BBN SYSTEMS AND TECHNOLOGIES
A Division of Bolt Beranek and Newman Inc.

Report No. 7795

Dynamic Analysis and Replanning Tool (DART) Final Functional Description

Prepared By:

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Brian Thacker, SRA
Robert McCormack, MITRE

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10 Moulton Street
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Prepared For:

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Information Science and Technology Office
Dynamic Analysis and Replanning Tool (DART)
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13. ABSTRACT (Maximum 200 words)
The Dynamic Analysis & Replanning Tool (DART) provides functions for Plan Generation and Processing, Plan Analysis and external integration. This document describes the functions of each of these major components of DART.

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DART FUNCTIONAL DESCRIPTION

SECTION 1 - GENERAL

1.1 Purpose of the Functional Description

This Functional Description (FD) is prepared in accordance with the guidelines of DOD-STD-7935A, and tailored to the needs of the Dynamic Analysis and Replanning Tool (DART) system development effort.

The purpose of the DART FD is to perform the following functions:

a. State the major functional requirements and objectives that are being satisfied by the DART testbed system and DART applications. These requirements will serve as a basis for mutual understanding between users and developers; and will assist program managers in evaluating user-recommended system enhancements and modifications.

b. Provide information on performance requirements, design considerations, and user impacts. The functional and performance requirements together provide a basis for developing system tests.

c. Support interface design between DART and other systems.

1.2 Requirements Evolution

DART continues to be developed using the principles of rapid prototype development. Under those principles a much closer relationship exists between user functional requirements generation and system development than is found in traditional development efforts.

a. DART was conceived as a testbed for new ideas under the DARPA Knowledge-Based Planning and Scheduling Initiative (PI), and was never intended to satisfy a single 'one-time' set of requirements or to produce a single application. DART development is an evolutionary process with a continuing cycle of new development, user evaluation, and user feedback of new ideas and approaches to the developers.

b. After limited initial development, the DART project received major impetus focussed on satisfying several critical needs identified by U.S. Transportation Command (USTRANSCOM) TCJ5 during Operation Desert Shield. This resulted in an intensive operationally oriented development effort during the fall of 1990. These operational needs were documented in the DART CONOPS, roughly in parallel with system development. The product of that intensive development effort was used at USTRANSCOM and USEUCOM during the winter of 1990-91.

   Further functional requirements were established as a result of operational use following Operation Desert Shield. DART was used extensively by USTRANSCOM and other joint commands for planning refinement conferences, special studies, exercises, and crisis operations. Requirements were documented in the briefings and minutes of DART In-Progress Review (IPR) meetings, and in system test reports.

   Other requirements were generated by users through the DART incident reporting and system change proposal process. User recommendations are reviewed and evaluated by

DART program management. This requirements generation and confirmation process is still on-going, and continues to play a significant role in directing DART development.

Recently, the DART client-server architecture has been used as a foundation for the Technology Insertion Project (TIP); early results from that process have generated new directions and further requirements affecting continued DART development.

c. As a consequence of the evolutionary user-directed DART system development, this FD is both a statement of what has been accomplished, and a roadmap for the future.

1.3 Project References

1.3.1 Project request or other initiation documents

a. A Proposed Initiative in Crisis Action Planning, Major Steve Cross, 18May1990, published by DARPA/ISTO.

b. A Preliminary Specification of the DARPA Transportation Planning Research Prototyping Environment, Mark H. Burstein, October 1990, prepared by BBN Systems and Technologies for DARPA.

c. Dynamic Analytical Replanning Tool (DART) Concept of Operations (CONOPS), 30 Oct 1990, published by USTRANSCOM/TCJ5-S.

d. Dynamic Analytical Replanning Tool (DART) Functional Specification, 10 Nov 1990, published by USTRANSCOM/TCJ5-S.

1.3.2 Previously developed technical documentation relating to DART (in order of publication)

a. Software Test Plan for the Dynamic Analytical Replanning Tool, 16 Nov 1990, prepared by SRA for Bolt Beranek and Newman Inc.

b. Test Analysis Report for the Dynamic Analytical Replanning Tool, 16 Nov 1990, prepared by SRA for Bolt Beranek and Newman Inc.

c. Dynamic Analysis and Replanning Tool (DART) Test Analysis Report, Build II, 22 Jul 1991, prepared by SRA for Bolt Beranek and Newman Inc.

d. Preliminary Data Element Analysis Report (Draft) for the Dynamic Analysis and Replanning Tool (DART), 31 July 1991, prepared by SRA for the JOPES Project Group (JPG), USTRANSCOM.

e. A Supplement to the DART, Build 2, Test Analysis Report, 14 Aug 1991, prepared by SRA for Bolt Beranek and Newman Inc. for USTRANSCOM/TCJ6GM, TCJ5-SC, and DARPA.

f. Dynamic Analysis and Replanning Tool (DART) Test Analysis Report, Build III, 17 Oct 1991, prepared by SRA for Bolt Beranek and Newman Inc.

g. Dynamic Analysis and Replanning Tool (DART) Test Analysis Report, Release 3.0.1, 3 Jan 1992, prepared by SRA for Bolt Beranek and Newman Inc.

h. Dynamic Analysis and Replanning Tool (DART) Test Analysis Report, Build 3.1, 29 May 1992, prepared by SRA for Bolt Beranek and Newman Inc.

i. DART Incident Reports (IR)/System Change Proposals (SCP), Feb 1991 through current.

1.3.3 Other DART Manuals or Documents (in order of publication)

a. Users Manual For The Dynamic Analytical Replanning Tool, 16 Nov 1990, prepared by SRA for Bolt Beranek and Newman Inc.

b. Dynamic Analysis and Replanning Tool (DART) Users Manual, Build I, 15 Mar 1991, prepared by SRA for Bolt Beranek and Newman Inc.

c. Dynamic Analysis and Replanning Tool (DART) Users Manual, Build II, 1 Aug 1991, prepared by SRA for Bolt Beranek and Newman Inc.

d. Dynamic Analysis and Replanning Tool (DART) Users Manual Supplement, Useful Data Codes and Data-Related Definitions for DART Users, 1 Aug 1991 (rev 25 Oct 1991 and 15 May 1992), prepared by SRA for Bolt Beranek and Newman Inc.

e. Dynamic Analysis and Replanning Tool (DART) Users Manual, Build III, 8 May 1992, prepared by SRA for Bolt Beranek and Newman Inc.

f. Dynamic Analysis and Replanning Tool (DART) Site System Administrator's Manual, Final Draft, 8 May 1992, prepared by SRA for Bolt Beranek and Newman Inc.

1.3.4 Significant Correspondence Relating to DART

DART In-Progress Review (IPR) Presentations, which were given on the dates listed below:

10 Jan 1991
24 Jan 1991
8 Feb 1991
21 Feb 1991
11 Mar 1991
12 Apr 1991
25 Apr 1991
24 May 1991
11 Jul 1991
31 Jul 1991
28 Aug 1991
17 Oct 1991

1.3.5 Documentation concerning related projects

a. WWMCCS ADP Modernization Prototype Standard, 15 Jan 90, JDSSC-WAM-STD-001.

b. JOPES System Summary Book, 29 Sep 89 (SRA: TR-89-433-8543).

c. JOPES Scheduling and Movements Subsystem Model (Version 2.0), Development Report, 9 Mar 90 (SRA: TR-90-537-8569).

d. JOPES Transportation Analysis Prototype (Version 3.0) Development Report, 12 Mar 90 (SRA: TR-90-537-8572).

e. JOPES Users Manual - Volume 1 (General Reference), TCJ6-D: CSM UM 339-90.

f. Joint Deployment System (JDS) Users Manual - Volumes 2-8, TCJ6D: TD-18-14-1.

g. Joint Deployment System (JDS) Users Data Element Dictionary, TCJ6-D: TD-18-14-2.

h. Joint Deployment System (JDS) Users Guide, TCJ6-D: TD-18-14-3.

i. Joint Deployment System (JDS) Functional Description, TCJ6-D: TD-18-47.

j. Joint Deployment System (JDS) Procedures Manual, TCJ6-D: TD-1848.

1.3.6 Risk Analysis Studies

None.

1.3.7 Standards or Reference Documentation

a. SunOS 4.1.1, User's Guides and System Documentation (series) from Sun Microsystems.

b. Oracle (Version 6.0.30) for Sun-4, System and User's Documentation (series), from Oracle Corp.

c. Common Lisp Reference Manuals

d. Cronus Documentation

1.3 Terms and Abbreviations

See Appendix A.

SECTION 2 - SYSTEM SUMMARY

2.1 Background

The DART program is intended to address limitations caused by the lack of improved technology for joint planning. The DART program is intended to demonstrate and provide new technologies and advanced applications for the DoD Joint Planning and Execution Community (JPEC).

2.2 Objectives

The DART program has the two following goals:

- To provide a planning initiative testbed that will demonstrate the benefits of new technology and rapid prototype development for DoD joint planning initiatives; and that will support continued new developments

- To develop continuously and rapidly new applications that offer significant improvement over previous ways of conducting joint planning.

The functions being targeted by the DART program are those which could benefit the most from advances in computer automation technology and artificial intelligence.

Applications (functions) developed through DART are eventually expected to be integrated into primary user planning systems, such as JOPES. Until then, DART applications may be used in stand-alone or indirectly linked configurations by planners at USTRANSCOM, and at other JPEC sites that require faster methods of planning data manipulation and analysis.

DART applications are expected to interoperate with the primary planning systems used by USTRANSCOM and the JPEC, specifically with JOPES, GTN, and further new systems developed through the DARPA PI program.

The DART architecture has been designed to provide a platform for creating, evaluating, and fielding additional planning decision aids. DART provides a vehicle for insertion of new technology being developed by the DARPA PI community. DART development provides functional and architectural insight into longer-term planning and execution problems being addressed by the JPEC and USTRANSCOM.

2.3 Existing Methods and Procedures

2.3.1 Organization

The planning of joint military operations, either for potential contingencies or in response to immediate crises, is a complex process performed by many organizations following synchronized procedures and linked by automated systems.

Peacetime and crisis action planning is performed by members of the JPEC. The JPEC consists of those headquarters, commands, and agencies involved in training, preparing, moving, receiving, employing, supporting, and sustaining military forces assigned or committed to a theater of operations or objective area. The JPEC includes the Joint Chiefs of Staff (JCS) and Joint Staff, Services, Service major commands, Unified and Specified

Commands (and their Service component commands), Joint Task Forces (JTF), and DoD Agencies.

The overall purpose of joint planning is to develop and disseminate operation plans (OPLAN), with sufficient detail to provide guidance to every level of operation; and, in time of crisis, to update, approve, and disseminate OPLANs. Execution of an operation is expected to follow the pertinent OPLAN. The OPLAN detail is provided by large databases called TPFDDs.

While overall direction for joint planning and operations is received through the JCS, the bulk of the planning activities and the required information system support occurs at joint command headquarters throughout the world. The center of activity may be anywhere within this structure; and may change from one part of the world to another within hours. Consequently, a great amount of flexibility must be provided by the planning systems and networks supporting this structure. The peacetime (deliberate) planning functions are virtually continuous, at joint headquarters around the world, and are driven by changes in policy direction and shifts in real world situations.

Joint planning is a complex task inhibited by many factors. Some of the operational factors are:

- A large worldwide group of organizations and individuals are involved in a military operation; and must have simultaneous access to the related OPLANs and supporting data

- Crises and multiple crises develop and change quickly, causing concurrent planning, replanning, and execution

- Transportation plans must support or be developed for multiple mission statements and associated courses of action

- Transportation resources are limited and planning time is compressed.

Transportation planning is a critical component of the planning process. USTRANSCOM, which plans, manages, and directs DoD transportation operations, must possess sufficient transportation planning and analytical capabilities to provide the JPEC with information for sound and timely decisions. In addition, these capabilities must provide accurate answers to strategic questions (e.g., lift capability, lift required, closure estimates) in the constrained time frames associated with course of action analysis.

Improvements to a wide variety of joint planning functions have been under study and development for many years, through many other programs. As a consequence, the functional terminology used by these programs variesand is documented in a wide range of literature.

2.3.2 Systems & Equipment

The JPEC currently employs a number of different systems and applications in the joint planning and transportation analysis functional areas.

a. Joint Operation Planning and Execution System (JOPES) is the keystone of the joint planning structure. JOPES provides the JPEC with a set of procedures, automation, and communications. Through JOPES automation, joint planners have coordinated access to large databases of planning data. The JOPES database is the primary repository of movement requirements associated with the OPLANs, known as TPFDDs.

b. Transportation analysis of OPLANs has been primarily accomplished, in various parts of the JPEC, with four models: Simulator for Transportation, Analyses and Planning (SITAP), Rapid Intertheater Deployment Simulator (RAPIDSIM), Model for Inter-theater Deployment by Air and Sea (MIDAS), and Transportation Feasibility Estimator (TFE). A new set of models has been produced recently, FAST/JFAST.

c. GTN will provide USTRANSCOM and its components with integrated automated support to plan, provide, and control common user airlift, sealift, and terminal services to deploy, employ, and sustain US forces globally in peace and war. GTN will acquire movement requirements, plan and direct movement operations, evaluate operational performance, and identify transportation costs to users.

2.3.3 Interfaces

JOPES, as the primary joint planning system and structure, provides a network linking the JPEC sites, and includes a (limited, as yet) variety of interfaces with related systems. Any new system or application must interoperate in some way at some point with JOPES. All new applications must be compatible with JOPES procedures. The JOPES network is the primary initial source of TPFDDs.

Links between the various models and JOPES vary considerably. DART has been designed to include RAPIDSIM and a variation called PFE. DART will also produce data that may be used by the JFAST model.

The USTRANSCOM GTN will link with JOPES as well as with several USTRANSCOM/TCC internal systems and networks.

A series of new systems and applications are being developed through the DARPA PI program. These will include links with JOPES at some level.

The TIP project has produced an architectural design that enhances the interface possibilities between JOPES and new systems such as DART.

2.3.4 Deficiencies

The planning functions that DART is intended to support are not new capabilities. All of the major functions are being performed today in some fashion, or to some extent, on other existing systems.

The primary deficiency with current planning systems is that they do not permit users to perform their planning functions with modern state-of-the-art tools. This lack is primarily due to the delays traditionally found in the DoD information systems development and acquisition process. The required (or desired) technology exists, and is being used by other (commercial and academic) sectors; but the technology has not transitioned to DoD users. Awareness of what could be, but has not been, provided contributes to an increasing sense of frustration on the part of planners and other members of the JPEC.

Among the technologies currently lacking are:

- Current state-of-the-art workstations, linked with standard local area networks, and supporting modern (relational) database management systems

- Standard (open system) architectures, which would permit the use of commercial-off-the-shelf (COTS) applications, and make development of new applications and systems much faster and cheaper

- Graphical user interfaces (GUI), which offer user-friendliness and better ease-of-use, and require less user training

- Workstation-based functions and applications, integrated into the workstation and servers, which would permit much faster operations and greatly improved response time for users.

As a result:

- Coordinated access to OPLANs/TPFDDs is difficult, and TPFDD data viewing and editing is slow and awkward. OPLAN TPFDD creation and modification often take longer than the crisis an OPLAN is designed to address

- Methods of planning and transportation analysis are complex and time consuming; and the results are inadequate

- The entire planning process is not user-friendly, requires extensive user training and experience, and effectively prohibits use of the current systems by users without extensive experience.

2.4 Proposed Methods and Procedures

DART will provide planners with a relational database management system and an integrated set of automated tools that run on modern workstation hardware supporting an open system architecture. DART-based applications will take advantage of standard GUI displays, standard system design, and standard network linkages.

DART is intended to address the following generalized joint planning processes:

- OPLAN course-of-action evaluation and selection

- Deployment and execution planning

- Transportation feasibility estimates

- Modeling and simulation activities.

These processes will be performed during both peacetime (deliberate) and time-sensitive (crisis action) planning conditions.

These processes may be summarized as the functions of:

- Creating OPLAN TPFDDs

- Editing and manipulating OPLAN TPFDDs

- Performing analyses of TPFDDs

- Producing graphics, reports, and similar decision aids
- Acquiring and disseminating OPLAN TPFDDs.

2.4.1 Summary of Improvements

DART will provide the following major benefits to planners:

- Modern workstation hardware, providing vastly increased processing power and storage, and greatly reducing processing time
- An open systems architecture that is readily adaptable to integration of related functional capabilities
- An easy-to-use X-Windows interface that supports a modern user-friendly graphical user interface
- A set of integrated planning functions operating on the user's own workstation; or operating on a network server, and accessible by distributed users
- Modern relational database capabilities.

2.4.2 Summary of Impacts

DART exploits intelligent systems technologies that allow the planner to examine a TPFDD graphically, ask 'What if?' questions, find errors, make changes, and produce a TPFDD in less time than with existing systems.

These innovations will make it possible for planners to consider more alternatives than with current capabilities, and to produce, in less time, a potentially feasible course of action, thus providing for more rapid decision-making.

DART provides rapid transportation models that can be run with little assistance by planners on their own workstations. DART also readily interfaces to other models.

DART supports force modularization (force modules) and movement requirement aggregation.

DART produces summary reports similar in format to existing reports, but which may also be further refined by users.

DART can be extended to network-based client-server architecture, allowing simultaneous access to TPFDDs by multiple users.

The DART database design will support database consistency.

2.4.2.1 User Organizational and Operational Impacts

DART and DART-like capabilities will have a very substantial impact upon users and their organizations. For the first time, planners will have the automation tools to rapidly and accurately do their job.

The availability and flexibility of workstation-based planning applications will move the focus of the planning effort from the computer center to the planner's office and to the crisis action

team's desks. The increased processing power and speed being made available greatly enhances the planner's ability to manage crisis and other time-sensitive conditions.

The traditional approach to developing transportation feasible OPLANs has involved a combination of the peacetime deliberate planning process and the crisis action process, supported by automation systems such as JOPS/JDS and various disconnected analysis tools. These systems were generally complex to use and manage, slow, laborious, lacked interoperability, and were supported by analysis tools that provided at best rough estimates of the situation. Turnaround time between running model simulations and being able to effect changes based on the model results was often measured in days. There was little need for rapid interpretation and highly accurate analysis; planners were essentially limited by their tools.

