

Because impending replenishments might alleviate existing or impending ammunition shortfalls, the CINC/J-4s should also have information about ammunition resupply coming into the theater or under way between regions within the theater.

Further, estimates of consumption for the major categories of munitions should be available by (short) time intervals for the theater's different regions. The CINC could then consider different COAs that might use available munitions more advantageously, and estimates of consumption would allow checks on the DOS figures themselves.

The DOS calculations performed by the theater components in exercises and war games rely on planned consumption rates (factors such as the EPSFs) and on order-of-battle information (weapon platform counts) that ignore possible deviations resulting from recent combat experience. Actual wartime expenditure rates for some munitions could be much higher than expected, for example, or more platforms might be available if enemy weapons prove less effective than expected. The CINC/J-4s should require that the DOS (or other) summary information they receive

in wartime always be based on explicit assumptions and that all changes in those assumptions or factors be reported.

Finally, information about remaining threats or targets should be incorporated into POR measures for TO weapons. Inevitably uncertainty about the number of threats or targets remaining will exist—for example, because the enemy may try to hide or rejuvenate threats or targets, or because U.S. or allied commanders may report combat results somewhat inaccurately. Nevertheless, we believe incorporating *some* dynamic information into POR measurements beyond mere changes in U.S. ammunition stocks would be beneficial. Without such improvements, the POR figure is directly proportional to the number of TO weapons remaining, and there is no reason to calculate and report it separately.

Incorporating and integrating these types of additional information would primarily improve the CINC/J-4s' abilities to monitor theater logistic capabilities (role 1).

Enhanced Knowledge and Analytic Capabilities

We have already noted how information about the potential for one Service to use munitions held by another Service could help the CINC/J-4 identify opportunities for cross-leveling ammunition stocks among the Services—possibly making feasible the CINC's current operational plans or opening up for consideration additional COAs. Short of this, the CINC/J-4s could simply forward information among the components about their changing holdings of common munitions items, or it could provide the components with full information about their ammunition commonalities and rely on them to share their resources. This information would promote the fulfillment of role 2—coordinating logistic resources with planned operations.

A rough capability for estimating the requirements for the major types of ammunition dictated by a stated COA would be especially useful to the CINC/J-4s. As we have stated, we do not favor replacing the Services' fine-grained assessments of COA requirements and supportability by equally fine-grained assessments at the unified command level. Rather, we believe the CINC/J-4s should be able to perform quick, fairly coarse evaluations of COA feasibility, both to facilitate COA explorations by the CINC and the CINC/J-3 (probably eliminating many COAs that might otherwise need evaluation by the components) and to provide "sanity checks" of requirements statements and feasibility assessments developed by the components.

An important key in making this capability practical would be developing a straightforward way of converting broadly stated COAs into opera-

tional information specific enough to drive rough determination of resource requirements.

The mirror image of such a capability is the capability to translate information about ammunition stocks and resupply into information about the types and quantities of operations that could be supported. This would represent an important step beyond even the improved status summaries suggested above. In Sec. VI, we return to this topic briefly and suggest one conceptual way of organizing and using this translation capability.

We cannot end this section without noting that numerous concepts—and even systems—already exist that should be reviewed carefully and exploited to develop the capabilities we suggest here. The Services have systems with many of these capabilities, but generally they embody more detail than is practical or desirable for CINC/J-4s. Planned upgrades to GUARDS should undergo review. The joint operational planning system (JOPS) uses the movement requirements generator (MRG) to compute nonunit-related cargo (movement) requirements for OPLAN time-phased force deployment data.⁸ The MRG uses logistic-planning factors to translate information about force size, combat intensity, attrition, duration, and so on into resupply requirements, but in detail inadequate for the purposes noted above. The logistics capability estimator (LCE) in JOPS does the same thing for generic “force modules.”⁹ Relevant concepts have been proposed for the joint operational planning and execution system.¹⁰ A PPBS-oriented ammunition planning system has been developed to a prototype stage.¹¹ The AMCCOM has an ammunition distribution system (ADS) model that simulates ammunition distribution from CONUS depots and production plants to overseas theaters—including storage, requisitioning, CONUS truck and rail shipment, trans-ocean shipping by air and sea, and within-theater movement to the forward ASPs.¹² And JS/J-4 has developed a microcomputer-based ammunition requirements generator (ARG) for use during time-sensitive planning, especially when dealing with sensitive, closely held operations.

None of these systems should be expected to serve the precise purposes that would be developed in designing explicit capabilities along

⁸See AFSC Publication 1, *The Joint Staff Officer's Guide*, Sec. 809.

⁹*Ibid.*, Sec. 808.

¹⁰See Systems Research and Applications Corporation, *Munitions Analysis Process J008: Logistics Information Requirements*, Arlington, Va., April 1986.

¹¹See Synergy, Inc., *Horizontal Integration: An Overview and Demonstration*, Washington, D.C., July 1987.

¹²Readiness Directorate, AMCCOM, *Ammunition Distribution System*, Rock Island, Ill., August 1985.

the lines outlined in this report; they have been designed for different purposes or contexts. But some of their *principles* and *data* may come fairly close to the mark.

