

**Global Deployment Analysis System
Algorithm Description
(with Updates)**

**By
Noetics, Inc.**

**For
U.S. Army Concepts Analysis Agency**

**Contract Numbers MDA903-93-C-0259, DASW01-94-C-0170,
DASW01-95-N-5536, and DASW01-97-D-0126 for**

Defense Supply Service Washington

Sept 1998

20000224 107

DISTRIBUTION STATEMENT A
Approved for Public Release
Distribution Unlimited

AO W00-02-0444

This Algorithm Description for the Global Deployment Analysis System (GDAS) was prepared by Noetics, Inc. for the U.S. Army Concepts Analysis Agency (CAA) under Contract Numbers MDA903-93-C-0259, DASW01-94-C-0170, DASW01-95-N-5536, and DASW01-97-D-0126 with the Defense Supply Service Washington (DSS-W). The Contracting Officer Technical Representative is Dr. Elizabeth Abbe of CAA, who is also the principal functional sponsor and tester of GDAS. Questions about the GDAS should be referred to her at the following address:

Dr. Elizabeth Abbe
US Army Concepts Analysis Agency
8120 Woodmont Avenue
Bethesda, MD 20814-2797
Telephone (301) 295-0027

GDAS for DOS uses the Paradox Database Management System under a sub-license agreement for the Paradox Runtime software, which requires the following statement. The Paradox Runtime software is copyrighted by Borland International and is covered by applicable copyright laws. The Runtime may not be copied without permission except as part of the GDAS installation. Borland International is not responsible for any negative effects resulting from the use of Paradox, and any application support for Paradox Runtime will be provided by the GDAS developers, CAA and Noetics Inc., and not by Borland International.

GDAS for Windows has also been developed by Noetics, Inc. with modifications to support the Voluntary Intermodal Sealift Agreement (VISA) under partial funding from USTRANSCOM, the DOT Volpe National Transportation Center, and Stanley Associates, Inc. GDAS for Windows uses Microsoft Access 97 as the database engine, which must be purchased and installed separately. GDAS for Windows can import the scenario data from GDAS for DOS, and both applications share common model code and scheduling algorithms.

Acknowledgements

GDAS could only be developed with the support and hard work of CAA staff and the GDAS programming team. Key management direction was provided by Mr. Daniel Shedlowski, Mr. Frank McKie, and Dr. Elizabeth Abbe of CAA. Testing and review of GDAS was supported by CAA staff including Mr. Jose Imperial, Ms. Nancy Daugherty, Major Ben Herr, Ms. Renee Carlucci, Ms. Vera Hayes, and Ms. Patricia Fleming of CAA. Prior program management and testing were provided in a previous contract by Stanley Associates, as well as ongoing testing and support on the GDAS for Windows software. The GDAS design, algorithm development, and programming were performed by Dr. Stephen Young, Mr. George Dalton, and Mr. Keith Hall of Noetics, Inc.

1. System Overview

1.1 Document Preview

This document contains the GDAS Algorithm Description. This initial section provides an overview of the GDAS system adapted from the GDAS User Manual. Subsequent sections summarize the data structures and model algorithms that are used in the GDAS software.

1.2 GDAS Summary

GDAS is a software package which performs transportation analysis of large or small scale DOD deployments including mode planning, port selection, routing, scheduling, and simulation. GDAS executes on desktop microcomputers running Microsoft DOS, Windows NT 4 or later, or Windows 95 or later. GDAS incorporates a global transportation network and schedules movements from CONUS origins to intra-theater destinations using intermodal, multi-theater transport by air, land, and sea. GDAS components include integrated database, query, world-map display, chart graphics, scheduling, simulation modeling, analysis tools, and reporting capabilities. Detailed analysis features include tracking of individual ship and aircraft locations, shortest path routing with node constraints for all modes, port facility throughput limitations with queuing, integrated air/sea/motor/rail mode selection, and staging of time-phased movements at intermediate ports. Use of GDAS requires an analyst who is knowledgeable in DOD transportation and can understand the data relationships, but does not require programming expertise.

