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Options for Improving Computing and Data System Support for HQ USTRANSCOM Deployment Planning

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Printed in the United States of America. Available from
National Technical Information Service
U.S. Department of Commerce
5285 Port Royal Road, Springfield, Virginia 22161
NTIS price codes—Printed Copy: A04; Microfiche A01

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ORNL/TM-10913
Dist. Category UC-32

ENERGY DIVISION

OPTIONS FOR IMPROVING COMPUTING AND DATA SYSTEM SUPPORT FOR HQ USTRANSCOM DEPLOYMENT PLANNING

1 August 1988

NOTICE: This document contains information of a preliminary nature. It is subject to revision or correction and therefore does not represent a final report.

Prepared for the

Deployment Systems Division
United States Transportation Command

OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee 37831
operated by
MARTIN MARIETTA ENERGY SYSTEMS, INC.
for the
U.S. DEPARTMENT OF ENERGY
under Contract No. DE-AC05-84OR21400

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ABSTRACT

The Decision Systems Research Section of the Oak Ridge National Laboratory (ORNL) is assisting the Deployment Systems Division of the Headquarters, U. S. Transportation Command (HQ USTRANSCOM) with an evaluation of options for improving the computing and data systems support for deliberate and time-critical joint deployment planning. USTRANSCOM, which is a unified command (i.e., personnel are drawn from all the services), was created in the fall of 1987 to consolidate the functions of the former military transportation operating agencies (the Military Airlift Command, the Military Traffic Management Command, and the Military Sealift Command). An important factor in the creation of USTRANSCOM was the possibility of achieving more efficient joint deployment planning through consolidation of the computing and data systems used by the command's strategic mobility planners and operation center personnel.

This report, the third in a series to be produced in the course of ORNL studies for USTRANSCOM, presents options for improving automation support for HQ USTRANSCOM deployment planning. The study covered methods for improving data concepts used in deployment databases, recommendations for extending the life of the Joint Deployment system, and alternatives for integrating HQ USTRANSCOM planning support with systems at MAC, MTMC, and MSC.

OPTIONS FOR IMPROVING COMPUTING AND DATA SYSTEMS SUPPORT FOR HQ USTRANSCOM DEPLOYMENT PLANNING

1. INTRODUCTION

Many JCS exercises and small-scale operations conducted over the past ten years, most notably the Nifty Nugget '78 and Port Call '85 command post exercises, indicated potentially serious shortcomings in the military's ability to plan and execute an overseas deployment. Studies by high-level panels, including the Commission on Defense Management (the Packard Commission), recommended addressing these problems by establishing a unified transportation command with central authority over all strategic lift capability.

In the fall of 1987, the Joint Chiefs of Staff (JCS) carried out the recommendations of these studies by activating the U.S. Transportation Command (USTRANSCOM), with the Air Force's Military Airlift Command (MAC), the Army's Military Traffic Management Command (MTMC), and the Navy's Military Sealift Command (MSC) as components. When USTRANSCOM becomes fully operational in October 1988, JCS tasking calls for USTRANSCOM to assume the responsibilities of the Joint Deployment Agency (JDA), including operation and maintenance of the Joint Deployment System (JDS).

In creating USTRANSCOM, the JCS emphasized the need for integrating deployment planning and execution support systems. To help accomplish this objective, the Oak Ridge National Laboratory (ORNL) is providing technical assistance to USTRANSCOM by identifying opportunities for realigning the automated support for the command's deployment planning support systems. ORNL's studies are being presented in a series of three reports. This report, which focuses on Headquarters USTRANSCOM, reviews the status of deployment data systems and transportation analysis capabilities, analyzes options for changes and new initiatives, and concludes with specific recommendations for actions that will rectify the problems discussed. The material presented in this report covers three general areas: the Joint Deployment System, computing support for transportation analysis, and overall system integration.

Section 2 of this report reviews the portions of USTRANSCOM tasking that require or imply availability of headquarters strategic planning data systems support.

Section 3 presents a short review of operation plan (OPLAN) development as it is now carried out by planners in the deployment community. This material discusses several problems in the planning process that developers of USTRANSCOM information systems should take into account to make sure existing difficulties are not made worse.

Section 4 discusses the status of the Joint Deployment System (JDS), the data system that maintains deployment databases for deliberate and time-sensitive planning and operation support. This section covers how JDS is currently used by the joint deployment community, analyzes some shortcomings, and forecasts its future. Plans for JDS are intimately connected to the status and development of the Joint Operation Planning and Execution System (JOPES), which will eventually replace not only JDS but the JCS's Joint Operations Planning System (JOPS) and Status of Resource and Training System (SORTS) as well.

Section 5 identifies and analyzes proposals for computer support for HQ USTRANSCOM transportation analysis. This presentation includes discussions of mode optimization, closure estimation, deployment estimates, and other topics associated with transportation concept development and analysis.

Section 6 explores opportunities for integrating HQ USTRANSCOM planning support systems with companion systems at MAC, MTMC, and MSC. This discussion covers both existing systems and systems under development.

Section 7 recaps the recommendations presented in the previous sections. The recommendations fall into four general areas:

- improving TPFDD data concepts;
- increasing resources available for JDS maintenance;
- improving capabilities that support transportation analysis; and
- improving interfaces among systems.

2. USTRANSCOM TASKING[1]

Deployment management and strategic mobility planning, described in Sections 2.1 and 2.2 below, are the two major areas of HQ USTRANSCOM's tasking having significant data management and transportation analysis aspects. Each area involves activities requiring automated information system support.

2.1 DEPLOYMENT MANAGEMENT

Wartime traffic management is an important part of USTRANSCOM's responsibility to manage a deployment of forces and materiel. Information system support for traffic management is essential for monitoring plan changes, automated receipt of reports on the use of transportation assets, comparison of actual with planned events, analysis for redirection, and report preparation and dissemination.

The JCS separated USTRANSCOM's wartime traffic management authorization from the corresponding peacetime traffic management functions carried out by MAC, MTMC, and MSC. For example, USTRANSCOM is not involved in traffic management of airlift channel operations or intra-CONUS unit moves during peacetime. Lack of day-to-day involvement in traffic management tends to create gaps in experience that could cause difficulties in HQ USTRANSCOM's ability to attain full traffic management capability in time of crisis. To help compensate for lack of day-to-day traffic management involvement, USTRANSCOM is tasked to compile and analyze, on an ongoing basis, common-user transportation needs related to wartime, JCS-exercise, and peacetime unit movement activities. This activity will not only keep HQ USTRANSCOM current, but will also assist in determining optimum use of transportation assets and facilities.

2.2 STRATEGIC MOBILITY PLANNING

JCS tasking requires USTRANSCOM to exercise authority as a supported CINC to accomplish strategic mobility planning objectives. Under this authority, the Commander-in-Chief of USTRANSCOM has broad authority to ensure availability of OPLAN information for deliberate and time-sensitive planning, and to coordinate

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[1]See Appendix A for the English equivalents of the military acronyms appearing in this report.

dissemination of deployment data during execution of a military operation. USTRANSCOM is authorized to select transportation modes and air/sea ports, consolidate movement requirements, and, with the guidance of the CINC responsible for the plan, establish movement time-phasing.

During the past several years, the joint deployment community has come to rely on JDS to support execution of real-world operations. In recognition of this evolution, the first item listed in USTRANSCOM's tasking is responsibility for operation, administration, and other ongoing support of JDS. Ongoing support includes:

- development of procedures for using JDS in plan development and maintenance,
- responsibility for training deployment planners and their support staffs in use of the system,
- development and refinement of policies and procedures to ensure current and accurate deployment databases,
- specification of the level of data detail, and
- specification of requirements for interfaces with other data systems.

Because of the planned transfer of JDS functions to JOPES, JDS itself is now on minimum maintenance status; new and improved capabilities for deployment planning and execution support are not being planned for inclusion in the present system. However, USTRANSCOM is tasked to address needs for computer systems to support strategic mobility planning. The results, to be submitted to the JCS as an ADP master plan, are to present a single, integrated system that supports plan development, maintenance, modeling, and execution for all members of the deployment community.[2]

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[2]The final version of this document will discuss how present and planned systems fit into the ADP Master Plan.