V. SPARE PARTS: CURRENT SITUATION AND POTENTIAL IMPROVEMENTS

Paralleling the previous two sections on POL and ammunition, this section describes how spare parts are currently managed and outlines some potential information and decision support improvements to assist CINC/J-4s in fulfilling the wartime roles Sec. II described. Whereas the previous two sections each concentrated on a single commodity, this section discusses both the spares "commodity" and the associated repair capabilities because the two directly relate to one another and, more important, to end-item availability.¹

THE SPARE PARTS AND REPAIR DOMAIN

Spare parts (supply class IX) include a wide variety of items—from complete engines to the spark plugs, gaskets, and filters that comprise engines. Spare parts obviously may be very large or small, very expensive (such as aircraft avionics "black boxes" that may cost hundreds of thousands of dollars), or inexpensive. In total, more than a million different spare parts for U.S. military equipment in a theater of operations may exist.

We can categorize spare parts in different ways. First, there is usually an indentured relationship between parts in a hierarchy. In one nomenclature, line-replaceable units (LRUs) are at the top of the indentured hierarchy. An engine or a navigational set is an LRU. At the end item (such as an aircraft), faults are diagnosed down to the LRU level, and LRUs are typically removed and replaced by organizational-level maintenance personnel. The LRU itself is composed of numerous shop-replaceable units (SRUs). For example, engine SRUs include the carburetor, fuel pump, and starter; navigational-unit SRUs include printed circuit boards (PCBs). Faulty SRUs within a removed LRU are usually diagnosed and replaced by intermediate-level maintenance personnel. These personnel may be part of a support unit, such as an Army maintenance battalion or on a Navy tender, or they may be assigned to an operating location, such as an air base. At the lowest level of the indentured hierarchy are bits and pieces. For example, a carburetor is composed of various nuts, bolts, and other minor parts;

¹Readers familiar with the nature and management of spares and repair can proceed directly to the subsection "Fulfillment of the CINC/J-4 Wartime Roles."

PCBs are composed of resistors, transistors, and capacitors. Bits and pieces are used to repair faulty SRUs, usually at rearward intermediate maintenance facilities or at maintenance depots.

Two other ways to classify spare parts are according to whether they are consumable or repairable and whether they are used by more than one Service. Being larger and more expensive, LRUs are usually repairable; SRUs may be repairable or consumable largely depending on their cost. Bits and pieces are almost always consumed. Most spare parts are unique to a single Service. However, some items of equipment, and therefore spare parts, are in the inventory of more than one Service. For example, trucks are used by all four military Services, and many trucks use similar tires, filters, and spark plugs.

Table 5.1 shows the number of repairable and consumable secondary items managed by each Service and distinguishes between single-user and multiple-user items. Besides spare parts, secondary items also include bulk items and material (for example, sheet aluminum, steel plate, and textiles) and expendable minor items (for example, soap, bandages, and canned goods). The vast majority of the expendable minor items are centrally managed by the DLA. More than 10 percent of both the consumable and repairable items are used by more than one Service.

Many logistic resources, such as ammunition and fuel, are consumed when they are used and can be replaced only by additional materiel. Consumable spare parts are like this too. But an important subset of the total spares domain can be regenerated through repair actions. For repairable spare parts, knowing not only what the current inventory is but also how quickly repair organizations can fix broken parts to replenish the inventory is important.

There are basically three levels of repair and maintenance actions: organizational, intermediate, and depot.² Organizational maintenance is typically performed by individual operating units; it involves minor corrective and preventive maintenance actions plus the removal and replacement of failed components. Organizational maintenance interacts with supply organizations to request replacement parts and to turn in failed components.

Intermediate maintenance, as its name implies, is between the organizational (operating) level and the depot or contractor. One intermediate maintenance unit typically serves several operating units. Intermediate maintenance interacts primarily with supply organizations: it receives

²Army ground units are supported by two sublevels of intermediate-level maintenance—direct support and general support. The Marine Corps distinguishes five levels of maintenance for nonaviation units.

Table 5.1

COUNTS OF SECONDARY ITEMS, BY TYPE, COMMONALITY,
AND SERVICE

Managing Service	Consumable Items		Repairable Items	
	Total	Multi- Service	Total	Multi- Service
Army	235,115	60,709	112,422	26,413
Air Force	758,024	74,636	110,014	3,876
Navy	446,824	38,170	144,994	11,170
Marine Corps	3,046	1,243	724	63
Total ^a	1,443,009	174,758	368,154	41,522

SOURCE: Logistics Systems Analysis Office, *Allocation of Secondary Items in Wartime*.

^aThese figures do not include the 2,604,217 consumable items managed by the Defense Logistics Agency, of which 803,259 are multiuse items.

failed components from supply organizations associated with operating units and sends the repaired components back to them.

Spare parts that cannot be repaired at the intermediate level are sent to the depot level for repair. Maintenance capabilities increase as one moves from the organizational to the intermediate to the depot level because of the maintenance personnel's increased skills, the more sophisticated test and diagnostic equipment, and the more substantial and permanent facilities.

Organizational and intermediate maintenance are typically in the theaters of operations. Intermediate-level maintenance is typically either part of a combat organization (as with an Air Force wing or a Navy aircraft carrier) or a separate organizational unit or facility (such as Army division and corps support units or centralized, shore-based Navy organizations). Depot facilities are typically in the CONUS, although depotlike capabilities may exist in the theater.

The Services differ in the level—intermediate or depot—at which the same type of spare part is repaired. The Air Force and Navy are more likely to repair components within the theater (at the intermediate) level, while the Army is more likely to send a similar component to the depot for repair. Differences in the designated level of repair are

usually related to the size and scope of the repair facilities the individual Services have within the theater. The more maneuver-oriented Army units typically do not have available the permanent types of facilities that exist in the Air Force and Navy.