With the advent of new systems that take advantage of current technology, such as DART and JFAST, planners can now develop a comprehensive plan, simulate and analyze it accurately, change it quickly, and repeat the process as long as necessary. Turnaround time is now measured in minutes. The primary limiting factor for OPLAN analysis has now become the ability of the planner to use the new tools.

2.4.2.2 User Development Impacts

a. User and SysAdmin Training. Users will need basic training in the operation of DART applications. System administration training will be required for those systems placed at sites without Unix experience or training.

b. Professional Planner Training. While the need for extensive system user (operator) training will significantly decrease with DART, the increased capability for in depth planning activity will undoubtedly reveal the need for increased joint planner and planning analysis training, at the professional school level.

c. Transition and Fielding. Plans will be needed to manage and control the fielding of DART prior to the integration of its applications into standard systems.

d. New Applications. New applications may be developed by users (assuming sufficient configuration management controls) through the mechanism of:

   - Providing access to the DART database via C, FORTRAN, Ada, or COBOL
   - Modifications to the DART top level screens
   - Use of X-Windows tools for graphic interface functions

e. Better Data. The increased ease by which users may access and view the basic TPFDD and standard reference file data may create a need to improve the accuracy and consistency of that data.

2.4.2.3 JOPES Support Elements

Based on an evaluation of DART Build II functionality, and as documented in JFCMT, the following JOPES Support Elements (JSE) are fully supported by DART:

J030.4 COA/PLAN/OPORD DATA BASE GENERATION PROCESS

J030.4-01 Identify all common-user, inter-and intra-theater movement requirements for a COA, OPLAN, or OPORD.

J030.4-02 Identify all organic inter-and intra-theater movement requirements for a COA, OPLAN, or OPORD.

J030.4-03 Estimate, at the macro level, lift requirements for a strategy option or COA.

J030.4-04 Review force closure priorities of previously approved OPLANs and revise as necessary.

J030.4-08 Allow tailoring of transportation data associated with force modules and/or individual unit types.

J030.4-10 Provide capability to generate or tailor all transportation data associated with force modules and/or individual units.

J030.4-15 Identify intra-CONUS and inter-theater movement requirements.

J030.4-27 Maintain adequate backups to keep from losing the data stores.

J030.7 TRANSPORTATION ANALYSIS PROCESS

J030.7-01 Extract movement requirements from the COA/Plan/OPORD Data Base Generation Process (J030.4).

J030.7-03 Generate time-phased requirements of airlift aircraft, sealift ships, surface lift vehicles, and air refueling aircraft for each day of COA/OPLAN.

J030.7-04 Determine capability of available assets (military, civilian, Allied, etc.) to support all or part of a COA/OPLAN.

J030.7-05 Determine capabilities and limitations of ports to support time-phased deployment sequence.

J030.7-06 Adjust POEs/PODs to eliminate under-utilized channels except where priority or movement characteristics require a specific channel.

J030.7-08 Determine impact of transportation constraints (to include interruptions in strategic flow or delays due to political or operational considerations) for global or multi-theater scenarios.

J030.7-12 Provide analytical products to the JTB to support potential allocation decisions.

The following JSEs may be fully supported by DART (JFCMT does not yet reflect these):

J030.8 COMPARATIVE ANALYSIS PROCESS

J030.8-05 Compare actual closure of forces and material with established delivery requirements as established by EAD, LAD, and RDD, and determine modifications to requirements.

J030.6 PLANS INTEGRATION PROCESS

J030.6-05 Integrate all deployment, redeployment and retrograde movement requirements.

The following JSEs are or may be supported in part by DART (JFCMT documentation varies):

J003 US-ALLIED COORDINATION PROCESS

J003-05 Assess host-nation transportation support.

J004 NEO ANALYSIS PROCESS

J004-04 Project time-phased NEO requirements and optimum ports of embarkation.

J004-06 Provide the capability to develop, modify, and review NEO-related plans.

J005 RETROGRADE ANALYSIS PROCESS

J005-01 For Class VII retrograde compute: weight, volume, port and special handling requirements; depot allocations for rebuild facilities; air, sea, and rail lift requirements; staging and materiel handling equipment requirements; and the recomputation of the foregoing based on changes to inputs. Weights and measures of supplies and equipment should be expressed in International (Metric) System figures in addition to U.S. weight and measure figures.

J005-02 For Class IX retrograde, accomplish all as for Class VII (above).

J008 MUNITIONS ANALYSIS PROCESS

J008-09 Identify time-phased munition-related mobilization, transportation, and storage facilities requirements.

J009 MATERIEL ANALYSIS PROCESS

J009-10 Develop time-phased non-unit data for use in determining transportation feasibility materiel transportation requirements by the Transportation Analysis Process (J030.7).

J030.7 TRANSPORTATION ANALYSIS PROCESS

J030.7-02 Select optimal modes and routes among available LOCs/ALOCs/SLOCs to support intra-CONUS, inter-theater, and intra-theater movement requirements for a specific COA/OPLAN considering but not limited to: a) Overflight and landing rights. b) Enroute support facilities. c) Staging areas. d) Air refueling support. e) Installation outloading capability. f) Port throughput. g) CONUS transit times. h) Critical sea/surface movement asset availability.

J030.7-07 Calculate the time-phased projected losses of transportation assets and escort vessels/aircraft over all LOCs projected for a particular scenario.

J030.7-09 Assess the impact of moving special requirements, e.g., POMCUS, relative to resources required and overall impact on COA/OPLAN.

J030.8	COMPARATIVE ANALYSIS PROCESS
J030.8-06	Assess impacts of reallocation of transportation resources on capability to meet schedules.
J034	COURSE OF ACTION (COA) ANALYSIS PROCESS
J034-01	Identify critical constraints in: a) Time-phasing. b) Resource allocation (global, multi-theater, and regional); c) Rules of engagement; d) Levels of risk; and e) Assumptions.
J046.2	OPTION GENERATION PROCESS
J046.2-02	Using aggregate force allocation and defined national and military objectives, develop military options on both a global and regional basis.
J004	NEO ANALYSIS PROCESS
J004-07	Determine the feasibility of NEO plans and COAs in terms of their interaction with other deployments or redeployments.
J005	RETROGRADE ANALYSIS PROCESS
J005-07	Analyze capability to move retrograde through CONUS ports to final destination.
J015	CIVIL ENGINEERING SUPPORT PROCESS
J015-08	Determine base loading and the extent to which facilities can support COA/Plan/OPORD flow.
J030.4	COA/PLAN/OPORD DATA BASE GENERATION PROCESS
J030.4-06	Establish and maintain time-phased force employment, sustainment, and deployment data for selected options, COAs, and OPLANs.
J030.4-11	Provide aggregate manpower requirements for each strategy option consideration.
J034	COURSE OF ACTION (COA) ANALYSIS PROCESS
J034-06	Prioritize COAs in order of: a) suitability; b) acceptability; c) feasibility; and d) any other established criteria.
J098	DATA MANAGEMENT PROCESS
J098-01	Display and brief information.
J098-06	Support preparation of other assessment documents, reports, and briefing items.
J098-07	Support briefing preparation and presentation.

2.5 Assumptions and Constraints

a. Database Design. The JOPES database design has been changing; a definitive logical model must be established in order for DART database design to be adequately completed.

b. Database Access. DART requires access to the JOPES database for TPFDD and standard reference file data.

c. JOPES Development. JOPES system architecture and resources are currently undergoing a wide variety of improvements and evolution. This has the effect of providing a moving target for new systems such as DART to link and align with.

d. Funding and Transition. Continued programmatic support must continue for DART development, fielding, and support.

e. DART Development. DART development will continue to follow the general guidelines of rapid prototype development.

3. DETAILED CHARACTERISTICS

DART is intended to provide significant improvement to planners involved in the job of joint operations planning. The determination of whether DART meets this objective can only be made by actual planners performing their job. The following statements of detailed characteristics are therefore not provided as limiting factors, and must not be considered inclusive.

3.1 Specific Performance Requirements

As a testbed, DART is intended to perform the following functions:

- Provide standardized and interoperable state of the art workstation capabilities: X-Windows, Ethernet, Unix
- Provide a standard commercial SQL-accessible relational database
- Support development of future DARPA PI and related projects

3.1.1 Accuracy and Validity

The DART database must maintain accurate information, with recovery and rollback features. History and modification logging features are required to be capable of supporting multi-user DART operation.

3.1.2 Timing

DART must support editing and refinement of a complete medium-sized TPFDD (approx. 7000 movement requirements), for a 30-day period, under typical operational crisis conditions, within 6 hours.

DART should permit a crisis action staff to analyze three COAs within two hours.

3.1.3 Capacity Limits

DART should provide storage for 15 typical OPLANs with TPFDDs, and complete copies of GEOFILE, TUCHA, CHSTR, and ASSETS files.

A DART system (Client-server) should support multi-user access to TPFDDs by at least six users.

3.1.4 User Interface

DART must provide a fully functioning graphical user interface (GUI), with color, mouse controls, and an integrated Help system.

3.2 System Functions

DART is intended to support the processes of:

- Creating OPLAN TPFDDs
- Editing and manipulating OPLAN TPFDDs

- Performing analyses of TPFDDs
- Producing graphics, reports, and similar decision aids
- Acquiring and disseminating OPLAN TPFDDs.

DART will accomplish these processes through a design of subsystems, each emphasizing one of these four major functional areas, which incorporate the above-listed processes:

- Plan Generation -- creating TPFDDs from a basic force list
- Plan Processing -- Editing and manipulating TPFDDs
- Plan Analysis -- performing analyses of TPFDDs, and producing decision aids
- External Integration -- acquiring and disseminating TPFDDs, and outputting graphics and other files.

Each of these subsystems is briefly discussed below. Plan Processing, Plan Analysis, and External Integration are described in detail in Appendix B.

3.2.1 Plan Generation

The following briefly describes the intended function of Plan Generation. The input to Plan Generation is a high-level plan description, consists of a deployment schedule for a list of major forces. Through the use of information in the TUCHA database and in a Planning Factors file, Plan Generation will generate a plan (i.e., construct a TPFDD).

a. The input to Plan Generation consists of data from several sources:

   1. High-Level Plan Description, which is a sequence of major force deployments (including CS and CSS)
   2. Joint Strategic Capabilities Plan (JSCP), which provides the availability of notional forces (by C-day)
   3. Force Module Library
   4. Planning Factors File.

b. Plan Generation output is a TPFDD suitable for DART manipulation.

3.2.2 Plan Processing

This functional area includes the visualization and editing of TPFDD movement requirements, and the creation or design of individual or groups of movement requirements. (Creation of an entire OPLAN/TPFDD from scratch is addressed under the previous section.)

DART currently focuses on the capability to modify the TPFDD. The user can quickly identify subsets of the TPFDD based upon user specified criteria, and can retrieve them for editing with simple commands. This capability allows large numbers of records with similar characteristics to be modified with a single command. Retrieved records are also available to the user for examination with graphic displays.

Future requirements are to support complete creation of individual or groups of similar movement requirements, within the context of existing TPFDDs.

The subsystem of DART that provides the functionality of plan processing is known as the TPFDD Editor or TPEDIT. The basic functions of TPEDIT are:

a. TPFDD Movement Requirement Retrieval. The user may select sets of movement requirements to be retrieved from the database using a very comprehensive set of user specified selection criteria, and a menu-based retrieval builder. Essentially, any aspect of the ULN/CIN/PIN data elements may be used to build the selection. This includes the characteristics of the movement requirement and the properties of its cargo, as well as the schedule of the movement requirement including the dates and locations of its movement. The user may also select sets of movement requirements by choosing a standard or predefined selection criterion. These are generally used to select movement requirements which contain common inconsistencies or other errors. A capability will be provided to store and recall user retrievals.

b. TPFDD Data Viewing and Editing. The user may display, view, and edit any portion of any movement requirement, either singly or as a group. Many of the attributes of the movement requirements such as the characteristics of the units and the properties of its cargo may be viewed and changed, down to and including the 4th level of detail. Also, all the attributes of the routing data planned for the movement requirement, including the dates and locations of its movement, may be viewed and changed. Individual movement requirements may be copied and modified, thus creating new movement requirements. Force requirements (ULNs) can be generated and edited, either singly or in groups.

c. Creating and Copying TPFDDs. New TPFDDs may be created quickly from existing TPFDDs. By accessing two TPFDDs simultaneously, the user can copy some or all the movement requirements from one TPFDD to another. In this way, a new TPFDD can be constructed by inserting selected portions of several existing TPFDDs.

d. Force Module Analysis. In addition to accessing a TPFDD in terms of its basic elements (ULNs, CINs, and PINs), the user can analyze the TPFDD at the Force Module level. The user may select or create FMs for review and analysis. The user can display daily profiles of planned deliveries by force module. These graphs provide summaries of daily or cumulative delivery requirements for one or more force modules. Furthermore, these requirements can be compared with a graph of daily delivery capability allocations, which are entered manually.

e. Geographic Display of TPFDD Movement Requirements. The TPEDIT map display is available for viewing movement requirements in geographic form. This map display shows the pertinent locations and channels (port-pairs) employed in the TPFDD.

f. Reference File Queries. The contents of two JOPES standard reference files (the GEOLOC file and TUCHA file) can be viewed at this time.

g. TPFDD Utility Functions. A variety of utility functions are available to the user, including viewing a summary of all the changes made to the TPFDD, and rolling back changes made since the last commit operation.

3.2.3 Plan Analysis

Plan analysis provides top-level system interface functions, and tools for the transportation planner to perform Course of Action and transportation feasibility analysis. The functions provided include:

- Set up a transportation situation for an analysis, including the numbers, types and characteristics of the transportation lift assets; and graphically view and edit the ports situation, using a map display.

- Apply the transportation situation assets and ports to the movement requirements in the TPFDD, using a selected transportation model.

- Examine, display, and print the results of the model analysis in graphical or hardcopy form.

a. Analysis User Interface. DART analysis function is operated from the DART top-level screen. Several icons, combined with pull-down menu buttons, allow the user to choose from a wide variety of options. In addition, each icon selection may contribute further pull-down menu selections; and each display may contain one or more mouse-sensitive items which may provide additional choices. The primary control vehicle for the analysis function is the Situation or Summary screen, which provides a series of three panels for user option selection and data summary. Other screens and windows, however, accessed through various icons, are used to display maps, reports, and analysis products.

b. Summary Panel Display. The Summary icon brings up a screen which can display three panels: TPFDD, Situation, and Model Analysis. Each of these panels is displayed when the appropriate files are selected or created: TPFDD file, Situation file, and Model analysis file.

    1. TPFDD. Plan analysis begins with the user selecting and retrieving a TPFDD from the DART database. The movement requirements of the TPFDD are analyzed and presented in summary form to the user.

    2. Situation. The user selects and retrieves a "transportation situation" for analysis with the selected TPFDD. The user can then view and modify the characteristics and the allocations of the transportation assets in the situation (aircraft and ships). Also, the user can specify the nodes, or notional ports, to be used in the transportation analysis. In addition, the user can specify the expected status of the Suez and Panama Canals. A summary of the situation is presented to the user.

    3. Model Analysis. The primary analysis mode of DART is based on more detailed transportation models. The user has the choice of RAPIDSIM, or PFE (Prototype Feasibility Estimator). For each of the supported models, the user can adjust the model parameters, run the model, and view the model results in summary tabular form, as well as in detailed graphical form. After running PFE, the user can make adjustments to the TPFDD and rerun the model. Desired TPFDD modifications may be transferred directly to the permanent TPFDD file from PFE.

c. Main Map Display. The Main Map display is used to view and edit ports and nodes, prior to running a model analysis. Unlike the TPEDIT map, the Main Map shows true geographical positions and great circle routes. The map can show the ports, nodes, and paths (routes and node-port links) for the entire selected TPFDD.

d. Capacity Graphs. Once a TPFDD and situation have been specified, the user can perform a rough model-independent analysis of the feasibility of the TPFDD movement requirements given the constraints of the situation.

e. Analysis Products and Results. These functions provide access to a series of graphical and report-based analysis products, which show the results of the model analysis run. (These are only available after a model has been run.) Several types of reports can be obtained at this point. (Outputs are discussed in the following section.)

3.2.4 External Integration

External integration covers the functions which transfer data between DART and other systems, and those which simply produce output for the user. (This section discusses applications; architectural issues relating to the data transfer are discussed below, in para 3.3.)

a. Capabilities are provided to acquire TPFDD data from JOPES/WWMCCS, and to return TPFDDs to JOPES/WWMCCS when required.

b. Tools are also provided to generate and export files and graphic analysis results to other systems. For example, TPFDDS, once modified by DART can be exported to FAST/JFAST for additional analysis.

c. Paper copies of all reports and graphical displays can be provided. Also, graphics resulting from DART analysis can be transferred to Macintosh and MS-DOS personal computer systems for conversion to presentation graphics form.

The TIP project is providing additional interface capabilities to DART, via high-speed link with the WWMCCS mainframe system; and improved LAN interconnections with other forms of workstations running other applications.

3.3 Inputs and Outputs

3.3.1 JOPES files

DART will use inputs from the following JOPES database files:

- TPFDD and Summary Reference Files, both complete files and partial transaction processing files.
- Standard Reference Files:
  - GEOLOC File
  - TUCHA File
  - CHSTR and ASSETS Files (pending).

DART provides outputs of the form:

- TPFDD and Summary Reference Files, both complete files and partial transaction processing files.

3.3.2 Analysis files

DART creates the following files for internal use and retention:

- Analysis files
- Situation files.

3.3.3 Mac/DOS PC Interchange Files

DART (through the SunOS Unix capabilities) can convert any window display into:

- GIF Screen Files
- Mac PICT files.

3.3.4 Reports and Graphics

DART will print graphics and reports using either laser (Postscript) or line printer formats.