3. THE OPLAN DEVELOPMENT PROCESS

The scope of new or revised joint planning activity is normally initiated by the publication of a revised Joint Strategic Capabilities Plan, a document that tasks unified or specified commanders with developing or changing operation plans in complete format (OPLANs) or concept format (CONPLANs). The three major steps in development or revision of an operation plan are concept development, plan development, and formal JCS plan review.[3] During concept development, work by the supported CINC's planners includes an identification of force types and concepts for moving forces and their sustaining supplies. In the succeeding plan development step, subordinate and supporting commands flesh out the concept with proposals for tactical employment and details relating to mobilization, strategic transportation, and logistics of resupply.

3.1 CONCEPT DEVELOPMENT

During the concept development phase, joint staff planners formulate a broad concept of operations, which identifies proposed courses of action, types of forces required (in notional format), and intended force employment. This work results in an OPLAN in concept format (CONPLAN) that is made available to other members of the joint deployment community. In certain cases, the joint planning tasking may call only for development of a CONPLAN. After the concept of operations is documented, it is reviewed by JCS for validity of assumptions and for compliance with original tasking and guidance.

3.2 PLAN DEVELOPMENT

During plan development, joint staff planners begin to work with their counterparts in Service components, supporting commands, and agencies to develop detailed force lists and time-phase them in a manner consistent with the CINC's concept of operation. The

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[3]Because formal plan review does not ordinarily involve USTRANSCOM planning staff, it is not discussed in this presentation.

availability of detailed lists initiates transportation analysis for personnel and accompanying cargo, replacement personnel, sustaining supplies, supply buildup, resupply, and civil engineering and medical support. Participating planners also complete the replacement of notional force data with actual force identifications (i.e., the requirements are sourced).

Most joint planning involves the proper statement and solution of a complex transportation problem involving movement of personnel and cargo from multiple origins (mainly in CONUS) across thousands of miles to a theater of operations. The problem is constrained by limited availability of transportation assets (airplanes, ships, transportation equipment, etc.) and capability of transportation facilities (origin, intermediate, and in-theater airport and seaport throughput). Once force requirements have been time-phased and sourced, joint staff planners process the working TPFDD through the JOPS Transportation Feasibility Estimator (TFE) to determine gross transportation feasibility and identify shortfalls in meeting RDDs. Planners deal with late arrivals by adjusting dates and, possibly, time-phasing to try to improve transportation feasibility.[4]

When the joint staff planners are reasonably satisfied with the working TPFDD transportation concept, USTRANSCOM converts the data for force requirements, unit and nonunit cargo, replacement personnel, etc., into transactions suitable for creating a JDS deployment database. This deployment database is then made available to planners throughout the joint planning community for TPFDD refinement.

The plan development step ends with TPFDD refinement conferences hosted by USTRANSCOM for all involved organizations. The Phase I conference concentrates on data regarding force requirements and nonunit cargo and personnel; the Phase II conference focuses on the transportation aspects of the plan. For refinement of a large plan, a third conference, which is dedicated to logistics issues, is often included between the usual Phase I and II conferences.

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[4]Details of this process are presented in Section 3.3.2.

The plan refinement process is described in detail in the following paragraphs to make clear the importance of JDS in disseminating working TPFDD data to MAC, MTMC, and MSC for development of carrier schedules and movement tables.

By the time a Phase I conference is convened, the supported CINC's staff will have developed an OPLAN concept of operations, including a general statement of forces required and areas of operation; constructed an initial TPFDD; and, using the JOPS TFE, determined gross transportation feasibility. Also, the CINC's staff is likely to have sourced critical parts of the force requirements. The objective of the Phase I conference is to develop a preliminary, but fully sourced, TPFDD, including both units and their resupply.

About one week after the Phase I conference, supporting commands expect to receive a TPFDD from the supported CINC in machine-readable form. During the 60 days immediately following the conference, USTRANSCOM component commands prepare informational copies of movement tables, which are exchanged with other supporting commands and with the supported CINC's planners.

After the supporting commands have had time to prepare and coordinate movement tables based on the data from the Phase I conference, a Phase II conference is called to produce a transportation-feasible plan. At the Phase II conference, USTRANSCOM planners are expected to discuss combined transportation requirements and any shortfalls, and to obtain approval from the supported CINC for the proposed closure profile. If necessary, working groups are established to resolve problems by adjusting APOE/SPOE selections, ship schedules, EAD/LAD windows, resupply origins, and origin outloading capability. If significant changes are made, USTRANSCOM component commands may be tasked to flow the requirements through their schedulers again. Finally, movement tables are made available to the supporting commands and other organizations requiring transportation schedules.

3.3 OPPORTUNITIES FOR IMPROVING THE PLAN DEVELOPMENT PROCESS

Although the present OPLAN development process produces usable results, it is complicated, time-consuming, and not always sufficiently complete to plan a commitment of transportation assets. Sections 3.3.1 through 3.3.3 present several proposals that could make the process more efficient and more appropriate for use in time-sensitive situations.

3.3.1 Controlling the Fragmentation of OPLANs

OPLANs vary greatly in size. A common measure of plan size is the number of separate movement requirement records associated with the plan. The number can range from several hundred for small plans to several tens of thousands for the largest plans. Moreover, large plans may be linked together as multiple-plan scenarios, sometimes consisting of over 100,000 TPFDD records.

There has been a steady growth over the past few years in the number of movement requirements used in OPLANs. Just a few years ago, the largest plans on file contained only several tens of thousands of movement records. Now, the same plans have grown two or three times larger. It's not that the plans now involve more strategic moves or forces, but that existing force movements have been stated in ever finer detail. To some planners, more detail means a better plan. To others, the situation is similar to a "forest obscured because of the many trees."

The main concern of many members of the deployment planning community about this situation is that defining movement requirements in ever greater detail does not necessarily help an operator in execution. As the amount of data becomes larger, everyone working with the data finds it takes longer to accomplish every task associated with OPLAN data analysis and reporting.

The tendency to use ever finer detail is a never-ending spiral because increasing the resolution of movement requirements by subdividing them is usually rewarded; reducing the number of records seldom is. As custodian of the JDS, USTRANSCOM system administrators must address the problem of creeping growth in deployment databases.

The best long-range solution would be to identify criteria that, when applied to a specific OPLAN, would indicate whether more detail would result in a better plan. Lacking such measures, the recommended solution is to determine methods for controlling the tendency toward an ever increasing number of records by educating users in the standards for rolling-up requirements of components or by instituting economic incentives.

3.3.2 Alternative Methods for Stating Dates in TPFDD Records

Development of the initial TPFDD from the concept of operation is a critical part of a plan development phase. The concept of operation specifies times at which forces are to be available in the theater of operations in two ways, either as absolute dates (on the fifth day of the operation ...) or relative to a prior or subsequent event (two days after the personnel marry up with their equipment ... / three days before the arrival of the landing party ...).

Because TPFDD records require stating all dates in absolute format, movement dates specified in terms of a sequence of deployment activities must be converted into absolute form. The conversion must result in absolute TPFDD dates that deploy units to the theater as expeditiously as possible, yet still maintain the required sequence of the concept of operations and stay within constraints on transportation assets and facilities. This can be a very time-consuming process, especially for plans with tens of thousands of records. To demonstrate this, the two methods presently used for generating TPFDD dates are described in detail in the following paragraphs.

Planners employ either of two methods in developing TPFDD dates, each based on sequential refinement of estimated RDDs until the movements approximate the flow called for in the concept of operations. Both methods start by assuming an unlimited amount of strategic lift. With this assumption, working values for RDDs are then determined solely on the basis of in-theater activities, strategic-leg travel times, and unit ready-to-load dates (RLD). Using standard travel times, dates for the LAD, ALD, and departure-from-origin are back-calculated from the RDD for each requirement. Next, dates are moved forward as necessary to honor RLDs.