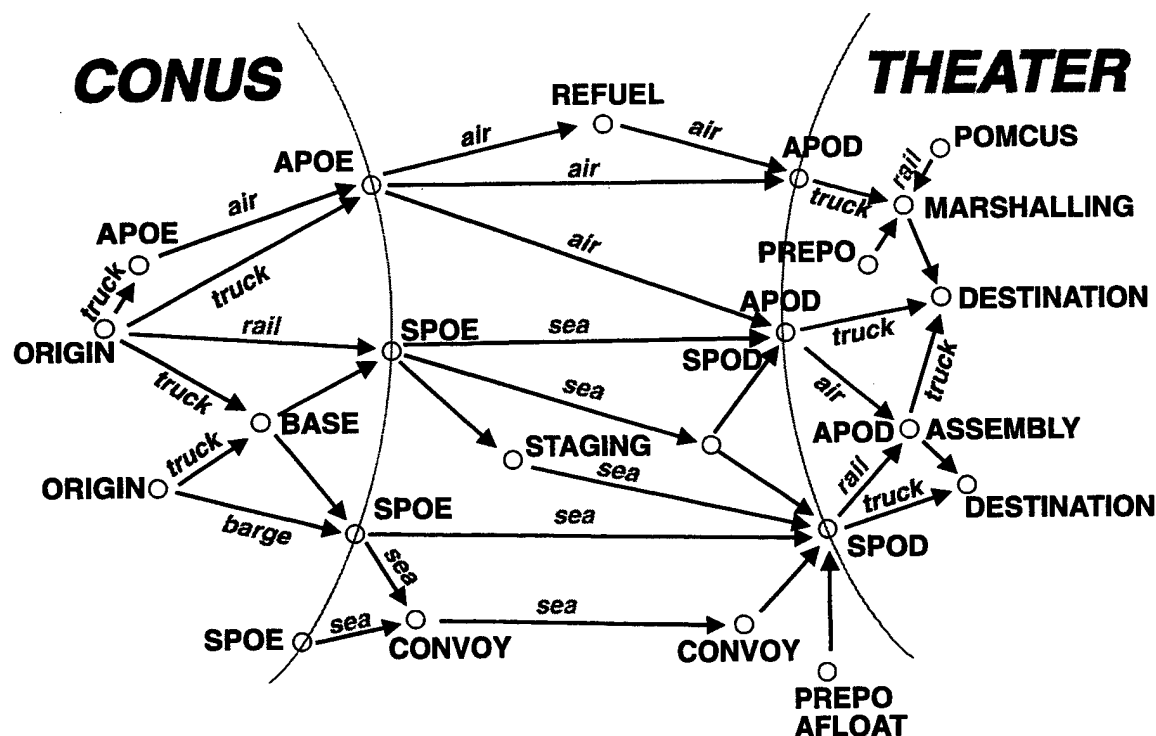


Figure 1-1. Intermodal Transportation Network

Features of GDAS include:

- All modes of transport are treated within a common framework.
- The system provides a framework for testing multiple scheduling algorithms which can be user-selected at runtime for each mode of transport.
- The scheduling algorithms explicitly account for the multi-modal, interdependent nature of DOD transportation, in particular predecessor/successor relationships and staging dependencies.
- The model can run at a high level of detail or a more aggregate level of detail simply by changing data inputs.
- All data is table-driven, including modes of transport, units of measure, vehicle types, vehicle compartments, cargo types, etc. and all of these can be changed in the data without modifying code.
- All model data is input from the database and output to the database, visible to the user.

1.3 *Why GDAS was Developed*

Because of the importance of DOD mobility, many models have been developed to analyze and simulate various aspects of deployment. These models include MIDAS and JFAST for intertheater air/sea deployment, and SUMMITS and ELIST for intratheater transportation flow analysis. Recently, USTRANSCOM has also developed the Advanced Mobility Platform (AMP), which provides a framework for interfacing with several of these planning models, including export to TPFDD B-8 files which can be processed by GDAS.