3.3.5 Other System Links

DART will provide output files suitable for the FAST/JFAST analysis system; and will accept files from LOGSAFE.

3.4 Database/Data Bank Characteristics

3.4.1 Relational Structure

DART is designed around a relational database structure using Oracle and SQL. TPFDDs and standard reference files imported into DART are converted into suitable tables within the Oracle database.

The existing database design is roughly based on the data elements used by the current JOPES database (flat) files, and modified somewhat by comparison with the planned JOPES logical data model. The major need has been to facilitate the storage of existing JOPES-derived data files.

Further work is needed to complete the conversion of files into a fully relational structure. The future designs of JOPES will be a major factor in this effort.

The existing DART relational table database schema is listed in Appendix C.

3.4.2 Data Storage Requirements

a. TPFDD files require from 6 MBytes (for a 10K requirements TPFDD) to 26 MBytes (for a large 40K requirements TPFDD).

b. The current TUCHA and GEOFILE standard reference files require approximately 70 MBytes total.

c. DART Internal Data. DART Oracle temporary storage requires about 30 MBytes.

3.5 Failure Contingencies

Single stand-alone DART systems have no inherent backup capability; manually generated file backups must be accomplished to protect valuable data.

In the DART distributed planning network, there are various means of reducing the impact of possible failures. The goal is to ensure that the system remains operational, perhaps in a degraded mode, at times when various pieces of the system are taken off-line, either due to scheduled maintenance operations or failures. Potential architectures include the following:

- Multiple, equivalent, workstations at each site
- Multiple servers at each site
- Additional servers available via the network (up to 1 second mouse-motion delay)
- Multiple network routes.

SECTION 4 - DESIGN CONSIDERATIONS

Because many of the DART functions have already been developed and produced, and these functions have been described above, in Section 3, only a brief synopsis is provided here.

4.1 System Description

DART consists of an integrated set of automated data processing tools and a database management system. It provides joint operators and planners the ability to visualize, edit, and analyze Time-Phased Force and Deployment Data (TPFDD) for transportation feasibility and deployment planning.

4.2 System Functions

The processes and functions addressed by DART can be grouped under four major functional subsystems. Following are short summaries of each of these subsystems, indicating which functions are currently available, and which are still pending. Details are provided in Section 3 and in Appendix B.

a. Plan Generation. Plan generation has not yet been integrated into DART. This function will be based on the Force Module Expanded Requirements Generator (FMERG). The input to FMERG is a high level plan (OPLAN) description. It consists of a deployment schedule for a list of major forces. Through the use of information in the TUCHA database and in a Planning Factors file, FMERG will generate a plan (i.e., construct a TPFDD).

b. Plan Processing. Plan processing is that portion of DART which provides planners with the capability to visualize, summarize, and make rapid changes to the TPFDD. The user is given functional tools that take advantage of aggregate levels of detail, such as force modules, thereby permitting modification of large amounts of data at one time. A limited TPFDD creation capability exists at this time.

c. Plan Analysis. Plan analysis provides tools for the transportation planner to perform course of action and transportation feasibility analysis. The user can quickly set up the transportation situation for the analysis, including the numbers, types and characteristics of the transportation lift assets. The user can then compare these transportation assets to the movement requirements of the TPFDD using one of several transportation models; and can examine the results of the model analysis in graphical form.

d. External Integration. External integration supports the other functions of Plan Generation, Plan Processing and Plan Analysis. Capabilities are provided to acquire TPFDD and reference file data from WWMCCS (JOPES), and to return TPFDD data to WWMCCS when required. Tools are also provided to export graphic analysis results and files to other systems.

4.3 Flexibility

A Relational database, object oriented code, and a distributed local area network (client-server) will allow DART to be adapted easily to changing requirements, such as un-anticipated operational changes, interaction with new or improved systems, and planned periodic changes.

The X-Windows design permits user access to the DART database from any interconnected X-Terminal workstation.

4.4 System Data

The DART database is a relational database implemented with ORACLE DBMS. SQL is the standard for database interaction both within DART and between other portions of the GTN data base.

The DART database is compatible with current versions of the JOPES TPFDD/SRF and standard reference files. DART user standard data codes derived from the JOPES procedures and related documentation.

SECTION 5 - ENVIRONMENT

DART provides developers and users with modern workstation-based technology and tools.

5.1 Equipment Environment

DART runs on UNIX-compatible (SunOS) workstations.

The minimum configuration for DART is 64 Megabytes of random access memory and two Gigabytes of disk storage. DART can run in either a LAN (client-server) or stand-alone configuration. SUN hardware requirements for an optimum configuration include:

- A SUN-4/470 SPARCstation or SPARCstation 2 with 64 Megabytes of memory (26.5 MIPs or faster)
- A three Gigabytes of disk storage
- A 9-track tape drive (for TPFDD transfer to and from JOPES), disk drives, printers (Postscript laser and line printer), and associated software drivers
- A keyboard, a 19-inch color video display monitor, and a mouse (16 inch minimum monitor)
- An 8 mm tape drive.

If a server is used to support 6 to 8 DART users, it should be at least a Sun 4/670 with 256 MByte RAM and 12 GBytes of disk storage.

5.2 Support Software Environment

DART applications are specifically designed (optimized) for ease of use through extensive graphical tools, using standard X-Windows graphical interface.

Software required for operation of DART includes:

- A SUN UNIX Operating System (version 4.1 or higher)
- An ORACLE Database Management System, with SQL*Plus
- An XPort (by Ascent)
- A SUN Common LISP Interface Manager (CLIM) and CLOS
- An X Windows (X11R5), OpenLook, and X-utilities
- Simulation Models (RAPIDSIM and PFE)
- A Cronos.

Development software includes:

- SUN FORTRAN, ACCU-COBAL Compilers
- A FORTH and a C compiler.

5.3 Communication Requirements

The DART workstations have Ethernet ports built-in, which will support a LAN connection. A modem would be required for direct link between sites.

5.4 Interfaces

DART will provide require a link with the local JOPES/WWMCCS system, either directly via hyper-channel or WAM Workstation, or indirectly using 9-track tape.

DART can obtain access to FAST/JFAST, and other systems such as LOGSAFE, via LAN connectivity.

DART will need a link with GTN systems, and with other DARPA PI-derived systems.

SECTION 6 - SECURITY

6.1 Background Information

DART can operate in either standalone or netted; and in either a classified or unclassified mode.

The classification is determined by the TPFDD data being used, and the local system connectivity.

- Working with OPLAN data in a deliberate planning or "real world" contingencies mode normally requires at least a SECRET classification

- If the hardware and software supporting DART is part of a LAN connected to WWMCCS, a TOP SECRET classification is required.

Normally, a production DART capability would operate at TOP SECRET. However, DART can be set up in an unclassified mode for demonstrations and training.

DART Windows will be modified to show classification markings.

Some DART workstations may be required to have removable hard drives, so that classified activities may be performed, after which the DART station can be declassified for storage or transport.

When the DART system is used in a local network configuration, linked with JOPES/WWMCCS, WWMCCS/JOPES/WASSO security directions and directives will be followed.

APPENDICES

APPENDIX A - GLOSSARY

APPENDIX B - DETAILED FUNCTIONS & OPERATIONS

APPENDIX A - TERMS AND ABBREVIATIONS

(Data code related abbreviations are not included here; the Supplement to the DART UM should be used as a reference.)

ADANS	Airlift Deployment Analysis System (AMC)
ADP	Automatic, Automated Data Processing
APORTS	Aerial Ports and Air Operating Bases File
ASSETS	Transportation Assets File
BBN	Bolt Beranek and Newman Inc.
CHSTR	Characteristics of Transportation Resources Files
CINC	Commander-in-Chief
CLIM	Common LISP Interface Manager Common LISP Object System
COA	Course of Action
CONOPS	Concept of Operations
C2	Command and Control
DARPA	Defense Advanced Research Projects Agency
DART	Dynamic Analysis and Replanning Tool
DBMS	Data Base Management System
DEST	Destination
DOD	Department of Defense
DTS	Defense Transportation System
EAD	Earliest Arrival Date
FAPES	Force Augmentation Planning and Execution System
FAST	Flow and Analysis System for TRANSCOM
FD	Functional Description
FM	Force Module
FMERG	Force Module Expanded Requirements Generator
GEOFILE	Specified Geographic Location File
GEOLOC	Geographic Location Code
GIF	Graphics Interface
GTN	Global Transportation Network
GUI	Graphical User Interface
HNS	Host-Nation Support
ILOC	Intermediate Location
IPR	In-Progress Review
JCS	Joint Chiefs of Staff
JDS	Joint Deployment System
JDSSC	Joint Data Systems Support Center (DISA) (formerly CCTC)
JFAST	Joint Flow and Analysis System for TRANSCOM
JFCMT	JOPES Functional Configuration Management Tool
JOPES	Joint Operation Planning and Execution System

JOPS	Joint Operation Planning System
JPEC	Joint Planning and Execution Community
JPG	JOPES Project Group
LAN	Local Area Network
LOGSAFE	Logistics Sustainment Analysis and Feasibility (JOPES)
MBYTE	Megabyte
MIDAS	Model for Intertheater Deployment by Air and Sea
MIPS	Million Instructions per Second
MHE	Materials Handling Equipment
MSC	Military Sealift Command
MTMC	Military Traffic Management Command
MTON	Measurement Tons
NEO	Noncombatant Evacuation Operation
OPLAN	Operation Plan
OPORD	Operation Order
ORIG	Origin
PAX	Passengers
PC	Personal Computer
PEDB	Planning and Execution Data Base
PFE	Prototype Feasibility Estimator
PORTS	Ports Characteristics File
RAPIDSIM	Rapid Intertheater Deployment Simulator
REQID	Requirement Identifier
RL	Rome Laboratory
SCP	Strategic Computing Program
SITAP	Simulator for Transportation Analysis and Planning
SQL	Standard Query Language
SRA	Systems Research and Applications Corporation
SRF	Standard Reference File and Summary Reference File
STON	Short Tons
STRADS	Strategic Deployment System (MTMC)
TCC	Transportation Component Command (USTRANSCOM)
TFE	Transportation Feasibility Estimator
TPEDIT	TPFDD Editor
TPFDD	Time-Phased Force and Deployment Data
TUCHA	Type Unit Characteristics File
TUDET	Type Unit Equipment Detail File
UM	User Manual
USEUCOM	US European Command
USTRANSCOM	United States Transportation Command
WAM	WWMCCS ADP Modernization Program
WASSO	WWMCCS ADP System Security Officer
WWMCCS	Worldwide Military Command and Control System

APPENDIX B - DETAILED FUNCTIONS & OPERATIONS

This appendix provides listings and detailed descriptions of the functions, operations, and menus of the Plan Processing, Plan Analysis, and External Integration subsystems of DART. Both current capabilities and planned requirements are described here.

1. Plan Processing

The subsystem of DART that provides the functionality of Plan Processing is known as the TPFDD Editor or TPEDIT.

1.1 Overview of TPEDIT

To start TPEDIT select the TPFDD icon on DART's top-level display screen. TPEDIT displays a dedicated TPEDIT window, within which further TPEDIT actions are performed.

TPEDIT provides users with access to the TPFDDs that have been loaded into the DART Oracle relational table database. The desired TPFDD must be specifically selected by the user, each time TPEDIT is started.

- Select one OPLAN from those listed
- Select TPFDD from those of the OPLAN.

Once a TPFDD has been selected, all of its data can be viewed and edited through the TPEDIT functions.

A second TPFDD may be specified to serve as a Target TPFDD for movement requirement copy actions. In this fashion a new TPFDD may be created, or another TPFDD may be extensively modified by copying movement requirements from the first selected TPFDD. Only the contents of the source TPFDD, however, may be viewed and edited.

The TPFDD selection of the TPEDIT subsystem is independent of the model analysis subsystem. The actions of the two subsystems occur separately. Only the TPEDIT subsystem can actually modify a TPFDD. The model analysis subsystem copies data from a TPFDD for analysis, and only works with the copy. The PFE model can send changes through the TPEDIT subsystem, but only under the control of TPEDIT. Any changes made to a TPFDD through the TPEDIT subsystem will be noticed by the model analysis subsystem, if that same TPFDD has been selected for analysis. (Whether the original or updated version of the TPFDD is used for analysis is optional.)

TPEDIT supports these detailed functional areas (sometimes called modes), each of which is accessed as shown here, and is described in the following paragraphs:

TPEDIT Function Area	In TPEDIT Window, Accessed Via
TPFDD Movement Requirement Retrieval	Select Icon
TPFDD Data Viewing and Editing	Editor Icon
Creating and Copying TPFDDs	Target TPFDD Arrow Box, and TPFDD Ops Pop-Up
Force Module Analysis	FM Icon
Geographic Display of TPFDD Movement Requirements	Map Icon
Reference File Queries	View Icon
TPFDD Utility Functions	Update Icon, and TPFDD Ops Pop-Up memo

1.2 TPFDD Movement Requirement Retrieval

Before movement requirements can be viewed or edited, they must be retrieved from a selected TPFDD. A retrieval makes a set of movement requirements, called collections, available for other operations. Retrieval is the necessary first step in editing movement requirements in TPEDIT.

The criteria for the retrievals may be specified by the user (a user-specified retrieval), or selected from a list of standard retrievals (a routine retrieval). The product of a retrieval may range from a single movement requirement (or even none) to the contents of the entire TPFDD. Multiple retrievals may be performed, each of which may be added to the previous collection.

After each retrieval is performed, the resulting collection of retrieved movement requirements is displayed on the Editor Screen, where the user may view the movement requirements, make changes to them, copy or delete them, and add them to a target TPFDD.

After each retrieval query is composed, it is translated by TPEDIT into an SQL statement that queries the DART TPFDD database. SQL statements may be viewed by the user.

PENDING FEATURE: Users will be able to store their retrieval statements (in the form of SQL queries) for later recall and use.

1.2.1 User-Specified Retrieval

Any attributes (codes) forming movement requirements may be used for the retrieval process, including the contents or variables of the movement requirements, characteristics of the units, and properties of the cargo.

Using mouse selection, icons, and pull-down menus, the user can construct a logical retrieval query. The query appears in clear text form on the screen, as the query is constructed.

Queries are built by logically combining up to three OR'ed clauses, each of which can contain a large number of AND'ed clauses. As an example, a retrieval for all movement requirements that either meet the constraints A1, A2, A3, and A4; OR the constraints B1 and B2; OR the constraints C1, C2, and C3, would appear as:

Select all movement requirements where

(A1 and A2 and A3 and A4)

or (B1 and B2)

or (C1 and C2 and C3).

Each constraint A1, A2, etc., is of the form:

ATTRIBUTE OPERATOR VALUE

or

ATTRIBUTE OPERATOR ATTRIBUTE.

1.2.1.1 Attributes

The ATTRIBUTE may be derived from any of the characteristics of the movement requirement, including:

Movement Requirement Identification (REQID)
Unit Description (Force Description)
Project Code

Unit-specific attributes including:
- Unit Name
- Service Code
- Unit ID Code (UIC)
- Unit Type Code (UTC)
- Unit Level Code (ULC)
- Force Description (Service Reserved)
- Parent Indicator Code (PIC)
- Force Indicator Code (FIC)
- Authorized Strength
- Number of Passengers
- Providing Organization
- POD Arrival Priority
- POD Priority Add-On
- Total Cargo (MTons or STons)
- Bulk Cargo (Mtons or Stons)
- Oversized Cargo (MTons or STons)
- Outsized Cargo (MTons or STons)
- Non Air Cargo (MTons or STons)
- Ports of Support

Critical Employment Indicator (CEI)
CINC Required Date (CRD)
TUCHA Status Indicator

Cargo-specific attributes including:
Using Organization/Service Code
Type of Movement
Fuel Type Code
POL CBbls
STons
MTons
Supply Class/Sub-class
Providing Organization
Cargo Category Code (CCC)

Personnel-specific attributes including:
Using Organization/Service Code
Type of Movement
Number of Passengers (PAX)
Providing Organization

The ATTRIBUTE may also be derived from the planned itinerary of the movement requirement, including:

Origin
Ready to Load Date (RLD)(for ULNs only)
Origin GeoLoc*

Port of Embarkation (POE)
Available to Load Date (ALD)
POE GeoLoc*
Transportation Mode
Transportation Source
Alternate POE
Alt POE GeoLoc*

Port of Debarkation (POD)
Earliest Arrival Date (EAD)
Latest Arrival Date (LAD)
LAD On Call
POD GeoLoc*
Transportation Mode
Transportation Source
Load Configuration
Discharge Constraints
Alternate POD
Alt POD GeoLoc*

Destination
Required Delivery Date (RDD)
RDD On Call
Dest GeoLoc*
Transportation Mode
Transportation Source

Load Configuration
Discharge Constraints

Intermediate Location (ILOC)
Days Delay at ILOC
ILOC Delay Code
ILOC Location Code
ILOC GeoLoc*
Transportation Mode
Transportation Source
Load Configuration
Discharge Constraints

Items marked with an asterisk include the following sub-menus:
GeoLoc Code
Location Name
Installation Type
Country/State Code
Country/State Short Name
Country/State Long Name
Province Code
Province Name
Longitude
Latitude

In addition to specific attributes of movement requirements, records may also be retrieved based on their membership in Force Modules.

1.2.1.2 Operators

The OPERATOR can be represented by any of the following symbols and words:
Equal (=)
Not Equal (!=)
Like
Not Like
In List
Not In List
Between
Less Than (<)
At Most (<=)
Greater Than (>)
At Least (>=)
Missing (field is space or null)
Not Missing (field is not space or null)

Once an operator is selected, the user is prompted for a VALUE.

1.2.1.3 Values

The VALUE is either a numeric value or a text string.

Wildcards may be used in any of the VALUE expressions:

% = Any one or more characters

_ = Any single character

(These are standard Oracle/SQL wildcards.)

VALUE entries are edited by TPEDIT prior to being placed in the SQL statement being created.

1.2.1.4 Switch Interface

The DART TPEDIT also provides a more complex version of the retrieval query function, which is accessible via the Switch Interface option; this feature is still under development.