At this point the two methods diverge. One method then flows the requirements through TFE using actual constraints on transportation assets and availabilities. Shortfalls (if any) are analyzed with particular attention given those occurring in the initial part of the plan. A few shortfalls at the beginning of the operation are eliminated by adjusting RDDs forward in a way that preserves the sequence of the concept of operation, and the requirements are again flowed through TFE. The process of calculating shortfalls and adjusting RDDs forward to eliminate them is repeated until an acceptably small number of shortfalls results.

The second method also employs repeated uses of TFE. This method begins by flowing the requirements through TFE to calculate the strategic lift utilization required to meet all delivery requirements on time. If the strategic lift utilization exceeds that actually available, an iterative process begins. First, the strategic lift just calculated is adjusted slightly closer to what is actually available. The requirements are flowed through TFE to calculate shortfalls, which are then eliminated by adjusting RDDs forward in a way that preserves the movement sequence in the concept of operation. The process of adjusting available lift for a TFE run, calculating shortfalls, and adjusting RDDs forward is repeated until the RDDs are met within the constraints on strategic lift.

In either case, RDDs are determined in a stepwise fashion to produce movement requirements that both preserve the required sequence and conform to limitations on transportation assets. Although the iterative process is theoretically sound, it is only marginally practical in routine (deliberate) development of large plans because of the considerable time required to cycle data through the JOPS TFE module. A much greater shortcoming, however, is that the present process precludes any possibility of mass date adjustments during the time-sensitive planning phases of an operation of significant size.

This iterative process could be eliminated, resulting in simplification of the OPLAN development process, if either of two formats were permitted for expressing TPFDD dates. One format would define an absolute date, the day relative to the start of the operation (e.g., C+24) as is presently done. The second type of TPFDD date would be defined with reference to an event or characteristic in the TPFDD of an earlier deploying unit (e.g., a relative date similar to those used in describing the sequence of movements in a concept of operation). The earlier arriving unit could have its date

specified in absolute terms, or could be linked to yet another previously occurring event.

The drawback to this proposal is that the algorithms and procedures used by the joint deployment community for scheduling and transportation analysis would have to be significantly modified. The JOPS TFE module and all of the scheduling systems used by USTRANSCOM component commands (MAC's FLOGEN and ADANS schedulers, MSC's SAIL scheduler, and MTMC's MAPS II scheduler and STRADS prototype) would be greatly impacted. Despite this, the possibility of significant reduction in OPLAN development time should provide sufficient incentive to study the viability of the alternative.

3.3.3 Improving the Concept for Stating Nonunit Cargo/Personnel Movement Requirements

Presently, all shipping to meet movement requirements, both unit and nonunit related, is planned using data stated as individual TPFDD records. The TPFDD concept for defining transportation requirements of unit personnel and cargo is satisfactory. For nonunit personnel and cargo, however, the concept breaks down because of lack of specificity in the data during planning phases.

Nonunit movement requirements are generally stated in terms of frequency (e.g., 12,000 STONs of rations per day), shipping capability (3,000 STONs bulk cargo delivered after the port is established), or both (4,000 STONs outsized cargo per week between Los Angeles and Fiji). In each case, at least one key item of information needed for detailed scheduling is missing, and in the last case the requirement itself is notional and is simply intended as a statement of expected need for transportation services. The logisticians usually cannot accurately supply such detailed data during plan development phases because accurate needs become apparent only as execution proceeds.

Unfortunately, lack of complete information during OPLAN development hampers transporters in planning effective utilization of their transportation assets. The problems are usually resolved when the transporters force the logisticians to supply values for the missing data. Usually, the data is supplied by simply entering values

which are consistent with the frequency or transportation capability to be supplied but otherwise arbitrary. For example, if the concept of operations specifies weekly delivery of 10,000 STONs of rations without stating specific RDDs, any date consistent with "weekly" (e.g., every Friday at noon) is as good as any other. Unfortunately, such apparently arbitrarily determined requirements often result in an awkward allocation of transportation assets. In the above example, movement on Friday at noon is unlikely to be either required by the shipper or convenient for the provider of transportation services.

Because of the lack of complete data for nonunit TPFDD records, many transportation planners tend to ignore the resupply aspect of OPLAN development. However, this omission may prove disastrous in the long run; transportation analysis for resupply is critical to the ultimate success of OPLAN execution.

Rather than base transportation planning for resupply on arbitrarily determined data, transporters should consider using a technique that accommodates uncertainty. For example, MSC must often generate sailing schedules without knowing where ships will be located when the contingency develops, what they will be carrying at the time, etc. MSC copes with this problem by running their scheduler a number of times, each time using different assumptions for the initial locations of the ships being scheduled.

MAC, MTMC, and MSC should consider a similar strategy to deal with nonunit requirements. Planners could run a number of cases through their schedulers, each time supplying a different set of representative values for dates, amounts of cargo, origins/SPOEs, or whatever information is insufficiently specified in the TPFDDs. The results of these runs will provide probable and worst-case scenarios that may develop during execution of the plan. If the results of the runs are retained, the one closest to a developing situation can then be retrieved and tailored to meet time-sensitive planning needs.

Alternatively, nonunit movement requirements could be stated in a format similar to that used in TPFDDs defining unit personnel and cargo movements. Nonunit movement requirements would differ in not stating an RDD, but rather use the EAD-LAD window to define a frequency (daily, every five days, weekly, etc.). The transportation planners

could use such data to establish channel requirements (i.e., an ability to ship cargo of a certain type between a particular POE/POD pair at a certain rate).

4. THE JOINT DEPLOYMENT SYSTEM

Development of the Joint Deployment System, the system that has recently gained widespread acceptance for management of real-world operations, was one of the major accomplishments of JDA.

JDS capabilities fall into two areas. First, the system provides a means for establishing the deployment databases for OPLANS during the final stages of the deliberate planning process. As was discussed in Section 3, supported CINCs depend on JDS as a means for exchanging TPFDDs, beginning with the Phase I refinement conferences and extending to final dissemination of the plan throughout the joint deployment community.

Second, the JDS serves as the essential time-sensitive planning and execution support information system for the joint deployment community. Several recent operations have demonstrated that the system can be used for coordination of deployment data during execution of real-world military operations.

The origins, current status, and shortcomings of JDS are discussed in Sections 4.1 through 4.3. Section 4.4 examines the planned replacement of JDS by JOPES.

4.1 THE ORIGINS OF JDS

The design of JDS was based on the Deployment Management System (DEPMAS) created by the former Readiness Command (REDCOM). Use of REDCOM information system concepts by JDA is not surprising given that all higher positions in JDA were dual-hatted with REDCOM.

Functional requirements for JDS and subsystem specifications for individual JDS subsystems were published in 1985. The requirements and specifications for JDS describe capabilities in 12 areas:

- simultaneous creation, maintenance, and management of exercise and real-world deployment plans;

- conversion of JOPS-created OPLAN or COA deployment data to JDS deployment databases and vice-versa;
- maintenance of deployment databases through use of on-line computer terminals and automated system interfaces;
- automatic update of deployment databases from DOD standard reference files;
- display of deployment information on computer terminals;
- production of hard-copy reports on computer printers;
- automatic generation of alerts to units and installations via AUTODIN messages;
- monitoring of JDS system performance and workload from any major JDS node;
- incorporation of force module concepts;
- improvement of the timeliness and accuracy of deployment information in related deployment information systems;
- provision for development of close-hold OPLANS; and
- provision for computer support for transportation feasibility estimation and mode selection analysis.

4.2 THE STATUS OF JDS

By mid-1985, JDS developers had met virtually all the functional requirements. However, in the opinion of most users, JDS system performance fell short in several key operations areas:

- System availability. Basically the system went down too frequently because of hardware, software, or communication failures, often with no forecast for resumption of normal operation.[5]
- Database integrity. Users would find that their data was garbled, had reverted to a prior version, or was completely missing.
- "User-friendliness." Users complained that the system was very intolerant of human errors, produced cryptic error messages, gave little chance for users to recover from mistakes, and forced retyping of unchanging information during data entry.