SPARE PARTS ORGANIZATIONS AND ALLOCATION MECHANISMS

Each Service has a centralized organization that controls the procurement and distribution of spare parts and monitors unit or base spare parts asset levels. The overall pool of spare parts is divided into (1) retail assets spread among units and operating locations, and (2) wholesale assets maintained in reserve to fill requisitions from the retail level when inventories fall below stockage objectives. A portion of wholesale stock is designated as war reserve materiel, for use only in time of war. Wholesale stocks may be positioned within a theater but are usually held at CONUS locations.

Item or materiel managers at the Service logistic or supply organizations oversee the wholesale stock status of a family of spare parts. Those managers' allocation decisions are complicated by the often insufficient (to meet the various wholesale and retail inventory requirements) quantity of available spare parts. The shortfalls can be caused by numerous factors—for example, budget limitations or optimistic predictions of failure rates. Often, item managers must circumvent policy and allocate war reserve stock to maintain weapon system availability rates in peacetime. We note that war reserve materiel (WRM) is also maintained at the retail level in many cases—for instance, in the form of Air Force war readiness spares kits (WRSKs). These reserves can also be tapped in peacetime when parts shortages jeopardize achievement of operating requirements.

As the values in Table 5.1 indicate, many spare parts are used by more than one Service. These multiuser parts are often managed centrally, by an item manager in a specific Service or by the DLA. These managers are faced with demands for scarce assets not only from various units within a given Service, but also from units from different Services. These demands are filled in peacetime on a first-come, first-served basis, but higher priority demands during a given processing cycle (for example, daily or weekly) are filled before routine requests.³

³A good description of the procedures for allocating spare parts and the potential wartime problems of these procedures is contained in Logistics Systems Analysis Office, *Allocation of Secondary Items in Wartime*, Office of the Secretary of Defense, August 1986.

The use of this type of allocation system in wartime can cause two problems. First, high-priority requisitions in one cycle do not compete with lower-priority requests in the previous cycle. That is, the routine requisition from a location not critical to the current combat situation would be filled before the more urgent requisition received later from a unit engaged in combat.⁴ The second problem, often stated by the supply personnel who place the demands on the item managers, is that in wartime numerous units will use high-priority codes for replenishment requests—sometimes higher priorities than are warranted. In these situations, item managers will be unable to distinguish among the competing demands and may allocate spare parts in a less than optimal manner in terms of meeting combat objectives.⁵

The item managers at the inventory control points (ICPs) typically have automated systems that provide visibility of wholesale stock levels and the status of demands from the retail levels. The supply personnel at the retail levels also have automated systems to monitor the status of their local assets. Thus, managers at the highest wholesale ICP level and at the lowest operating location level have good visibility of their assets. Commanders in the theaters, however, both at the Service component level and, to a greater extent, at the unified level, generally lack even coarse asset visibility. A theater commander may know that a problem exists, but may be unaware that it might be solved by providing assets from another location in the theater.

The repair process can play an important role in the Services' ability to fill demands for critical spare parts in a timely fashion. Retail supply organizations at the operating locations interact with organizational and intermediate maintenance organizations, while wholesale supply organizations interact with maintenance depots. Usually missing from all of these interactions, however, is the relationship to and the effect of supply and maintenance actions on meeting operational needs and objectives.

In summary, each Service maintains an inventory of spare parts in the theater in order to keep weapon systems operational. As parts are

⁴But note that parts are not always released automatically to fill routine requisitions. Once stockage drops below specified levels, only priority requisitions are filled without an item manager's manual override. And for certain critical items, every requisition would require an item manager's approval before parts were released.

⁵This problem is being addressed at the Service level (at least by the Air Force), although not yet at the unified command level. In fact, work at RAND by L. W. Miller, J. B. Abell, J. Payne, and C. C. Sherbrooke on the DRIVE algorithm (distribution and repair in variable environments), which is concentrating first on the timely allocation of serviceable spares and scarce maintenance resources at the depots in response to changing priorities and objectives in the operational theaters, is being extended to address this problem within the theaters themselves.

mechanisms for replenishing stocks. First, additional assets can be requisitioned from wholesale stocks, usually held in the CONUS. If the requested spare part is in short supply, the unit may face competition from other units within the theater or from units in other theaters. For some items, this competition may also include other Services or even other nations. The allocation mechanisms for scarce spares currently do not ensure that the most combat-critical request is filled before other, less critical requests. Second, repairable items can be repaired—either within the theater or at depots in the CONUS. Items in the repair pipeline also face competition from other items that use the same repair facilities and personnel. Again, current repair priority procedures do not ensure that the broken part most critical for combat operations is repaired before less critical items.

If adequate numbers of spare parts were available, either within the theater or at the wholesale level, stockage problems would be minimized. Unfortunately, however, budget limitations, inaccurate forecasting, and the uncertainties of wartime guarantee that spare part shortages will occur and, consequently, that mission-incapable weapon systems will exist.