1.2.2 Routine Retrieval

The user may also retrieve movement requirements by choosing from a list of predefined selection criteria, called routine retrievals. These are generally used to select movement requirements that contain common inconsistencies or other errors. The current list of routine retrievals is derived from the JOPES Logical Error Report and JOPS F50 Report requirements (see JCS Pub 1-03.21, Table 28). The routine retrievals currently provided in DART check for the following indications:

Service Code and UTC Incompatible
Service Code and ULN Incompatible
ULN and PIC Incompatible
UIC/Unit Name for Shortfall
In-Place Unit with Routing Data
FIC Invalid for Non-Standard UTC (99BB and Z99)
Invalid TPSN for Army Unit
TPFDD Personnel Not Equal TUCHA Personnel, FIC 0 or 2
TPFDD PAX Not Equal TUCHA PAX, FIC 0 or 2
TPFDD Cargo Not Equal Sum of SRF, FIC 2, 8, 9
All Dates Equal Zero
Dates are Missing
Dates Out of Order
ILOC GeoLoc Code Matches Other GeoLoc Code
POE Equals POD
POD Equals Dest but LAD Does Not Equal RDD
POD Equals Dest but Load Configuration and Discharge Constraints Not Equal N
POD or POD Missing
Transportation Mode or Source Invalid
Non-Air Transportable Cargo with Air Mode
Bulk POL Designated with MAC Move
Illogical Use of Intermediate Location
Number of PAX Exceeds Authorized Strength
Non-Unit Cargo Record with Personnel Data
Incomplete Split Shipment
Personnel Split Shipment with Cargo

Cargo Details Missing for FIC or 2, 8, or 9
Required Cargo Quantities Equal Zero
Required Personnel Quantities Equal Zero.

1.3 TPFDD Data Viewing and Editing

Once a collection of movement requirements (consisting of ULNs, CINs, or PINs) have been selected and retrieved, many of the characteristics of the movement requirements, such as the attributes of the units and the properties of their cargo, may be viewed and changed. Also, all the attributes of the planned itinerary of the movement requirements, including dates and locations, may be viewed and changed.

Most operations may be carried out by choosing the records and picking menu options using the mouse.

1.3.1 Operations on Selected or Marked Records

TPEDIT allows the editing, copying, and deleting of movement requirements, singly or as a group. The group may be either a collection (every record brought to view by a retrieval), or as a subset of a collection, identified by 'marking'.

Movement requirements can be marked using the middle mouse button.

When a single movement requirement identifier (REQID) is selected via the mouse, the following operations are possible through a menu of options, which appears as the mouse button is clicked:

- Mark or unmark the movement requirement, or a sequence of movement requirements
- Add a note to the movement requirement
- Add an Intermediate Location (ILOC) to the planned itinerary of the movement requirement
- Delete the movement requirement from the TPFDD
- Remove the movement requirement from the current collection
- Display movement requirement characteristics (for viewing or editing).

After one or more movement requirements has been marked, additional operations become available from the Marked Records and FM Edits menus:

- Unmark all marked records, or toggle all record markings in the collection
- Delete all marked movement requirements from the TPFDD
- Remove all marked movement requirements from the current collection
- Generate an F11D or F11E report on the marked movement requirements
- Copy all marked entries within the TPFDD

- Copy all marked entries to another (target) TPFDD
- Perform various Force Module-related operations.

Group modification of data associated with the planned itinerary of the movement requirements can also be performed.

In addition, a planned feature includes the capability to perform simultaneous updates to multiple fields displayed in the movement requirements characteristics menu. These could apply to a group of marked records or to a collection.

1.3.2 Viewing and Editing Movement Requirement Characteristics

The characteristics or attributes of movement requirements can be viewed or edited by choosing REQID. The data that is displayed is different for ULNs, CINs, and PINs.

1.3.2.1 ULNs

The following basic attributes of unit movement requirements (ULNs) may be viewed and edited in the following order:

Attribute	View Only
Parent Indicator Code	X
Description	
Providing Organization Code	
Project Code	
Number of Pax	
Service Code	
POD Arrival Priority	
POD Priority Add-On	
CEI (Critical Employment Indicator)	
Unit Type Code	
Unit Level Code	
Force Description (Service Reserved)	
Force Indicator Code (FIC)	X
Unit Identification code (UIC) (Actual UIC)	
(Actual) Unit Name	
Authorized Strength	
Bulk Cargo STons	
Bulk Cargo MTons	
Oversize Cargo STons	
Oversize Cargo MTons	
Outsize Cargo STons	
Outsize Cargo MTons	
Non Air Cargo STons	
Non Air Cargo MTons	
Bulk POL Cbbls	
CINC Required Delivery Date (CRD)	
TUCHA Status Indicator	

The cargo category data of standard ULNs (those with cargo and personnel values obtained from the TUCHA file) can be displayed, but not modified. These entries include:

Cargo Category Codes, and for each:
- Square Feet
- STons
- MTons
- Bulk POL Cbbls.

Through a separate screen, for each Cargo Category Code, further cargo detail may be viewed but not modified, including:

- Cargo Detail Description
- Number of Pieces.

PENDING FEATURE: Cargo detail will be displayed to the fourth level of detail.

The cargo data for 'non-standard' ULNs, (those with cargo that is different from the TUCHA file) may be viewed (but not modified) through another set of screens. The data displayed includes:

Overall totals for:
- Square Feet
- STons
- MTons.

(NOTE: These totals are derived by summing up the values for the subordinate Cargo Category Codes; these totals do not track directly to cargo totals provided in the ULN Attributes menus. This Cargo screen specifically includes the words "Not Aggregated" to highlight the distinction.)

Cargo Category Codes, and for each:
- Square Feet
- STons
- MTons
- Bulk POL Cbbls.

For each Cargo Category Code, further cargo detail may be viewed but not modified, including:

- Cargo Detail Description
- Number of Pieces.

PENDING FEATURE: It is a DART requirement to edit the cargo details (which are cargo level 4 details), including detail descriptions, number of pieces, and dimensions. In the future, DART will update the cargo categories and rollup values.

1.3.2.2 CINs

The following attributes of Nonunit Cargo movement requirements (CINs) may be viewed and edited (except as indicated):

Attribute	View Only
Description	
Providing Organization Code	
Project Code	
Using Organization/Service Code	X
CEI	
Type Movement Code	X
Cargo Category Code (CCC)	X
Character Cargo Code Description	X
Heavy Lift Category Code	
Supply Class/Sub-Class Code	
Total Square Feet	
Total Cargo - STons	
Total Cargo - MTons	
Bulk POL Cbbls	
Fuel Type Code	

1.3.2.3 PINs

The following attributes of Nonunit Personnel movement requirements (PINs) may be viewed and edited (except as indicated):

Attribute	View Only
Description	
Providing Organization Code	
Project Code	
Using Organization/Service Code	X
CEI	
Type Movement Code	X
Number of Passengers (PAX)	

1.3.3 Viewing and Editing Planned Itinerary Data

Many aspects of the planned itinerary of each movement requirement may be viewed and modified on the display by means of a graphical spreadsheet, which represents the C-day schedule of the collection of movement requirements. Each movement requirement in the current collection appears as one row in the graphical display. The days of the planned itinerary are shown as columns of the display, referenced by C-days, N-days (negative C-days) are also shown. The locations and planned itinerary days of each movement requirement are represented horizontally as colored symbols, or lozenges.

Location	Color & Symbol
Origin	Magenta lozenge at RLD
POE	Orange lozenge at ALD
POD	Yellow lozenge drawn from EAD to LAD
Destination	Turquoise lozenge at RDD
ILOC	Purple lozenge representing the number of ILOC delay days

The CRD is indicated by a small colored bar. Although the CRD is normally associated with the Destination, it is not fixed graphically against one specific location.

If sufficient space is available along the timeline, each lozenge is labeled with the GeoLoc code corresponding to the location it represents.

A red '?' symbol indicates an unspecified location.

The transportation indicators for each movement requirement are indicated by colored lines or other marks linking the location symbols. The colors indicate the desired mode of transportation.

Transportation Mode	Line Color
Sea	green
Air	blue
Land	yellow
Optional or transportation not needed	gray
Transportation mode unknown, or illegal sequence	red
LAD falls before EAD	yellow hash marks

The lozenge symbols and transportation lines are mouse sensitive and provide a means of viewing and editing the planned itinerary data.

Transportation data is displayed, for viewing, by highlighting the appropriate symbol or line with the mouse. The following views are available when the appropriate location/date symbol is selected:

Highlighted	Displayed
Origin lozenge	RLD and Origin location
POE lozenge	ALD and POE location
Left side of POD lozenge	EAD and POD location
Middle of POD lozenge	POD location and EAD-LAD
Right side of POD lozenge	LAD and POD location
	On-Call status
ILOC lozenge	ILOC location, ILOC delay in days, and delay code
Destination lozenge	RDD and Destination location
	On-Call Status
CRD bar	CRD (Location, here, means both the GeoLoc code and location name.)

PENDING FEATURE: A DART requirement is to include the Installation Type Code as part of the location data.

Transportation data is selected for editing by highlighting the appropriate symbol or line with the mouse and clicking. The following changes are possible when the appropriate location/date symbol is selected:

Selected	Possible Changes
Origin lozenge	RLD and Origin GeoLoc
POE lozenge	ALD and POE GeoLoc
	ALD of that record or of all records in the current collection can be changed
	Any dates of that record or of all records in the current collection can be set relative to any specific date
Left side of POD lozenge	EAD and POD GeoLoc
	EAD of that record or of all records in the current collection can be changed
	Any date of that record or of all records in the current collection can be set relative to any specified date

Right side of POD lozenge	LAD and POD GeoLoc
	LAD of that record or of all records in the current collection can be changed
	Any dates of that record or of all records in the current collection can be set relative to any specified date
	On-Call status of that record can be set
ILOC lozenge	ILOC GeoLoc, ILOC delay in days, and delay code can be changed or deleted for that record or for all records in the current collection
Destination lozenge	RDD and Destination GeoLoc
	RDD of that record or of all records in the current collection can be changed
	Any dates of that record or of all records in the current collection can be set relative to any specified date
	On-Call status of that record can be set
CRD bar	CRD

When any transportation line is highlighted for viewing, the transportation mode and source, the preceding location, and the following location are displayed. Location data includes both the GeoLoc code and the location name.

When a transportation line is selected for editing, the following changes are possible:

Selected	Possible Changes
Line to POE	Transportation mode and source of the movement requirement or all the movement requirements in the current collection
Line to POD	Transportation mode and source, load configuration, and discharge constraints of the movement requirement or all the movement requirements in the current collection
Line to Destination	Transportation mode and source, load configuration, and discharge constraints of the movement requirement or all the movement requirements in the current collection
Line to POE	Transportation mode and source, load configuration, and discharge constraints of the movement requirement or all the movement requirements in the current collection

1.3.4 Force Module Edits and Related Operations

Force Modules are sets of movement requirements.

FMs may be derived from either of two sources:

- Downloaded from WWMCCS/JOPES, along with appropriate OPLANs/TPFDDs
- Constructed by DART users, on an ad hoc basis.

Within the three-character space limitation, FM identifiers may either:

- Follow formal naming conventions established through JOPES procedures
- Be given any ad hoc name by DART users.

Once available in DART TPEDIT, FMs may be modified, copied, and deleted. The TPEDIT, FM Edits menu, provides functions for creating and modifying FMs:

- Individual records, marked records, or the entire collection of records can be:
  - Added to an existing FM
  - Deleted from an existing FM
  - Grouped into a wholly new FM.
- Any existing FM may be deleted as an identifiable grouping; this operation (properly termed 'dissolving') does not delete the basic movement requirements themselves, but eliminates the FM grouping.
- An FM may be printed out as an F11 report, and may be copied to a target TPFDD.

PENDING FEATURE: A DART requirement is to preserve the selection criteria used to create an FM, so that any changes made to the TPFDD database may be reflected in existing FM situations.

1.3.5 Flags and Other Display Functions

Once a collection of movement requirements has been retrieved to the display screen, TPEDIT can mark some of the movement requirements with unique symbols.

Symbol	Indication
Yellow Note	A text note has been attached to the corresponding record
Red Flag	An error has been identified, based on user selection from a series of error conditions checked
Turquoise S	Shortfall record (PROVORG = X)

Purple P	Parent record (PIC = X)
Blue Telephone Handset	On-call forces (LAD or RDD = 9999)
Green Downward Arrow	In-place forces (Mode of transport to destination = Z)

PENDING FEATURE:

Blue Parachute	Airdropped requirement (Load configuration to POD = P)

The Yellow Note symbol is always displayed; the other symbols are selectable from the Display Options menu and the Conditions Checked menu.

The Red Flag symbol conditions-checked options at this time are:

- GeoLoc for unknown location for MAC move
- GeoLoc not air installation for MAC move *
- GeoLoc not sea installation for MSC move *
- Non-CONUS location for MTMC move
- Transportation mode and source for CONUS SPOE invalid.

* NOTE: The source for air/sea constraints for Installation Type Codes is rather vague because of limitations in the GEOFILE database.

The C-day markings of the display screen may be augmented with calendar-date equivalents, which become visible whenever the C-day entry is highlighted with the mouse.

PENDING FEATURE: The calendar-date entries may be displayed along the C-day row.

The Display screen itself may be modified by adjusting the number of rows (movement requirement records) and columns (days) that are displayed.

1.3.6 Copying Movement Requirements Within a TPFDD

Movement requirements may be copied within a TPFDD, to create new movement requirements. The process requires the user to retrieve a collection of records, mark one or more of them, and select the copy of existing TPFDD options from the Marked Records menu.

When copying marked records within a single TPFDD, the movement requirements must be changed so that there will not be duplicate movement requirements identifiers. The user has these three choices of renumbering schemes. These are described under the section, Creating and Copying TPFDDs.

1.4 Creating and Copying TPFDDs

A user can create or modify another TPFDD by copying records to it from an original TPFDD. By selecting the Target TPFDD Arrow box, new TPFDDs may be created either with new or under existing OPLANs. The descriptive details for the new TPFDDs may be copied from an existing TPFDD, or entered new. Once created, a new TPFDD becomes a Target TPFDD, and movement requirements may be copied into it. After they have been created and modified, target TPFDDs are stored into the DART TPFDD database. Later, they can be selected (as a primary TPFDD) for viewing, editing, analysis, and uploading to JOPES.

By accessing two TPFDDs simultaneously (a primary or source TPFDD and a Target TPFDD), the user can copy some or all of the movement requirements from one TPFDD to another. In this way, a new TPFDD can be constructed by inserting selected portions of several existing TPFDDs.

Because of the complexity of movement requirement numbering, within TPFDDs, the user must select a renumbering scheme whenever any new movement requirements are added to a TPFDD. The user has a choice of several renumbering schemes, which appear in a pop-up menu.

- Leave the movement requirements unchanged

  Can only be used when no duplication is possible; cannot be used when copying.

- Renumbering by Basic FRN

  Renumbers the basic FRN (1st three characters) of each ULN, preserving other characters.

- Renumbering by Subordinate

  Renumbering the basic FRN of each ULN, starting with U-XXXA within groups.

  Using the third or fourth character starting point, subsequent IDs will include the key plus appended characters (starting with ...AA).

- Renumbering by Sequential four-Character ULNs

  Renumbering using four-character starting values.

  Subsequent requirements will be numbered (either four or five characters) beginning with the key and revising the fourth character sequentially.

After selecting a new numbering sequence, DART provides a display of expected conversions for user review. After copying marked records from one TPFDD to a destination TPFDD, the user can create a force module, consisting of the newly inserted records.

1.5 Force Module Analysis

In addition to the functions of creating and deleting FMs through Display screen operations, TPEDIT also provides a capability to perform FM rollup and analysis.

The user can display profiles of delivery requirements, by C-day, for FMs. These graphs display summaries of daily or cumulative delivery requirements for one or more force modules.

Furthermore, these requirements can be compared against entries indicating daily delivery allocations, called Capability Lines, which are entered manually.

By default, the profiles show the MTon, STon, and PAX delivery requirements. However, the user can specify any three types of delivery quantities (cargo types) for display:

MTons
STons
PAX
AIR-STons
AIR-PAX
SEA-MTons
Sea-Square-Feet
SEA-PAX
Total CBbls
CBbls Without Water (=POL)

Also, the user has several options to specify which cargo is to be included based on transportation mode alone:

All Cargo (all MTons, all STons, All PAX)
Air Cargo alone (Air STons, Air PAX)
Sea Cargo alone (Sea MTons, Sea Sq-Ft, Sea PAX)

The graph symbols are color coded:

- Air cargo = blue
- Sea cargo = green
- Combined cargo = yellow

1.5.1 Analysis of Single Force Modules

When analyzing a single FM, the user can display a profile of daily or cumulative delivery requirements. Separate graphs are displayed for each of the days specified in the schedule: RLD, ALD, EAD and LAD, and RDD. In addition, delivery requirements are also shown spread (averaged by day) between the EAD and LAD.

1.5.2 Comparing Multiple Force Modules

When comparing multiple FMs, the user can display a profile of daily or cumulative delivery requirements. For each FM selected, a single graph is displayed for one of the date types specified in the schedule: RLD, ALD, EAD and LAD, RDD, or the average requirements between the EAD and LAD. In addition, a graph is shown for the sum of the delivery requirements of all the selected FMs.

1.5.3 Delivery Capability Allocations

The user can manually enter daily delivery capability allocations for each FM. For each of the displayable cargo types, the user can set an arbitrary daily delivery capability. These capabilities can be displayed along with the requirements of the same cargo type.

