

Logistics Management Institute

# Synchronizing Defense Transportation System Reference Files

TR702R1



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*Logistics Management Institute*

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February 1998

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Synchronizing Defense Transportation System  
Reference Files

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## Executive Summary

Automated information systems (AISs) that support Defense Transportation System (DTS) business operations rely extensively on data from other Defense and commercial systems. Most data exchanges use codes instead of full definitions, such as item, location, and other descriptive data. Files containing codes and the corresponding definitions are referred to as *reference files*. Many DTS AISs frequently use outdated reference files. As a result, electronic transactions and documents containing reference file information have data errors that cause those AISs to reject the transactions or report erroneous information.

Recognizing that reference file errors are a common problem throughout DTS, the Assistant Deputy Under Secretary of Defense (Transportation Policy) directed the U.S. Transportation Command (USTRANSCOM) to enhance the distribution and synchronization of transportation-related reference files. Our study provides a strategy for such an enhancement.<sup>1</sup>

Our analysis found a complex environment in which reference files are updated and exchanged in an uncoordinated manner. Frequently, the same reference file is available from several source AISs. In addition, managing file updates is difficult because source and user AISs are operated by several DoD organizations. Consequently, many user AISs do not use the most current and accurate reference files. Efforts to improve the use of reference file information are not coordinated and do not systemically address the problem.

We identified three alternative strategies that could be used to enhance the distribution and synchronization of reference files. They are a distributed systems network, multiple reference servers, and a central reference server. We assessed those alternatives using three criteria—technical merit, program management, and system administration. We eliminated one alternative—distributed systems network—because of its low technical merit and program management ratings. We

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<sup>1</sup> Data processing professionals use the term *synchronization* to identify the condition when the same version of a file is used by all AISs.

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analyzed the costs of the two remaining alternatives and concluded a central reference server would be less expensive.

We recommend USTRANSCOM develop a central reference server to manage the dissemination of reference files from source AISs to user AISs. A central reference server is a technical configuration of hardware, software, and telecommunications components that receives and consolidates current reference files from source AISs in a single location. A central server permits files to be distributed to user AISs using several push-pull telecommunications methods, including the World Wide Web and database replication software.

A central reference server has several advantages. First, it provides "one-stop shopping" for users and guarantees access to a single approved version of each reference file. Second, the central server is the least complex alternative because it establishes one interface between all source and user AISs. Third, it simplifies system administration. Finally, the central server enables the program manager to monitor the dissemination of reference file information. While the program manager cannot ensure that user AISs incorporate the most recent reference files into their business applications, monitoring reference file dissemination will aid in detecting data errors.

USTRANSCOM can implement a central reference server in 3 years. An initial investment of \$4.3 million will be needed to establish the server and enhance source and user AISs. When the server is fully implemented, the operating costs will be \$2.4 million annually. USTRANSCOM, the Military Services, and the Defense Logistics Agency will be responsible for paying the investment and operating costs.

If a central reference server is successfully developed and maintained, most Defense transportation AISs will no longer receive conflicting, outdated reference files from uncoordinated source AISs. Consequently, a central server will significantly reduce DTS reference file errors.

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# Chapter 1

## Introduction

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Automated information systems (AISs) that support the Defense Transportation System (DTS) rely on data from other Defense and commercial systems. To limit the amount of data transmitted and permit automated data processing, those systems use codes as a form of abbreviation. Codes are used in place of full definitions, such as item, location, and other descriptive data. We refer to files containing codes and corresponding definitions as *reference files*. However, many AISs often use outdated reference files. When that situation occurs, data exchange among those AISs often creates errors. For example, when a shipping activity creates a government bill of lading (GBL), it typically uses a Department of Defense activity address code (DoDAAC) to identify the origin and destination of the shipment. The GBL information is used by several AISs, including the Global Transportation Network (GTN), to provide in-transit visibility. If GTN uses a DoDAAC file different from that used by a shipping activity, the GBL will incorrectly identify the location of the items.

*Synchronization* is the term used by data processing professionals to identify the condition when several AISs use the same version of a file.<sup>1</sup> In a memorandum to DoD Components, the Assistant Deputy Under Secretary of Defense (Transportation Policy) recognized a file synchronization problem.<sup>2</sup> That memorandum established the U.S. Transportation Command (USTRANSCOM) as the responsible organization to distribute and synchronize transportation-related reference files for all DTS AISs. USTRANSCOM tasked the Logistics Management Institute to identify and evaluate alternatives for synchronizing reference files.

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<sup>1</sup> The term *synchronization* is not to be confused with *version control*. Version control is a tool used to manage the changes made to software programs, data, and other electronic materials. It is most frequently used by software developers to provide an audit trail of the changes made and the person that made them. Version control also allows two versions of the same information to be compared. Finally, version control provides the capability to revert a file or program to a previous version.

<sup>2</sup> Memorandum for DoD Components, Assistant Deputy Under Secretary of Defense (Transportation Policy), Subject, *Synchronization of Transportation-Related Data Reference Tables*, 20 June 1996. That memorandum states, "Data errors result when automated systems employ different reference tables due to untimely or incomplete table distribution or when table updates are not synchronized across all systems."

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## DEFINITIONS

We use the following terms in this report:

- ◆ *Reference file.* A table of codes that “points” or refers to definitions, other codes, or supplemental data used by more than one AIS.
- ◆ *Synchronization.* The simultaneous use of the same version of a reference file by AISs.
- ◆ *Source AIS.* An AIS that is responsible for disseminating the most recent version of a reference file to other AISs.
- ◆ *Reference server.* A technical configuration of hardware, software, and telecommunications components that receives and consolidates current reference files from source AISs, and distributes or makes them available to user AISs. (A reference server is sometimes identified as a *repository*.<sup>3</sup>)
- ◆ *User AIS.* An AIS that uses reference files obtained from a source AIS or a reference server.
- ◆ *Site.* The physical location of the computer hardware used by source or user AISs.

## MAIN POINTS

We address the following main points in this report:

- ◆ A central reference server offers USTRANSCOM the best opportunity to manage the dissemination of DTS reference files from their source AISs to user AISs. A central reference server
  - provides “one-stop shopping” for DTS users,
  - guarantees access to a single approved version of each reference file,
  - establishes a single interface for all source AISs and is the least complex alternative,
  - simplifies system administration, and

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<sup>3</sup> A repository can include data, metadata (descriptive information about data), and interfaces (access views and application program interfaces). The DoD repositories identified in Chapter 2 include some or all of these functions. In this report, reference servers include only data, although they may include interfaces in the future.

- enables the program manager to monitor the dissemination of the most recent reference file information from source AISs to user AISs and detect data errors.
- ◆ A central reference server is the less costly of the two technically feasible alternatives. It requires a total investment of approximately \$4.3 million and incurs annual operating costs of \$2.4 million.
- ◆ We estimate a central reference server concept, including all source and user AISs, can be fully implemented in 3 years.

## REPORT ORGANIZATION AND SCOPE

This report assesses alternative strategies for synchronizing DTS reference files. The remainder of this report is divided into three chapters. Chapter 2 describes the current environment, including an overview of the reference files and current synchronization initiatives. In Chapter 3, we identify three alternatives for synchronizing DTS reference files and use technical feasibility criteria to assess each one. That chapter also provides a cost analysis of the two feasible alternatives. Chapter 4 presents our recommendations for synchronizing reference files. Finally, several appendixes provide supplementary information, including reference file information, additional cost information, and the implementation tasks to execute the recommended alternative.

We do not address two items in this report because they are outside the scope of our analysis. First, we do not address source data quality. Such an analysis requires addressing the procedures and processes reference file owners use to update their files before distributing them. Second, we do not address standardizing reference files stored at a reference server. Source AISs use a variety of standards and data formats to store reference files on computers. A central reference server must either accommodate multiple standards for storing data or standardize the storage of the data at the reference server. The latter option requires the reference server to convert the data to its original format before distributing it to user AISs.

## Chapter 2

# Current Environment

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In this chapter, we describe the source and user AISs, and the reference files that are used by those AISs. We also provide an overview of the problem and identify ongoing initiatives to improve the dissemination of reference files.

## SOURCE AND USER AISs

We estimate that approximately 30 source AISs are responsible for disseminating reference files to user AISs. Those source AISs vary in sophistication—some use state-of-the-art computers, telecommunications, and relational databases; others use outdated systems with minimal technical capabilities. In addition, we estimate that 50 to 100 commercial sites own commercial files used by user AISs, further complicating the distribution of reference files.

User AISs include the 23 transportation migration systems recommended by the Joint Transportation CIM (Corporate Information Management) Center (JTCC). Those systems also vary in technical capabilities. Many AISs have limited telecommunications capabilities and do not have relational databases. In addition, some AISs have many remote sites that use reference files received from a master or host computer. One example is the CONUS Freight Management (CFM) System. It consists of hundreds of shipping activities that generate GBLs using specially developed software (the CFM Field Module) that exchanges data with the CFM host computer. Consequently, each CFM Field Module software package requires its own copy of reference files; thus the timely and accurate dissemination of reference file updates is complicated.

## REFERENCE FILES

We estimate that DTS uses approximately 300 reference files. To understand the challenge of synchronizing reference files, we separated DTS reference files into three categories—Defense transportation, Defense non-transportation, and commercial—based upon the source AIS that disseminates the files. (Appendix A provides file information for each of these categories.) USTRANSCOM has identified more than 180 transportation files. Transportation file sources include those identified by the GTN program management office, Military Traffic Management Command (MTMC), Defense Finance and Accounting Service (DFAS), Air Mobility Command (AMC), and Military Sealift Command (MSC). DTS also uses about 11 files owned by Defense non-transportation sources. Those files include files in the *Security Assistance Management Manual* as well as others maintained

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by the Defense Automatic Addressing System Center (DAASC) and Defense Logistics Services Center (DLSC).<sup>1</sup> For the third category, we estimate that 50 to 100 commercial files are used by commercial transportation carriers and vendors. Our research noted some reference files in more than one category. For example, the standard carrier alpha code (SCAC) file was identified by the GTN program management office, but that file is commercially owned. Therefore, it appears in both the Defense transportation and commercial file categories.

Our research also discovered that reference files vary in how frequently they are updated. For example, the DoDAAC file is very dynamic and requires frequent updates. Other files change infrequently, sometimes as little as one or two times per year. Thus the frequency with which files are updated further complicates their distribution.

## PROBLEM OVERVIEW

Maintaining the current version of reference files at user AISs is complex and often occurs on an ad hoc basis. A user AIS currently obtains reference files from commercial (non-DoD), Defense non-transportation (primarily supply and maintenance), and Defense transportation AISs. However, user AISs do not always have the most current file. As a result, electronic transactions and documents containing reference file information have data errors that cause AISs supporting DTS to reject the transactions or report erroneous information.

The current environment can be characterized by the following three problems:

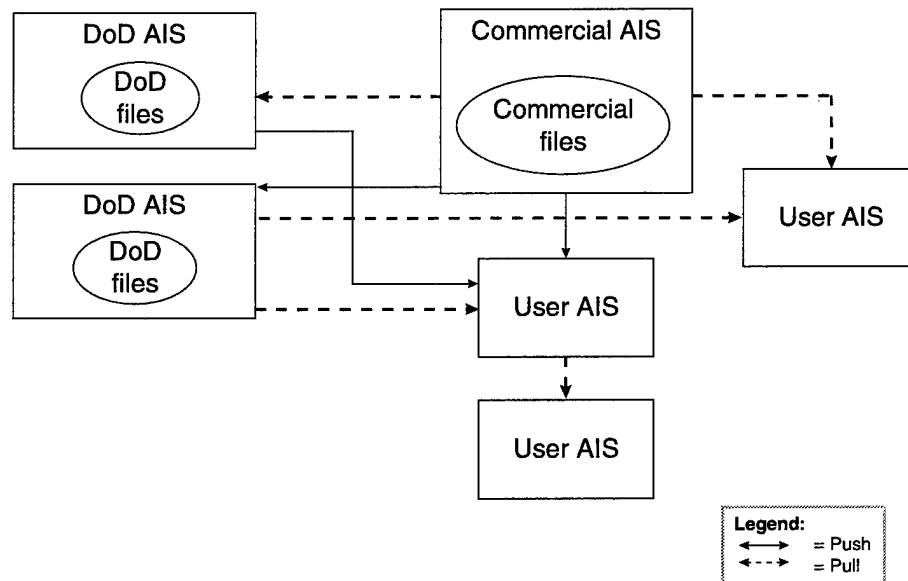
- ◆ Decentralized file management in which no one manages the process and verifies the most recent file is available for distribution
- ◆ Uncoordinated file updates among source and user AISs operated by several DoD organizations
- ◆ Distribution of the same reference file by several AISs.