FULFILLMENT OF THE CINC/J-4 WARTIME ROLES

Currently, the CINC/J-4s receive from the Service components information on the inventory status of only a few selected spare parts that are on a critical item list (CIL) developed by the Services and the Joint Staff. The CINC/J-4s apparently have no visibility of the number of operational weapon systems within a Service component (although this information may be known to other members of the CINC staff) or of the particular spare part shortfalls causing major weapon systems to be inoperable.⁶ Finally, they have no ready means to relate the limited information they do receive about spares to weapon system availability rates or combat capabilities. Hence, the CINC/J-4 can scarcely affect the distribution of critical spares or their prioritization for repair—either within the theater or within wholesale organizations.⁷

The Services react in informal ways to the lack of effective mechanisms to ensure that limited spare parts are allocated in ways that best

⁶Naturally, the same is true at the JS level, where the logistic readiness center relies on information from the Service headquarters and the CINC/J-4s.

⁷At the JS level, the Joint Materiel Priorities and Allocation Board is to make decisions on the allocation of critical spare parts in wartime. Because many different types of spare parts could become critical as a war progresses, the number of decisions necessary could become overwhelming.

support unfolding combat objectives. Knowledgeable supply officers learn how to "game" the rigidly structured priority schemes to hasten the resupply of parts they need. However, the allocation process breaks down when too many requirements are placed in the highest priority category. On a local basis, supply personnel from different Services may barter materials or supplies. Such cross-Service sharing in wartime will largely result from the initiative of unit personnel and will, therefore, be limited and relatively unsystematic. However, the prospect is especially poor that any common, critical, high-priced spares that are in short supply will be shared adequately, let alone optimally, without centralized facilitation, perhaps even including coordination and control.

Paralleling similar tables in the previous two sections, Table 5.2 compares the information about spares that is routinely available at USPACOM/J-4 to the information posited in Sec. II as necessary for the four CINC/J-4 wartime roles. The disparity is almost complete, so almost *no* fulfillment of the four roles is currently possible. Powerful arguments favoring this situation exist, however: The sheer number of different spare parts and the Service-uniqueness of their resupply networks suggest that CINC/J-4s would probably be overwhelmed with data, detail, and inevitable confusion if they tried to obtain and use many data of the types listed in Table 5.2. And, conceivably, a greater involvement by the CINC/J-4s could hamper the Services' resupply and repair processes.

Consequently, we do not suggest that the CINC/J-4s should assume an active role in item management or become involved in the Services' spares management procedures. The management of spare part inventories is, and should remain, the responsibility of the individual Services (except in cases where a centralized organization, such as the DLA, has management control). We do suggest, however, that both the Joint Staff and the CINC/J-4 have greater visibility of major end-item availabilities and of the critical spare parts shortfalls that are causing problems. They should also have knowledge and information about spare parts and repair capabilities that are common across multiple Services and, based on the CINC's operational priorities, they should assist the Service components in interacting with the wholesale community and other Services to alleviate critical spare parts problems.

Some other study efforts are addressing aspects of the problems we raise. The Office of the Assistant Secretary of Defense for Production and Logistics has recommended developing a defense materiel allocation

Table 5.2

CINC/J-4 INFORMATION AVAILABILITIES FOR CRITICAL
SPARES AND REPAIRS, BY WARTIME ROLE

	Role 1: Monitoring Logistic Capabilities	Role 2: Coordinating Logistic Support	Role 3: Evaluating Proposed Plans	Role 4: Advocating Theater Needs
Planned operations				
By component and region				
Type	(a)	(a)	Need	Need
Scale	(a)	(a)	Need	Need
Intensity	(a)	(a)	Need	Need
CINC's priorities	(a)	Need	(a)	Need
Relationships between operations and required logistic resources				
	(a)	(a)	Need	Need
Logistic information				
Required resources (anticipated consumption)				
By component	Need	Need	Need	Need
By region	Need	Need	Need	(a)
Available stocks				
In theater				
By component	Need more	Need more	Need more	Need more
By region	Need more	Need more	Need more	(a)
En route	Need more	Need more	Need more	(a)
En route to theater				
By component	Need more	Need more	Need more	Need more
Cross-Service commonalities	Need more	Need more	Need more	Need more
Facilities and capacities	Need more	Need more	Need more	Need more
Transport capabilities	Need more	Need more	Need more	Need more
J-4's capability for performing role				
	Negligible	Negligible	Negligible	Fair

^aNot applicable.

system (DMAS) to replace the current system in use for allocating scarce secondary items (the first-come, first-served system noted earlier).⁸ The

⁸The DMAS concept is an outgrowth of the Logistics Systems Analysis Office's study, *Allocation of Secondary Items in Wartime*; the concept is outlined in an attachment to a memorandum from the deputy assistant secretary of defense (Logistics) dated May 19, 1987. (This DMAS should not be confused with the Dyna-METRIC microcomputer analysis system in use throughout the Air Force's tactical operating commands.)

DMAS would automate and improve the timeliness and effectiveness of the materiel allocation process by providing a screening mechanism to augment the current issue priority designators to identify the most combat-critical requests. Another study⁹ has addressed the logistic information for decision support in the joint operational planning and execution system. This effort identifies information systems in all the Services that track the types of data JOPES requires. Finally, the Logistics Directorate of the Joint Staff has efforts under way to update and automate the CINC critical item list and to develop decision support software to support the Joint Staff and the CINC/J-4 in prioritizing CIL inputs.

These ongoing study efforts are important and promise to provide necessary improvements to the materiel allocation system in wartime. The DMAS effort, if developed and implemented, could advance the CINC/J-4s' fulfillment of role 4, acting as an agent/advocate to non-theater logistic organizations. However, the DMAS does not currently appear to have much support within the joint community, and no efforts are under way to begin developing the proposed priority mechanisms. The overall JOPES effort may eventually result in a very sophisticated and complex system for joint logistics planning and execution, but the actual fielding of the system—especially the parts concerned with wartime execution and management—will not occur for several years. Also, the sheer number of different spare parts and the Service-uniqueness of their resupply networks suggest that CINC/J-4s may be overwhelmed with data and detail when these systems are implemented, perhaps to such a degree that involvement by the CINC/J-4s will actually hamper the Services' resupply and repair processes.