To set or change the capability allocations, the user selects the C-day on which to make the change (by mouse button), and then specifies the cargo type of the capability to be changed. Then, the user has several options to specify the type of change:

Option	Effect
Current C-day	Change the value for this C-day only
Until Specified	Change the value for a range of days, starting at this C-day
Until Change	Change the value for this C-day and all later days until a new value is present
Until End	Change the value for this C-day and all later days to the last day
Indefinitely	Change the value for this C-day and indefinitely (this differs from the previous option only in the way it copies to other FMs)
From Beginning	Change the value for this C-day and all earlier days beginning at the first day for which there is a value
Clear	Remove all value for all C-days

The Copy Limits option, allows users to copy capability limits from one date type in a force module to another date type, or from one date type to the same date type in another FM.

1.6 Map Display of TPFDD Movement Requirements

The TPEDIT map display shows movement requirements in geographic form.

This map shows color-coded connections between Origin-POE, POE-POD, and POD-Destination as channels, or 'port-pairs'. Channels appear as straight lines linking the appropriate itinerary locations. Unlike the Main or Situation map, the TPEDIT map does not yet show actual routing (great circle) paths for the requirements.

The TPEDIT map display provides two levels of information for the geographical area drawn on the screen:

The display shows the location points (Origin, POE, POD, and Destination) of all movement requirements in the active TPFDD.

The display can show the channels (or port-pairs) used by the current collection of movement requirements. The user may choose which (if any) of the types of legs to

have displayed; however only the legs of those records in the collection can be displayed.

PENDING FEATURE: This map should show the ILOC locations.
PENDING FEATURE: Correction is needed to a bug that causes all GeoLocs used by a TPFDD (except ILOCs) to remain permanently stored in the map database, even after they have been deleted from the TPFDD. These 'deleted' locations appear as white points on the map.

No editing can be performed through the TPEDIT map display.

The map display provides 4 button options, which are discussed later:

- Options
- Display Area
- Zoom In
- Zoom Out

1.6.1 Color codes for the TPEDIT Map

The color codes used for the locations and channels on the map are similar to other TPEDIT displays.

Symbols	Meaning
(Locations)	
Magenta points	Origins
Orange points	POEs
Yellow points	PODs
Turquoise points	Destinations
Red points	More than one type of location
White points	Locations no longer used by the TPFDD
(Channels)	
Blue lines	Movement by air
Yellow lines	Movement by land
Green lines	Movement by sea
Gray lines	Transportation not needed
Mixed color lines	Combination of transportation modes

1.6.2 Displaying Information about Locations

Highlighting a location on an information line displays the GeoLoc code, location name, and latitude and longitude of the location.

PENDING FEATURE: The ITC value is a requirement for display in a later version.

The map Options button displays a menu for:

- Turning the display of the different channels on and off
- Labeling all the locations used in the TPFDD
- Labeling only the locations in the current collection
- Turning off or on all location labels (working as a toggle).

NOTE: The map label capability, along with the label select options, are designed to disappear whenever the selected map coverage makes it difficult to label all locations and retain clarity.

PENDING FEATURE: The selection of routes to display needs modification; each leg displayed should be marked with an option box; all desired legs should be selectable by marking the boxes.

Clicking the left mouse button on a location brings up a menu of options that enables the user to modify the display; or to display additional information about that location and about the channel movements in the current collection through the location. The options are:

- Center map around this point
- Display GeoLoc data for the point; if selected, this produces a display, for that location, of:

  GeoLoc Code
  Name
  Longitude
  Latitude
  Type (Origin, POE, POD, Destination)
  Installation Type Code
  Country/State Code
  Country/State Short Name
  Country/State Long Name
  Province Code
  Province Name
  Logistic Planning Code
  Prime GeoLoc Code
  (International) Civil Aviation Code (ICAO)

- Display TPFDD data for this point

  The TPFDD data provided shows the number of channel movements in the current collection through that location. (The type of location is not yet shown.)

- Turn name label on/off (toggle)

1.6.3 Displaying Information about Channels (Legs or Port-pairs)

Highlighting a channel (center knot or end point) with the mouse displays the location type, GeoLoc code, name, and latitude and longitude for the two end points.

Clicking the mouse on a channel displays the number of movement requirements in the current collection through the channel.

Under the Options button, the type of channel displayed on the map (Orig-POE, POE-POD, POD-Dest) can be selected. Selection changes are accomplished one at a time.

1.6.4 Changing the Displayed Area

Any region of the Earth may be displayed. The map display always defaults to show the CONUS area when the TPEDIT Map function is first accessed; at that point any other region may be selected from a menu list available under the Display Area button.

The following map regions are available:

Africa
Australia
Canada
China
England
Europe
Gulf of Mexico
Hong Kong
Ireland
Japan
North America
Russia
South America
United States (CONUS)

PENDING FEATURE: These regions do not provide required coverage, and are not consistent with those of the main map. Further development is required here. The capability for user-selectable map defaults is needed.

There are several ways to change the area displayed by the map:

- Select a new region from the **Display Area** button
- Zoom in about the center of the map, using the **Zoom-in** button
- Zoom out about the center of the map, using the **Zoom-out** button
- Re-center the map about a selected location, using the **Center Map** option available through the mouse selection
- Scroll with horizontal and vertical scroll bars
- Move the rectangle showing the displayed area on a miniature map of the entire world, via mouse.

1.7 Reference File Queries

The DART database at present includes complete copies of the GEOFILE and TUCHA standard reference files, derived from JOPES.

The user has the option of viewing data from the GEOFILE portion of the database, or from the TUCHA portion of the database, using the TPEDIT View (icon) function.

The user performs queries by specifying values for one or more of the data fields in the database. Limited logical relationships may be established for these queries, under the present system.

PENDING FEATURE: A more comprehensive retrieval process, similar to that used by the TPFDD Retrieval function, is a DART requirement.

1.7.1 Viewing the GEOFILE

The user can view the properties of any selected worldwide location, which has been assigned a GeoLoc code, from the GEOFILE.

By means of a GeoLoc query the user retrieves a set of GeoLocs into a current GeoLoc list. The query is constructed by specifying values for one or more of the following fields:

GeoLoc Code
Location Name
Installation Type Code
Country State Code
Country State Short Name
Country State Long Name
Province Code
Province Name
Latitude
Longitude
Logistic Planning Code
Prime GeoLoc Code
Record Owner UIC
(International) Civil Aviation Code (ICAO)
GSA State Code
GSA City Code
GSA County Code

The alphanumeric search fields can be specified explicitly, or with a wildcard character (as in TPFDD retrievals, with % and _). The user can specify one of the following operators for specifying the Latitude and Longitude numerical search fields:

=, >, <, >=, or <=

(This retrieval process is much less capable than the TPFDD retrieval process discussed above.)

Once the GeoLocs in the current collection are retrieved, their GeoLoc codes are visible in a scrollable list. When the user highlights one of the GeoLoc codes with the mouse, its Location Name appears in the documentation window. When the user selects one of the GeoLoc codes by clicking on it with the mouse, its values for all of the above fields is displayed.

1.7.2 Viewing the TUCHA File Data

The user can view the properties of one or more selected standard unit types (keyed by the UTC) selected from the TUCHA file.

The TUCHA view capability provides a series of screens of data for each standard unit type:

- Top-level data (1st and 2nd level cargo detail)
- Cargo category data (3rd level detail)
- Cargo detail data (4th level detail)

1.7.2.1 Top-Level TUCHA Data

By means of a TUCHA query the user retrieves a set of TUCHA unit types into a current TUCHA unit type collection. The query is constructed by specifying values for one or more of the following alphanumeric fields:

Unit Type Code
Short Unit Type Name
Unit Type Name
Unit Type Status
Unit Level Code
Service Code
Deployment Indicator Code
Security Class Code
F1 Security Class Code
Record Indicator Code
Originator's UIC
Reference Document
Replacer UTC

in combination with one or more of the following numeric or date fields:

Nonorganic PAX
Authorized Wartime Personnel
Bulk Cargo STons
Bulk Cargo MTons
Oversize Cargo STons
Oversize Cargo MTons
Outsize Cargo STons
Outsize Cargo MTons
Non Air Cargo STons
Non Air Cargo MTons
Bulk POL Cbbls
Creation Date
Cancel Date
Change Time

The alphanumeric search fields can be specified explicitly, or with a wildcard character. The numeric search fields are specified with one of the following operators:

=, >, <, >=, or <=

(This retrieval process is much less capable than the TPFDD retrieval process discussed above.)

Once the TUCHA unit types in the current collection are retrieved, their Unit Type Codes (UTCs) are visible in a scrollable list.

When the user highlights one of the UTCs with the mouse, its Unit Type Name appears in the documentation window.

When the user selects one of the UTCs by clicking on it with the mouse, its values for all of the above fields is displayed.

1.7.2.2 TUCHA Cargo Category Data

Once a TUCHA Unit Type has been selected, the user has the option of viewing its associated cargo category data (if any). Clicking on the View TUCHA Cargo Categories button brings up a scrollable list of all the cargo categories for that basic TUCHA unit type.

When the user highlights one of the cargo categories with the mouse, the string associated with the first character of the cargo category code appears in the documentation window. When the user selects one of the cargo categories by clicking on it with the mouse, its values for all of the following fields is displayed:

Unit Type Code
Cargo category Code
1st Character Translation
2nd Character Translation
3rd Character Translation
Security Class Code
Heavy Lift Category Code
Cargo Square Feet
Cargo STons
Cargo MTons
Bulk Pol Cbbls
Expected Number of Cargo Details
Detail Aggregation Flag
Change Time

1.7.2.3 TUCHA Cargo Detail Data

Once a cargo category for a TUCHA Unit Type has been selected, the user has the option of viewing its associated cargo detail data. Clicking on the View TUCHA Cargo Details button, brings up a scrollable list of all the detailed cargo records associated with that cargo category. (These are simply sequence numbers, one to x.)

When the user highlights one of the cargo detail numbers with the mouse, the cargo detail description appears in the documentation window. When the user selects one of the cargo detail numbers by clicking on it with the mouse, its values for all of the following fields is displayed:

Unit Type Code
Cargo category Code
Detail Number
Security Class Code
Description
Number of Pieces
TUDET Flag
Change Time
Length in Inches
Width in Inches
Height in Inches
Detail Square Feet
Detail STons
Detail MTons

1.8 TPFDD Utility Functions

Several miscellaneous utility functions are provided to users and system administrators.

1.8.1 TPFDD History File

By clicking on the UPDATE icon, the user can get access to the TPEDIT History (Update) control window. When this window appears, it provides four option buttons:

- Commit
- Mark
- Maintain
- Programmed Updates

This window supports the following functions:

a. Review TPFDD changes. The user can view a summary of all the changes made to the TPFDD since the last commit operation. The summary is presented as a scrollable list. For each change, the following items are displayed:

Change Number
Change Date and Time
Change Description.

Each change represents a particular state of the TPFDD in the DART database.

b. Commit TPFDD Changes. Using the Commit button, the user can commit a sequence of changes to the TPFDD, making these changes permanent and no longer subject to roll back. After selecting a particular change, the user has two options for committing the changes up to that point:

Commit Up To	Commit all changes up to, but not including this change.
Commit Through	Commit all changes up to, and including this change.

c. Roll Back TPFDD Changes. The user can roll back changes made since the last commit operation. After selecting a particular change, by clicking on it with the mouse, the user is given two options for rolling back the changes for that point:

Undo	Roll back this change and all later changes.
Back To	Roll back everything after this change.

d. Mark the TPFDD State. By clicking on the Mark button, the user can mark the present state of the TPFDD in the DART database with a text string. This mark can provide an easily found point for future commit or roll back operations. (This function works similarly to the Add Note feature on the Display window.)

e. Database Maintenance Functions. Through the Maintain button, the user has four options for performing database maintenance:

Scan	Search the present TPFDD for internal error conditions.
Scan All	Search all TPFDDs for internal error conditions.
Repair	Attempt to repair internal error conditions for the present TPFDD.
Repair All	Attempt to repair internal error condition for the all TPFDDs.

f. Programmed Updates. Through the Programmed Updates button, a user can direct the system to read and execute an update file received from one of the DART models (PFE). This allows the recommended updates from PFE to be incorporated directly into the TPFDD database.

g. Upload JOPES Transaction Records. When the Upload button is selected, the system will create a file of JOPES-acceptable transaction records, which may be used to apply TPFDD changes made by DART to a corresponding TPFDD loaded in the JOPES database. This feature reduces the quantity of update data which must be passed between DART and JOPES.

1.8.2 TPFDD Ops Pop-Up

The TPFDD Ops Pop-Up menu, on the TPEDIT main screen, allows users to perform TPFDD functions such as select and delete. These functions include the following options:

Options	Effects
Select TPFDD	Allows the user to select an OPLAN and TPFDD for viewing and editing. (The selection sequence is not consistent with the Main Menu Summary screen selection.)
Show TPFDD Details	Displays the following TPFDD description data, for viewing and editing; several data items are always displayed in the TPFDD Ops window:

TPFDD Details	Always Displayed
TPFDD Number *	
TPFDD Name	X
OPLAN ID *	
OPLAN Date	
Change Number	
Security Classification	X
Description	X
Objective Area	X
Task Organization	
Owner UIC	
Concept of Operations	

* NOTE: The TPFDD Number and OPLAN ID cannot be changed; the TPFDD Number is assigned automatically by the DART database, and the OPLAN ID is fixed at the time of TPFDD download or creation.

Clear	Ends use of, and saves, the currently selected TPFDD.
Copy	Copies entire current TPFDD to new TPFDD.
Delete	Erases the current TPFDD from the DART database.
Close DB	Closes operation of the Oracle database (developer use only).
Exit from TPEDIT	Exits and closes TPEDIT.

2. Plan Analysis

Plan analysis provides tools for the transportation planner to perform course-of-action and transportation feasibility analysis, and also includes the top-level DART navigation and user interface.

2.1 Top-Level User Interface

DART is operated from the DART top-level screen. Several icons, combined with pull-down menu buttons, allow the user to choose from a wide variety of options. In addition, each icon selection may contribute further pull-down menu selections; and each display may contain one or more mouse-sensitive items, which may provide additional choices.

While the TPEDIT subsystem is accessed through the TPFDD icon on the main screen, the primary control vehicle for the analysis subsystem is the Situation or Summary screen, which provides a series of three panels for user option selection and data summary. Other screens and windows, however, accessed through various other icons, are used to display maps, reports, and analysis products.

The following paragraphs describe the DART top-level control structure.

2.1.1 Permanent Main Menu Bar

Five menu buttons along the top of the DART main window provide a consistent set of pull-down menus during all of the DART analysis functions. The five permanent main menu buttons, and their functions, are:

Button	Function
File	Controls selection and manipulation of: TPFDD files (Select for Summary Panel; Import into DART Database; Export from DART Database) (see also under External Integration) Analysis files (Open, New, Save, Close, Delete) Situation files (Open, New, Save, Delete) Model Results files (Import, Delete) (see also under External Integration) Selects Exit from DART (closing all DART operations)
Window	Provides a list of the available Analysis windows

Model — Selects the type of model to run, from a list of the potentially available transportation models, which currently shows:

Rapidsim *
Rapidsim for Sitap
FAST
STRADS
ADANS
PFE *
SITAP
TFE

* = actually available in DART

Utilities — Provides access to various utility functions, including:

Refresh Screen
Hardcopy Window
Save Window to File
Retrieve Window from File
Reload DART Preferences (tailored maps, etc)
Set Printer Options
Import Rapidsim Setup
Self Test
Show Legal Notice

Help — Activates the on-line system help function of DART; allows the user to select the Display Users Manual option, which will activate a window containing the text of the current DART Users Manual; the user can search on key words to find specific topic areas.

2.1.2 Main Icon Bar

A column of icons appears on the main DART top-level screen. These icons allow the user to control which DART sub-system is operating, and to control the analysis process. Each of these icons causes a change in the window or screen being displayed. The icons are summarized below:

Icon	Function
Summary	Provides summary rollup and control of the analysis process; three panels are provided for the TPFDD Summary, the Situation Summary, and the Model Summary; each of these panels appears after further options are selected; when selected, this icon also brings up a Reports menu button with options for the F11D/E and MR Summary reports.
TPFDD	Activates the TPEDIT subsystem, and displays the TPEDIT screen.

Map	Provides access to the main map-based DART analysis and situation editing functions; when selected, activates three additional Menu Buttons (Map Region, Options, and Zoom).
Capacity	Provides two sets of graphs showing: - Lift capacity of the air and sea assets established in the Situation, versus a comparably scaled view of the TPFDD movement requirements - Port throughput capability versus TPFDD requirements.
Results	Allows selection of several types of graphs, based on the model analysis results; these are only available after a model run.
Database	Allows access to database utility functions; when selected, brings up two additional main menu buttons: Access SQL and DB Summary.
Timeline	Accesses the PFE timeline display; this icon only appears after the PFE model option is selected (see further under PFE).
DART	Exits the current mode and repaints the DART logo in the center of the screen; restores the Main Menu bar back to the generic functions.

2.2 Summary Panel Display

The Summary icon brings up a screen that displays three panels: TPFDD, Situation, and Model Analysis. Each of these panels is displayed after the appropriate file is selected or created: TPFDD file, Situation file, and Model Analysis file. Following is a brief description of the purpose of each panel:

a. TPFDD Panel. When a TPFDD file is selected (as a completely separate action from the selection within the TPFDD Editor) the TPFDD movement requirements are analyzed and presented in summary form to the user in this panel. This panel also notes the respective versions (dates) of the TPFDD file and the TUCHA file used to create the TPFDD. TPFDD file selection, for this panel, is the first step towards performing Plan analysis.

b. Situation Panel. The user selects and retrieves a transportation situation file to support analysis of the selected TPFDD. Through this panel, the user can then view and modify the characteristics and allocations of the transportation assets in the situation (aircraft and ships). The user can specify port throughput for the nodes, or notional ports, to be used in the transportation analysis. In addition, the user can specify the expected condition of the Panama and Suez canals.

c. Analysis Panel. The primary analysis mode of DART is based on specific detailed transportation models. The DART user, at this time, has the choice of RapidSim or PFE (Prototype Feasibility Estimator). For each of the supported models, the user can adjust the model parameters, run the model, and view the model results in summary tabular form, as well as in detailed graphical form.

The Analysis Information Panel, shown in the top right corner of the main DART screen, reflects the file names of the files selected for the Summary panels.