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[5]JDS availability/reliability/recovery goals were downtime of less than 8.4 hours per week (1.75 hours per week during crisis or exercise conditions); 36 hours between system failure (10 minutes mean time to repair); one hour maximum time for database recovery.

- System response. During critical periods of heavy use, and especially during exercises and real-world operations, JDS system response would fall off to unsatisfactory levels of performance.[6]

- Computer proficiency. Establishing proficiency in the use of the system was a continuing problem. Most organizations resorted to requiring that their crisis action teams include a computer professional.

By the beginning of 1988, JDS system managers had eliminated the overwhelming majority of user complaints about system availability and database integrity. The remaining problems (lack of user-friendliness, system response, requirement that a user must be a skilled computer technician) are still problems, especially when the system is used for JCS-exercise and real-world contingency support.

4.3 JDS SHORTCOMINGS

The inability of JDS developers to adequately correct the remaining system problems can be traced to constraints arising from several early design decisions:

- JDS is written mainly in COBOL, an implementation language not noted for its applicability to real-time database management systems. Moreover, JDS is written in an obsolete version of COBOL, not the current ANSI standard. Few, if any, present day developers of commercial online database management systems consider COBOL to be a suitable software environment for a system like JDS.

- JDS is based on the Integrated Data Store database management system, with explicit links connecting all data together to form a single, large structure. IDS was a state-of-the-art technique when developed by General Electric in the 1960s. Today, relational database management techniques make possible systems that can be implemented as a series of parallel modules with data relationships and definitions that can be updated easily and quickly.

- Lack of modularity in JDS generally causes even the most trivial change to involve review and recompilation of many parts of the system. This, in turn, results in a significant test and verification requirement.

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[6]JDS response time goals are one minute maximum for TPFDD data presentation, 30 seconds for deployment data review, and 5 seconds for presentation of data update and display screens.

- The JDS design uses Honeywell-provided general-purpose software to implement the user-interface screens for video display terminals. Inefficiency in the software that implements the screens is a major cause of system response degradation when many interactive users are logged on during exercises and real-world contingencies.

- The JDS JSIT subsystem for ad hoc summaries, retrievals, and data presentation is generally not usable by planners. As an indication of JSIT's weakness, deliberate planners prefer to use the JOGS subsystem, which is "guerrilla" (unauthorized) software developed by the JDA's Deliberate Planning Branch, rather than use the authorized JSIT subsystem.

Addressing these design problems would involve a rewrite of the system, a significant task that would be difficult to justify given the planned replacement of JDS. For this reason, JDS system managers are asking users to live with the present situation, basically forcing users to accept the status quo until JOPES becomes available.

4.4 REPLACEMENT OF JDS WITH JOPES

JDS was conceived as a stop-gap system, developed with the intent to minimize the time to produce an operational system. Little emphasis was placed on careful, reasoned planning to generate well-thought-out specifications and implementation strategies. In part, JDS was allowed to proceed pell-mell toward operational status because the JCS had authorized the concurrent development of JOPES, which will integrate deliberate planning, time-sensitive planning, and execution support within a single system.

Although development of JOPES began in 1981, no operational capability has yet been produced. In fact, functional requirements are still being written. Part of this delay is intentional because key elements of JOPES (interactive user work stations and local area networks) are dependent on hardware features being developed for WIS, the upgrade to the networked computers supporting military command and control. Nonetheless, many involved with joint planning find it surprising that seven years of development have resulted in essentially nothing but paper.

So far, the first two increments of the transition to JOPES have been defined. Increment I will integrate existing planning and deployment systems. The target is to

provide current capabilities with new user interfaces, database managers, and computer-to-computer communications. This increment will be fielded in three releases.

- Release 1 will concentrate on providing a single, consistent user interface for the systems being subsumed by JOPES.[7] As few changes as possible will be made to the systems that accomplish the actual functions. In this release, naming conventions will be standardized across all the systems through means of a common data dictionary.

- Release 2 will incorporate WIS database management and networking software.

- Release 3 will complete the transition to the WIS environment for systems to be incorporated into JOPES. Mainly this involves replacement of COBOL software with Ada and WIS database management utilities.

In Increment II, JOPES developers will begin to upgrade the mobilization, employment, and sustainment capabilities. Implementation of the remaining deliberate planning, time-sensitive planning, and execution support will occur in later increments.

The 1985 plans for JOPES called for Increment I to be operational by the end of 1987 and Increment II by the end of 1991. However, because funding for WIS and JOPES programs was significantly "stretched out" in FY88, Increment I is now scheduled for completion in 1993 and Increment II in 1994.

Meanwhile, planners in the deployment community have raised concerns about three important issues relating to the implementation of JOPES. The first concern is whether Ada is an appropriate language for implementing JOPES application software. Critics continue to ask the question, "If Ada is so good, why isn't it being used for commercial applications such as airline scheduling, fund transfer systems, telecommunication system management, and other real-time information systems that are somewhat similar to WWMCCS?" The answer is probably that Ada is not as attractive for these applications as off-the-shelf systems such as Oracle, INGRES, DB2, and other currently-used development platforms.

Second, JOPES and the companion development of WIS represent an enormous effort that will require hundreds of millions of dollars to accomplish. Even if the technical

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[7]JOPES is intended to incorporate functions now provided by JDS, JOPS, SORTS, and Pub 19 systems (WWMCCS).

work is completed on schedule, it is questionable whether the military can afford to provide the required WIS system features in the timeframes on which JOPES Increment II is dependent.

Third, the design of JOPES gives many indications that it will exacerbate the need for highly skilled computer professionals to accomplish even the most straightforward tasks. The situation with JDS and JOPS is very poor now and will probably get a lot worse when JOPES is implemented.

These concerns aside, the expected delays in fielding JOPES have a serious implication. JDS is on minimum maintenance status so that users can expect no further improvements to the system. It is in the interest of JOPES system managers, naturally, to continue this situation to give as much impetus as possible for completing JOPES. Whether the JDS user community will be able to tolerate this situation until 1994 (and possibly later, given the tendency of JOPES schedules to "stretch out") is debatable.

Given the current situation with regard to the implementation of JOPES, USTRANSCOM should evaluate the possibility of upgrading JDS support to extend its operational life well into the 1990s. Continuing to rely on JDS for years to come without responding to user needs for application and system enhancements could lead to significant execution support shortfalls.

5. DATA SYSTEMS FOR TRANSPORTATION ANALYSIS

To carry out its responsibilities in traffic management and strategic mobility planning, HQ USTRANSCOM requires computer support for a number of types of transportation analysis:

- lift optimization (including mode selection);
- closure estimation;
- transportation concept development;
- gross transportation feasibility estimation;
- analysis of movement consolidation options;
- identification and analysis of time-phasing adjustments;
- estimation of transportation asset and facility usage;
- deployment flow analysis; and
- redeployment analysis (reflow and planning during execution).

Moreover, many of these analyses must take place in both deliberate and time-sensitive planning situations.

Because HQ USTRANSCOM was so recently created, it currently has only one major computer-based analysis tool at its disposal. This is the Deployment Analysis Prototype, the microcomputer-based demonstration system that evolved from the now-defunct MODES subsystem of JDS.

Section 5.1 discusses the development history and capabilities of the Deployment Analysis Prototype. Section 5.2 deals with transportation needs for which other systems must be developed.

5.1 THE DEPLOYMENT ANALYSIS PROTOTYPE

Two responsibilities specifically named in USTRANSCOM's JCS tasking are mode selection and closure estimation. The Deployment Analysis Prototype is an ADP tool that can be used to accomplish these analyses for deliberate and time-sensitive deployment planning. To understand the objectives of the prototype, it is useful to review the requirements and development of its predecessor, the Mode Optimization and

Delivery Estimation Subsystem (MODES) of JDS.