Figure 2-1 depicts the current environment. User AISs obtain reference files from source AISs or from other AISs that store the file for others to download. The technical capabilities of the source and user AISs determine if the source AIS automatically distributes (pushes) a file to the user AIS or if the user AIS accesses the source AIS to retrieve (pull or download) the file. Finally, because a reference file strategy does not exist, authorized sources are not designated. Consequently, user AISs cannot verify they have the most current and accurate file.

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<sup>1</sup> DoD 5105.38-M, *Security Assistance Management Manual*, October 1988 (as revised), authorized by DoD Directive 5105.38, 10 August 1978.

Figure 2-1. Current Environment



## REFERENCE FILE INITIATIVES

Several different organizations within DoD have independently addressed the reference file problem. However, those initiatives are not coordinated and do not systemically address the problem. The most significant initiatives are the following:

- ◆ USTRANSCOM is responsible for the following initiatives:
  - The GTN program management office is identifying and assessing the reference files used by GTN. More than 180 reference files have been identified, and another 75 are estimated as part of GTN Delivery 2.
  - JTCC is developing a repository of DTS data models, process models, business rules, and documentation. JTCC is also sponsoring a survey by the Defense Information Systems Agency (DISA) of the 23 transportation migration systems. JTCC is studying the feasibility of standardizing reference file data used by those systems.
  - MTMC, in an effort cosponsored by its CFM Office and DFAS, identified nine CONUS freight management files required to pay GBLs. MTMC's Transportation Engineering Agency also manages several DTS reference, infrastructure, and transportability files.
  - AMC is developing plans to distribute command and control reference files for airlift planning and execution systems.
  - MSC is developing a central repository for ocean reference files.

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- ◆ DISA is selectively making reference tables accessible using the DISA World Wide Web (WWW) site.
  - ◆ DAASC is reengineering its process for modifying DoDAACs. That effort includes designing a WWW DoDAAC file repository.

## SUMMARY

Source and user AISs vary in their technical capabilities. Some use the most sophisticated computers, databases, and telecommunications available while others use minimal technical configurations. Those capabilities affect how user AISs obtain the required reference files. We estimate that user AISs use approximately 300 reference files.

User AISs obtain reference files from a variety of sources. In addition, file updates between source and user AISs are not coordinated but are accomplished on an ad hoc basis. This problem leads to the proliferation of incorrect or unsynchronized reference files. Finally, DoD has several initiatives that attempt to solve the reference file synchronization problem. However, those initiatives are independent actions that do not address the problem on a DTS-wide basis.

## Chapter 3

# Alternative Strategies

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In this chapter, we present three alternative strategies for synchronizing DTS reference files. We assess the technical feasibility of each alternative and perform a cost analysis of the technically feasible alternatives.

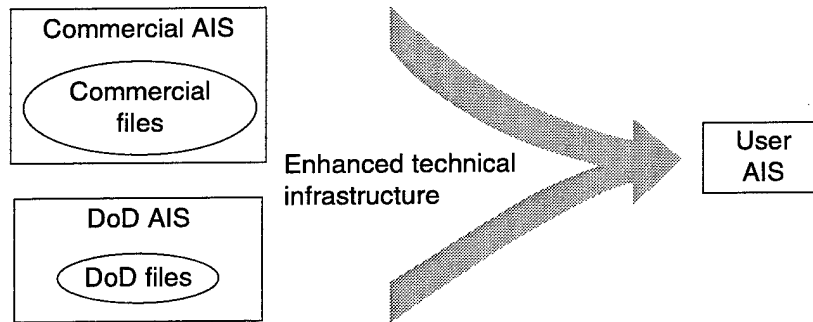
## STRATEGIES

In Chapter 2, we show that DTS depends on a large number of reference files—approximately 300 files. However, the number of reference files is not the primary consideration in developing a synchronization strategy. Source and user AIS capabilities are significant factors and need to be considered. Therefore, a viable strategy needs to address more than the single relationship of one source AIS and its user AISs. A strategy needs to accommodate the different technical capabilities of all source and user AISs. In this chapter, we identify and discuss three strategies—a distributed systems network, multiple reference servers, and a central reference server—that could be used to synchronize DoD and commercial reference files.

### Alternative 1—Distributed Systems Network

The first alternative, a distributed systems network, is a decentralized network of source and user AISs to disseminate reference file information. This alternative uses the status quo as its system architecture (Figure 3-1). The reference files continue to be maintained by source AISs. User AISs continue to access several AISs to retrieve reference file data. In addition, commercial files are also available from many source AISs. However, this alternative is better than the current approach because it designates a single source AIS for each reference file and provides an enhanced technical infrastructure for improving the existing network. This alternative requires additional software on each source and user AIS computer to take advantage of WWW, other telecommunications, and file management and dissemination technologies.

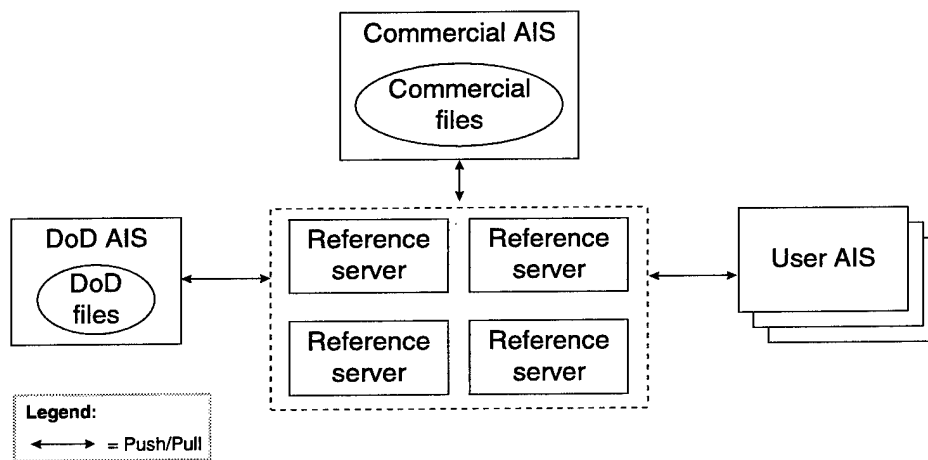
Figure 3-1. Distributed Systems Network



### Alternative 2—Multiple Reference Servers

The second alternative, multiple reference servers, is a network of source and user AISs linked by a limited number of Defense reference servers. Each server manages a specific set of reference files. Figure 3-2 shows the multiple reference servers strategy. We estimate between three and six servers would be needed. Under this concept, each transportation component command (TCC) would maintain a reference server. Additional servers could include DAAS (Defense Automatic Addressing System), DLSC, and the repository under development by JTCC. In addition, all commercial reference files used by DTS would be stored on a single server. A combination of push and pull telecommunications solutions, such as specialized database management systems, Web push technologies, and scheduled downloads, would disseminate reference files to user AISs.

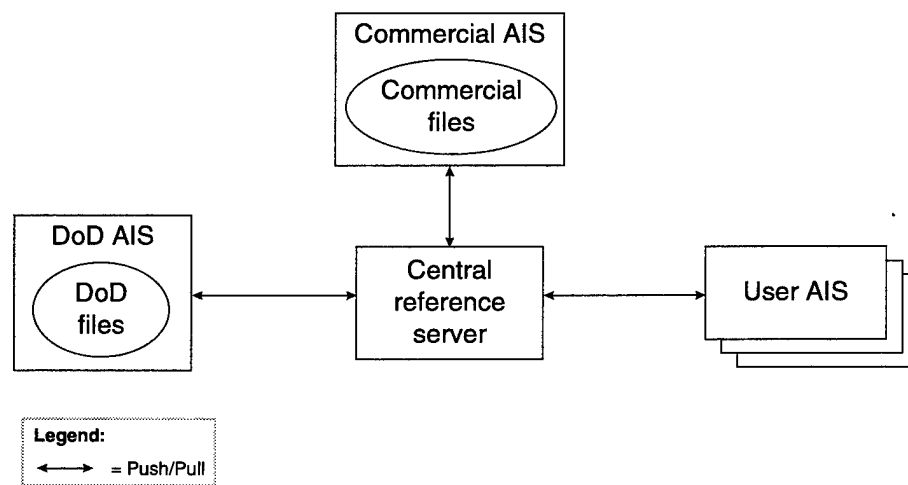
Figure 3-2. Multiple Reference Servers



## Alternative 3—Central Reference Server

A central reference server—alternative 3—is similar to the multiple reference servers alternative except all source and user AISs are linked by a single server that stores all DoD and commercial files used by DTS. Figure 3-3 depicts this strategy. We envision a central reference server with several methods for user AISs to retrieve or receive reference files. Methods of exchanging data include specialized database management systems, Web push technologies, and scheduled downloads.

Figure 3-3. Central Reference Server



## TECHNICAL FEASIBILITY

We used the following three feasibility criteria to evaluate each alternative:

- ◆ Technical merit (source and user AISs)
- ◆ Program management
- ◆ System administration.

The public and private sectors frequently regard *technical merit* as the most important criterion. That view is based on the assumption that the solution must be capable of being developed without being overly complex. We assessed the number and type of interfaces required by the source and user AISs to synchronize files for each alternative.

The capability to effectively manage the synchronization strategy must also be considered. *Program management* includes overseeing contractor efforts, overseeing server administration, planning changes to the synchronization strategy,

identifying program enhancements, monitoring the dissemination of reference file information among source and user AISs, and detecting data errors. We assessed the degree to which a program manager could perform these functions. (Because several DoD organizations operate source and user AISs, a program manager would have only limited authority to ensure user AISs update their business applications with the most recent reference file information. This condition is true for all alternatives. As a result, the program manager's authority is not considered as part of the assessment.)

Finally, we assessed how effectively *system administration* duties could be performed for each alternative. System administration includes managing the daily operations of the computers and the AISs, including system interfaces.

We assessed each alternative relative to one another using the three feasibility criteria and assigned a low, medium, or high rating. A *high* rating is the most favorable and indicates that the alternative completely satisfies the criterion. A *medium* rating indicates the alternative is feasible and basically satisfies the criterion, although minor deficiencies exist. A *low* rating indicates the alternative does not meet the criterion. All criteria had to be rated medium or higher for an alternative to be considered technically feasible. A summary of our assessment appears in Table 3-1.

Table 3-1. Technical Feasibility Assessment

Alternative	Technical merit		Program management	System administration
	Source AIS	User AIS		
Distributed systems network	Low	Low	Low	High
Multiple reference servers	High	Medium	Medium	Medium
Central reference server	High	High	Medium	High

## Distributed Systems Network Assessment

In our assessment, we find the *technical merit* of both source and user AISs to be low. This alternative would require too many interfaces to synchronize reference files, making it too complicated to develop and manage. In addition, substantial effort would be required to enhance the technical infrastructure at most source and user sites.

*Program management* for a distributed systems network would be complicated to execute and is rated low. Performing contractor oversight and planning changes to the strategy as it becomes operational would be very difficult for many locations. In addition, monitoring reference file dissemination among source and user AISs would be complex because many systems are involved.

*System administration* for this alternative receives a high rating because source and user AISs are already interfaced. The interfaces would require only minor changes as the technical infrastructure is enhanced.

This alternative has low technical merit and program management ratings. We conclude a distributed systems network is not technically feasible and eliminate it from further consideration.

## Multiple Reference Servers Assessment

We find the *technical merit* for source AISs to be high because few interfaces would be required. Source AISs would only require an interface with a single reference server. Although the number of interfaces for user AISs would also be reduced, user AISs would need to access more than one server to receive reference files. Therefore, user technical merit receives a medium rating. However, this alternative would guarantee user AISs access to a single authorized source for each reference file. This alternative would also likely streamline the telecommunications requirements for user sites because of the reduction in interfaces.

*Program management* functions would be easier than those in a distributed systems network and, as a result, are rated medium. Overseeing file administration and coordination would be considerably easier because the number of reference servers is limited. Although a large number of systems would be involved, monitoring the dissemination of the most recent reference file information from source to user AISs is simplified because all AISs would interface with one of the servers.

*System administration* would be fairly effective and receives a medium rating. Although the number of system interfaces would be reduced, system administrators at the source and user sites would be responsible for developing and maintaining new interfaces with one or more servers.

The multiple reference servers alternative satisfies the initial technical feasibility criteria and is further evaluated in the cost analysis section.

## Central Reference Server Assessment

We find the *technical merit* for source and user AISs to be high because this alternative is the least complex of the three alternatives. All AISs would require only one interface. A single authoritative source for all files would provide better control for user AISs to receive up-to-date reference files. This alternative would also likely streamline the telecommunications requirements for source and user sites because of the single interface.