2.3 Situation

The situation, also referred to as the setup file or the scenario file, contains data concerning the number and types of ports, aircraft, and ships, and other transportation parameters. The situation panel provides the means for modifying and editing the transportation resources and resource constraints that affect a model analysis. Multiple situation files may be maintained in DART.

Various records in the situation specify the speeds, capacities, attrition rates, load and unload times for the ships and aircraft, and the utilization rates to be applied to the aircraft used during model processing.

In addition, the situation includes information relevant to the various air and sea ports designated for use in the model. Pertinent port data includes the days required to assemble the cargo at the POD (marry-up time) and port constraints.

The situation also reflects the status of the Panama and Suez canals (whether they should be considered open or closed during model runs), the TPFDD date on which to stop model processing, and factors concerning convoy routes.

Entries in the DART situation panel were originally derived from the RAPIDSIM model, but in DART are designed to be model independent. Although the system allows editing of every item, not all parameters are applicable to every transportation model available in DART.

2.3.1 Selecting a Situation File

To prepare a situation, the user can select an existing situation file for modification or create a new situation.

a. Selecting the New Situation option, from the menu activated from the File button on the DART Main Menu, displays a pop-up requiring verification that this is the path desired. When this path is chosen, all situation parameters must be defined.

b. Accessing and editing an existing situation file may be easier than creating a new one because input or changes may not be required for all data items in a previously established situation. Time required to create a new situation will depend on the complexity of the transportation allocations and assets.

When Open Situation option is selected from the pop-up menu under the File button, or the situation line of the Analysis Information Panel is highlighted, a list of names of existing stored situations is displayed. These files are marked either Personal or Public.

- Personal situations are only accessible by a user logged in with the same User Id used to create that file.

- Public situations are available to everyone.

Once a public situation is changed and saved, the original remains in the public directory and the modified copy becomes a personal situation. To transform a personal situation into a public situation, see the System Administrator.

To select a situation file, the situation name must be highlighted and the left mouse button pressed. The situation name will appear in the Analysis Information Panel when the situation has completed loading. (A TPFDD need not be loaded at this point in processing.)

At any time during a DART session, a different situation can be loaded from the menu under the File button or by highlighting the situation line in the Analysis Information Panel. Either path will produce a pop-up list from which to select situation names.

2.3.2 Aircraft Capacity

Information regarding aircraft allocations and characteristics can be accessed and modified using the Edit Characteristics and Edit Allocations buttons in the Aircraft Capacity portion of the situation panel. The following paragraphs explain how to edit aircraft data. All data fields can be accessed by highlighting the desired option and pressing the left mouse button.

A small box symbol, called a detail symbol, is used to indicate that further detail exists for a data element. If the symbol is small, the detail is not currently in view.

- Clicking the left mouse button on the symbol will cause it to expand, and will bring the detail into view

- Clicking on the expanded symbol will cause it to contract and hide the detail data

RAPIDSIM and DART/RAPIDSIM categorize cargo by Commodity Type. Many DART Situation entries have a sub-menu for Commodity Type. Commodity Type values may be entered either at the top or sub-menu levels; lower-level values are intended to sum upwards; and their totals should be reflected at the upper levels.

2.3.2.1 Edit Aircraft Characteristics

Selection of the Edit Characteristics window for aircraft activates a pop-up menu with a list of all aircraft used in the situation (that is, aircraft already included in the situation) and an additional option to add a New Aircraft Type.

If a new aircraft type is desired, the system will provide a prompt for the name of the new aircraft type before proceeding.

Selection of a given aircraft type, or addition of a new type, from this pop-up menu activates a subsequent window that allows revision of detailed information about a specific type of aircraft.

The Edit Aircraft Characteristics window has the following entries:

Entry	Function/Use
Plane-Type	System-derived from Long Name below
Name	Upper-case version of initial Long Name; cannot be changed or edited thereafter; used as Aircraft-Type in the Allocations menu
Long Name	Initially, user-entered version; becomes Plane-type; can be edited later, and can be made a duplicate
Standard Name	Editable; unused
Vehicle Type Code	Editable; unused
SITAP Type Code	From a menu; unused
Speed	Supposed to be block speed; default is 20 knots
Utilization Rate	Average flying time per 24 hours; by C-day; default is C0:24; (appears to accept values greater than 24)
Cargo Capability	A fraction, 0.0 - 1.0 (these values are apparently the non-transportable fraction values mentioned but not explained in the RAPIDSIM UM; they don't appear to serve any purpose)
Cargo Capacity (STons)	The breakout is without Pax or POL, which are shown separately below
Cargo Capacity (PAX)	Total max PAX
Cargo Capacity (POL)	Assumed to be zero by RAPIDSIM, use in DART uncertain
Accompanying PAX	PAX with cargo, if any
Cargo Type Capability	Sub-menus for: Bulk, Oversize, Outsize, Nat, each Yes/No
Cargo Loading Delay	For each of above types; probably has no utility for a/c
Days to Load	Utility doubtful, for a/c
Days to Offload	Utility doubtful, for a/c
POM Days	(Preparation for Overseas Movement); applies to Orig/POE leg; not used by PFE
Days to Marry-Up	(At POD); not used by PFE

All of these entries (except where stated) may be edited, or new data entered.

2.3.2.2 Edit Aircraft Allocations

Selection of Edit Allocations for aircraft activates a window that allows the editing of information, which reflects the number of aircraft allocated, by C-day, in the current situation. This pop-up menu refers to aircraft allocations as timeseries.

An aircraft type cannot be deleted; it can be effectively removed from the situation only by deleting the timeseries or by entering only one timeseries of C0:0. Then, while the aircraft type name remains in the list, it is ignored by the model.

The entries in the timeseries are additive in that the 10 C141B aircraft entered on day 10 will be added to those 75 available on day 0 for a total of 85 C141B aircraft. The values entered must be positive integers.

To decrease the quantity of aircraft available, a second entry of the aircraft type is needed. In addition, the first aircraft must have its UTE Rate set to zero for the effective (and following) dates.

2.3.3 Ship Capacity

Detail information regarding ship allocations and characteristics can be accessed and modified using the Edit Characteristics and Edit Allocations buttons in the Ship Capacity portion of the Situation panel.

2.3.3.1 Edit Ship Characteristics

Selection of the Edit Characteristics option for ships activates a pop-up menu with a list of the ships that are already being used in the situation, and an additional option to add a New Ship Type. If a new ship type is desired, the system will provide a prompt for the name of the ship before proceeding.

Selection of a given ship type, or addition of a new type, from this pop-up menu activates another window that allows revision of detailed information about a specific type of ship. Review and change characteristics, as applicable, and select OK.

The Edit Ship Characteristics window including has the following entries:

Entry	Function/Use
Ship-Type	(These are used just as with aircraft names)
Name	Not editable
Long Name	Editable
Standard Name	Editable
Vehicle Type Code	Editable
SITAP Type Code	Menu selection
Speed	Cruising speed; default 20

Transfer Policy	Whether ships may be moved between ports for improved loading; RAPIDSIM adds many additional values here; DART use uncertain
Convoy Policy	Yes or no, by C-Day; not used by PFE; RAPIDSIM uses many additional values here, also; DART use uncertain
Cargo Capability	Defined as cargo restrictions; apparently the non-transportable fraction; fractions 0.0 - 1.0; not used by PFE
Cargo Capacity (STons)	Does not include PAX or POL; poss not used by PFE; in RAPIDSIM, values are derived from deadweight, stow factors, and cargo type vs ship type calcs; here, users may insert any values
Cargo Capacity (MTons)	User values
Cargo Capacity (SqFt)	Not used by PFE (uncertain)
Cargo Capacity (PAX)	User values
Cargo Capacity (POL)	User values
Accompanying PAX	
Cargo Deadweight	In RAPIDSIM, a key value (CDWT) used with great complexity; may not be used anywhere by DART, so 0 is apparently OK
Primary Ship Cargo Type	Container, RoRo, BreakBulk, Combination; BB is default; stored in RAPIDSIM as a +/- value to indicate whether ship travels on a round trip; DART apparently stores as only +; use is uncertain
Cargo Type Capability	Sub-menus: Yes/No for Container, Roro, Break-Bulk; these don't track the above categories; default is all Yes; RAPIDSIM apparently uses fractions here; DART apparently uses the yes/no's to determine whether a ship can carry each category of cargo
Cargo Loading Delay (Days)	Same three categories as above; default is all 0; RAPIDSIM use is uncertain
Days to Load	Same delays, different arrangement; above category is shorter to type
Days to Offload	
POM Days	At Orig/POE; not used by PFE
Days to Marry-Up	At SPOD; not used by PFE
Load Configurations	Menu A-W, or none; not used by PFE; RAPIDSIM use uncertain

Discharge Constraints	Menu A-V, or none; not used by PFE; RAPIDSIM use uncertain

NOTE: Sealift totals include MTons, STons, SqFt, and CBbls POL; these are not completely accurate at this time.

The PFE model does not recognize the following Edit Characteristics options for Ship Capacity:

Transfer and Convoy Policy

Cargo Capability (also known as Cargo Restriction)

STON and SQFT capacities (only MTONs are used in this version)

POM Days

Days to Marry Up

Load Configuration

Discharge Constraints.

2.3.3.2 Edit Ship Allocations

Selection of the Edit Allocations option for Ship Capacity displays formatting options for editing the number of ships apportioned to the current situation, and the date they are available.

All ship allocations are established by port, and by ship type for each port. Consequently, the formatting options are either to show details by ship type, for each/all ports; or to show detail by port, for each/all ship types. The display of ships for all ports, and ports for all ships reflect totals and cannot be edited. Editing must be accomplished by selecting either ships by specific port, or port by specific ship.

The Display All Ports and Display All Ships options allows allocating a new ship to an existing port or making an initial allocation to a port.

2.3.4 Ports/Nodes

This section of the situation panel displays the number of air POE nodes, sea POE nodes, air POD nodes, and sea POD nodes. The buttons provided in this portion of the screen allow editing of node capability and default nodes.

2.3.4.1 Concept of Node

The Node concept is used to facilitate model analysis functions. TPFDD POEs and PODs are combined into one or more notional POEs and PODs that are then referred to as nodes. While the RAPIDSIM model software will compute closure from individual POEs to PODs, the transportation assets can be used more efficiently if the requirements are aggregated to a select few onload and offload locations. Also, it may be advantageous for transportation analysis to use an arbitrary location as an artificial onload or offload location. These two options are made possible through the use of nodes.

The PFE model has a switch so that PFE can be executed using either DART/RAPIDSIM notional ports or individual ports.

2.3.4.2 Nodes Parameters

Selection of Edit Nodes, from the Port/Nodes section of the situation panel displays a list of air and sea nodes available in the specified situation. Each location in the list is mouse sensitive. When one is selected, a subsequent pop-up allows editing of cargo parameters for that node.

Node Parameters are also available from the main map's Edit Node Parameters option.

Nodes cannot be ADDED or DELETED from this DART location; nodes are created and deleted using the Map display.

PFE also recognizes the Edit Nodes parameter options and model results will reflect the values entered in the Cargo Amount Capacity option. The comparison of these values to simulated deliveries and port requirements may be viewed by the Port Workload graphs available from the Map and Capacity icons.

The Edit window that appears provides:

- Type of node selected
- GeoLoc code and Name of location, and types of nodes represented by that location
- Definition of ITC for that location derived from an unknown source

Only the following parameters are recognized by the current RAPIDSIM model, for the specified locations:

Air-POE	None of the parameters regarding this node are recognized
Air-POD	Loc Time (Days of delay, by commodity type, to be added to computer-derived closure date)
	Max Sorties per day
Sea-POE	Cargo Capability (Whether port can handle Container, Ro/Ro, or Breakbulk cargo)
Sea-POD	Loc Times (Days of delay, by commodity type, to be added to computer-derived closure date)

The Edit Nodes window has the following entries:

Entry	Function/Use
Cargo Capability	
Cargo Amount Capacity	Allows entry of port (daily) capacity, or throughput
Max Sorties Per Day	Air ports

Plane Type Restriction	Max limit?
Plane Type Allocation Fraction	Probably tracks to MOG ratio

2.3.4.3 Edit Default Nodes

Selection of the Edit Default Nodes button activates a window that allows the edit of the default port for each type of node, air POE, air POD, sea POE, and sea POD. One of each type must be provided to accommodate the models; PFE and RAPIDSIM use default nodes to fill in missing POE or POD geographic codes when records with missing codes are used to generate movement requirements.

2.3.5 Other Parameters

a. Routes. This option is not yet available.

b. Canals. These options in the situation panel are used to designate the Panama and Suez Canals as either open or closed.

2.3.6 Save Situation

A DART situation can be created or modified and a model can be executed without first saving the situation. However, if the user wants to retain a situation, it must be saved before exiting DART. This is accomplished by selecting "Save Situation" from the File menu on the DART screen.

The situation can also be saved as part of an Analysis.

2.4 Main Map Display

The main map can show the routes, ports, nodes, and node-to-represented-port links, for the entire selected TPFDD. The features displayed depend on the user's selections.

The Main Map display is also used to view and edit transportation nodes, prior to running a model analysis.

2.4.1 Showing Port and Route Information

Unlike the TPEDIT map, the Main Map shows actual sea and air routes that would be followed by the lift assets. Initially (unless modified by the user) the map displays only:

- Locations (POE and POD) used by the selected TPFDD
- Nodes established in the selected situation; if a situation has not been selected, no nodes will be displayed

Additional nodes may be inserted by the user, either at TPFDD port locations, or by adding new locations to the map (see below).

Routes and points on the map are mouse sensitive and information, such as actual flying and sailing distances, location name, and geographic location code, is displayed in the Mouse Information Panel.

The map symbols use coding similar to other sections of DART.

Symbol	Meaning
Magenta Square	Origin
Orange Square	POE
Yellow Square	POD
Turquoise Square	Destination
Purple Square	ILOC or unassigned port
Green ARC over Square	Sea Node
Blue ARC over Square	Air Node
Yellow Arc under Square	POD Node
Orange Arc under Square	POE Node
Red Arc under Square	Both POE and POD Node
Green Line	Sea movement or sea port assignment
Blue Line	Air movement or air port assignment

When the mouse left button is clicked on any of the ports or nodes, the following GeoLoc file data is displayed for that location.

GeoLoc Code
Name
Installation Type Code
Installation Type (definition)
Country/State Code
Country/State Short Name
Country/State Long Name
[Province Code][missing]
[Province Name][missing]
Location (Latitude, Longitude)
Logistic Planning Code
Prime GeoLoc Code
Record Owner UIC
International Civil Aviation Code (ICAO)
GSA State Code
GSA City Code
GSA County Code
Asset GeoLoc

2.4.2 Modifying the Main Map

The Main Map menu bar adds three pull-down menu button options that provide ways to change the data being displayed:

Map Region — Changes region being displayed

Africa	Japan	Saudi Arabia
Australia	Korea	South America
Central America	Kuril Wedge	South East Asia
Europe	Mediterranean	United States
Gulf of Mexico	North America	West Indies
Gulf of Siam	North Atlantic	World (Atlantic)
Hawaii	North East Asia	World (Pacific)
Indian Ocean	North Pacific	

Note: These are the current default regions. Others may be added by modifying the DART preferences file (through the Utilities Menu).

Options — Selects types of routes or node-port links displayed

- Show Routes?
  - Air
  - Sea
- Ports to Display:
  - Origin
  - Air POE
  - Sea POE
  - Other POE
  - Intermediate Location
  - Air POD
  - Sea POD
  - Other POD
  - Destination
  - Any
- Node Assignments to Display
  - Air POE
  - Sea POE
  - Air POD
  - Sea POD

Zoom

- Zoom in about center
- Zoom in about (a) point
- Zoom out about center
- Zoom out about (a) point

When the mouse is clicked (right button) on any blank area, a pull-down menu appears with these options:

Option	Report/Use
Add GeoLoc	Allows a new (non-TPFDD) port location to be added to the map, for use as a node
Center on a Point	Moves map center
Crosshairs	Allows readout of Latitude and Longitude
Edit Map Options	Brings up Options Button Menu
Redisplay Map	Refreshes map display
Zoom in about center	Same as Zoom button
Zoom in about (a) point	Same as Zoom button
Zoom out about center	Same as Zoom button
Zoom out about (a) point	Same as Zoom button

If an additional geographic location is required as a node, but it does not appear on the map because it is not listed as a port in the current TPFDD, the Add GeoLoc function allows addition of a new GeoLoc code with all associated information.

Center On A Point brings up a blinking crosshair symbol on the map. This may be used as the new center point for a map display.

Crosshairs activates the Crosshairs symbol that can be used to locate the latitude and longitude of a location on the map. (Crosshairs can also be activated by clicking the left mouse button directly on a black background.)

2.4.3 Editing Node/Port Functions

Single clicking the right mouse button on a port or node location will access a menu of node and port functions.

(A node does not have to be a port used in the TPFDD. In fact, the air or sea node does not have to be an airport or seaport, respectively. If a desired node is not listed in the TPFDD, it may be added.)

The node/port functions menu provides the following capabilities:

Option	Result/Use
Describe Object	To view a description of a port; provides the same GeoLoc data noted above
Edit Node Parameters	(see following paragraphs)
Edit Node Status	(see following paragraphs)
Show Port Workload	(see following paragraphs)

Edit Node Parameters is only available if the location has been assigned as a node in the situation. This function produces a window that allows editing of node parameters. These parameters can also be edited through the interface available in Summary mode. PFE does not recognize changes made to parameters using this function.

Edit Node Status will create a node from an actual port or allows editing of the type of node this port has been assigned to represent. The choices are:

Air POE Node
Sea POE Node
Air POD Node
Sea POD Node

A location can be assigned to be all or none of these representations, regardless of its actual port type. The map display will be revised and repainted to reflect the changes made to these nodes.

Show Port Workload displays a port workload graph; these are described below, under Capacity Graphs.

Note: A TPFDD must be selected and loaded before a Port Workload graph can be drawn. This option is only available with the PFE model.