POTENTIAL DEVELOPMENTS

The vastness of the spares and repair "universe" argues against involving the CINC/J-4s substantially in its detailed monitoring or management, whether in peacetime or wartime. Nevertheless, we believe two levels of potential involvement for the CINC/J-4s merit consideration by the joint community. The first would consider the changing list of critical spares that are causing or might soon cause low levels of weapon system availability. The second would step up one level and focus on those weapon system (major end-item) and mission availabilities.

⁹Systems Research and Applications Corporation, *Material Analysis Process: Logistics Information Requirements*, Arlington, Va., July 1986.

Tracking Spares and Repairs

For conventional ammunition, we recommend in Sec. IV that the CINC/J-4 staffs coordinate the distribution of information on cross-component commonalities and substitutabilities; that they receive, consolidate, and distribute information on theater and in-transit stocks of critical and common items; and that they use such information to direct the redistribution or redirection of ammunition to support planned operations. However, because the variety of spare parts is so much larger and because the CINC/J-4s are virtually uninvolved in spares and repair management and decisionmaking today, we cannot recommend the same level of involvement here. Nevertheless, we propose that unified staffs at least consider the following two tasks:

- **Compile and promulgate information on cross-Service commonalities and compatibilities with respect to the spare parts and repair capabilities currently considered critical to the theater's war-fighting capability.** This activity should be conducted in peacetime; the results would be for the components' use during wartime. The objective is to give each component explicit knowledge of the parts it might obtain or the repair assistance it might request on an emergency basis from its companion components in the theater.
- **Report the components' changing holdings of those critical common items and repair capabilities to the other components in the theater.** The CINC/J-4s would serve as conduits between the components, passing each component information about the other components' holdings of the spares it judges "critical." Information describing changing repair capabilities could also be collected and exchanged. Clearly, the components could exchange such information without the CINC/J-4s, but the exchange will likely be much more thorough and consistent if the CINC/J-4s serve as "clearinghouses."

If these two developments were to undergo implementation, the CINC could use the resulting information to direct cross-component assistance. This task's potential size can be assessed only after the commonalities and compatibilities are identified. Each Service already keeps special track of the dynamic list of spares that currently limit its weapon system or mission availability. To focus CINC/J-4 attention on coordinating cross-component assistance by giving them access to these lists for their theaters would thus be natural.

Weapon System and Mission Availability

Information about the quantity and types of spare parts available is not very meaningful to a combat planner when it is considered in isolation. Of greater importance is a measure of end-item availability and how that availability is affected by the absence of required spares. A unit may have an abundance of spare parts, but if it is missing a single critical part, a weapon system may be unable to perform one or more of its missions.¹⁰

Short of involving them in data and management related to specific spare parts or repair capabilities, two developments would enable the CINC/J-4s to exert useful influences on such management. These we can recommend with considerably more confidence.

Track system and mission availability rates. In many ways, end items can be viewed on the same level as POL and munitions—all are required to perform operational missions. The objective of this development would be simply to keep the CINC staffs routinely informed of the numbers of weapon systems capable of performing missions of different types. Many weapon systems (for example, ships and aircraft) are designed to perform multiple missions. When such a weapon system is not fully mission-capable (NPMC), it may still be capable of performing one or more of its intended missions. This is why we suggest tracking mission availability rates, not just weapon system availability rates.

In wartime, unit and parent commanders will report remaining weapon system or platform counts routinely in daily situation reports (SITREPs). The CINC/J-3s will receive aggregated versions of these reports. In peacetime, such data are submitted in frequent status of resources and training system (SORTS) reports. These reports *ostensibly* would become even more frequent in wartime, but the prevailing view is that SITREPs would carry the burden instead.

Information about mission availability rates would also be helpful both in monitoring theater logistic capabilities (role 1) and in assessing proposed operations or COAs (role 3). This development would compile such information for only the then-current situation, thus building up a history of availability rates and not requiring the components to report availability projections regularly. At a minimum, this would provide at least baselines that the CINC and the operations staff couldn't expect the components to exceed by very much in pursuing either current operational plans or potential new ones.¹¹

¹⁰Units classify their weapon systems using categories such as fully mission-capable (FMC), partially mission-capable (PMC), and not mission-capable due to the lack of supply (NMCS).

¹¹A much more ambitious option would require the components or Services to project weapon system/mission availability rates into the near future, providing insight into shortfalls or improvements that could affect operational plans. Some computational methods now exist for making such projections, taking into account changing operations,

Assist in translating the CINC's operational objectives into support goals for the components. In practice, this could be as simple as checking to see that the components and their supporting Services are working to achieve system and mission availability rates consistent with the CINC's unfolding operational plans. For example, plans may require many more air-to-ground missions in two weeks' time and many fewer air-to-air missions. That should shift priorities for spare parts resupply, redistribution, and repair toward those aircraft and subsystems required for air-to-ground missions.¹²

Ideally, the supporting supply, distribution, and repair organizations would derive their priorities from changing operational availability objectives designated by the components' own operations planners.¹³

In summary, we recommend for spare parts (and implicitly for repair and end items) only the third and fourth developments outlined: assisting in translating the CINC's operational objectives into support goals for the components, and tracking system and mission availability rates. We make this recommendation because we believe these developments would require less burden on the components, less development time, and less routine operating effort than the others. The potential benefits and costs of pushing ahead with the other developments need further discussion and assessment. A necessary first step would be to identify the extent of parts and repair commonalities or interchangeabilities among the components.

stocks, and repair capabilities, but they would need to be augmented by information about weapon system attrition and replenishment. (For example, see K. Isaacson and P. Boren, *Dyna-METRIC Version 5: A Capability Assessment Model Including Constrained Repair and Management Adaptations*, The RAND Corporation, R-3612-AF, August 1988.) This would obviously be a longer-term development—one that would require substantially more effort from the components than from the CINC/J-4s.