5.1.1 Mode Optimization and Deployment Analysis Requirements

Development of MODES was initiated because of the need to:

- rapidly determine gross transportation feasibility, including deployment estimates for use in a course-of-action phase of contingency planning;
- determine deployment constraints and optimize lift utilization;
- apportion lift assets;
- estimate deployment routes and flow; and
- evaluate multiple deployments.

To these were added requirements for data management utilities:

- user interface and database management modules for use with movement requirements, model parameters, and options data;
- management-oriented output graphics for use with interactive display devices; and
- tabular data report generators for use with high-speed line printers.

5.1.2 The Channel Analysis Algorithm

The MODES developer's design to meet the requirements presented above was basically a three-stage channel development and analysis tool. In the first stage, data was aggregated in preparation for the second stage, analysis by a type of global linear programming (LP) optimization known as a Benders decomposition. (Aggregating movement requirement data having common characteristics by time-periods can be thought of as a transformation of a scheduling problem into a channel-determination problem.) Finally, the results of the analysis were used to create data for individual TPFDD records.

To begin the first stage, an analyst divided the period spanned by the movement requirements of interest (obtained from JDS) into a number of intervals. Individual movement requirements were then assigned to the time interval most representative of the movement.[8] Next, movement requirements having a time interval and all other key characteristics (POE/POD pair, cargo category, etc.) in common were aggregated. As an option, movement requirements could be further aggregated by replacing groups of POEs or PODs with "regional port designations." Aggregation was necessary because of the large size of the LP problems when stated in terms of movement requirements.

The second stage of the algorithm, which used the Benders decomposition to determine what cargo aggregates were to travel over what routes, was an iterative process. The first step of the process was to determine candidate channels and assign transportation assets to them. Next, aggregates of movement requirements were assigned to the channels just developed, and shortfalls in meeting delivery dates were calculated. The candidate channels and assignment of transportation assets to them were then adjusted to better meet delivery dates, and shortfalls were redetermined. These two steps were then repeated until the changes to channel definitions were smaller than a given predefined criterion.

Users were permitted to choose the objective to be met in calculating the deployment flow. There were three choices: close as quickly as possible regardless of early delivery constraints; close requirements before each requirement's latest delivery date at the POD; and close within individual earliest date/latest date windows at the PODs.

In the third stage of the algorithm, the dates and routing data for each aggregate of movement requirements were assigned to all the individual moves making up the aggregate. This assignment completed the TPFDD record data for individual movement requirements.

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[8]The assignment of individual movements to "representative" intervals (e.g., assignment by RDD, ALD, or by the interval comprising the majority of the travel time) was a difficult transformation that troubled many potential users.

5.1.3 Status of MODES

In the summer of 1987, work to implement MODES as a module of JDS was suspended because severe difficulties were encountered:

- Data preparation was an extremely complex procedure.
- Operational control of the calculation was also complex.
- There were many cases of incorrect results thought to be caused by inappropriate or misapplied use of the optimization theory in the computer programs or by faulty software implementation.
- Inexplicable differences were found between deployment flow estimates made by MODES and flows determined by the detailed scheduling systems used by the TOAs (i.e., FLOGEN, MAPS II, SEACOP).
- TPFDD data was often aggregated (in time and geographically) in an inexplicable manner.

In short, MODES users could not produce consistently usable results.

5.1.4 Genesis of the Deployment Analysis Prototype

After studying the MODES situation in detail, JDS system managers decided to redirect resources toward developing a demonstration prototype as a proof-of-principle for mode determination and lift optimization algorithms. The demonstration prototype, called the Deployment Analysis Prototype, was to operate on an AT-class microcomputer. Specifications for the prototype, issued in the summer of 1987, called for it to have user interfaces for entering and editing movement requirements, a preliminary estimator, a lift optimizer, a delivery optimizer, and a user interface for presentation of results.

As implemented, the prototype follows a three-stage procedure similar to that of MODES, but appropriately scaled down to microcomputer size. Thus, for purposes of aggregation by the estimator, the amount of TPFDD data is limited to 20,000 records, lift assets are limited to seven aircraft types (five for cargo, two for passengers) and five ship types, and the division of the time horizon is set to 12 equal periods.

Based on the aggregated requirements, the prototype uses a global LP optimization to calculate mode, estimated time of cargo and passenger delivery, port workloads, and aircraft and ship utilization rates. Finally, each of the original TPFDDs is updated by assigning to it the route and schedule calculated for the aggregation of which it is a part.

Presently, all parts of the demonstration prototype are operational. Current work on the prototype involves:

- improving the graphics for the user interfaces for both data management and presentation of results;
- adjusting the optimization algorithms to make the tool more suitable for time-sensitive planning;
- accommodating "what if" analysis such as "how much lift is required to close the plan as required?" and "what fraction or how much cargo can move given the available lift resources?"; and
- exploring the use of heuristics in the lift optimizer.

Long-term objectives for the prototype are to:

- add a database manager;
- standardize the system software (the present version uses six different software packages and languages);
- develop maintenance and support utilities;
- add simulation capability; and
- convert the demonstration prototype into an operational prototype within JDS.

5.1.5 The Future of the Deployment Analysis Prototype

The Deployment Analysis Prototype appears to have settled questions regarding the applicability of global linear programming to lift optimization of a deployment flow problem. However, other basic questions from the MODES experience remain to be answered:

- Can deployment planners master the data preparation requirements and operational control of a subsystem based on the Deployment Analysis Prototype?

- Can the Deployment Analysis Prototype be scaled-up to handle most types of real-world problems?

- Can the entire set of original MODES functional requirements be met?

- Can the Prototype be tuned to support both deliberate and time-sensitive analysis needs in a single subsystem?

- Will deployment planners accept transportation analysis results based on the Deployment Analysis Prototype's underlying constraints (aggregation of movement requirements by regional ports, limited number of time periods, etc.)?

- Are deployment estimates of the Deployment Analysis Prototype acceptably close to deployment flows calculated using detailed scheduling?

5.2 OTHER HQ USTRANSCOM TRANSPORTATION ANALYSIS NEEDS

Of the transportation analysis needs listed in the introduction to this section, only a few are being addressed by the Deployment Analysis Prototype. USTRANSCOM must develop capability to perform other analyses to support the responsibilities assigned to them.

5.2.1 Monitoring/Analysis of Shippers Data and Transportation Operations

JCS tasking to USTRANSCOM includes an ongoing responsibility for compiling and analyzing wartime, JCS-exercise, and peacetime unit movement transportation forecasts. To meet this responsibility, HQ USTRANSCOM must have appropriate data systems for monitoring, aggregating, and analyzing the planned movements of shippers and the operational capability of USTRANSCOM transporters. Data to accomplish the monitoring is available from two sources. During wartime and JCS-exercises, data on shippers' requirements and transportation capability is available in JDS deployment databases.[9] Peacetime unit-move forecasts can be obtained by tapping the rating/routing, airlift shipping requests, and export release information being exchanged between shippers and USTRANSCOM components.

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[9]Certain critical data, such as actual departure from origin and movement of cargo through ocean terminals, is not yet available in JDS (cf. Section 6.4).

Systems for carrying out analyses of the forecasts must still be developed. The required analyses include lift optimization, movement consolidation, and transportation asset and facility usage estimation.

5.2.2 USTRANSCOM Analysis Toolkit

MAC deliberate planners and crisis action team personnel are enthusiastic about their MAC Planners Toolkit (MPT), a set of microcomputer programs that provide gross analysis for transportation concept development, closure estimates, transportation asset utilization, etc.

HQ USTRANSCOM should explore the possibility of using the concept to develop a USTRANSCOM planners toolkit for answering questions related to sea/air mode determination decisions, CONUS surface/sealift asset utilization issues, generation of alternative closure profiles, etc. Modules in the toolkit could be used for a variety of situations occurring in deliberate and time-sensitive planning. For example, during a course-of-action analysis, the supported CINC may task USTRANSCOM to determine, in a matter of a few hours, how much shipping is required to send an additional tank battalion, or whether the plan is still viable if all nonunit cargo is sent by sea after C+20. Like the MAC Planners Toolkit, HQ USTRANSCOM COA analysis tools should be designed to produce an answer with accuracy dependent on the amount of time given to develop the result. In other words, analysts should always be able to produce a result regardless of time allocated for consideration, and increasingly better answers should be obtainable as more time is available for study.