2.5 Models

DART takes advantage of transportation simulation models developed by other projects. The original Rapid Intertheater Deployment Simulator (RAPIDSIM) was developed as a stand-alone model that primarily supported the Joint Staff in achieving simulation of movement of combat and support units required for a contingency operation. A version of this RAPIDSIM has now been integrated with DART.

The Prototype Feasibility Estimator (PFE) is another DART integrated transportation simulation model. PFE is a dispatch rule simulation of military transportation movements that was developed to support research and development efforts under the DARPA/Rome Laboratory sponsored Transportation Planning Initiative. DART provides a user friendly "front end" for easier entry of transportation asset information and output analysis.

In addition to DART RAPIDSIM and PFE, files can be formatted in DART for transfer to the Joint Flow and Analysis System for Transportation (JFAST).

2.5.1 Models Input

Two files provide the inputs for analysis:

- The TPFDD, i.e., movement requirements, describe the units and cargo to be moved within the environment described by the scenario data, or Situation as it is called in DART.

- The situation data provides the models with the environmental characteristics of the simulation problem. In general, the situation data is viewed as the "how" and the movement requirements data is viewed as the "what" in a simulation problem. One set of situation data is required for a single simulation run. Several sets of movement requirements data may be associated with one set of situation data, and vice versa.

2.5.2 Model Settings

The Edit Model Settings button in the Model panel produces a window that is used to adjust the parameters used for running RAPIDSIM and PFE. Modifying the settings and limits on this list alters model run results and produces analysis data streamlined to a given transportation situation.

The Edit Model Settings options for each model are discussed below;

a. RAPIDSIM

- The default Simulation Start Day is day 0 and the default Simulation Stop Day is 120.
- Specify units of measurements (Measurement Tons, Short Tons, or Square Feet) for ships. The option selected will be used to simulate loading ships based on the corresponding values found in the Edit Ship Characteristics option of the Situation panel.
- When records with missing ports are not excluded, the computer will substitute a default port from those specified in Edit Default Nodes, from the Situation.
- Limit the situation to one or more force modules with the Force Modules to Include option, only the FMs specified will be included in the flow. To revert to the entire TPFDD, select the Include All Units in the TPFDD option.
- The transportation source and mode can be limited by highlighting the fields and selecting options from a subsequent pop-up menu. Normally, strategic transportation analysis is limited to MAC (air) and MSC (sea) movements. Others may be analyzed through this option.

b. PFE

The PFE model parameters window is divided into two parts by lines of instruction.

- The top half of the pop-up starts with, "Note: After changing any of the following parameters, you must select Generate Requirements before you run the PFE model." This means that the options in the first half of the window are used by PFE software to generate movement requirements. Consequently, changes to any of these options must be followed by the selection of the Generate Requirements option, discussed below.
- The bottom portion of the PFE parameters window begins with the statement, "Note: The following parameters can be changed at any time before selecting the Run PFE option." This means that these selections can be altered without having to update movement requirements.

Before executing PFE for the first time in a session, the Generate Movement Requirements option must be enacted. After the first execution of the Generate Movement Requirements option, the word Generate is changed to Update.

The following parameters should only be changed before enabling the Generate Requirements option:

- Discard Missing Ports. When the POE and/or POD geographic location code is missing from TPFDD records and "yes" is selected for this option, the records will be ignored when generating movement requirements. When records with missing port codes are not excluded, the port information is taken from the entries made in the Edit Default Nodes option of the Situation.

- Discard Retrograde Movements. Retrograde movements are cargo or PAX returning from the AOR. If retrograde movements are not ignored, PFE summary information for generating requirements and model execution will include the movement of retrograde requirements. The PFE algorithm will attempt to use a ship that is already in port, from an already scheduled POD delivery. If a ship is not available an empty one may be dispatched to pick up the retrograde movement. If the retrograde is to be moved by air, the program assumes the pick-up and delivery can be accomplished in one day because of the speed of an aircraft, ignoring the location of the pick-up.

- On-Call Options. The Set the LAD of On-Call Units to Threshold option allows movement requirements to be generated with on-call units included in order to identify the transportation required to accommodate these requirements. A "threshold" must be set to change the on-call LADs, e.g., "9999", to an actual LADs.

- Use POD to Compute Missing Transportation Modes. When yes is selected, all requirements with missing transportation mode to POD will be designated as air or sea depending upon the installation type code of the PODs in the requirements. Records with an airport installation type will be added to the air requirements, etc. The unit is ignored if the installation type code is neither air or sea and the MR Report will identify these ignored records under the label, Transportation-Mode-Couldn't-Be-Determined. If "no" is selected for this option, the unit is also ignored and the "MR Report" will label these records as, Transport-Mode-Not-Air-Or-Sea.

- Transportation Sources to Include. Clicking the left mouse button on MAC and MSC produces another pop-up window with a list of thirteen possible transportation sources for selection. TPFDD records containing the sources selected from this list will be included in the execution of Generate Requirements option. Transportation source is treated independently of transportation mode, even though there are a number of illogical pairs that can be selected. When incompatible mode and source pairs are specified for inclusion, the requirements will be ignored.

- Transportation Modes to Include. Click the left mouse button on Air and Sea and select any number of transportation modes from a pop-up list of eight possible modes that exist in the TPFDD.

- Send Non-Air PAX Requirements by Air. When a TPFDD requirement has PAX moving by sea, a yes response will count the PAX as moving by air.

- Aircraft Earliest Embarkation Date. When ALD is selected, the model will compute movement from the POE based on the ALD of the requirement(s). In this case, the model may violate (arrive earlier than) the EAD. If EAD is selected, the model will delay movement of the requirement so it will arrive at the POD on or after the EAD.

The following parameters can be changed at any time before enabling the Run PFE option.

- Transportation Modes to Simulate <Sea Simulation/Air Simulation>. Sea Simulation will simulate only the PFE requirements considered sea, and Air Simulation will model only the PFE requirements considered air.

- Simulation Stop Day. PFE will simulate movement up to the C-day specified as stop day. However, the model will not provide information on movements past C-120.

- Use Notional Ports. A "no" response will allow the model to use the actual ports specified in the TPFDD. When notional ports are selected, all actual ports are aggregated, based on notional ports assigned in the Situation, into multiple "nodes" that provide an arbitrary location as an artificial onload and offload location.

- Minimum Ship Loading Fraction before Launching. This factor will be used to determine the number of days the ship can remain in port waiting for additional requirements. A ship can only be delayed a certain number of days in an attempt to meet load requirements, before it must sail to meet delivery schedules. Consequently, a partially loaded ship, or a ship loaded with less than the fraction specified in this setting, may have to sail to make a delivery on time. The following table illustrates how PFE calculates a launch date using an MSLF of .75.

DAYS Since Start of Load	
0-1	Launch if at least 98% full
2-3	Launch if at least MSLF full (e.g., >= 75%)
4	Launch if at least MSLF/2 full (e.g., >= 37.5%)
5	Launch if at least MSLF/3 full (e.g., >= 25%)
6-10	Launch if at least 10% full
> 10	Launch if the ship is not totally empty

- Simulation Trace Options: Selects whether trace information is displayed. The system provides a trace window of information while generating movement requirements and during model execution. However, only when the response is "yes" is detailed trace and status information displayed.

2.5.3 Movement Requirements

Requirements from the TPFDD are aggregated into air and sea movements and converted into model-readable format with the Generate Requirements function.

If the Generate Requirements option was performed previously, the button will read Update Requirements. When any of the options in the top portion of Edit Model Settings pop-up menu are changed, this option must be executed to update movement requirements.

When the update process is complete, the total air and sea requirements for Pax and cargo are available in the Movement Requirements portion of the Model panel. When RAPIDSIM is selected, an additional entry is provided for Free Mode cargo and Pax.

The MR Summary Report can now be viewed or printed to identify warnings and errors that may impact model results.

PFE Unique Procedures:

In a day-by-day process, PFE sorts air movement requirements into groups based on the ALD of the requirement, and then sorts the units each day by LAD, ALD, EAD, RDD, POE, COMMODITY-TYPE, SERVICE, and UNIT-TYPE-CODE.

In addition, the model uses a single preference list when aircraft of different types are available on the same day: lower delay-penalty values go with aircraft types higher on the preference list.

Finally, PFE does not parameterize aircraft payload capacity by commodity-type.

2.5.4 RAPIDSIM

RAPIDSIM provides the user with a gross estimation of air and sea transportation feasibility with closure profile estimates for force and resupply requirements. The model consists of input files, a processing program, and output data.

The results of RAPIDSIM runs are heavily dependent upon the setup parameters, which cover a wide set of factors. Some parameters concern specific vehicles and ports and are changed from the situation panel; and some parameters are unique to the RAPIDSIM model and are changed from the model panel.

During RAPIDSIM execution the TPFDD movement requirement records are simulated for flow, based upon the transportation situation and model settings, to produce output data in the form of a history file. When RAPIDSIM processing terminates, portions of the history file are presented for analysis. A pre-determined selection of data in the history file is presented in graphic form by clicking on the Results icon on the Main Icon Bar and selecting the graph to be viewed.

RAPIDSIM execution is activated by selecting the "Run RAPIDSIM" option on the Model panel. A prompt will be provided to allow the entry of a name for the model run and any desired descriptive comments. A default model run name, derived from the system date and time, will automatically appear in the window.

RAPIDSIM accepts and processes the movement requirements in the order they were read from the file prepared by DART. This is normally a priority-sorted order based principally on the LAD, or latest arrival date. Once a unit has been selected for deployment, RAPIDSIM simulates the movement of the unit by its specified mode in order to project its delivery at the POD. If the mode was not specified in the movement requirement, the mode that will result in the earliest delivery is used. Each movement requirement is processed until entirely deployed or the duration of the model run is exceeded.

For each movement requirement in the pre-sorted order, RAPIDSIM repeatedly assigns cargo to ships or aircraft (depending on the transportation mode for that unit) in an effort to simulate its actual movement. The fastest un-allocated ship that will move the cargo, and partially loaded ships that will arrive at the unit's POD are compared, and all, or as much of the cargo as possible, is placed on the ship that will arrive soonest. Aircraft are treated similarly in this regard.

After the RAPIDSIM run concludes, the lower portion of the Model panel displays a statistical summary of RAPIDSIM results of the simulation run.

RAPIDSIM can be executed with the TFE (Transportation Feasibility Estimator) flag set. When the TFE option is selected, all RAPIDSIM algorithms will be used with the exception that the EAD (vice ALD) will be used as the earliest possible delivery date during the simulation.

2.5.5 PFE

The Prototype Feasibility Estimator (PFE) is a day-by-day simulator designed to produce results consistent with those of RAPIDSIM, and in a comparable time. The process for preparing and executing the PFE simulation model in DART is identical to the process for RAPIDSIM, with the exception of selecting PFE as the model.

PFE uses two similar but distinct algorithms, one for simulating sealift and the other for airlift. The air and sea simulators are run separately and a model run can be limited to one or both simulators.

Aircraft are treated as aggregate capacities in RAPIDSIM and PFE with some number of each type of aircraft available each day, for some number of hours each day, doing continuous round trips between a POE and POD. Essentially, PFE allocates whole numbers of aircraft of a type to each channel each day from a central pool of aircraft, as it is faced with demand from movement requirements needing transport along channels. In PFE, once aircraft are assigned to a channel for the day to meet some demand, that channel has all of the throughput capacity of that integral number of aircraft for that day. PFE is somewhat more likely to use aircraft at less than full capacity.

Ships are made available (individually) at specific notional ports, called port groups, on specific days. Thereafter, they can be recycled once they have taken a load to a POD.

The results of PFE simulations are dependent upon the setup parameters. Some parameters concern specific vehicles and ports and are changed from the Situation panel; and some parameters are unique to the PFE model and are changed from the Model panel. Both panels can be accessed from the Summary mode and activated from the Main Icon Bar. Descriptions of the functions required to prepare the input, execute the PFE process, and evaluate the PFE output are provided in the following paragraphs.

At the conclusion of PFE execution, output data can be displayed in graphs identical to the RAPIDSIM graphs. In addition, PFE output data can be analyzed in a force module graph provided through the Timeline button displayed in the DART Main Icon Bar. Finally, simulated port workload, requirements, constraints, and the simulated flow through individual nodes may be graphically compared from the map.

2.5.6 Analysis Files and the Analysis Concept

The Analysis Concept has been developed in order to help DART users save the inputs, parameters, and results of a model run, and then allow them to compare these results with previous model runs.

The analysis file is a roll-up of all data used for, and resulting from, a model run. It can contain all, or a portion of, the following: TPFDD summary information, all current situation information, and all results information related to the most recent model run. The significance of having this capability is that if users iterate the database and situation through many changes, and later decide that they preferred the TPFDD and situation at the state they were in at the time of a previous model run, the changes are readily at hand. For this to be the useful, the user

must always save the TPFDD summary, situation, and the results of a good model run to an Analysis file.

2.6 Capacity Graphs

Once a TPFDD and situation have been specified, the user can perform a rough model-independent analysis of the feasibility of the TPFDD movement requirements given the constraints of the situation.

When the Capacity icon has been selected, a Graphs button is added to the menu bar. At this time there are two graphs available in this mode:

- Capability vs. Requirements
- Show Port Workload and Capacity.

2.6.1 Capability vs. Requirements Graphs

DART provides the capability to compare the TPFDD requirements with the daily capability of the airlift and sealift assets identified in the situation. The Capability vs. Requirements graphs provide the output of this process. The user can specify the transportation mode and cargo units to be displayed on a pop-up window activated by this selection.

Two charts show Air Delivery Requirements versus Aircraft Capacity, and Sea Delivery Requirements versus Ship Capacity, by day.

Capacity data is calculated from the daily quantities of ships and aircraft contained in the Situation. For aircraft, the utilization rate is also used in the calculation.

Requirements data is derived from the TPFDD. A TPFDD must be selected and loaded for these graphs to be displayed, otherwise, an error may result. The values plotted are the TPFDD totals spread over their EAD-LAD window.

This graph shows only daily figures, and not cumulative. (The Force Module graphs in the TPFDD Editor can be used for that purpose.)

There is some difficulty in estimating the capacity for ships, since ship speed and travel distance are important factors. A complex algorithm has been developed for this purpose.

2.6.2 Show Port Workload and Capacity Graph

This selection will display a graph which shows a comparison of the values entered in the Cargo Amount Capacity option and the simulated deliveries and port requirements.

A TPFDD must be selected and loaded, and PFE chosen as the model, before a Port Workload graph can be drawn.

This graph provides, for each port, a chart comparing either two or three values:

- Port Requirements — Aggregate TPFDD Requirements
- Port Capacity — The port throughput; values entered from Edit Port Parameters cargo amount capacity

- Port Load — Simulated port onload/offload activity, only when a model has been run to provide this data

2.7 Analysis Products and Results

The Results icon provides access to a series of graphical analysis products, which are based on the results of the model analysis run.

Graphs of a single model run can be viewed individually or in groups of four (the four types set by the system).

It is possible to show two graphs, from two different model runs, together. The planner must setup each TPFDD, run the model, and save the results. The choice of which results to compare is selected when a graph type is picked. When comparing results, the second analysis must already be loaded into memory. Also, it is possible to iconify a graph from one analysis and bring it back to compare it to another.

2.7.1 Mouse-sensitive Objects

The graphic output produced by DART in the Results and Capacity modes have similar features. Many objects on the graphs are mouse-sensitive. This means that when the user positions the mouse over a particular object on the graph, it is highlighted (outlined in white). All of the mouse-sensitive objects allow the user to click the right mouse button to activate a menu of options. Most of the mouse-sensitive objects on the graph allow the user to click the left mouse button to perform the most common operation performed on this object (based on the view of the programmer).

Entire Graph

Single-clicking the left mouse, when the entire graph is highlighted, performs no action.

Single-clicking the right mouse when the entire graph is highlighted, activates a menu with these options:

- Add Free Text...

  Freely places plain text on graph with or without a pointer to a place on the graph. Text is placed with crosshairs.

- Crosshairs

  Activates a cross, which can be used to locate an X and Y value of a point on a graph. As the mouse is moved across the graph, the X value will appear on the X-axis and the Y value will appear on the Y-axis. Click the left mouse button to terminate the crosshairs.

- Edit Graph Border & Labels...

  Activates a window that allows the user to edit the border attributes and labels.

- Identify Data Set Point...

  Activates a pop-up menu of data sets that are currently in view on the graph that is activated. Choose one, then select a point on the graph. It will be labeled with the following information:

  - Dataset Name
  - X-axis Heading
  - Point on X-axis
  - Y-axis Heading
  - Point on Y-axis.

- Identify Data Set Region...

  Activates a pop-up menu of data sets currently in view on the graph that is activated. Choose one, then designate an area on the graph with lines, using the left mouse button to change the drawing direction of the lines. When the box is complete, a pop-up window prompting the user for information about the data region to be displayed will be activated.

- Redraw Graph

  Refreshes the graph. This may be necessary if the window is disturbed while the graph is being drawn.

- Reveal Hidden Data Sets

  Allows the user to reveal all data sets previously hidden using the "Hide Data Set" graph option. Only available if a data set has been hidden.

- Zoom In...

  Allows the user to zoom in on a graph. Using left mouse button, choose one corner of rectangle, size the graph to the desired size, and click left mouse button. The graph will be redrawn to the specified size.

- Zoom Out...

  Returns the graph to its original size. Only available if the graph has already been Zoomed In.

Text Objects

A click on any of the following objects:

- Graph title
- X-axis title
- Y-axis title
- Box containing graph key ("Edit Annotation Text" not available)
- Summary of data point or data region
- Free text previously added to graph

activates the following operations:

A left mouse click allows the movement of the object.

A right mouse click activates the following menu:

Change Style

Delete

Edit Annotation Text

Move.

Entry in Graph Key Box

Single-clicking the left mouse on a single entry in the graph key box allows the user to revise the data symbol used to display this entity.