We rate *program management* as medium. Overseeing file administration and coordination would be the easiest of the three alternatives because only one

reference server would exist. Monitoring reference file dissemination is simplified because all AISs would interface with a single server.

*System administration* would be very effective. It is rated high because all source and user AISs would require only a single interface.

The central reference server alternative is technically feasible and is further evaluated.

## COST ANALYSIS

In this section, we present a cost analysis of the two technically feasible strategies. We estimate the investment and annual operating costs of each strategy and develop a 7-year cost comparison. We conclude by defining the uncertainty in those cost estimates.

### Investment Costs

Investment costs are one-time expenditures to establish the selected reference server solution as well as upgrade technical capabilities at source and user AISs. Table 3-2 shows that implementing a central reference server strategy will require DoD to make a one-time investment of approximately \$4.2 million while a multiple reference servers strategy requires \$6.0 million.<sup>1</sup> Appendix B provides comprehensive cost information, including source AIS, reference server, and user AIS costs.

*Table 3-2. Total Investment Costs*

Investment category	Central reference server cost (\$000)	Multiple reference servers cost (\$000)
Hardware	132	334
Software	1,309	1,751
Systems analysis, development, and integration	2,656	3,463
Telecommunications	1	5
Training	50	50
Program management	98	382
Total	4,246	5,985

<sup>1</sup> Investment costs using implementation rates and the estimated inflation factor are not included in Table 3-2. When these items are considered, the costs increase to \$4.3 million for a central reference server and \$6.1 million for multiple reference servers. See Table 3-4.

We base our investment cost estimates on the following key assumptions:

- ◆ *Hardware.* A central reference server requires two new computers—one as the primary processor and the other for backup in case the primary computer fails. Although the multiple reference server sites already have computers, we assume that backup computers must be procured and installed. Additional hardware is not required at the source and user sites.
- ◆ *Software.* State-of-the-art products that automate the exchange and update of files are required at each reference server and most source and user AISs. Those products include WWW push products and database replication products. Our estimate also includes firewall software at each server to prevent unauthorized users.
- ◆ *Systems analysis, development, and integration.* Each source and user AIS as well as each reference server requires systems analysis to identify the system modifications if new software is added. Other costs include developing new software at the servers. We also include costs for initializing or establishing the first copy of reference files at each server. Finally, the costs for integrating new software products with existing AISs and testing the reference server strategy are included. We assume this work is entirely performed by private-sector contractors.
- ◆ *Telecommunications.* Additional or upgraded telecommunications lines need to be procured to accommodate the increased communications traffic from source and user AISs to the reference servers.
- ◆ *Training.* Personnel require training in the daily operations of the server. Training will be performed by private-sector contractors.
- ◆ *Program management.* Personnel at the reference server are required to establish relationships and interfaces with the DoD and commercial reference file sources. Our estimate is limited to one full-time civilian employee, GS-12, based on USTRANSCOM's guidance.

## Operating Costs

Table 3-3 shows the estimated annual operating expenses for the central and multiple reference server alternatives are approximately \$2.4 million and \$3.8 million, respectively. Appendix B provides additional information on the annual operating expenses of source AISs, reference servers, and user AISs.

Table 3-3. Annual Operating Expenses

Cost category	Central reference server cost (\$000)	Multiple reference servers cost (\$000)
Telecommunications	433	433
System administration	505	677
Commercial file licenses	40	40
CD-ROM production and distribution	2	7
Program management	385	851
Technical support	798	1,436
Hardware and software maintenance	206	286
Training	78	79
Total	2,447	3,809

The operating expenses in Table 3-3 include the following costs:

- ◆ *Telecommunications.* The reference servers require telecommunications facilities to exchange data with a large number of sites. WWW access is also required. Therefore, we include the monthly costs for communications facilities, such as leased lines. We also assume that many user sites will upgrade their telecommunications lines to take advantage of sophisticated file update technologies.
- ◆ *System administration.* Personnel are required to manage and operate the computers used by source AISs, reference servers, and user AISs.
- ◆ *Commercial file licenses.* Each reference server that interfaces with commercial file sources needs to pay annual license fees to obtain the commercial reference files.
- ◆ *CD-ROM production and distribution.* The reference servers will use CD-ROMs to distribute static reference files.
- ◆ *Program management.* A program manager is needed to oversee the server operations and direct the system administrator. Additionally, part-time program management functions are required at the source AISs to oversee efforts related to the reference server.
- ◆ *Technical support.* Technical support actions are needed to ensure the files are accurate, resolve telecommunications problems, resolve hardware and software problems, and maintain source and user AIS interfaces with a reference server.

- ◆ *Hardware and software maintenance.* Annual maintenance contracts are needed for the hardware and software.
- ◆ *Training.* Personnel at the source and user sites and the reference servers require annual training to maintain their skills and learn about changes to the operating concept.

## Cost Comparison

Table 3-2 and Table 3-3 provide the investment and annual operating costs of each alternative. However, projects involving a significant number of computers and AISs, such as this project, typically require several years to implement. Therefore, we apply implementation rates and an annual inflation factor to those costs. The implementation rates are described in Appendix B. We use the following key assumptions:

- ◆ Investment costs at the reference servers will be incurred in the first year.
- ◆ Investment costs at source AISs will be incurred in the first 2 years.
- ◆ Investment costs at user AISs will be incurred in the first 3 years.
- ◆ The annual inflation rate will be 2.3 percent as estimated by USTRANSCOM.

Table 3-4 provides a 7-year comparison of the investment and operating costs for multiple and central reference server strategies. We use a 7-year period to coincide with the time period of USTRANSCOM's program objective memorandum. We estimate the total 7-year costs to be more than \$31 million for multiple reference servers and approximately \$20 million for a central reference server. Of those costs, more than 75 percent are attributable to recurring costs, including program management and system administration requirements.

Table 3-4. Seven-Year Cost Comparison (\$ million)

Alternative	Year							Total
	1	2	3	4	5	6	7	
<b>Multiple reference servers</b>								
Investment	4.21	1.26	0.59	0.00	0.00	0.00	0.00	6.06
Operating	1.38	3.17	3.79	4.08	4.18	4.27	4.38	25.25
<b>Total</b>	<b>5.59</b>	<b>4.43</b>	<b>4.38</b>	<b>4.08</b>	<b>4.18</b>	<b>4.27</b>	<b>4.38</b>	<b>31.31</b>
<b>Central reference server</b>								
Investment	2.25	1.46	0.60	0.00	0.00	0.00	0.00	4.31
Operating	0.73	1.83	2.38	2.62	2.68	2.74	2.80	15.78
<b>Total</b>	<b>2.98</b>	<b>3.29</b>	<b>2.98</b>	<b>2.62</b>	<b>2.68</b>	<b>2.74</b>	<b>2.80</b>	<b>20.09</b>

## Probability of Costs

Although we conservatively estimate the costs for each alternative, we recognize that the costs may vary in a project of this size. Therefore, we used risk analysis software to define the uncertainty in the cost estimates and determine the probability distributions of the costs of each strategy. For each cost element we identify a minimum and maximum cost in addition to the cost we believe is most likely (see Appendix B). The purpose of minimum and maximum costs is to define the range of costs for each cost element.

We evaluated the potential investment and operating costs of each alternative using a risk analysis simulation program. Figures 3-4 and 3-5 summarize the results of that risk analysis for a central reference server and multiple reference servers, respectively, for 7 years. Figure 3-4 shows that the total investment and operating costs for a central server will range between approximately \$13 million and \$29 million. Although the range of possible costs is quite broad, a cost of \$20.09 million (the most likely cost in Table 3-4) or less has a 50 percent probability of occurrence. The risk analysis shows an 80 percent probability the cost will not exceed approximately \$22.5 million.

*Figure 3-4. Probability Distribution for Central Reference Server Costs*

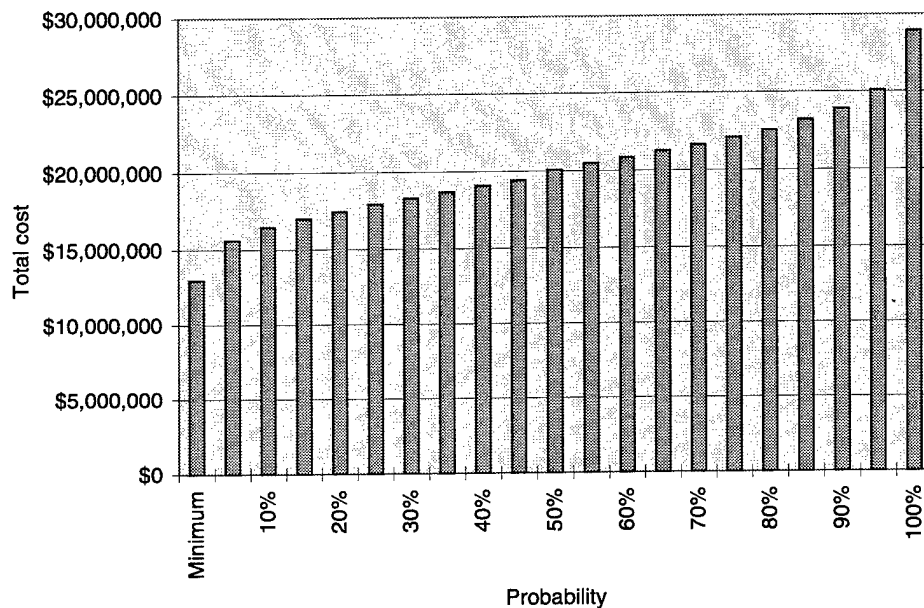
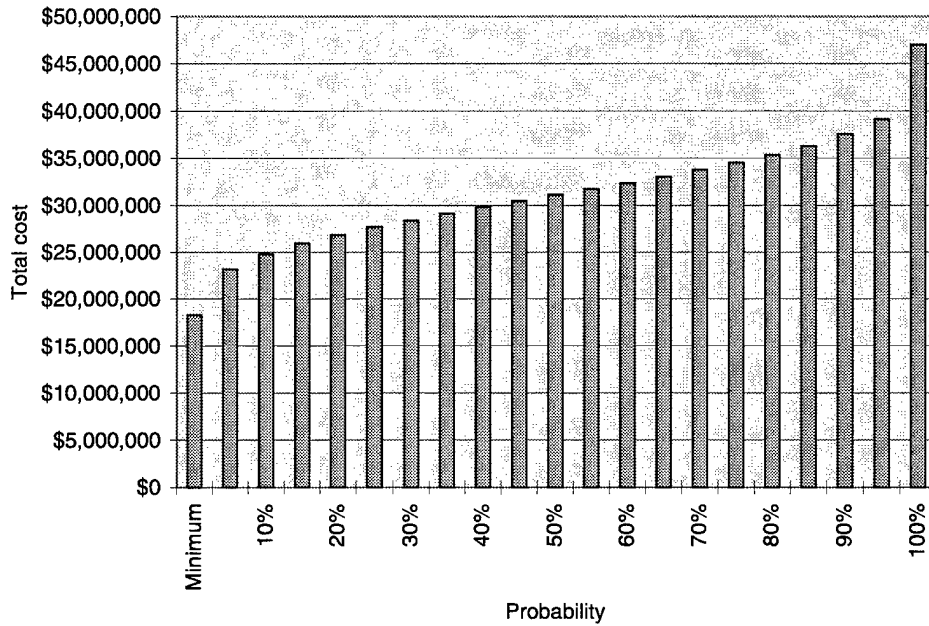


Figure 3-5 shows the total investment and operating costs for multiple reference servers will range between approximately \$18 million and \$47 million. A cost of \$31.31 million (the most likely cost in Table 3-4) or less has a 50 percent probability of occurrence. The risk analysis shows an 80 percent probability the cost will not exceed \$35.1 million over 7 years.

Figure 3-5. Probability Distribution for Multiple Reference Server Costs



## SUMMARY

In this chapter, we identified three alternatives for synchronizing reference files—a distributed systems network, multiple reference servers, and a central reference server—and assessed their technical feasibility. We eliminate the distributed systems network because of its low technical merit and program management ratings. We find the multiple and central reference server alternatives to be technically feasible. After comparing their investment and annual operating costs, we conclude a central reference server is less expensive. Its cost over a 7-year period is approximately \$20 million.

## Chapter 4

# Recommendations

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Based on our technical feasibility assessment and cost analysis, we recommend USTRANSCOM develop a central reference server to manage the dissemination of reference files from source AISs to user AISs. A central reference server is the less costly alternative and offers USTRANSCOM the most potential because it

- ◆ provides “one-stop shopping” for DTS users,
- ◆ guarantees access to a single approved version of each reference file,
- ◆ establishes a single interface for all source AISs and is the least complex alternative,
- ◆ simplifies system administration, and
- ◆ enables the program manager to monitor the dissemination of the most recent reference file information from source AISs to user AISs and detect data errors.