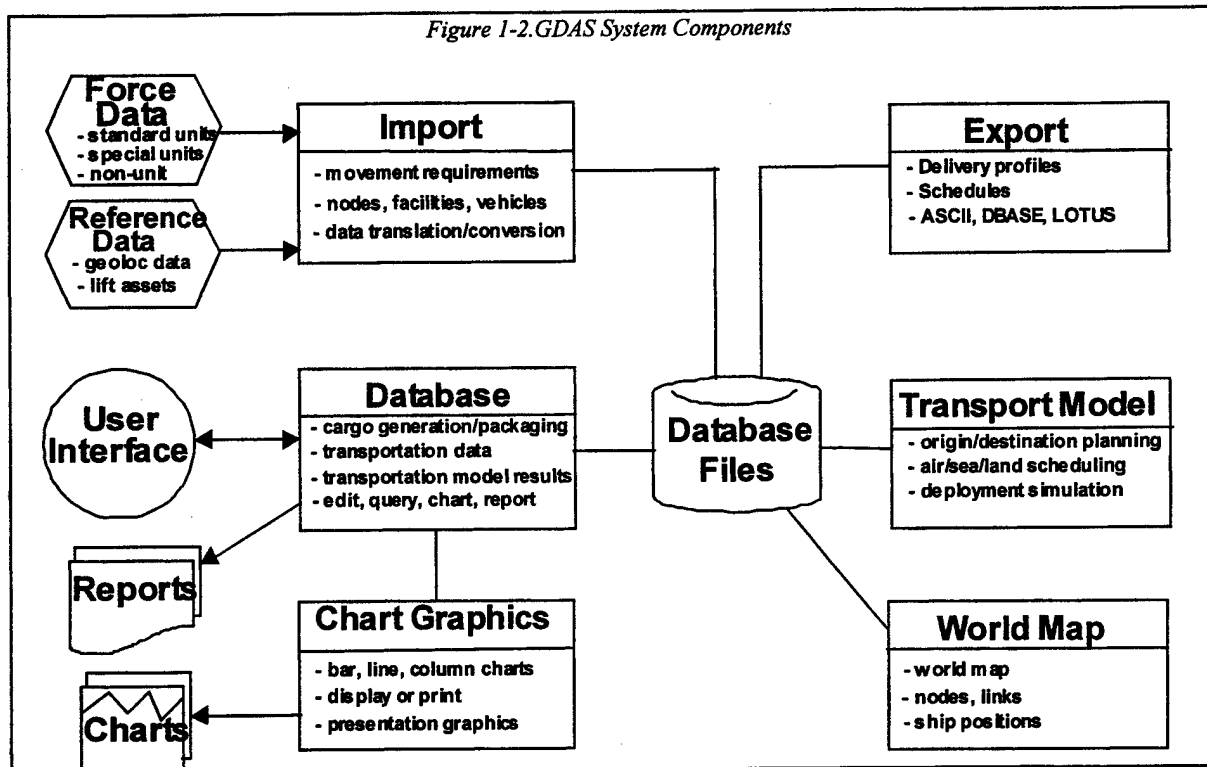
Within the context of these other models, GDAS was developed with several objectives:

- to perform both intertheater and intratheater mobility analysis within an integrated framework, including mode planning, port selection, staging at intermediate ports, and shared use of resources in combined operations plans;
- to support more detailed analysis of lift assets and facilities, such as scheduling of individual aircraft, tracking of hourly facility constraints, matching of truck/rail cargo constraints, and setup for pre-scheduled cyclical liner routes and preset vehicle itineraries;
- to schedule more realistic, balanced force deployments with proper time-phased delivery of related movements, suitable for input into combat models
- to provide adjustable levels of detail in movement requirements, ranging from aggregate totals for quick studies to individual line item dimensions for detailed analyses;
- to provide fully integrated, end-to-end scheduling, so that bottlenecks in the theater can be identified and alter the planned mode and port selection (POE, POD) prior to shipment from CONUS;
- to provide support for ad-hoc queries and analyses using relational database capabilities;
- to implement large-scale scheduling and simulation algorithms on readily available, portable, and increasingly powerful microcomputer platforms.

GDAS was designed from the beginning to be a highly detailed model for multi-modal scheduling, and simulation from origin to destination. The relational database structures are designed to represent the complete transportation network using common, unified data structures for all modes of transport, including lift assets, vehicle types and compartments, facilities, transportation links, routes, movement requirements with staging and pre-positioning, multiple cargo dimensions and quantity measures, and scheduling time/cost objective functions. By using completely table-driven model inputs, ranging from units of measure to transport modes

and vehicle types, the various algorithms developed for GDAS can be applied to each mode at user-adjustable levels of detail appropriate for the study.

An overview of GDAS system components is provided in Figure 1-2 followed by a summary of the major subsystems.



1.4 Database Subsystem

The GDAS database subsystem provides view, edit, query, and report capabilities for a full range of transportation data including:

- movement requirements for unit, prepositioned, resupply, staging, and retrograde movements;
- origins, mobilization stations, theaters, and final destinations;
- intermodal transportation network for air, sea, motor, rail, and other modes with node/link constraints;
- aircraft types, compartments, and characteristics;
- individual ships and ship compartment data;
- seaports, berths, and port constraints;
- airports and airport constraints;
- various scenario data such as attrition and convoying;
- detailed scheduling results by vehicle, trip, and stop
- summary results and delivery profiles.