Single-clicking the right mouse on a single entry in the graph key box activates the following menu:

- Change Data Symbol
- Hide Data Set

Point on Graph

If the point has already been annotated, a left mouse click allows the user to drag the annotation to another point on the graph.

If the point has not been annotated, a left mouse click does nothing.

A right mouse click activates the following single-entry menu:

- Identify Data Point

  Annotates a selected point with the following information: Dataset Name, Heading and point on X-axis, Heading and point on Y-axis.

2.7.2 Graph Types

When the Graphs button is activated, a pop-up appears listing the graphs that are accessible. The list is as follows:

- Standard 4
- Cumulative Closure Graphs
- Vehicle Activity Graph
- Scatter Graphs.

2.7.2.1 Standard 4

The "Standard 4" display shows three closure graphs, air PAX, air STons, and sea MTons, and a Delivery Scatter graph. This four-graph display is useful for providing the initial top-

level view of analysis results. The user may then investigate selected details using individual graphs. Four graphs are present on this screen:

- Cumulative Short Tons by Air
- Cumulative Measurement Tons by Sea
- Cumulative PAX by Air
- Closure Day Scatter Plot.

2.7.2.2 Cumulative Closure Graphs

These graphs are line charts that compare various types of cumulative deliveries against delivery dates. These graphs can be set to show any combination of air/sea/STons/ MTons/PAX/POL.

All Closure graphs include color-coded lines for cumulative deliveries versus:

- Available day (equivalent to ALD) (in light green)
- Platform loaded (equivalent to Leave day) (in yellow)
- LAD (latest desired arrival day at POD) (in light blue)
- Closure day (the actual arrival day at POD) (with red circles)
- Attrition (attrition of cargo/PAX) (in purple) (plotted as zero if no attrition factors are loaded).

All graphs show C-Days increasing to the right against deliveries, which increase upwards.

2.7.2.3 Vehicle Activity Graphs

These bar charts show daily ship and aircraft activity over the duration of the plan. The values are number of sorties, by air; and ships in use, by sea. The ship graph also includes overlapping color coded bars to differentiate between ship activities: source to POE (meaning pre-positioning); loading; POE-to-POD (meaning enroute); and unloading.

2.7.2.4 Scatter Graphs

Scatter graphs (also called scatter plots) show each individual movement requirement (or aggregated movement requirement, in some cases) as a point. This selection activates a pop-up containing the following options:

- Loading Scatter Graph
- Lateness Scatter Graph
- LAD vs. Closure Day

If a graph is chosen, a window prompting the user for specifications on the contents and format of the graph appears.

On the scatter plot, sea deliveries are represented by green dots, and air deliveries are represented by blue dots. Intensity of color indicates the amount of cargo represented by the dot. These points are mouse-sensitive and a single left mouse click will allow DART to display the cargo makeup of the dot.

Loading Scatter Graphs

This graph is available for both air and sea loading activities, covering both APOEs and SPOEs, and show the day ready to load (ALD) versus the day loaded and leaving the port. The difference between these two dates is the time spent at the port due to loading, and to any other delays.

Every movement requirement is plotted as a point. No points can be below the line (that would mean leaving before arriving). However, those movement requirements never loaded (for various reasons), and therefore never leaving, are shown as points along the lower margin.

This graph does not provide the diagonal line for reference.

Lateness Scatter Graphs

This graph plots Days Late against Days Waiting to Load. These graphs show only late arrivals and are available showing air and sea movement requirements.

LAD versus Closure Day Scatter Graph

These chart the predicted closure day (the date of actual arrival at the POD) against the LAD (the latest desired date). Every movement requirement is plotted as one point, sea movements in green, air in blue.

This graph is available either as one of the four Quick View graphs (along with three Closure graphs noted above), or paired, showing sea and air deliveries, or individually. When included in the group of four, this chart shows all deliveries. When viewed individually, this chart may show either STons, MTons, or PAX deliveries, as requested.

A straight diagonal line is provided to mark the "Closure = LAD" point.

2.8 Reports

Several types of reports can be obtained at different points in the process. When the Summary icon is selected, a new menu button labeled Reports, appears.

Initially, this button provides a list of three reports:

F11D
F11E
MR Summary.

If the RAPIDSIM model has been selected, the reports list becomes:

F11D
F11E
MR Summary
Requirements
Channels Report
Detail Report
Air Detail

Sea Detail
Major Units Detail
Ship Report
Summary Report
Sortie Summary
New DETONE
DART Run Comment.

Only the F11D and F11E are completely model independent reports. The MR Summary becomes an available option only after a model has been selected and requirements have been generated. The rest of the reports listed relate only to RAPIDSIM and are only available after the model has been run. (For more information on the RAPIDSIM unique reports, see the RAPIDSIM Users Manual.)

When a report is run in DART, it first appears in a window (called an xlook window) on the screen. Once the window appears, the buttons on the menu bar in the window can be used to search and print the report. The report can also be scrolled, using the scroll bar on the left side of the window.

- Clicking the left mouse button on the scroll bar will scroll down in the window.
- Clicking the right mouse button on the scroll bar will scroll up in the window.
- Holding and dragging the middle mouse button on the scroll bar will slowly scroll the window in the direction the mouse is being dragged.

If the report selection does not prompt for a printer, the one specified in Set Printer Options (from the Utilities button) will be used.

2.8.1 F11D/F11E Reports

The F11D and F11E are JOPES standard reports which may be produced from several different combinations of movement requirements; all those contained in the TPFDD, or a collection (or subset) of records.

Either of the reports can currently be accessed through different methods in DART, both top-level and TPEDIT. When a sort option is not available, or not used, the report will be listed in ULNs/CINs/PINs order.

The following data is provided in the F11D and F11E reports:

- F11D Report: Force List/Movement Requirements Working Paper

OPLAN Nr	SVC
ULN/CIN/PIN	PROV ORG Name
CEI	AUTH Pers, PAX
Force Description	STons
UIC	Loc Names: POD, DEST
ULC	EAD, LAD, RDD
UTC	Mode POD/DEST
ORIGIN	SRC
FIC, PIC	PCD (DEST).

- F11E Report: Time-Phased Transportation Requirement List (TPTRL)

OPLAN Nr
ULN/CIN/PIN
CEI
Force Indicator (whether std or other)
Deployment Status
Description
Cargo Category/HL/CL
SVC
PROV ORG
ULC
UTC
UIC
PCD
APERS (Auth Pers)
ORIG/POE/POD/DEST/ ILOC; for each:
GEOLOC, CC, Ins
M/S, LD
RLD/ALD/EAD/
LAD/RDD
DLY, L, T
PAX
BULK(MT/ST), OVER(),
OUT(), NAT(), POL
(choice of ST or MT for above)

2.8.2 Movements Requirements (MR) Summary Report

The MR Summary option provides information on the results of filtering the TPFDD movement requirements through the existing Model Setup. In effect, this evaluates the quality of the data in the TPFDD. This report can only be run after a model is selected, the model setup operation completed, and the model run movement requirements are generated.

This report is useful for showing errors and similar problems in movement requirements. (These may be similar to the errors detected by the Routine Retrievals process.)

The Movement Requirements Summary Report is available through two methods in the DART system:

- Reports Icon on DART Top Level
- Report Button in Summary Mode

The report states the names of the Analysis, the TPFDD (with update number), and the Situation. The report also lists the model (unique) parameters and selected options:

Start and Stop days
Sea mode (MTons/STons)
Discard movement requirements with missing ports (Y/N)
Omit on-call requirements (Y/N)
Omit on-call units (Y/N)
Use POD to compute missing transportation modes (Y/N)
Include transportation sources (MAC/MSC)
Include transportation modes (Air/Sea/Missing/ Land/Undef/Optional/None/In-place)
Retain original mode of non-Air PAX (Y/N)
Include Land mode (Y/N)

The report shows: Air and Sea requirements (number, STons, MTons, SqFt, PAX, CBbl), for:

All TPFDD Requirements
MAC and MSC Requirements
TPFDD Requirements ignored and not included due to:
On-call
Non-MAC/MSC transportation source

Source
Shortfalls
Retrogrades.
Total TPFDD records given to RAPIDSIM

The report lists ReqIDs for erroneous entries, including, for example:

No SRF Use TUCHA
Missing Data
Undefined Mode
No TPSN
Missing POD
No TUCHA for Standard Unit
Missing Mode
No Cargo or PAX
STons No MTons
Changed Movement Type.

Also, a selected number of ULNs, CINs, and PINs, categorized by error types, are included in this report.

2.9 PFE Timeline

In addition to the standard analysis output graphs, PFE provides an enhanced capability for model analysis, data modification, and model execution, from a Timeline window.

The PFE Force Module Timeline Display and four additional Main Menu Bar functions are provided through the Timeline button displayed in the Main Icon Bar. The Timeline button appears on the icon bar as soon as "Generate Requirements" has been completed using the PFE model.

The PFE Timeline Display is used to visualize the transportation closure, by force module and by units, accomplished in the last PFE simulation and to view or change parameters of the TPFDD force modules and/or requirements in preparation for subsequent model simulations.

The Timeline display reflects a wide variety of information. The force module names are on the left of the display, and the arrow symbols at the top and bottom of the bar to the left of the names can be used with the left mouse button to move the display up or down. When a force module is "opened", using methods discussed below, all of the units (ULNs/CINs/PINs) associated with the module are displayed under the module name. The actual timeline for each module and unit has multiple parts:

- The orange vertical bar represents the POE
- The yellow outline represents the POD
- The turquoise vertical bar represents the Destination
- A gray transportation line represents mixed transportation
- A blue transportation line represents air transportation
- A green transportation line represents sea transportation

- A white bar shows closure; requirement is on-time
- A red bar shows closure; requirement is late

When the entire line of a force module, ULN, CIN, or PIN is highlighted on the display, the following information is displayed in the Mouse Information Panel, depending on which type of entity is marked:

FM	FM name Total tons Total PAX Total number of requirements FM title and date/time created.
ULN	ULN number Mode Status Total tons and PAX Unit name
PIN	PIN number Mode Status Total tons and PAX Identification of "filler personnel" or "replacement."
CIN	CIN number Mode Status Total tons and PAX Resupply type

When the time schedule line of a force module, ULN, CIN, or PIN is highlighted on the left side of the display, the following information is displayed in the Mouse Information Panel:

FM	FM name Mode Status Total tons and PAX Origin=>POE=>POD=>Destination GEOLOC codes ALD/EAD/LAD/RDD C-day departed/C-day closure
ULN	ULN number Mode Status Total tons and PAX Origin=>POE=>POD=>Destination GEOLOC codes ALD/EAD/LAD/RDD C-day departed/C-day arrived
PIN	PIN number Mode

Status
Total tons and PAX
Origin=>POE=>POD=>Destination GEOLOC codes
ALD/EAD/LAD/RDD
C-day departed/C-day arrived

CIN — CIN number
Mode
Status
Total tons and PAX
Origin=>POE=>POD=>Destination GEOLOC codes
ALD/EAD/LAD/RDD
C-day departed/C-day arrived

When a Force Module is closed, the timeline represents the extremes of the records it contains. (E.g., if any requirement is late, the closure line is red.) The timeline bars will expand or contract when dates are changed.

Operations such as changing dates or priorities on the timeline display, can only be performed if the force module and unit information is selected first.

The following provides methods for selecting individual modules or units within modules:

Individual force modules can be selected and a white check mark will appear to the right of the FM name or transportation line. There are two methods for accomplishing individual selections. The first method for individual force module or unit display uses only the mouse buttons. The second way to select an individual force module is to click the right mouse button while highlighting one entry in timeline display.

While one module is selected, units in another force module can be viewed by highlighting the desired force module and clicking the middle mouse button. This action will not select the additional force module but will expand it, so that the units will be in view.

In addition to the PFE Force Module Timeline Display, the PFE screen provides four additional buttons on the Main Menu Bar:

Display
Modify Dates
Set Status
Run Model.

The Display option provides choices for the screen display in the PFE Force Module Timeline Display.

Refresh Timeline Display
Normal Display
Condensed Display
Set Days to Display.

The Set Days to Display allows the specification of a beginning and ending date for the Timeline display. Only the specified section of the transportation schedule lines will be displayed.

Modify Dates, listed below, change the specified dates in the selected requirements or save all changes made to the TPFDD. After dates are modified, the model can be re-executed for analysis of the impact of the date changes on closure and transportation requirements.

Set LAD = FAD. This function changes the (planner specified) Latest Arrival Date to whatever the (analysis derived) Feasible Arrival Date is, in the selected requirements. After the dates are changed, the Timeline will repaint the screen and the transportation lines with each requirement will be posted with the dates changed.

Reset Dates. Dates in selected requirements will be set back to what they were before any change was made to them in the current PFE Force Module Timeline Display session.

Shift All Unit Dates. Results of this function are the same as the shift dates function in the TPFDD Editor. Selection of this option will provide a pop-up prompting for a number for the days to shift selected units by field. All dates in the selected requirements will shift by the specified number.

Shift Unit Arrival Dates. Selection of this option will provide a pop-up prompting for a number for the days to shift selected units by field. Both the EAD and the LAD at the PODs in the selected requirements will shift by the specified number.

Save TPFDD Changes. Changes made to requirement records during the PFE session can be saved to the basic TPFDD using this function. Once the changes have been saved to the TPFDD, the changed requirements can be viewed from other DART screens.

After changes have been made in the TPFDD Editor, the rollback selection in the TPFDD Editor Update mode will have no affect on the PFE Force Module Timeline Display.

Set Status functions will change the movement priority for specified groups of units. By altering the priorities and rerunning the PFE, the effects of priorities on simulated closures may be evaluated. The priority of a specific movement requirement or for an entire force module is displayed on the right side of the PFE Force Module Timeline Display as a red, blue, or black ball.

The six Set Status functions are:

Normal Priority for Selected Units	(blue)
Normal Priority for Ignored Units	(blue)
High Priority for Selected Units	(red)
High Priority for Non-Ignored Units	(red)
Ignore Selected Units	(black)
Ignore All Unselected Units	(black)

Run Model allows the PFE simulation to be executed directly from the Timeline screen. When the Run Model button is selected, the bottom half of Edit Model Settings pop-up menu is automatically displayed.

3. External Integration

External integration supports the primary functions of Plan Processing and Plan Analysis. External integration capabilities are provided to acquire TPFDD and reference file data from WWMCCS (JOPES), and to return TPFDDs to WWMCCS when required. Tools are also provided to export files and graphic analysis results to other systems.

- For example, TPFDDS, once modified by DART can be exported to FAST for additional analysis.

- Also, graphics resulting from DART analysis can be sent to Apple Macintosh systems for conversion to a presentation graphics format.

3.1 Import from WWMCCS into DART

Both TPFDD data and standard reference file data (currently GEOFILE and TUCHA file) can be imported (downloaded) from WWMCCS (JOPES).

TPFDD data may be imported either as a whole, or as update changes.

3.1.1 Import a Complete TPFDD

TPFDDs are maintained in WWMCCS in either the JOPES database or as a JOPS TPHOLD file. After DART processing, the TPFDD may be returned to WWMCCS as a JOPS-format TPHOLD file.

The TPFDD may be transferred on 9-track tape, or DOS-compatible floppy disks, or via a direct connection (LAN) between the DART system and WWMCCS.

The JOPES files are normally stored on the WWMCCS computer in Honeywell BCD format, and must be converted to ASCII before they are transferred to media to be used by DART.

3.1.2 Import TPFDD Changes (Transactions)

Instead of importing an entire TPFDD from WWMCCS to DART, it is desirable to import only the changes made to the TPFDD on WWMCCS since the last import. This "transaction" import can substantially reduce the time required to import a TPFDD from WWMCCS to DART.

3.1.3 Import Reference File Data

The reference file information used in DART is also maintained and updated in WWMCCS. These files include the GEOFILE, TUCHA and (PENDING) CHSTR and ASSETS files. These files may be converted to ASCII and imported into the DART database.

3.2 Export from DART to WWMCCS

TPFDD data may be uploaded to WWMCCS (JOPES) either as complete TPFDDs or as update data.

3.2.1 Complete TPFDD

The TPFDD may be transferred on 9-track tape, or DOS-compatible floppy disks, or via a direct connection (LAN) between the DART system and WWMCCS. The ASCII DART files must be converted to Honeywell BCD before they are loaded into the JOPES database.

3.2.2 TPFDD Changes (Transactions)

Instead of exporting an entire TPFDD from DART to WWMCCS, it is possible to export only the changes made to the TPFDD in DART. This "transaction" import can substantially improve the ability to synchronize the different databases.

3.3 Export from DART to FAST/JFAST

In addition to exporting TPFDD data to WWMCCS, DART provides a mechanism for exporting TPFDD data to another transportation analysis system, FAST/JFAST.

To export TPFDD data, select the FAST file format when exporting the TPFDD data. The option to "Export TPFDD from DART Database" is on the pop-up menu that is activated by selecting the File button on the DART main menu. After selecting FAST Input Format.

3.4 Export Graphics

Various capabilities have been provided for exporting graphics and textual data.

3.4.1 Export DART Graphics Windows

DART is capable of capturing and exporting screen graphics, consisting of snapshots of any DART window. These windows may be captured at any time, during Plan Editing (TPEDIT), Plan Analysis, or External Integration.

The term macify means to perform a screen capture on the contents of the desired window for subsequent display and printing from a Macintosh or other personal computer. There are two forms of macify: black and white, and color.

- The black and white capture stores a picture of the designated window in a MacPaint (Macintosh COTS software) format. This format has limited size capabilities and will not completely store the larger DART windows.

- The color capture stores a picture of the designated window in a ".gif" format. This format is a format widely used on the Macintosh computer. This form of macify will completely capture any of the DART windows.

Commercially available software, which runs on Macintosh and PCs, imports these .gif images into presentation graphic software packages such as PowerPoint (TM).

3.4.2 Export Analysis Data

DART also provides a mechanism for exporting the data underlying its analysis graphs. The data is placed in tabular form in an ASCII file, and may then be moved to a Macintosh, IBM-compatible PC, or other computer and pasted into a spreadsheet or other data analysis package.