5.2.3 Rapid Cycling of Plan Data through Component Command Schedulers

One of the shortcomings of using a channel analysis model such as that used in the Deployment Analysis Prototype is the difference of its deployment estimate from closure estimates produced by detailed schedulers. The rationale for developing the Deployment Analysis Prototype was that the prototype should be able to produce deployment estimates in time frames far shorter than those needed by detailed schedulers operating on individual movement requirements.

Now that MAC, MTMC, and MSC have plans to develop schedulers that produce answers quickly, USTRANSCOM should consider using component command's systems as a supplemental method for obtaining closure estimates. The new schedulers, which are based on improved algorithms, produce considerably better results than their predecessors and often require less calculation time. By using improved interfaces for providing requirements and obtaining results, results should be available in the same timeframes previously associated with the time required for providing off-the-cuff estimates.

Even if component command schedulers are usable for producing closure estimates in situations permitting several hours to develop results, other situations may preclude involvement of component commands because of a close-hold situation or because time frames are too short for involvement of another organization, regardless of how fast results can be obtained. For these reasons, the need will still exist for an HQ USTRANSCOM deployment estimation analysis capability such as that provided by the Deployment Analysis Prototype.

6. INTEGRATION OF DEPLOYMENT PLANNING DATA SYSTEMS

ORNL's first study for USTRANSCOM surveyed the deployment planning systems now being operated or under development at MAC, MTMC, and MSC. The following table presents the names of these systems by types of application and operational status.

	MAC	MTMC	MSC
Systems Currently Operational			
Deliberate Planning			
Quick Analysis	MPT	JDS	JDS
Scheduling	FLOGEN	MAPS II	SEACOP
Time-Sensitive Planning			
Quick Analysis	MPT	JDS	JDS
Scheduling	FLOGEN	-	-
Monitoring	JDS	JDS	JDS
Operations Support			
Monitoring	-	JDS	CEFARS
Systems Under Development			
Deliberate Planning			
Quick Analysis	GDSS	STRADS	-
Scheduling	ADANS	STRADS	MOPEX
Time Sensitive Planning			
Quick Analysis	GDSS	STRADS	-
Scheduling	ADANS	STRADS	MOPEX
Monitoring	GDSS	GDSS	-
Operations Support			
Monitoring	GDSS	-	-

The major initiatives now underway in the component commands are the ADANS scheduler and GDSS execution support systems at MAC, the STRADS system at MTMC, and the MOPEX system at MSC.

USTRANSCOM component commands are making significant improvements to their planning systems, which is generating new needs for exchanging data and results. The following sections present several situations that USTRANSCOM must coordinate to make sure that HQ USTRANSCOM initiatives for new systems are consistent with changes occurring in the component commands.

6.1 INTEGRATION OF MTMC/MSC DEPLOYMENT PLANNING SYSTEMS

In a study of opportunities for integrating USTRANSCOM component command planning systems, ORNL compared new procedures now being implemented for planning CONUS surface/sealift moves with those previously used. Up to now, MTMC has always scheduled the CONUS surface move first, then supplied MSC with ALDs and SPOEs for determination of sealift schedules. MTMC's first step determines ALDs, which are calculated from the LADs and preferred SPOEs for movement requirements (both supplied to MTMC in the OPLAN TPFDD), standard tables for sailing times between SPOEs and SPODs, and port throughput capacities. MTMC then develops departure-from-origin dates for the CONUS leg of moves by back-calculating (using standard CONUS movement times and taking into account origin outload capacity) from the LADs determined in the prior step. To check consistency, RLDs for movement requirements are compared with the date of departure from origin to make sure the schedule does not call for departure before the unit is ready to move. After the consistency check is performed, MTMC adds the schedule information to the TPFDD records, which are then supplied to MSC for sealift scheduling.

MTMC and MSC planners have been working to improve the quality of plans for CONUS surface/sealift moves. One initiative currently being implemented streamlines the interface between MTMC and MSC systems by giving MSC the ability to schedule sealift first, after which they supply their results in "generalized" form to MTMC for scheduling the origin-to-SPOD move. The new process uses the concept of a "port complex," which is a group of ports in close proximity with one another. For example,

the Texas ports of Lake Charles, Orange, Beaumont, Port Arthur, Baytown, Houston, Galveston, Freeport, and Corpus Christi are all defined as part of a Houston port complex. MSC first establishes sealift schedules from port complexes to SPODs, then MTMC schedules the CONUS portion of moves to individual ports, attempting to honor the port complex data developed by MSC on a record-by-record basis.

Procedures for scheduling CONUS surface/sealift are likely to continue to change because everyone involved agrees that better sealift planning can be achieved through use of a single scheduler to determine the entire move from origin to SPOD. If this were done, all constraints associated with the flow (i.e., origin outloading capacity, availability of CONUS transportation assets, SPOE throughput, vessel availability, lift capability and positioning) would be considered simultaneously by the scheduler.

HQ USTRANSCOM should consider extending the new MSC MOPEX scheduler to meet the requirement for a single scheduler for CONUS surface/sealift moves. The rationale for this recommendation is that the most difficult part of CONUS surface/sealift scheduling is determination of ship itineraries and port workloads. MSC's MOPEX scheduler presently uses MTMC-provided ALDs and SPOEs data for when and where the cargo is available for shipment. By substituting RLDs and origins for ALDs and SPOEs, and taking into account times for movement from origin to SPOE, the MSC scheduler could determine strategic surface moves from origin to SPOD.[10]

6.2 SEQUENCE OF AIRLIFT AND SEALIFT SCHEDULING

Mode determination in deliberate planning is currently a two-step procedure that first attempts to use airlift to meet movement requirements. When airlift capacity is exhausted, remaining requirements are designated for sealift. The steps are performed in this order because FLOGEN has been able to produce results much more rapidly than MSC's SEACOP, allowing planners to have something to work with as soon as possible. Developers of MSC's new planning systems have suggested reversing the present

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[10]Although extending the MSC scheduler from the SPOE to origin appears simple conceptually, a number of details would have to be worked out, such as the level of detail needed for scheduling and the interrelationship between types of cargo outloading simultaneously and total outloading capability.

procedure. Requirements, except those specifically marked for airlift, would first be flowed through the sealift scheduler. Any requirements not scheduled for delivery on time would be combined with those marked for airlift, and the combined set run through MAC's airlift scheduler. If there were shortfalls in the airlift scheduling, the planner might consider adjusting sealift assets and repeating the cycle. Basically, this process is an implementation of the maxim, "send everything by sea except for the cargo that can't get there on time."

Adoption of this proposal would improve lift utilization in large plans. The degree of improvement should be evaluated to determine whether the concomitant radical change in procedures is warranted.

6.3 ADDING MOVEMENT REQUEST/TRANSPORTER OPERATIONS DATA TO JDS

Although accommodation is made in JDS TPFDDs for both planned and actual dates and times for events, few if any transportation operators (organic or common-carrier) ever supply the "actual" data because the operators do not have systems that can supply reports with the record keys necessary for updating the deployment database.[11] However, new execution planning and operations support systems, such as MTMC's ASPUR and MAC's GDSS, should be able to link plan identifiers (which may be classified) with detailed transportation requests (keyed by TCN) and operator reports to produce transactions suitable for updating "actual" event data in a JDS deployment database.

The main difficulty in accomplishing integration of operations support systems like ASPUR and GDSS with JDS is the latter's minimum maintenance situation. Thus, it is unlikely that "actual" date/time information will be used to update JDS deployment databases until JOPES is a reality.

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[11]Most common-carrier operations are conducted in unclassified areas and have no ability to process data keyed by a classified TPFDD record identification number.