In addition, implementing a central reference server does not preclude expansion to other DoD servers and repositories, such as those at DAAS, DLSC, and the TCCs, if USTRANSCOM determines such expansion is advisable.

If a central reference server is successfully developed and maintained, we believe most user AISs will access the server to retrieve reference files rather than receive them from several other users and sources. Consequently, a central reference server will dramatically reduce DTS reference file errors. Appendix C identifies the tasks and schedule needed to implement a central server.

## RELATED ACTIONS

USTRANSCOM and other DoD organizations that will use the central reference server need to perform several actions as part of our primary recommendation. Those actions include programming resources, establishing a program manager, and considering commercial approaches and products as part of the central reference server solution. We discuss those actions in the next subsections.

## Program Resources

USTRANSCOM, Military Service, and Defense Logistics Agency (DLA) owners and users of reference files need to program and budget the personnel and financial resources identified in our cost analysis. Table 4-1 identifies the costs and the responsible organizations needed for the 7-year program objective memorandum. The cost estimate includes \$4.3 million for investment costs and \$15.8 million for operating costs. Investment costs of \$0.8 million are attributable to the central reference server in the first year. The remaining investment costs are for source and user AIS enhancements and would be expended in the first 3 years. Similarly, \$5.7 million of the operating costs are for USTRANSCOM to maintain and operate the central reference server. The remaining \$10.1 million of operating costs are for the Military Services and DLA to maintain and administer their source and user sites.

*Table 4-1. Central Reference Server Costs by Organization (\$ million)*

Category	Type of cost	Year							Total
		1	2	3	4	5	6	7	
USTRANSCOM reference server	Investment	0.82	0.00	0.00	0.00	0.00	0.00	0.00	0.82
	Operating	0.41	0.83	0.85	0.87	0.89	0.91	0.93	5.69
Military Services, DLA, TCC sources	Investment	0.85	0.87	0.00	0.00	0.00	0.00	0.00	1.72
	Operating	0.17	0.52	0.71	0.72	0.74	0.76	0.78	4.41
Military Services, DLA, TCC users	Investment	0.57	0.59	0.60	0.00	0.00	0.00	0.00	1.76
	Operating	0.16	0.48	0.82	1.02	1.05	1.07	1.09	5.69
Total		2.98	3.29	2.98	2.62	2.68	2.74	2.80	20.09

Notes: Strategy assumes USTRANSCOM contracts all reference server operations except one full-time employee. Source and user costs cannot be validated until site surveys are conducted.

Of the total \$20.09 million over 7 years, approximately 32 percent will be required for USTRANSCOM reference server expenses, 31 percent for source AISs, and 37 percent for user AISs. As previously stated, our estimate assumes the server is operated by a contractor and USTRANSCOM oversight is limited to one full-time civilian employee (GS-12 grade).<sup>1</sup>

## Establish Program Manager

USTRANSCOM needs to establish a program manager to oversee the development and implementation of the reference server. The program manager will also oversee the development of interface requirements with the source and user AISs needed to exchange the files efficiently and effectively with the central reference server. Program management responsibilities also include performing long-term

<sup>1</sup> Although assigning one person to manage the synchronization program is likely to be insufficient, USTRANSCOM resources are limited; committing additional personnel is not feasible.

planning and budgeting required for the central reference server to satisfy requirements of the source and user AISs. The program manager will also oversee the administration of the server and ensure that it performs as expected. Finally, the program manager needs to monitor the dissemination of reference file information. While the program manager cannot ensure that user AISs incorporate the most recent reference files into their business applications, monitoring reference file dissemination will aid in detecting data errors.

## Consider Commercial Approaches and Products

During our research and analysis for this report, we identified several commercial approaches and products that USTRANSCOM should consider as it develops a central reference server. To maximize its effectiveness, the central server should provide source and user sites with several methods of exchanging reference file data and the capability to receive and send entire files, file subsets, or updated portions of a file. Potential technical solutions include installing WWW push products at the source sites to send updated reference files automatically to the central reference server. Another option is to install heterogeneous database replication software at the source sites. That software can automatically update the same or a different database type at the central server. For example, an Oracle database with this feature at a source site can update a Sybase database at the central server.

The central reference server should tailor its file distribution methods to user requirements. Potential methods include maintaining a user AIS profile that indicates the files required by each AIS, the frequency a file is updated, and the last time it is updated. If a user AIS retrieves a file from the server and the file is later updated at the server, the server would send an electronic notification to the user AIS to indicate the file had been updated since its last retrieval. In addition, the central reference server could use WWW push products to distribute files to user AISs. The server should also be able to convert and electronically store paper-based documents, such as Military Standard Requisitioning and Issue Procedures code lists. Finally, it permits USTRANSCOM to establish a central point for monitoring data quality. As a result, data scrubbing and cleansing products could be installed at the central reference server to identify and correct data inconsistencies for many different types of files.<sup>2</sup>

User AIS technologies include “scheduling” software that automatically retrieves files, subsets, and updated records from the central reference server on a scheduled basis using dial-up or WWW access. User AISs with WWW access should consider receiving data via WWW push distribution products. These technical

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<sup>2</sup> Data scrubbing and cleansing tools are commercially available software products that identify inconsistencies among files containing similar information, such as DoDAAC addresses. In some instances, the products can correct errors.

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tools will aid USTRANSCOM in managing the program and administering the system.

## SUMMARY

We recommend that USTRANSCOM implement the central reference server strategy to disseminate and manage the reference files used by AISs within the DTS. We also identify related actions, including programming resources, establishing a program manager, and considering commercial technical approaches and products for incorporation into a central reference server strategy.

# Appendix A

## Reference Files

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This appendix describes our approach for identifying more than 300 reference files that support Defense Transportation Systems (DTS) business operations. We identify three categories of DTS reference files based upon the source automated information systems (AISs) that disseminate the files. The categories are Defense transportation, Defense non-transportation, and commercial file owners.

### APPROACH

To identify DTS reference files, we began with a list provided by the U.S. Transportation Command (USTRANSCOM) of files used by the Global Transportation Network (GTN). Although we found some reference files in more than one category, we call these files *Defense transportation* files. In addition, we identified other reference files—*Defense non-transportation* and *commercial*—by relying on American National Standards Institute (ANSI) electronic data interchange (EDI) transaction set standards and their corresponding Defense transportation implementation conventions.

The EDI structures that ANSI developed use standards to exchange business transactions electronically. ANSI chartered the Accredited Standards Committee (ASC) X12 to develop standards to facilitate the electronic interchange of business transactions, such as order placement and processing, shipping and receiving, invoicing, and payment. The X12 standards define commonly used business transactions in a formal, structured manner called *transaction sets*. A transaction set is a meaningful unit of information exchanged between trading partners. Source and user AISs use the transaction set standards to process business transactions related to transportation services.

EDI transaction sets use codes to take the place of data to save space in a record and reduce the information transmitted to an AIS. A reference file defines those codes and the corresponding definitions.<sup>1</sup> Most codes are defined by the ASC X12 committee. Other codes used by EDI transaction sets originate in reference files outside the ASC X12 domain. However, the ASC X12 transaction set standards identify the external sources of all codes the committee does not control or define.<sup>2</sup>

To identify reference files that DTS uses, we reviewed the DoD implementation conventions for each applicable ASC X12 transaction set. (An implementation

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<sup>1</sup> ANSI refers to reference files as *code sources*.

<sup>2</sup> See “Code Sources” Appendix in ANSI, *Electronic Data Interchange X12 Standards*, Volume 1, Version Release 003060, December 1995.

convention is a subset of a transaction set standard and defines how the standard will be used.) DoD's *Defense Transportation EDI (DTEDI) Program Implementation Plan* identifies the ASC X12 transaction sets used or planned to be used by DTS. Table A-1 lists those transaction sets. The DTEDI plan includes two supply transaction sets (511 and 856) that are also included in Table A-1. The table also includes three additional ASC X12 transaction sets (867, 940, and 945), commonly referred to as Defense Logistics Management System (DLMS) transaction sets, that contain data provided to transportation systems but are not included in the DTEDI plan.

*Table A-1. ASC X12 Transaction Sets*

Set number	Transaction set name	Reference number
110	Air Freight Details and Invoice	X12.100
204	Motor Carrier Shipment Information	X12.103
210	Motor Carrier Freight Details and Invoice	X12.104
213	Motor Carrier Shipment Status Inquiry	X12.105
214	Transportation Carrier Shipment Status Message	X12.106
300	Reservation (Booking Request) (Ocean)	X12.109
301	Confirmation (Ocean)	X12.109
303	Booking Cancellation (Ocean)	X12.110
304	Shipping Instructions	X12.113
309	U.S. Customs Manifest (Ocean)	X12.117
310	Freight Receipt and Invoice (Ocean)	X12.118
312	Arrival Notice (Ocean)	X12.119
315	Status Details (Ocean)	X12.122
353	U.S. Customs Events Advisory Details	X12.132
355	U.S. Customs Manifest Rejection	X12.134
410	Rail Carrier Freight Details and Invoice	X12.139
421	Estimated Time of Arrival and Car Scheduling	X12.261
422	Shipper's Car Order	X12.262
511 <sup>a</sup>	Requisition	X12.225
602	Transportation Services Tender	X12.126
820	Payment Order/Remittance Advice	X12.4
824	Application Advice	X12.44
842	Nonconformance Report	X12.21
850	Purchase Order	X12.1
856 <sup>a</sup>	Ship Notice/Manifest	X12.10
858	Shipment Information	X12.18
859	Freight Invoice	X12.55
864	Text Message	X12.34
867 <sup>b</sup>	Product Transfer and Resale Report	X12.33
920	Loss or Damage Claim—General Commodities	X12.174

Table A-1. ASC X12 Transaction Sets (Continued)

Set number	Standard title	Reference number
925	Claim Tracer	X12.176
926	Claim Status Report and Tracer Reply	X12.177
940 <sup>b</sup>	Warehouse Shipping Order	X12.189
945 <sup>b</sup>	Warehouse Shipping Advise	X12.194
990	Response to a Load Tender	X12.180

<sup>a</sup> A supply transaction set included in the DTEDI plan.

<sup>b</sup> A DLMS transaction set (not included in the DTEDI plan).

## DTS REFERENCE FILES

The three categories of reference files—Defense transportation, Defense non-transportation, and commercial—that support DTS business operations are reviewed in the following subsections.

### Defense Transportation Reference Files

More than 180 reference files are used by GTN to provide in-transit visibility. The following list identifies those reference files. The GTN file names are not universally recognized. In addition, we did not attempt to determine the overlap between GTN files and other reference files. (Each file in the list is identified using the file name provided by the GTN program office.)<sup>3</sup>

Accessorial Charges by Type	Business Entity Subtype
Accessorial Code	Business Entity Type
Advice Code	Cargo Category Codes
Air Dimension Code	Cargo Container Codes
Air Refuel Category	Cargo Dimension Codes
Air Refuel Mode	Cargo Type Code
Air Refuel Type	Cargo Vessel Detail
Air Special Handling Code	Category of Service
Aircraft Configuration	Charge Rate Code
Aircraft ACL	Charge Type
Aircraft Categories	Comment Type
Aircraft Load Configuration	Commodity Code Standards
Aircraft Load Type	Commodity Reference
Aircraft Rate	Communication Type
Aircraft Tail Number	Configuration Codes
Aircraft Type	Contact Type
Aircraft Type Alias	Contacts
Aircraft Type of Speed	Contractor and Government Entity Code
Aircrew Qualifications	Country
Aircrew Type	Currency Code
AMC Carrier Code	DDDS
Blood Types	Defense Fuels Seaport Codes

<sup>3</sup> Note: Acronyms in file names were not defined by the USTRANSCOM source documents.