¹²This is an important element of a concept that RAND has labeled "CLOUT." This concept also chooses supply, distribution, and repair actions in view of current asset status, availability objectives, and projected availability rates rather than relying on rigid, categorical priority schemes.

¹³A RAND project ("combat support command, control, and communication, CSC3") for the Air Force is seeking straightforward ways of eliciting dynamic availability objectives from information operations planners can provide conveniently.

VI. SUMMARY AND RECOMMENDATIONS

We believe that preoccupation in the joint logistic community with peacetime responsibilities has prevented thorough delineation of the roles, responsibilities, and procedures necessary for wartime, especially at the unified command level. Many specialized reporting procedures and some decisionmaking authorities (the latter mainly in bulk fuels) that the CINC/J-4s would use in wartime are in place, but by and large they are extremely coarse and provide only weak support for the unified commanders' wartime decisionmaking about then-current or proposed operational plans or about the use of the CINCs' directive authority over logistics.

From our review of documentation and from interviews with component and joint staffs in both logistics and operations, we identify four distinct roles the CINC/J-4s should fulfill in wartime:

- Monitoring current and evolving theater logistic capabilities (primarily to track the changing supportability of operational plans).
- Coordinating logistic support with current and planned operations (through active direction and/or [re]allocation of logistic resources).
- Advising the CINC about the supportability of proposed operations and COAs (estimate critical logistic resource requirements and assess the feasibility of meeting them).
- Acting as the agent/advocate to nontheater logistic organizations.

We emphasize that the CINC/J-4s now have capabilities that enable them to fulfill parts of these roles, but that (1) the capabilities are not consistent across logistic resources or across unified commands, (2) important information is missing (for example, about the geographic distribution of resources and the commonalities of resources among Service components), and (3) the mechanisms for handling information need considerable improvement. Table 6.1 summarizes our qualitative assessments of how thoroughly the CINC/J-4s can fulfill the four wartime roles for three types of logistic resources. These assessments are based largely on observations at USPACOM (for all three resource areas) and at USCENTCOM (for ammunition).¹

¹The criticisms implicit in the evaluations this table summarizes should not be viewed as peculiar to any particular command. We believe any flaws in current systems result much more from the traditional limitations of the joint environment in general than from differences among unified commands.

Table 6.1

QUALITATIVE ASSESSMENTS OF CINC/J-4s' CURRENT
ABILITY TO FULFILL SUGGESTED WARTIME ROLES

Wartime Role	Logistic Resource		
	Bulk Fuels	Conventional Ammunition	Spare Parts
1. Monitoring theater logistic capabilities	Good	Poor	Negligible
2. Coordinating support with upcoming operations	Good	Poor	Negligible
3. Advising CINC about supportability of proposed operations or courses of action	Poor	Poor	Negligible
4. Acting as agent/advocate to nontheater logistic organizations	Good	Fair	Fair

The situation is relatively good with respect to bulk fuels, probably because relatively few types of fuels exist, they are handled separately from other commodities, and the wholesale portions of the fuels supply system are managed jointly. Relative strengths in the bulk fuels area include the CINC/J-4s' (1) visibility of the geographic distribution of fuels across the theater, of incoming resupply, and even of fuels stocks outside the theater; and (2) ability to manage actively the distribution of fuels (including the last-minute loading of fuels at CONUS ports, the redirection of en-route shipments, and cross-leveling among fuels terminals within the theater). The major weakness in the fuels area is the CINC/J-4s' inability to estimate quickly the fuel requirements implied by a proposed COA.

The CINC/J-4s' abilities to fulfill the wartime roles are lower in conventional ammunition and spare parts because in these areas, the CINC/J-4s have less complete information and less current ability to influence the distribution or use of available assets. Information about and allocation of repair capabilities would be an important adjunct in the area of spare parts.

The upshot of the assessments reflected in Table 6.1 is that in wartime, the CINC/J-4s could not (1) inform the CINCs or the CINC/J-3s as rapidly, objectively, or effectively as possible about the supportability of

current OPLANs or potential COAs, or (2) routinely influence the distribution of logistic resources to maximize the likelihood of achieving the CINCs' operational objectives.