6.4 COMMINGLING MOVEMENT REQUEST AND DELIBERATE PLAN DATA

Assuming JDS system managers succeed in making transportation officer's movement requirement data available for update of deployment databases, care should be taken to make sure that plan data is identified as to whether it is data resulting from the deliberate planning process or updated data furnished by a transportation officer in connection with a rating/routing request or request for air transportation. If no provision is available for identifying the source of planning data (as is now the case with JDS), reports on lift requirement summaries could result in adding coarse requirements from deliberate planning with refined estimates from movement requests without any indication that the sums involve numbers with radically different degrees of resolution.

7. SUMMARY

HQ USTRANSCOM has an important role in deployment management and strategic planning for military operations. To discharge its responsibility to manage a deployment of forces, USTRANSCOM must have computer support needed to monitor and analyze shipping requirements and traffic operations reports. An essential element of maintaining its ability to quickly assume full wartime traffic management capability is ongoing involvement in monitoring and analyzing JCS-exercise and peacetime unit move activity.

The Command-in-Chief, USTRANSCOM is directed to exercise authority as a supported CINC for strategic mobility planning over members of the joint deployment community. To support decisions regarding mode and port selection, consolidation of movement requirements, and time-phasing of movement requirements (done with coordination of the CINC responsible for the OPLAN), HQ USTRANSCOM requires appropriate data systems for monitoring and analyzing deployment plans and actions as well as analysis capability for developing transportation concepts, calculating deployment estimates, optimizing lift, and analyzing movement consolidation and time-phase adjustment options.

HQ USTRANSCOM options for improving data systems and analytical support for transportation systems include:

- Reasons for fragmentation of TPFDD records in OPLANs should be analyzed, and proposals formulated for controlling the trend.

- The possibility of defining "linked" RDD data in TPFDDs should be explored to minimize the time-consuming establishment of absolute dates for TPFDD records.

- Alternative concepts to the fixed RDD for nonunit movement requirements should be explored to provide a better basis for estimating transportation resources for nonunit transportation requirements.

- JDS should be pulled off minimum-maintenance status to permit incorporation of improvements required by users in the joint deployment community.

- The Deployment Analysis Prototype should be converted from a demonstration prototype into an operational prototype suitable for use in deliberate and time-sensitive planning.

- Functional requirements for a USTRANSCOM "Planner's Toolkit" should be established.

- Possibility of rapid cycling of requirements data through component command scheduling systems should be investigated.

- Plans to maintain consistency of USTRANSCOM planning systems with the evolution in CONUS surface/sealift planning must be developed.

- Possibility of mode determination by a "sea, then air" procedure should be examined.

- Capability should be provided for adding shippers' movement request data and transporters' operations reports to JDS.

- Provision should be made for distinguishing deliberate plan data from shipping request and transportation operations data in the deployment database.

APPENDIX A.

TERMS AND ABBREVIATIONS

ADANS	Airlift Deployment Analysis System.
ADP	Automated Data Processing.
ALD	Available-to-Load Date. The date a unit or item of cargo will be ready to begin outloading at the POE.
Algorithm	A computational procedure for solving a problem.
ANSI	American National Standards Institute.
APOD	Aerial Port of Debarkation.
APOE	Aerial Port of Embarkation.
ASPUR	Automated System for Processing Unit Requirements.
AUTODIN	Automated Digital Network.
CAT	Crisis Action Team.
C-day	The unnamed day on which movement in a deployment operation begins or is to begin.
CEFARS	Contingency and Exercise File Acquisition/Retrieval System.
CESPG	Civil Engineering Support Plan Generator. An application subsystem of JOPS that helps the planner to determine manpower, equipment, and materiel needed to construct and upgrade facilities that support forces in an OPLAN.
Channel	The capability to move cargo from an origin to a destination during a set period.
CINC	Commander-in-Chief.
Close-hold	Not available for discussion within the deployment community.
Closure	When a supporting command's obligations for moving forces to a theater of employment are completed.
COA	Course of Action.
COBOL	Common Business Oriented Language.

Common-user	Military transportation services provided by the USTRANSCOM component commands to other DOD components under an industrial fund system.
Concept of Operation	A verbal or graphic statement, in broad outline, of a commander's assumptions or intent regarding an operation or series of operations.
CONPLAN	Concept Plan. An operation plan in concept format. An abbreviated plan that would require expansion into an OPLAN or OPORD before implementation. A CONPLAN includes a fully defined concept of operations. Some CONPLANS contain selected annexes and appendices, and even portions of a TPFDD (as may be required by the supported commander), but this is not the normal practice.
Contingency Planning	Planning for major contingencies that can reasonably be anticipated in the principal geographic subareas of the command.
CONUS	Continental United States.
Database	A collection of one or more computer files that represents all the data associated with or supporting the objective of an ADP system. For example, one JOPS database, the TPFDD/SRF, supports each OPLAN. It consists of two files, the Time-Phased Force and Deployment Data and the Summary Reference File.
DDN	Defense Data Network.
Deliberate Planning	Routine development of operation plans as directed by JSCP or other tasking directive using JOPS Volumes I, II, and III procedures.
Deployment Database	The JDS database containing the necessary information on forces, materiel, filler and replacement personnel movement requirements to support plan execution. The database contains information converted from an OPLAN's refined TPFDD, data developed during the various phases of the Crisis Action System, and the movement schedules or tables developed by the TOAs to support the deployment of required forces, personnel, and materiel.
Deployment Estimate	The estimated time required for all the units and nonunit cargo and personnel increments of a JDS deployment database to arrive at the POD(s). The deployment estimate is expressed in days and hours from the time of notification to deploy.
Deployment Flow	The rate at which deploying personnel, accompanying cargo, or nonunit personnel or cargo is moving over channels.
Deployment Planning	That part of operation planning concerned with relocation of forces to the desired area of operation.
DEPMAS	Deployment Management System (REDCOM).
DOD	Department of Defense.

EAD	Earliest Arrival Date. The day and time, relative to C-day, specified by the CINC as the earliest date that a unit, item of cargo, or personnel increment can be accepted at the in-theater port of debarkation. When used with the latest arrival date, it defines a delivery window at the port of debarkation.
ELD	Earliest Date to Load at the POE.
Employment	The strategic or tactical use of forces and materiel within the area of operations.
Execution Planning	The phase of the Crisis Action System in which an approved operation plan or other designated course of action is adjusted and refined to fit the prevailing situation and converted into an OPORD that can be executed at a designated time. Execution Planning can proceed on the basis of prior deliberate planning, or it can take place under a NOPLAN situation.
Feasibility	An operation plan review criterion. To meet this criterion, the plan must assure that the assigned tasks could be accomplished by using available resources.
FLOGEN	Flow Generator subsystem of IMAPS.
Flow	(verb) To produce movement schedules and carrier itineraries for a particular set of movement requirements and availability of lift assets.
Force Module	A group of key combat units, their associated support and sustainment to accomplish a designated function. Force modules can by used to great advantage in time-sensitive planning to reduce time required for sourcing and determining transportation requirements.
Force Requirement	A statement of the forces needed to support a military operation.
GDSS	Global Decision Support System.
Heuristic	An algorithm which uses some key feature specific to the problem being considered to quickly obtain a good, but not necessarily optimal, solution for the given instance of the problem. Heuristics provide a pragmatic way to solve complex routing and scheduling problems that are too difficult to be solved optimally.
HQ	Headquarters.
IDS	Integrated Data Store (data management concept used with Honeywell computers).
IMAPS	Integrated Military Airlift Planning System.
JCS	Joint Chiefs of Staff.
JDA	Joint Deployment Agency.

JDC — Joint Deployment Community. The headquarters, commands, and agencies involved in training, preparation, movement, support, reception, employment, and sustainment of military forces assigned or committed to a theater of operations or objective area.

JDS — Joint Deployment System. The personnel, procedures, directives, communication systems, and computer systems for supporting time-sensitive planning and execution. JDS complements peacetime deliberate planning by providing an efficient means of converting OPLANs to OPORDs and coordinating the exchange of deployment status data during execution of an OPORD.