Delay Code	Module Type Code
Deleted Reason Code	Occupation Code
Delivery Date Code	Ocean Vessel Alias
Delivery Method	Ocean Vessel Class
Delivery Term	Ocean Vessel Identifier
Demand Code	Ocean Vessel Type
Demilitarization Code	Ownership Code
Deployment Mode Codes	Package Type Code
Disposition Code	Packaging
Distribution Code	Passenger Duty Code
DoD Address Activity Code	Passenger Type
DoD Carrier Provider Code	Payment Method
DoD Equipment Owner Code	Payment Terms
DoDIC Code	Payment Type
EDI Standard (Type)	Personal Property Code
Equipment	Place
Equipment Axles	Place Alias
Equipment Classification Codes	Place Alias Type
Equipment Description	Place Type
Equipment in Equipment	Plain Language Address
Equipment on Aircraft	Postal Location Code/Lat/Long
Equipment Type	Product Component
Event Phase	Product Commodity
Event Type	Product Country
Freight Category	Product Description
Frustrated Reason Codes	Product HAZMAT
Fuel Type	Product Keys
Fund Code	Product Type
General Instruction	Product Update
GEOLOC Code	Project Code
Government Bill of Lading Location Code	Rate Location Tables
Grade	Rates
HAZMAT Class	Reason Code
HAZMAT Reference	Reference Type
HAZMAT Type	Region
Heavy Lift Codes	Rendezvous Type
Hold Code	Role and Address Type Codes
IATA City Code	Schedule D Code
IATA Code	Schedule K Code
ICAO Code	Schedule Mission Type
Instruction Type	Seats Reason Code
JCS Priority Code	Security Classification
Leg Purpose Code	Security Risk Code
Line Item Number Index Numbers	Service Branch
Line Item Number on Aircraft	Service Grade
Line Item Numbers	Shelf Life Codes
Mail Handling Code	Shoring Types
Management Code	Signal Code
MAPAD	Special Priority Code
Measure Type	Standard Carrier Alpha Code
Media and Status	Standard Point Location Code
Mil Air Code	State
Mil Sea Code	Supply Condition Code

Supply Priorities	Transport Mode
Supply Status Codes	Transportation Hold Code
Tanker Vessel Detail	Transportation Priority Code
TC-ACCIS Type Data Code	Travel Priority
Time Zone	Travel Type
Time Zone, Daylight Savings Time	Truck Identifier
Track Reservation Code	Unit Identification Codes
Trade Partner	Unit Line Numbers
Trade Partner Addresses	Unit of Measure
Trade Partner Alias	Utilization Code
Trade Partner Contact	Vessel Detail
Trade Partner Number	Vessel General
Trade Partner Role	Vessel Propulsion
Trade Partner Type	Vessel Status
Trade Partner Use Codes	Voyage Document Detail
Train Engine Identifier	Water Special Handling Code
Transport Account Code	Weight Type
Transport Mode	

GTN uses reference files generated or managed by USTRANSCOM component commands as well as sources outside their control. For example, supply and advice codes are provided by the *Military Standard Requisitioning and Issuing Procedures (MILSTRIP) Manual*, DoD 4000.25-1-M. In addition, commercial sources, such as Lloyd's Register of Shipping and Data Universal Numbering System (DUNS), provide other codes. According to USTRANSCOM sources, approximately 75 additional reference files will be incorporated into GTN as part of Delivery 2.

## Defense Non-Transportation Reference Files

Defense non-transportation reference files are provided through automated sources, such as the Defense Automatic Addressing System (DAAS) and the Defense Logistics Services Center (DLSC) systems. Several codes in some transaction sets are listed in DoD manuals maintained by the DLMS Office. (DLMS is a system governing logistics functional business management standards and practices rather than an automated system.) Those reference files are described in the DoD 4000.25 series manuals.

We identified 11 reference files or code sources used by DLMS EDI transaction sets that have implementation conventions. Table A-2 lists the DLMS code sources. (Several reference files are used by more than one EDI transition set.) The source for the information in Table A-2 is the ASC X12 transaction set standards.

The column headings for Tables A-2 through A-4 are as follows:

- ◆ *Identifier.* A number assigned by the ASC X12 committee that identifies the code source.
- ◆ *Code source title.* Title or description of the code source used by the ASC X12 committee.
- ◆ *TS ID.* ASC X12 transaction set that uses a code originating in the code source.
- ◆ *Transaction set name.* ASC X12 name of the transaction set identified in the TS ID column.

*Table A-2. Code Sources Used by Non-Transportation Transaction Sets*

Identifier	Code source title	TS ID	Transaction set name
1	CAGE	867	Product Transfer and Resale Report
16	DUNS Number	511 856 867 940 945	Requisition Ship Notice/Manifest Product Transfer and Resale Report Warehouse Shipping Order Warehouse Shipping Advice
17	SCAC	856	Ship Notice/Manifest
27	Federal Supply Classification and National Stock Number	511 856 940 945	Requisition Ship Notice/Manifest Warehouse Shipping Order Warehouse Shipping Advice
180 <sup>a</sup>	Security Assistance Management Manual	511 856 940	Requisition Ship Notice/Manifest Warehouse Shipping Order
184 <sup>a</sup>	Foreign Military Sales Financial Management	856 945	Ship Notice/Manifest Warehouse Shipping Advice
191 <sup>a</sup>	Defense Reutilization and Marketing Manual	940	Warehouse Shipping Order
196	DoD Identification Code	511 856 867 940 945	Requisition Ship Notice/Manifest Product Transfer and Resale Report Warehouse Shipping Order Warehouse Shipping Advice
350 <sup>a</sup>	DLMS Manual	511 856 867 940 945	Requisition Ship Notice/Manifest Product Transfer and Resale Report Warehouse Shipping Order Warehouse Shipping Advice

Table A-2. Code Sources Used by Non-Transportation Transaction Sets (Continued)

Identifier	Code source title	TS ID	Transaction set name
402	Materiel Quality Control Storage Standards	856	Ship Notice/Manifest
		940	Warehouse Shipping Order
		945	Warehouse Shipping Advice
410	Federal Supply Classification Catalog	867	Product Transfer and Resale Report

Note: Acronyms and abbreviations in titles and names were not defined by the source documents

<sup>a</sup> DLMS and DoD manuals.

## Commercial Reference Files

We identified 27 commercial reference files used by transaction sets that have implementation conventions.<sup>4</sup> (We used draft implementation conventions for the Ocean transaction sets.) Those files are used to support several applications, including invoices, government bills of lading (GBL), tenders, and booking and ocean processes. Table A-3 lists several commercial code sources used by transaction sets with implementation conventions. (Several sources in Table A-3 are used by more than one EDI transaction set.)

Table A-3. Commercial Code Sources Used by Transaction Sets with Implementation Conventions

Identifier	Code source title	TS ID	Transaction set name
1	CAGE	820	Payment Order/Remittance Advice
		858	Shipment Information
		867	Product Transfer and Resale Report
4	American Bankers Association (ABA) Routing Number	310	Freight Receipt and Invoice (Ocean)
		820	Payment Order/Remittance Advice
8	Canadian Freight Classification	858	Shipment Information
9	Coordinated Freight Classification	858	Shipment Information
11	National Motor Freight Classification	602	Transportation Services Tender
		858	Shipment Information
13	STCC Code	858	Shipment Information
16	DUNS Number	511	Requisition
		820	Payment Order/Remittance Advice
		856	Ship Notice/Manifest
		867	Product Transfer and Resale Report
		940	Warehouse Shipping Order
		945	Warehouse Shipping Advice

<sup>4</sup> Implementation conventions are under development for other transaction sets. Those sets could contain an additional 234 reference files if all codes within the transaction set standards are used. However, we assume DTS will use only a limited number of those additional files because the transaction sets are developed to meet many commercial needs and not just those pertaining to Defense transportation.

*Table A-3. Commercial Code Sources Used by Transaction Sets  
with Implementation Conventions (Continued)*

Identifier	Code source title	TS ID	Transaction set name
17	SCAC	110	Air Freight Details and Invoice
		210	Motor Carrier Freight Details and Invoice
		213	Motor Carrier Shipment Status Inquiry
		410	Rail Carrier Freight Details and Invoice
		602	Transportation Services Tender
		856	Ship Notice/Manifest
		858	Shipment Information
		859	Freight Invoice
21	SPLC	210	Motor Carrier Freight Details and Invoice
		410	Rail Carrier Freight Details and Invoice
		859	Freight Invoice
24	Lloyd's Register of Shipping	300	Reservation (Booking Request) (Ocean)
		310	Freight Receipt and Invoice (Ocean)
		315	Status Details (Ocean)
25	UFC	602	Transportation Services Tender
		858	Shipment Information
27	Federal Supply Classification and National Stock Number	511	Requisition
		856	Ship Notice/Manifest
		858	Shipment Information
		940	Warehouse Shipping Order
		945	Warehouse Shipping Advice
31	Hazardous Materials for International Ocean Shipments	300	Reservation (Booking Request) (Ocean)
51	Zip Code	300	Reservation (Booking Request) (Ocean)
52	Hazardous Materials ID, DOT	858	Shipment Information
54	Schedule D Location Qualifier	300	Reservation (Booking Request) (Ocean)
		310	Freight Receipt and Invoice (Ocean)
55	Schedule K Location Qualifier	300	Reservation (Booking Request) (Ocean)
		310	Freight Receipt and Invoice (Ocean)
75	United States Harmonized Code System	858	Shipment Information
180	Security Assistance Management Manual	511	Requisition
		856	Ship Notice/Manifest
		940	Warehouse Shipping Order
184	Foreign Military Sales Financial Management	856	Ship Notice/Manifest
		945	Warehouse Shipping Advice
191	Defense Reutilization and Marketing Manual	940	Warehouse Shipping Order

*Table A-3. Commercial Code Sources Used by Transaction Sets  
with Implementation Conventions (Continued)*

Identifier	Code source title	TS ID	Transaction set name
196	DoD Identification Code	511	Requisition
		856	Ship Notice/Manifest
		858	Shipment Information
		867	Product Transfer and Resale Report
		940	Warehouse Shipping Order
		945	Warehouse Shipping Advice
253	Military Specification	602	Transportation Services Tender
270	Military Ordnance Security Risk Number	858	Shipment Information
350	DLMS Manual	213	Motor Carrier Shipment Status Inquiry
		300	Reservation (Booking Request) (Ocean)
		511	Requisition
		824	Application Advice
		856	Ship Notice/Manifest
		858	Shipment Information
		867	Product Transfer and Resale Report
		940	Warehouse Shipping Order
402	Materiel Quality Control Storage Standards	856	Ship Notice/Manifest
		940	Warehouse Shipping Order
		945	Warehouse Shipping Advice
410	Federal Supply Classification Catalog	867	Product Transfer and Resale Report

Note: Acronyms and abbreviations in titles and names were not defined by the source documents.

Table A-4 lists other commercial code sources used by transaction sets that do not have implementation conventions. The column headings in Table A-4 are the same as those in the two previous tables.

*Table A-4. Commercial Code Sources Used by Transaction Sets  
without Implementation Conventions*

Identifier	Code source title	TS ID	Transaction set name
1	CAGE	204	Motor Carrier Shipment Information
2	Airlines Code	204	Motor Carrier Shipment Information
3	Airport Code	304	Shipping Instructions
4	ABA Routing Number	204	Motor Carrier Shipment Information
5	Countries, Currencies and Funds	850	Purchase Order
6	TSUSA Number	312	Arrival Notice (Ocean)
7	Schedule B Number	312	Arrival Notice (Ocean)
8	Canadian Freight Classification	312	Arrival Notice (Ocean)
9	Coordinated Freight Classification	312	Arrival Notice (Ocean)
10	Brussels Nomenclature	312	Arrival Notice (Ocean)

*Table A-4. Commercial Code Sources Used by Transaction Sets  
without Implementation Conventions (Continued)*

Identifier	Code source title	TS ID	Transaction set name
11	National Motor Freight Classification	312	Arrival Notice (Ocean)
12	Standard International Trade Classification	312	Arrival Notice (Ocean)
13	STCC Code	312	Arrival Notice (Ocean)
15	STCC 49 Level Codes	312	Arrival Notice (Ocean)
16	DUNS Number	204	Motor Carrier Shipment Information
17	SCAC	204	Motor Carrier Shipment Information
18	Federal Maritime Commission	204	Motor Carrier Shipment Information
19	Motor and Equipment Manufacturers Association	850	Purchase Order
21	SPLC	204	Motor Carrier Shipment Information
22	States and Outlying Areas of the U.S.	204	Motor Carrier Shipment Information
24	Lloyd's Register of Shipping	353	U.S. Customs Events Advisory Details
25	UFC	312	Arrival Notice (Ocean)
27	Federal Supply Classification and National Stock Number	312	Arrival Notice (Ocean)
29	Hazardous Materials for Domestic Air Shipment	312	Arrival Notice (Ocean)
30	Hazardous Materials for Domestic Water Shipment	312	Arrival Notice (Ocean)
31	Hazardous Materials for International Ocean Shipments	312	Arrival Notice (Ocean)
32	Hazardous Materials for International Air Shipments	312	Arrival Notice (Ocean)
35	Incoterms	850	Purchase Order
36	Federal Court Jurisdiction Identifier	204	Motor Carrier Shipment Information
37	California Ethnic Subgroups Codes	204	Motor Carrier Shipment Information
38	Product Characteristic Data	850	Purchase Order
39	Packaging Characteristic Data	850	Purchase Order
41	Universal Product Code	204	Motor Carrier Shipment Information
42	Book Industry—Standard Address Number	204	Motor Carrier Shipment Information
43	FIPS-55	204	Motor Carrier Shipment Information
44	Under Development	204	Motor Carrier Shipment Information
45	American Apparel Manufacturers Association	850	Purchase Order
46	Telecommunications Industry Codes	204	Motor Carrier Shipment Information
48	Freight Stations	304	Shipping Instructions
49	Customs Entry Type	304	Shipping Instructions
51	Zip Code	204	Motor Carrier Shipment Information
52	Hazardous Materials ID, DOT	312	Arrival Notice (Ocean)
53	United Nations Number (Dangerous Goods)	312	Arrival Notice (Ocean)
54	Schedule D Location Qualifier	204	Motor Carrier Shipment Information
55	Schedule K Location Qualifier	204	Motor Carrier Shipment Information
56	Rail Territory	864	Text Message
61	Council of Petroleum Accountants Societies	204	Motor Carrier Shipment Information
62	American Paper Institute, Inc.	204	Motor Carrier Shipment Information