For the same three logistic resource areas, Table 6.2 summarizes the additional information judged necessary to support one or more of the CINC/J-4 wartime roles. We reemphasize that we do not recommend duplicating at the CINC/J-4s the detail and volume of data that the

Table 6.2

CINC/J-4 INFORMATION NEEDS IN THREE LOGISTIC RESOURCE AREAS

Technical Development	Logistic Resource		
	Bulk Fuels	Conventional Ammunition	Spare Parts ^a
Planned operations			
By component and region			
Type	Need	Need	Need
Scale	Need	Need	Need
Intensity	Need	Need	Need
CINC's priorities	Need	Need	Need
Relationships between operations and required logistic resources	Need	Need	Need
Logistic information			
Required resources (anticipated consumption)			
By component	Has	Need	Need
By region	Has	Need	Need
Available stocks			
In theater			
By component	Has	Has	Need more ^b
By region	Has	Need	Need
En route	Has	Need	Need
En route to theater			
By component	Has ^c	Need	Need
Cross-Service commonalities	Has	Need more	Need
Facilities and capacities	Has	Need more	Need
Transport capabilities	Need more	Need	Need

^aThe term *need* in this column reflects needs only in case the joint community elects to have the CINC/J-4s undertake for some set of spares (and repair) the same wartime roles as for fuels and ammunition.

^bStocks are known only for spares on the critical items list.

^cEn-route fuels are generally designated as bound for specified fuels terminals, not necessarily for individual service components.

components maintain and use to provide logistic support to their combat forces. That would be expensive and counterproductive. Instead, we recommend seeking suitable aggregations of detailed component data in five dimensions: time, geographic areas, organizational levels, combat operations, and materiel subcategories. The aggregations might differ from one wartime role or logistic resource to another. In some cases (especially, under role 4, when requesting additional resources for a component in the theater—for example, ammunition, spares, or repair), the components' detailed data could be used directly, and, just as is the case today, the data would need to be passed to the CINC/J-4s only for small subsets of total resources and only in cases of special need.

To enable the CINC/J-4s to play their wartime roles more fully, we recommend that the roles be spelled out more clearly in JCS Publication 2 (*Unified Action Armed Forces*) and Publication 3 (*Joint Logistic Policy Guidance*). These articulations should specify the types of decisionmaking (and the decisionmaking authorities) the CINC/J-4s must support in wartime and the types of information they should collect and use to provide that decision support. Certainly the joint community might choose to define the CINC/J-4s' wartime roles somewhat differently from the ways this report suggests; the important thing is to specify them clearly and authoritatively.

Regardless of any formal efforts by the joint community to clarify the CINC/J-4s' wartime roles, we believe that several technical developments are necessary to improve the CINC/J-4s' wartime functionalities. Table 6.3 lists seven such developments and shows the resource categories for which they should be considered. Relatively more developments are suggested for conventional ammunition because (1) more of the necessary capabilities are already in place for bulk fuels, and (2) the number, detail, and complexity of spare parts (and corresponding aspects of their associated repair) argue compellingly for limiting the CINC/J-4s' involvement therein. All these developments are suggested to improve the CINC/J-4s' reporting and assessment capabilities; in some cases they could also enable the CINC/J-4s to take a more active role in ensuring the simultaneous fulfillment of the components' logistic resource requirements in wartime.²

Estimating resource requirements for proposed operations or COAs (development 6a in Table 6.3) and translating information about available stocks and incoming resupply into information about supportable operations (development 6b) are essentially mirror images of each other. The inputs of one are the outputs of the other. A useful way to

²A delineation of the specific dynamic data, relatively stable knowledge, and analytical tools to relate them is in Schank et al., *Enhancing Joint Capabilities*, which documents work completed in a subsequent phase of this research.

Table 6.3

TECHNICAL DEVELOPMENTS NECESSARY TO IMPROVE CINC/J-4
WARTIME FUNCTIONS

Technical Development	Logistic Resource		
	Bulk Fuels	Conventional Ammunition	Spare Parts
1. Incorporate/integrate information to make status summaries more meaningful	(a)	X	(a)
2. Compile cross-Service commonalities	(a)	X	(a)
3. Track system and mission availability rates	(a)	(a)	X
4. Assist in translating CINC's operations objectives into support goals for components	(a)	(a)	X
5. Evaluate feasibility of meeting stated resource requirements	X ^b	X	(a)
6a. Estimate critical resource requirements for proposed operations or courses of action	X	X	(a)
6b. Translate information on critical stocks and resupply into supportable operations	X	X	(a)

^aNot applicable.

^bThrough a custom-made spreadsheet program, USPACOM already has a trial-and-error capability for evaluating the feasibility of meeting stated requirements for fuels.

consider this duality—and a potentially practical way to exploit it—is in the form of an electronic spreadsheet with sections like those depicted conceptually in Fig 6.1. Structured this way, a spreadsheet conceivably could be shared by operations and logistic staffs. Each could input and receive data peculiar to its own expertise, but the data would be influenced by status and plans in the other's purview. The primary linkage would be the relationships between the characteristics of operations and the associated logistic resource requirements. Again, the key to making such a concept practical would be identifying suitable levels of aggregation (with respect to time, geographic area, organizational level, and so on) for treating both operations and logistic assets.