JOGS — Joint Operations Graphics System Prototype 3.0. A prototype analysis aid developed by the plans division, USTRANSCOM. It is not a command-approved system.

JOPES — Joint Operation Planning and Execution System. The planning and execution system now being developed as the successor to JOPS and JDS. It will integrate deliberate and time-sensitive planning and execution support.

JOPS — Joint Operation Planning System. The DOD-directed, JCS-specified system for global and regional joint military operations planning.

JSCP — Joint Strategic Capabilities Plan. The part of the Joint Strategic Planning System defining the strategic concept of support for national security objectives. By providing guidance to CINCs and the Services on the resources available for accomplishing military objectives, it is used for allocating forces and lift assets available to a particular OPLAN or family of OPLANs.

JSIT — JDS Information Trace. A generalized JDS retrieval system that displays JDS information directly to the display terminal.

LAD — Latest Arrival Date. A date and time, relative to C-day, that the CINC specifies as the latest arrival of a unit, item of resupply, or replacement personnel at the port of debarkation consistent with an OPLAN concept of operation. When used with the EAD, it defines a delivery window at the in-theater port of debarkation.

LCE — Logistics Capability Estimator. An application subsystem of JOPS used to generate estimates of nonunit cargo for units in an OPLAN TPFDD. Selected data elements from the TPFDD and Logistics Factors File are combined to generate the nonunit cargo records.

LLD — Latest Date of Loading at the POE.

LP — Linear programming (a mathematical optimization technique)

MAC — Military Airlift Command.

MAPS II — Mobility Analysis and Planning System, Version II.

Mobilization — The process by which the armed forces or part of them are brought to a state of readiness for war or other national emergency. This includes activating all or part of the Reserve components as well as assembling and organizing personnel, supplies, and materiel for active military service.

MODES — Mode Optimization and Delivery Estimation System.

MOPEX — Mobility Planning and Execution System (MSC).

Movement Requirements — Transportation required to support mobilization, deployment, resupply, and redeployment of forces in a military operation.

Movement Table — A table prepared by the TOAs for each force requirement and each nonunit-related cargo or personnel increment of the TPFDD concerning the scheduled movement from the origin or POE through intermediate location to POD or destination. The table is based on the estimated or planned availability of lift resources and hence is not an execution document.

MPT — MAC Planners Toolkit.

MSC — Military Sealift Command.

MTMC — Military Traffic Management Command.

MTON — Measurement ton. The unit for volumetric measurement of equipment associated with surface-delivered cargo. Measurement tons equal total cubic feet divided by 40 (1 MTON = 40 cubic feet).

Nonunit Cargo and Personnel — All equipment, supplies, and personnel requiring transportation to an area of operations, other than those identified as the unit equipment or accompanying supplies of a specific unit. Nonunit cargo would be required for resupply, military support for allies, and support for nonmilitary programs, such as civil relief. Nonunit personnel would include filler personnel, replacements, temporary duty/temporary additional duty, civilians, medical evacuees, and retrograde personnel.

Notional — Use of a concept having one or more key characteristics which are yet to be specified. For example, a movement requirement record for a notional tank battalion may contain complete data for type cargo, tons to be shipped, dates and locations of the shipment, etc., but lack the unit identification number because the actual unit to be used has not yet been chosen.

Operation Plan — A plan for the conduct of a single military operation or series of connected operations to be carried out simultaneously or in succession in a hostile environment, prepared by the commander of a unified or specified command in response to a requirement established by the Joint Chiefs of Staff. It usually is based on stated assumptions. The term "operation plan" is a generic term that can refer to either an operation plan in

complete format (OPLAN) or an operation plan in concept format (CONPLAN). An operation plan may be put into effect at a prescribed time and then becomes an operational order.

OPLAN	Operation Plan in Complete Format. A plan that can be converted to an OPORD for conducting military deployment and employment operations. A computerized TPFDD for units and their cargo, personnel increments, and resupply is an essential element of an OPLAN.
OPORD	Operation Order. A directive, usually formal, issued by a commander that instructs subordinates to carry out an operation.
Origin	The beginning point of a deployment; the point or station at which a movement requirement is located. For type (notional) requirements, the origin will be the most likely station at which the requirement will originate.
ORNL	Oak Ridge National Laboratory.
Personnel Increments	Nonunit personnel for replacement of casualties, etc.
POD	Port of Debarkation. The geographic point (seaport or airport) in the routing scheme where a movement requirement will complete its strategic deployment. The POD may or may not be the same as the destination.
POE	Port of Embarkation. The geographic point (seaport or airport) in the routing scheme where a movement requirement will begin its strategic deployment. This point may or may not be the same as the origin.
RDD	Required Delivery Date. The date and time, relative to C-day, when a unit or item of cargo must arrive at its destination to support the CINC's concept of operations.
REDCOM	U.S. Readiness Command, a disestablished JCS unified command.
Reflow	Redirection of forces to respond to the needs of a changing military situation.
RLD	Ready to Load Date. The date and time, relative to C-day, when a unit is ready to depart its home station in support of a military operation.
SAIL	Scheduling Algorithm for Improving Lift, a subsystem of MSC's MOPEX.
SEACOP	Strategic Sealift Contingency Planning System.
Shortfall	The lack of forces, equipment, personnel, materiel, or capability - apportioned to and identified as a plan requirement - that would adversely affect a command's ability to accomplish its mission.
SORTS	Status of Resources and Training System.

Sourcing	The process of identifying the actual units, their origins, POEs, and movement characteristics to satisfy the time-phased force requirements of a supported commander.
SPOD	Seaport of Debarkation.
SPOE	Seaport of Embarkation.
Standard Reference Files	Files maintained in WWMCCS and JOPS containing unchanging information, such as the cruise speed of a certain category of ship or the load-carrying capacity and range of a type of aircraft.
STON	Short tons.
STRADS	Strategic Deployment System.
Supported Commander	The unified or specified commander having primary responsibility for all aspects of a task assigned in the Joint Strategic Capabilities Plan (JSCP) or otherwise assigned. The commander has responsibility for developing OPLANS as directed by the JCS.
Supporting Commander	A commander who furnishes augmentation forces or other support to a supported commander or who develops a supporting plan.
TC/AIMS	Transportation Coordinator's Automated Information for Movements System.
TCN	Transportation Control Number.
TFE	Transportation Feasibility Estimator. The JOPS ADP application program that assists planners in evaluating (in a gross sense) the feasibility of the deployment scheme developed in support of an operation plan. The program takes into consideration the desired scenario for deployment of forces, supplies, equipment, and replacement personnel, the available transportation resources (sea and air), facility constraints at ports and aerial ports used for the deployment, and other planning factors bearing on the strategic movement. The program modules interface with the standard JOPS files and the TPFDD file. TFE execution is in four general phases: TPFDD evaluation, simulation preparation, simulation execution, and post-simulation processing.
Throughput	The estimated traffic (expressed as an average daily capability of measurement tons, short tons, and/or passengers) that can be moved into and through a port/aerial port. The total port/aerial port movement capability is a function of reception, discharge, and clearance - the smallest of these is the estimated throughput.
TOA	Transportation Operating Agency.

TPFDD	Time-Phased Force Deployment Data. A computerized file describing detailed dates, locations, characteristics of personnel and material, and other information associated for the transportation of the forces and nonunit cargo and personnel required to support an OPLAN.
USTRANS-COM	United States Transportation Command. The agency that supports the Joint Chiefs of Staff and supported commanders in strategic planning and deployment execution. As directed by the Joint Chiefs of Staff, the USTRANSCOM is responsible for coordinating deployment planning and execution and will act as the focal point for coordinating TPFDD refinement and maintenance of the current, accurate database in the JDS. During execution, USTRANSCOM will monitor the movement of forces deploying by organic lift, and advise the JDC on deployment matters.
WIS	WWMCCS Information System.
WWMCCS	Worldwide Military Command and Control System.

APPENDIX B.

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