*Table A-4. Commercial Code Sources Used by Transaction Sets  
without Implementation Conventions (Continued)*

Identifier	Code source title	TS ID	Transaction set name
64	Fabric and Supplier Linkage Council	850	Purchase Order
65	Chemical Industry	850	Purchase Order
66	Treasury Management Association Service Codes	850	Purchase Order
67	Electronic Industries Association	850	Purchase Order
68	Commander—Rome Air Development Center	850	Purchase Order
69	Chemical Abstract Service	304	Shipping Instructions
70	VICS	850	Purchase Order
71	UPC Shipping Container Code	850	Purchase Order
72	National Wholesale Druggists Association	850	Purchase Order
73	Drug Enforcement Administration	204	Motor Carrier Shipment Information
74	Journal of Commerce	204	Motor Carrier Shipment Information
75	United States Harmonized Code System	312	Arrival Notice (Ocean)
76	Graphic Communications Association	850	Purchase Order
78	Canadian Harmonized Code System	304	Shipping Instructions
80	Government Agency Acquisition Regulations	304	Shipping Instructions
81	Tax Rates	850	Purchase Order
82	Department of Defense	850	Purchase Order
83	Bureau of Explosives Tariff No. BOE-6000	312	Arrival Notice (Ocean)
86	Petroleum Accountants Society of Canada	204	Motor Carrier Shipment Information
87	American Textile Manufacturers Institute	850	Purchase Order
88	National Retail Merchants Association	850	Purchase Order
89	FASLINC Cotton Council Code List	850	Purchase Order
90	Prompt Payment Act	850	Purchase Order
91	Canadian Financial Institution Branch and Institution Number	204	Motor Carrier Shipment Information
92	EDX	850	Purchase Order
93	Postal Service Code	204	Motor Carrier Shipment Information
95	Vehicle Maintenance Reporting Standards	850	Purchase Order
103	American Conference of Governmental Industrial Hygienists	850	Purchase Order
105	National Fire Protection Association	850	Purchase Order
106	National Toxicology Program	850	Purchase Order
107	National Institute of Occupational Safety and Health	850	Purchase Order
108	OSHA	850	Purchase Order
109	U.S. EPA	204	Motor Carrier Shipment Information
111	Copper and Brass Fabricators Council, Inc.	850	Purchase Order
112	Protective Service Rule	312	Arrival Notice (Ocean)
113	Standard Industrial Classification Code	312	Arrival Notice (Ocean)
114	ASTM	850	Purchase Order
116	Canadian Customs Office Code	864	Text Message
117	Dun's SIC 2+2	312	Arrival Notice (Ocean)

*Table A-4. Commercial Code Sources Used by Transaction Sets  
without Implementation Conventions (Continued)*

Identifier	Code source title	TS ID	Transaction set name
121	Health Industry Identification Number	204	Motor Carrier Shipment Information
122	NGPA Category Code	304	Shipping Instructions
123	Open and Prepay Station List Number	864	Text Message
124	DoD Transportation Service Code Number (Household Goods)	304	Shipping Instructions
126	American Petroleum Institute	850	Purchase Order
130	Health Care Financing Administration Common Procedural Coding System	850	Purchase Order
131	ICD-9-CM Procedure	850	Purchase Order
132	NUBC Codes	850	Purchase Order
133	CPT Codes	850	Purchase Order
134	National Drug Code	850	Purchase Order
135	American Dental Association Codes	850	Purchase Order
136	Drug UPC Consumer Package Code (1-4-6-1)	850	Purchase Order
137	Drug UPC Shipping Container Code (1-2-4-6-1)	850	Purchase Order
138	Bell Communications Research	850	Purchase Order
140	Alpha State Code	304	Shipping Instructions
143	Relative Value Units	850	Purchase Order
146	U.S. Customs Quota Category Codes	312	Arrival Notice (Ocean)
148	DIDS	304	Shipping Instructions
149	Health Insurance Industry Codes	850	Purchase Order
150	Petroleum Information GRID Location and Facility Code	204	Motor Carrier Shipment Information
151	National Business Forms	850	Purchase Order
154	FIRMS Codes	864	Text Message
155	Customs House Broker License Number	204	Motor Carrier Shipment Information
156	Occupation Code	204	Motor Carrier Shipment Information
158	HCFA	850	Purchase Order
159	EIDX	850	Purchase Order
168	Optical Industry Product Code	850	Purchase Order
170	ASAP	850	Purchase Order
172	Lender by Lender Name or Lender Number Report	204	Motor Carrier Shipment Information
173	Education Institute Alpha or Numeric Listing	204	Motor Carrier Shipment Information
180	Security Assistance Management Manual	304	Shipping Instructions
181	Allied Communications Publication	304	Shipping Instructions
182	Joint Army, Navy, and Air Force Allied Publication	304	Shipping Instructions
184	Foreign Military Sales Financial Management	304	Shipping Instructions
185	Budget and Fiscal Coding Manual	304	Shipping Instructions
186	Defense Priorities and Allocation System Codes	304	Shipping Instructions
187	DoD Manual for Standard Data Elements	304	Shipping Instructions
188	DoD Federal Acquisition Regulation Supplement	204	Motor Carrier Shipment Information

*Table A-4. Commercial Code Sources Used by Transaction Sets  
without Implementation Conventions (Continued)*

Identifier	Code source title	TS ID	Transaction set name
189	Department of Defense Accounting Manual	304	Shipping Instructions
191	Defense Reutilization and Marketing Manual	304	Shipping Instructions
192	Shelf Life Item Management Manual	850	Purchase Order
193	Integrated Material Management of Consumable Items	304	Shipping Instructions
194	Uniform Source, Maintenance and Recoverability Codes	304	Shipping Instructions
196	DoD Identification Code	304	Shipping Instructions
197	Packaging Requirement Codes	850	Purchase Order
199	Disbursing Station Symbol Numbers	204	Motor Carrier Shipment Information
200	IATA Dangerous Goods Code	312	Arrival Notice (Ocean)
202	UNLOCODE	864	Text Message
204	DoD Material Procedures for Development and Application of Packaging Requirements	850	Purchase Order
207	Alberta Energy Resources Conservation Board	204	Motor Carrier Shipment Information
208	Alberta Petroleum Marketing Commission	204	Motor Carrier Shipment Information
209	British Columbia Ministry of Energy, Mines and Petroleum Resources	204	Motor Carrier Shipment Information
210	Canadian Petroleum Association	204	Motor Carrier Shipment Information
211	Manitoba Department of Mines and Resources	204	Motor Carrier Shipment Information
212	Saskatchewan Department of Energy, Mines and Resources	204	Motor Carrier Shipment Information
213	NICB	850	Purchase Order
214	Coverage Code List	304	Shipping Instructions
218	Foreign Trade Zones	864	Text Message
219	Air Transport Association Specification 2000 Codes	304	Shipping Instructions
220	BEA Region Code	864	Text Message
221	MSA Region Code	864	Text Message
222	ACORD	850	Purchase Order
223	Property and Casualty Service Code	850	Purchase Order
224	Defense Logistics Agency Manual 8000.3	304	Shipping Instructions
225	American Furniture Manufacturers Association	850	Purchase Order
240	National Drug Code by Format	850	Purchase Order
242	Textile Apparel Linkage Council	850	Purchase Order
243	Labeler Identification Code	204	Motor Carrier Shipment Information
244	Line of Business	304	Shipping Instructions
245	NAIC Code	304	Shipping Instructions
246	Policy Type	304	Shipping Instructions
247	ABCD Convention for Electronic Data Interchange	850	Purchase Order
249	AMS	850	Purchase Order
250	UNS	850	Purchase Order

*Table A-4. Commercial Code Sources Used by Transaction Sets  
without Implementation Conventions (Continued)*

Identifier	Code source title	TS ID	Transaction set name
251	ASME Boiler and Pressure Vessel Code	850	Purchase Order
252	Federal Specification	850	Purchase Order
253	Military Specification	850	Purchase Order
254	BS	850	Purchase Order
255	AWS	850	Purchase Order
256	DIN	850	Purchase Order
257	JIS	850	Purchase Order
260	Food and Drug Administration Therapeutic Equivalence Evaluation Code	850	Purchase Order
261	API	850	Purchase Order
262	SAE	850	Purchase Order
263	NACE	850	Purchase Order
264	Escrow Status	850	Purchase Order
265	Health Care Financing Administration National Standard Format Podiatry Codes	850	Purchase Order
266	Type and Cause Code	304	Shipping Instructions
269	Contractor Establishment Code	304	Shipping Instructions
270	Military Ordnance Security Risk Number	304	Shipping Instructions
276	Test Results Code	304	Shipping Instructions
278	Laboratory Results ID Code	304	Shipping Instructions
279	Laboratory Test Condition Code	850	Purchase Order
280	MIB Company Codes	204	Motor Carrier Shipment Information
282	Federal Jurisdiction	204	Motor Carrier Shipment Information
287	AIHA	850	Purchase Order
288	ESDX	850	Purchase Order
289	WHMIS	850	Purchase Order
292	Textile Distributors Association, Inc.	850	Purchase Order
293	Gas Flow Code	850	Purchase Order
294	Advertising Industry	850	Purchase Order
296	USIS Field of Study Classification	204	Motor Carrier Shipment Information
299	Manual Class Codes	304	Shipping Instructions
300	USIS Institution Codes	204	Motor Carrier Shipment Information
301	Gas Code	204	Motor Carrier Shipment Information
302	Serials Industry Systems Advisory Committee	850	Purchase Order
307	National Association of Boards of Pharmacy Number	304	Shipping Instructions
308	Well Number	850	Purchase Order
309	American Trucking Associations	850	Purchase Order
311	Domicile Type Code	864	Text Message
312	Newspaper Association of America	850	Purchase Order
314	U.S. Department of Housing and Urban Development	850	Purchase Order

*Table A-4. Commercial Code Sources Used by Transaction Sets  
without Implementation Conventions (Continued)*

Identifier	Code source title	TS ID	Transaction set name
316	Federal Information Resources Management Regulation	304	Shipping Instructions
320	Alcohol Beverage Industry Product Code	850	Purchase Order
321	Bureau of Alcohol Tobacco and Firearms, Department of Treasury	850	Purchase Order
323	Statistics Canada Canadian College Student Information System Course Codes	204	Motor Carrier Shipment Information
324	Statistics Canada Canadian College Student Information System Institution Codes	204	Motor Carrier Shipment Information
325	BAI	304	Shipping Instructions
326	Canadian Inter-EDI Financial Transaction Codes	304	Shipping Instructions
327	SWIFT	304	Shipping Instructions
328	TMA	850	Purchase Order
329	Department of Defense Manual 5010.12-M	304	Shipping Instructions
350	DLMS Manual	312	Arrival Notice (Ocean)
353	Association of American Railroads Exception List	304	Shipping Instructions
355	Hazardous Response Codes	304	Shipping Instructions
358	Association of American Railroad Standard Transportation Commodity Code Qual.	304	Shipping Instructions
359	Treatment Codes	850	Purchase Order
360	FCC Form 574 Instruction Manual	304	Shipping Instructions
361	NABER Supplemental Form 574	850	Purchase Order
401	PIDD	304	Shipping Instructions
402	Materiel Quality Control Storage Standards	304	Shipping Instructions
403	RRC Record Number Listing	304	Shipping Instructions
405	Storage Compatibility Group Designator	312	Arrival Notice (Ocean)
406	Hazard Class or Division ID	312	Arrival Notice (Ocean)
407	Occupational Injury and Illness Classification Manual	850	Purchase Order
409	Internal Revenue Service Terminal Code	204	Motor Carrier Shipment Information
410	Federal Supply Classification Catalog	304	Shipping Instructions
412	National Center for State Courts	850	Purchase Order
434	AMA	850	Purchase Order
437	Subject Categorization Guide for Defense Science and Technology	304	Shipping Instructions
438	DSMIIR Code List	304	Shipping Instructions
440	World Code	850	Purchase Order
441	Defense Logistics Agency Manual 8000.3	304	Shipping Instructions
442	Contractor Establishment Code	204	Motor Carrier Shipment Information
447	Pennsylvania Courts	850	Purchase Order
448	United States Courts	850	Purchase Order
449	AAR Railway Accounting Rules	304	Shipping Instructions

Note: Acronyms and abbreviations in titles and names were not defined by the source documents.