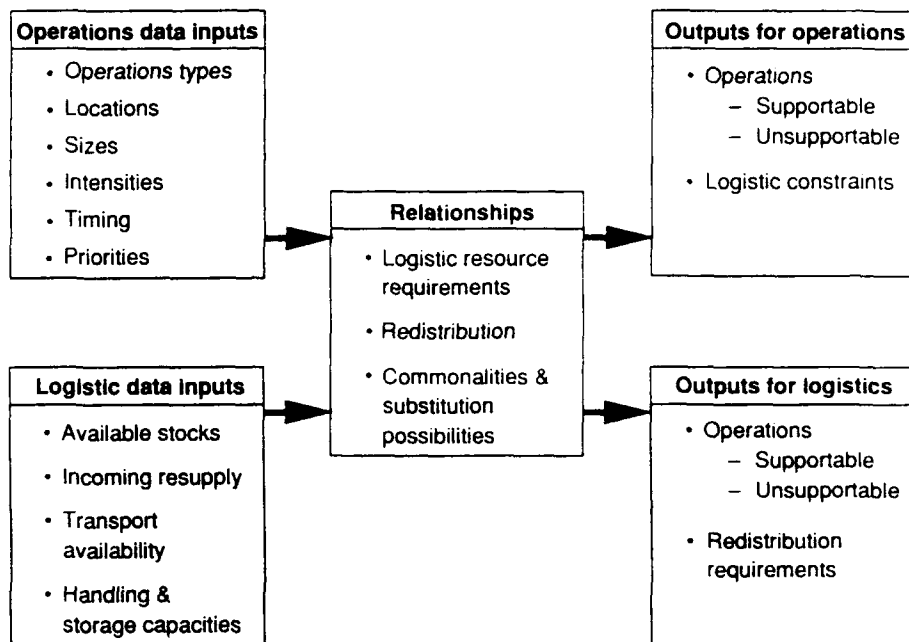


Fig. 6.1—Conceptual elements of a spreadsheet relating planned (or proposed) operations and logistic supportability

To be most useful, of course, this framework should include the range of logistic resources—for example, fuel, ammunition, spares, repair, and distribution. Operations planners have little need to know many specifics about logistics; they mainly need to know whether planned or proposed operations/COAs are logistically supportable and, if not, which portions need reconsidering. Clearly, this requires assessing supportability across logistic resources, considering both materiel and (probably, in most cases) the means of servicing and/or delivering—that is, providing—the materiel. We believe the logistic staff's assessments and its interactions with the operations staff—all in support of the CINC—would be much more useful (and interesting) if they clearly addressed the changing scope of operations and their supportability through time, instead of simply describing the current availability of materiel. The assessment framework Fig. 6.1 depicts would also identify logistic redistribution actions required by specified near-term OPLAN—for example, cross-leveling munitions among components or

regions, redirecting incoming supplies, or even altering the priorities for shipments from CONUS.

Thus, in addition to the developments we have outlined for the three categories of logistic resources examined so far, we recommend two additional undertakings: (1) examination of the unified commands' capabilities to exert wartime command and control over their distribution systems (including materiel handling, storage, and transport), paralleling this report's evaluations for bulk fuels, conventional ammunition, and spare parts (and, to a degree, repair); and (2) design of a practical and rapid way of integrating wartime reports and assessments for individual resource categories into evaluations of the overall supportability of specified operations/COAs.

REFERENCES

- AFSC Publication 1, *The Joint Staff Officer's Guide*, Sec. 809.
- Cook, W. H., et al., *JOPEs POL Analysis Process: Development of POL Analysis Prototype*, Systems Research and Applications Corporation, Arlington, Va., January 1987.
- Defense Logistics Agency, *Defense Fuels-Supply Center Fact Book—Fiscal Year 1987*, Alexandria, Va.
- Isaacson, K., and P. Boren, *Dyna-METRIC Version 5: A Capability Assessment Model Including Constrained Repair and Management Adaptations*, The RAND Corporation, R-3612-AF, August 1988.
- Joint Chiefs of Staff, *Dictionary of Military and Associated Terms*, Publication 1, January 1986.
- Joint Chiefs of Staff, *Joint Logistic Policy Guidance*, Publication 3, December 1987.
- Joint Chiefs of Staff, *Joint Reporting Structure*, Publication 6, Vol. 2, Part 13, Change 2, March 22, 1982.
- Joint Chiefs of Staff, *Unified Action Armed Forces*, Publication 2, August 1986.
- Joint Tactical Command, Control, and Communications Agency, *Joint Tactical C3 Architecture for Combat Service Support: Requirements for Inter-Service Coordination*, JTC3A Publication 8008, Fort Monmouth, N.J., October 1987.
- Logistics Systems Analysis Office, *Allocation of Secondary Items in Wartime*, Office of the Secretary of Defense, August 1986.
- National Defense University, *Guidebook for Exercise of Authority*, August 1986.
- NATO Logistics Handbook, Senior NATO Logisticians' Conference, Secretariat, NATO Headquarters, Brussels, June 1989.
- Readiness Directorate, AMCCOM, *Ammunition Distribution System*, Rock Island, Ill., August 1985.
- Richardson, J. D., Jr., and C. F. Stocky, *Aviation Fuel Forecasting at Base Level Using Programmed Air Force Flying Activities*, AFIT/GLM/LSM/84S-61, Air Force Institute of Technology, September 1984.
- Synergy, Inc., *Horizontal Integration: An Overview and Demonstration*, Washington, D.C., July 1987.
- Systems Research and Applications Corporation, *Material Analysis Process: Logistics Information Requirements*, Arlington, Va., July 1986.

Systems Research and Applications Corporation, *Munitions Analysis Process J008: Logistics Information Requirements*, Arlington, Va., April 1986.

Thomson, James L. H., III, *A Look at the Corps Level Bulk POL Supply System*, Defense Logistics Systems Information Exchange 48588A, June 1980.

Van Rooy, L. A., Jr., "Defense Fuel Region Pacific: Management of Commercial Fuel Supply Support," *The Navy Supply Corps Newsletter*, July/August 1987, pp. 21-22.