## Appendix B

# Cost Analysis

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This appendix describes our methodology for estimating and analyzing the costs of implementing the two feasible strategies—central reference server and multiple reference servers. First, we identified the significant cost elements in two categories—investment costs and annual operating costs—for each alternative. We estimated each cost element’s “most likely” cost. Second, we conducted a risk analysis to establish a minimum and maximum cost for each element and provide a probable range for each alternative. Finally, we applied implementation and inflation rates and calculated each alternative’s costs for the 7 years of USTRANSCOM’s program objective memorandum.

## COSTS

Table B-1 presents the investment costs and annual operating costs to implement and maintain a central reference server for 7 years. Table B-2 presents the corresponding costs for multiple reference servers. We allocate all costs to three categories—source automated information systems (AISs), reference server, and user AISs—as defined in Chapter 3.

We categorized source and user AISs into three types based on their site’s technical capabilities:

- ◆ *Low.* Sites with minimal technical sophistication. These sites do not have World Wide Web (WWW) access. They also have limited or outdated computer hardware.
- ◆ *Medium.* Sites with adequate telecommunications capabilities, including WWW access, and adequate computer hardware capabilities.
- ◆ *High.* Large sites with robust telecommunications capabilities, including WWW access and a large bandwidth. These sites have sophisticated computer hardware, database capabilities, and state-of-the-art technology.

Table B-1. Central Reference Server Costs (\$ thousands)

Costs	Source AISs			Reference server	User AISs			Total
	Low	Medium	High		Low	Medium	High	
<i>Investment</i>								
Hardware	—	—	—	132	—	—	—	132
Software	58	280	240	168	—	435	128	1,309
Systems analysis, development, and integration	69	511	545	371	75	794	291	2,656
Telecommunications	—	—	—	1	—	—	—	1
Training	—	—	—	50	—	—	—	50
Program management	—	—	—	98	—	—	—	98
Total investment costs <sup>a</sup>	127	791	785	819	75	1,230	419	4,246
<i>Operating</i>								
Telecommunications	—	—	—	28	140	233	32	433
System administration	10	40	27	332	19	63	15	505
Commercial file licenses	—	—	—	40	—	—	—	40
CD-ROM production and distribution	—	—	—	2	—	—	—	2
Program management	25	102	68	190	—	—	—	385
Technical support	34	139	107	181	64	215	57	798
Hardware and software maintenance	9	42	36	34	—	65	19	206
Training	3	17	17	2	6	26	9	78
Total annual operating costs	81	339	255	809	228	602	132	2,447

Note: Table totals reflect the results of rounding.

<sup>a</sup> Implementation rates and the estimated inflation rate have not been included in this table; see Table B-6 and Table B-7.

Table B-2 uses the same format as Table B-1 and provides the investment and annual operating costs of multiple reference servers.

Table B-2. Multiple Reference Server Costs (\$ thousands)

Costs	Source AISs			Reference servers	User AISs			Total
	Low	Medium	High		Low	Medium	High	
<i>Investment</i>								
Hardware	—	—	—	334	—	—	—	334
Software	58	280	128	722		435	128	1,751
Systems analysis, development, and integration	69	511	291	1,432	75	794	291	3,463
Telecommunications	—	—	—	5	—	—	—	5
Training	—	—	—	50	—	—	—	50
Program management	—	—	—	382	—	—	—	382
Total investment costs <sup>a</sup>	127	791	419	2,925	75	1,229	419	5,985
<i>Operating</i>								
Telecommunications	—	—	—	28	140	233	32	433
System administration	10	40	15	516	19	63	15	677
Commercial file licenses	—	—	—	40	—	—	—	40
CD-ROM production and distribution	—	—	—	7	—	—	—	7
Program management	25	102	36	687	—	—	—	851
Technical support	45	170	69	671	106	298	76	1,436
Hardware and software maintenance	9	42	19	132		65	19	286
Training	3	17	9	10	6	26	9	79
Total annual operating costs	92	371	148	2,092	270	685	151	3,809

Note: Table totals reflect the results of rounding.

<sup>a</sup> Implementation rates and the estimated inflation rate have not been included in this table; see Table B-8 and Table B-9.

## RISK ANALYSIS

Although we conservatively estimate a most likely cost for each cost element, we recognize that actual costs may vary significantly from estimated costs in a project of this size. For this reason, we used risk analysis software to define the uncertainty in the cost estimates. We selected minimum and maximum values for each cost element to define the parameters within which we were confident the costs would occur. (Table B-1 and Table B-2 use only the most likely costs for each cost element.) We then used a risk simulation program to produce a range of values for source AIS, reference server, and user AIS investment and operating costs. Table B-3 shows the minimum, most likely, and maximum costs for a central reference server.

*Table B-3. Central Reference Server Costs After Risk Analysis (\$ thousands)*

Cost area	Investment costs			Operating costs		
	Minimum	Most likely	Maximum	Minimum	Most likely	Maximum
Source AISs	1,060	1,709	2,502	423	676	1,020
Central reference server	684	819	989	675	814	973
User AISs	989	1,731	2,580	457	953	1,570

Table B-4 shows similar costs for a multiple reference servers strategy.

*Table B-4. Multiple Reference Server Costs After Risk Analysis (\$ thousands)*

Cost area	Investment costs			Operating costs		
	Minimum	Most likely	Maximum	Minimum	Most likely	Maximum
Source AISs	770	1,336	1,908	342	611	964
Multiple reference servers	1,807	2,973	4,227	1,322	2,095	3,014
User AISs	966	1,718	2,822	547	1,108	1,779

We applied implementation rates to the cost ranges in Table B-3 and Table B-4 to develop the 7-year cost comparison of the two alternatives in Chapter 3 (Table 3-4).

## IMPLEMENTATION RATES

Implementing a central or multiple reference server strategy is a large project and involves a significant number of AISs. Projects of this magnitude require several years to implement because the sites are implemented incrementally to permit system architects to resolve problems as additional systems and users are added. To develop separate implementation rates for source, reference server, and user sites for investment and annual operating costs, we used the following assumptions:

- ◆ Source AISs will be implemented over a 2-year period. In each year, source sites will begin incurring operating costs 6 months after implementation has begun.
- ◆ The central and multiple reference servers will be fully implemented during the project's first year; all investment costs for servers will be incurred that year. Operating costs will begin the first year.
- ◆ User AISs will be implemented over a 3-year period. In each year, user sites will begin incurring operating costs 6 months after implementation has begun.

The implementation rates we developed are shown in Table B-5. Each annual column of the investment costs represents a percentage of total investment costs; each annual column of the operating costs represents a percentage of entire annual costs that will be incurred when the strategy is fully implemented. For example, in the first year, 50 percent of the investment costs will be incurred while only 25 percent of the entire annual operating costs will be incurred for source AISs. In the second year, the remaining 50 percent of investment costs will be incurred while 75 percent of the entire annual operating costs will be incurred. Beginning in the third year and for all subsequent years, 100 percent of the entire annual operating costs for source AISs will be incurred.

*Table B-5. Annual Percentage of Costs*

Cost area	Investment				Operating			
	Year 1	Year 2	Year 3	Year 4	Year 1	Year 2	Year 3	Year 4
Source AISs	50	50	0	0	25	75	100	100
Reference servers	100	0	0	0	50	100	100	100
User AISs	33	33	33	0	16.5	49.5	82.5	100

In Table B-6 through Table B-9, we apply the implementation rates from Table B-5 to the minimum, most likely, and maximum costs in Table B-3 and Table B-4. We used USTRANSCOM's estimated annual inflation rate of 2.3 percent.

Table B-6 shows the investment costs for a central reference server could be as low as \$2.8 million and as high as \$6.1 million with a most likely cost of \$4.3 million.

*Table B-6. Central Reference Server Investment Costs*

Cost area	Year	Minimum (\$000)	Most likely (\$000)	Maximum (\$000)
Source AISs	1	530	855	1,251
	2	542	874	1,280
Reference server	1	684	819	989
User AISs	1	326	571	852
	2	334	584	871
	3	342	598	891
Total	All	2,759	4,301	6,133

Note: Table totals reflect the results of rounding.

Table B-7 shows the annual operating costs of the central reference server strategy for 7 years vary from a low of \$10.2 million to \$22.8 million. Based upon our inputs, the most likely figure is \$15.7 million.

*Table B-7. Seven-Year Central Reference Server Operating Costs*

Cost area	Year	Minimum (\$000)	Most likely (\$000)	Maximum (\$000)
Source AISs	1	106	169	255
	2	325	519	783
	3	443	708	1,068
	4	453	724	1,092
	5	463	741	1,118
	6	474	758	1,143
	7	485	775	1,170
Reference server	1	337	407	486
	2	690	833	995
	3	706	852	1,018
	4	722	871	1,041
	5	739	891	1,065
	6	756	912	1,090
	7	773	933	1,115
User AISs	1	75	157	259
	2	232	483	795
	3	395	823	1,355
	4	490	1,020	1,681
	5	501	1,044	1,719
	6	512	1,068	1,759
	7	524	1,092	1,799
<b>Total</b>	<b>All</b>	<b>10,202</b>	<b>15,779</b>	<b>22,806</b>

Note: Table totals reflect the results of rounding.

Table B-8 shows multiple reference server investment costs range from \$3.5 million to \$9.0 million. The most likely cost is \$6.0 million.

*Table B-8. Multiple Reference Server Investment Costs*

Cost area	Year	Minimum (\$000)	Most likely (\$000)	Maximum (\$000)
Source AISs	1	385	668	954
	2	394	683	976
Reference servers	1	1,807	2,973	4,227
User AISs	1	319	567	931
	2	326	580	953
	3	334	593	975
<b>Total</b>	<b>All</b>	<b>3,565</b>	<b>6,065</b>	<b>9,016</b>

Note: Table totals reflect the results of rounding.

Table B-9 shows the annual operating costs of the multiple reference servers strategy for 7 years vary from \$14.7 million to \$38.0 million with a most likely cost of \$25.2 million.

*Table B-9. Seven-Year Multiple Reference Server Operating Costs*

Cost area	Year	Minimum (\$000)	Most likely (\$000)	Maximum (\$000)
Source AISs	1	86	153	241
	2	263	469	740
	3	358	639	1,009
	4	367	654	1,032
	5	375	669	1,056
	6	384	684	1,080
	7	392	700	1,105
Reference servers	1	661	1,048	1,507
	2	1,353	2,144	3,083
	3	1,384	2,193	3,154
	4	1,416	2,243	3,227
	5	1,448	2,295	3,301
	6	1,481	2,348	3,377
	7	1,516	2,402	3,454
User AISs	1	90	183	293
	2	277	561	901
	3	473	956	1,536
	4	586	1,186	1,904
	5	600	1,213	1,948
	6	613	1,241	1,993
	7	627	1,269	2,039
Totals	All	14,749	25,249	37,980

Note: Table totals reflect the results of rounding.

# Appendix C

## Implementation Strategy

This appendix identifies the tasks and subtasks for DoD to implement the central reference server strategy. It also proposes the time needed to complete the implementation tasks.

### IMPLEMENTATION PLAN AND SCHEDULE

Eight critical steps are needed to execute the central reference server strategy. Table C-1 lists the tasks and the subtasks. The schedule includes the actions to develop the server as well as capabilities at source and user sites. It uses time periods because actual start and end times will not be established until the Office of the Secretary of Defense approves the concept and identifies resources to implement the program. Table C-1 also lists lead agents for each task. In addition, a project team led by USTRANSCOM will need to coordinate all implementation tasks. The project team will include representatives of USTRANSCOM (J-4 and J-6), the Joint Transportation CIM (Corporate Management Information) Center (JTCC), and the transportation component commands (TCCs).

*Table C-1. Implementation Tasks and Schedule*

Task	Lead Agent	Year 1				Year 2				Year 3				Year 4			
		Quarter				Quarter				Quarter				Quarter			
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
1. Identify reference files, source sites, and user sites.	JTCC																
1.1 Identify reference file sources and owners.		—															
1.2 Identify source and user site technical capabilities and issues.		—															
1.3 Prioritize source and user sites for implementation.			—														
2. Develop a central reference server.	USTRANSCOM																
2.1 Develop functional requirements.		—															
2.2 Specify central reference server technical operating requirements.			—														
2.3 Procure and install hardware and software.				—													
2.4 Test the central reference server.				—													

Table C-1. Implementation Tasks and Schedule (Continued)

Task	Lead Agent	Year 1				Year 2				Year 3				Year 4			
		Quarter				Quarter				Quarter				Quarter			
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
3. Establish program manager. 3.1 Define requirements. 3.2 Identify organizational structure. 3.3 Implement program management organization.	USTRANSCOM		—														
4. Develop business procedures and operating guidelines. 4.1 Develop business procedures. 4.2 Develop operating instructions. 4.3 Update operating procedures. 4.4 Train central reference server personnel.	USTRANSCOM		—				—				—				—		
5. Develop source and user system capabilities. 5.1 Identify software and telecommunications requirements. 5.2 Procure and install software and telecommunications.	USTRANSCOM		—				—				—				—		
6. Establish partnerships with commercial file owners. 6.1 Execute trading partner agreements. 6.2 Develop a test plan.	USTRANSCOM		—				—				—				—		
7. Integrate and test system. 7.1 Modify AISs. 7.2 Develop interface programs. 7.3 Establish telecommunications connectivity. 7.4 Train the operators. 7.5 Test, evaluate, and modify the system.	USTRANSCOM		—				—				—				—		
8. Implement the central reference server project.	USTRANSCOM		—				—				—				—		

## TASKS AND SUBTASKS

Each task and subtask in Table C-1 is explained in this section.

1. Identify reference files, source sites, and user sites.

In this task, JTCC will identify the reference files that will be maintained by the central reference server. JTCC will identify source and user sites and their respective technical capabilities. JTCC will also prioritize the source and user sites for implementation.

- 1.1. Identify reference file sources and owners.

- 1.1.1. Identify sources and owners.

JTCC will identify the sources and owners of the reference files used by the Defense Transportation System (DTS).

- 1.1.2. Identify reference files.

JTCC and USTRANSCOM (J-4 and J-6) will review the list of reference files and identify the files that should be maintained by the central reference server. They will also add any additional files identified in subtask 1.1.1.

- 1.2. Identify source and user site technical capabilities and issues.

- 1.2.1. Survey source sites.

As JTCC and the project team complete task 1.1, they will survey the reference file sources to determine their computer configuration, type and name of any database management system used, and telecommunications capabilities, including Internet and World Wide Web (WWW) access. The survey team will identify issues relevant to the reference files owned by specific AISs. The team should document funded and unfunded but planned enhancements.

- 1.2.2. Survey user sites.

In this subtask, the project team will survey the user AISs to determine their computer configuration, the type and name of database management systems used, and telecommunications capabilities, including Internet and Web access. The survey team should document funded and unfunded but planned enhancements.

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1.3. Prioritize source and user sites for implementation.

JTCC and USTRANSCOM (J-4 and J-6) will prioritize the source and user sites using criteria that include the technical sophistication of each site, files owned by the site, frequency of file changes, file quality issues, benefit to DTS, and implementation cost. (We assume that all source and user sites cannot be implemented concurrently.)

2. Develop a central reference server.

In this task, USTRANSCOM's J-4 directorate will identify the functional and technical operating requirements. USTRANSCOM will procure and install the required hardware and software components to implement a central reference server.

2.1. Develop functional requirements.

2.1.1. Develop an operating concept.

The project team will develop an operating concept for the central reference server. The team will prepare a document that describes data flows, methods of exchanging data, and the electronic procedures.

2.1.2. Determine data requirements.

In this subtask, the project team will identify the data requirements to satisfy the information flows identified in subtask 2.1.1. In addition, the project team will determine if data should be stored in the original format or in a relational database (or similar product). USTRANSCOM will need to compare its findings with the capabilities of the reference file source and user trading partners. This subtask will determine if specific query or interface programs need to be developed for users to download the data in a specific format.

2.1.3. Identify business and legal issues.

The project team will review current business policies and legal issues to identify changes to implement the operating concept expeditiously.

2.2. Specify central reference server's technical operating requirements.

USTRANSCOM and its contractors will identify the hardware, software, and telecommunications to support the functional requirements.

2.2.1. Review and complete hardware specifications.

In this subtask, the project team will review the technical architecture and assess the system throughput requirements to determine the central reference server's hardware specifications.

2.2.2. Identify software requirements.

In this subtask, the project team will determine the additional software and AIS modifications to support the operating concept. In addition, the project team will review the source and user site surveys to determine the required software, including database management system and WWW push software.

2.2.3. Establish telecommunications strategy.

The project team will develop a telecommunications strategy for receiving reference file data from DTS trading partners. In addition, the project team will develop a telecommunications strategy for receiving reference file data from commercial file owners. The project team will also develop a telecommunications strategy for users to receive or retrieve reference files.

2.3. Procure and install hardware and software.

In this task, USTRANSCOM will procure, install, and configure the hardware, software, and telecommunications components identified in subtask 2.2. USTRANSCOM and contractor personnel responsible for the central reference server will also be trained to use the selected database management system and Web push products.

2.3.1. Procure and install hardware and software.

USTRANSCOM will procure and install the hardware and software to support the operating concept. Applicable AIS modifications will be completed.

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2.3.2. Provide training in using selected software.

In this subtask, USTRANSCOM and contractor personnel will receive training in using the selected software products.

2.3.3. Procure and install telecommunications components.

USTRANSCOM will procure, install, and configure the components to satisfy the telecommunications strategy identified in subtask 2.2.3.

2.4. Test the central reference server.

In this task, USTRANSCOM and the project team will oversee the testing of the central reference server to verify it satisfies the functional requirements and operating concept. Test data will be used to test the operating concept. (Testing with source and user sites will occur in the system test task.) At the completion of this task, the server will be a functional entity, although it will not have any trading partners.

3. Establish program manager.

In this task, USTRANSCOM's J-4 directorate will identify program manager requirements, identify the organizational structure needed to meet those requirements, and implement the program management organization.

3.1. Define requirements.

Based on the responsibilities specified in the report, USTRANSCOM will identify the requirements for a program manager.

3.2. Identify organizational structure.

In this subtask, USTRANSCOM J-4 will assess the requirements identified in subtask 3.1 to determine the staffing and infrastructure to implement a program management office.

3.3. Implement program management organization.

Based on the assessment in subtask 3.2, USTRANSCOM J-4 will establish the program management organization and select a program manager.

4. Develop business procedures and operating guidelines.

In this task, USTRANSCOM and the project team will develop the business procedures and operating guidelines for the central reference server. USTRANSCOM and the project team will also develop the operating instructions for the source and user sites.

4.1. Develop business procedures.

This subtask requires the project team to develop the business procedures for the reference server. The procedures include the resolution of errors, points of contact, and frequency of operations. The procedures also include resolving the business and legal issues identified in subtask 2.1.3. The procedures will be disseminated to all source and user sites.

4.2. Develop operating instructions.

The project team will develop instructions that define how sources and users will access the reference server. These instructions will identify the access methods, frequency of updates, and other information required by sources and users to determine how they will update reference files. The instructions will be distributed to the source and user sites when this subtask is completed.

4.3. Update operating procedures.

Building on the business procedures developed in subtask 4.1, the project team will formulate detailed operating procedures for day-to-day operations. The operations include software operation, transmission times, error-handling procedures, customer service levels, and backup routines.

4.4. Train central reference server personnel.

In this subtask, the project team will formulate and oversee a comprehensive training program that includes database operations, Web push product operations, and new internal operating procedures.

5. Develop source and user system capabilities.

With USTRANSCOM oversight, the TCCs, Military Services, and Defense Logistics Agency will identify the software and telecommunications required at their source and user sites to support the operating concept. This task will be completed for each source and user site. The source and

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user project teams responsible for this task should identify funded or planned software and telecommunications enhancements.

5.1. Identify software and telecommunications requirements.

5.1.1. Identify software requirements.

This subtask will identify the additional software and AIS modifications required at individual source and user sites to support the central reference server's functional requirements and operating concept developed in subtask 2.1. Potential software requirements include database management system and Web push software. The teams responsible for this task will coordinate their findings with the central reference server's project team.

5.1.2. Identify telecommunications requirements.

The project team will identify the telecommunications requirements for sending and receiving reference file data.

5.1.3. Develop interface requirements document.

In this subtask, each source and user site project team will work with USTRANSCOM J-4 to develop an interface requirements document that identifies the files to be exchanged, method of telecommunications, and frequency of file updates.

5.2. Procure and install software and telecommunications.

In this subtask, each source and user site project team will procure, install, and configure the software and telecommunications components identified in subtask 5.1.2.

5.2.1. Procure and install software.

Source and user project teams will procure and install the software to support the operating concept. Applicable AIS modifications will be completed.

5.2.2. Train users in using selected software.

In this subtask, DoD personnel at source and user sites will receive training in using selected software products.

5.2.3. Procure and install telecommunications components.

Source and user project teams will procure, install, and configure the components to satisfy the telecommunications strategy identified in subtask 2.2.3.

6. Establish partnerships with commercial file owners.

USTRANSCOM J-4 will contact its commercial trading partners to establish license agreements, execute trading partner agreements with those partners, and develop a test plan for receiving source reference file data from those trading partners.

6.1. Execute trading partner agreements.

In this subtask, USTRANSCOM will execute trading partner agreements with commercial file owners to send reference file data electronically to USTRANSCOM.

6.2. Develop a test plan.

In this subtask, the project team will develop a plan for testing the exchange of reference file data with each commercial trading partner.

7. Integrate and test system.

USTRANSCOM and its contractors will modify the AISs, develop the necessary interface programs, establish the telecommunications connectivity, update the operating procedures, train the operators, and test the system.

7.1. Modify AISs.

In this subtask, the project team will ensure that the AIS modifications developed as part of subtask 2.2.2 are implemented in a timely and coordinated manner.

7.2. Develop interface programs.

In this subtask, the project team will develop and install interface programs that format data from the central reference server's database system for a user AIS. This subtask depends on the outcome of subtask 4.2 and may not be necessary.

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7.3. Establish telecommunications connectivity.

The project team will establish and test the telecommunications connectivity installed by subtask 5.2.3.

7.4. Train the operators.

In this subtask, the project team will formulate and oversee a comprehensive training program for source and user sites that includes database operations, Web push product operations, and new internal operating procedures as needed.

7.5. Test, evaluate, and modify the system.

The project team will field the technical configuration, establish telecommunications links, test the system using actual reference file data, and make system modifications. The testing should be completed in two phases. First, the project team will test the system using sample data, evaluate the results, and make appropriate modifications. In the second phase, the team will test the system using data sent by a selected number of trading partners. The team will evaluate and modify, as appropriate, every system component—telecommunications, hardware, database management software, interface programs, and AISs. Both phases should be repeated until the system passes all testing criteria.

8. Implement the central reference server project.

After testing has been completed and a selected set of trading partners is ready to send or receive data electronically, the system will move into a production environment.

## Appendix D

# Abbreviations

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AIS	automated information system
AMC	Air Mobility Command
ANSI	American National Standards Institute
ASC	Accredited Standards Committee
CD-ROM	compact disk—read-only memory
CFM	CONUS Freight Management
CIM	Corporate Information Management
CONUS	continental United States
DAAS	Defense Automatic Addressing System
DAASC	Defense Automatic Addressing System Center
DFAS	Defense Finance and Accounting Service
DISA	Defense Information Systems Agency
DLA	Defense Logistics Agency
DLMS	Defense Logistics Management System
DLSC	Defense Logistics Services Center
DoD	Department of Defense
DoDAAC	Department of Defense activity address code
DTEDI	Defense Transportation Electronic Data Interchange
DTS	Defense Transportation System
DUNS	Data Universal Numbering System
EDI	electronic data interchange

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GBL	government bill of lading
GTN	Global Transportation Network
JTCC	Joint Transportation CIM Center
MILSTRIP	Military Standard Requisitioning and Issuing Procedures
MSC	Military Sealift Command
MTMC	Military Traffic Management Command
SCAC	standard carrier alpha code
TCC	transportation component command
TS ID	transaction set identification
USTRANSCOM	U.S. Transportation Command
WWW	World Wide Web

# REPORT DOCUMENTATION PAGE

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