All data is table driven, so it is easy, for example, to define new ship types having an arbitrary number of compartments with individual capacities and units of measure.

Key features of the database include:

- user friendly editing with either tabular views or single record form views of data
- “help and fill” lookup screens for data entry without typing
- comprehensive edit checks at the time of data entry to maintain data quality
- global search and replace for changing large amounts of data
- automatic propagation of data changes to maintain normalized referential integrity
- menu-driven data tables and data entry forms with pick lists and edit checks
- extensive data checking tools (*critically important for any study!*)
- ad-hoc query capabilities with data export
- chart graphics for reports and queries
- output reports, analysis, and query tools.

Powerful, but easy-to-use, query capabilities are provided simply by checking the tables/fields desired, with tools to perform automatic multi-table query linking, define record selection criteria with “help and fill”, perform Boolean selection and comparisons, provide on-screen or formatted report output, and provide presentation chart graphics (stacked bar, multi-line, area, pie, etc.) on the results of any query.

Figure 1-3. Sample GDAS Database Input Forms

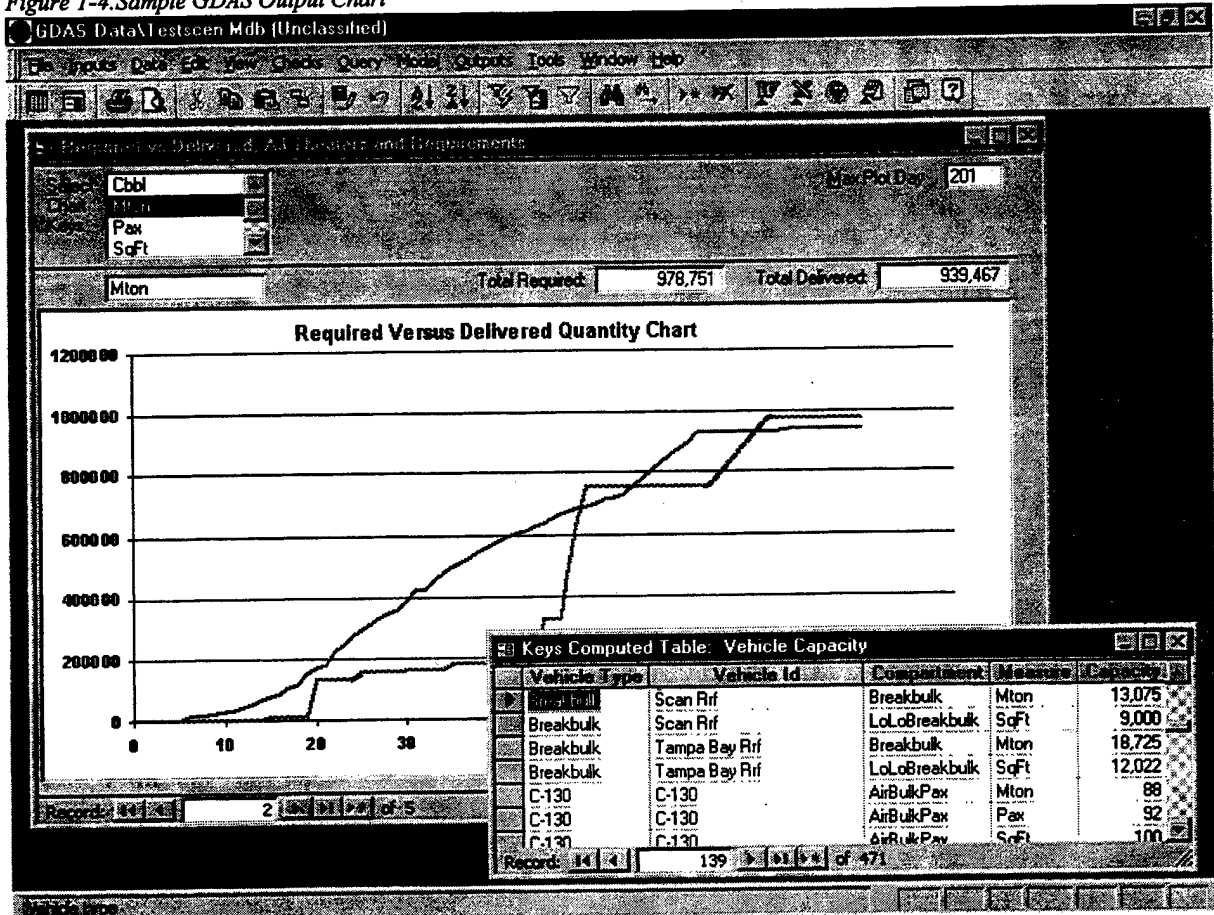
The screenshot displays the GDAS DataView application interface. The window title is "GDAS DataViewscreen Mdb (Unclassified)". The interface is divided into several sections:

- Left Panel (Tree View):** A hierarchical tree structure for selecting data fields. It includes categories like "Airlift", "Conus", "InPlace", "Pipeline", "Rail", "Road", and "Sealift". Under "Sealift", there is a sub-entry for "Route Type: Sealift" which further branches into "Vehicle Type: Barge Dry", "Vehicle Type: Barge Liquid", and "Vehicle Type: BB + Cont SS". The "Vehicle Type: BB + Cont SS" entry is expanded, showing a table with columns for "Id", "Fleet", "Msc-Crb", "Breakbulk", "Container", "Count", and "Start".
- Central Table View:** A table showing data for the selected "Vehicle Type: BB + Cont SS". The table has columns for "Id", "Fleet", "Msc-Crb", "Breakbulk", "Container", "Count", and "Start". The data rows are:

Id	Fleet	Msc-Crb	Breakbulk	Container	Count	Start
			10100		1	
			1431			
- Right Panel (Form View):** A form for data entry. It includes fields for "Vehicle Type" (set to "BB + Cont SS"), "Vehicle Name" (set to "Adabelle Lykes (C/Mod)"), "Cruising Speed" (20), "Max Cargo Load" (3,613), "Facility Depth Required" (660), "Facility Width Required" (81), and "Facility Dimension Required" (26). There is also a "Records" section at the bottom showing "1" record.

For the DOS version, the database capabilities are implemented using Paradox Runtime for DOS, so that it is not necessary to purchase a commercial database package. For the Windows version, the database is implemented in Microsoft Access 97, which must be purchased and installed separately. The figures display sample data input and chart output forms in the GDAS database.

Figure 1-4. Sample GDAS Output Chart



1.5 Mode Planning and Transportation Scheduling

GDAS scheduling algorithms use a combination of data-driven decision rules, mathematical cost/benefit analyses, dynamic programming, path algorithms, insertion routing, and heuristics in order to plan modes of transport, select ports (POE, POD, intermediate), configure cargo (e.g., for containerization), and schedule individual aircraft, ships, and motor/rail trips. The detailed scheduling model tracks individual trips or sorties for all modes, matches cargo/vehicle/facility constraints, loads separate compartments with multiple capacity measures, and assigns multiple POE/POD trips. Scheduling can also include route insertion with multiple pickups and deliveries per trip, typically used for sealift. In addition, cyclical liner routes and pre-scheduled itineraries can be specified prior to the model run. Simulation techniques are used to generate supply requirements, model facility throughput constraints and queuing at ports, simulate loading and unloading, and calculate travel times.

Because of the large number of decisions to be made, the GDAS strategy is to break the overall scheduling problem into major subproblems, which are then solved iteratively at several levels using optimization and heuristic algorithms based on user-input constraints, decision rules, and cost factors. The major subproblems comprise:

- long-range mode planning, which tentatively assigns ports, modes, fleets, cargo configurations, target lift times, and target delivery times
- mid-term cargo/vehicle *scheduling and routing*, which assigns and schedules (or re-schedules) specific vehicles, trips, stops, facilities, and cargo loads
- current-day *execution and simulation*, which simulates the actual vehicle loading, unloading, facility throughput, facility vehicle handling, queuing, surprise events, etc.

FOR EACH DAY:

PLAN	Assign ports, fleets, modes, cargo configurations, target lift times into future
SCHEDULE	Schedule cargoes and vehicle itineraries forward into the future
SIMULATE	Simulate current hourly loading, facility throughput, queues, travel time, etc.
UPDATE	Update future plans and schedules from simulation, add surprise events
ITERATE	Iterate on planning, scheduling, simulating, and updating

Figure 1-5. GDAS Planning and Scheduling Process

These major subproblems utilize the solutions of other more localized subproblems which are solved separately, including:

- *route insertion* for a candidate cargo assignment in an existing vehicle route
- *vehicle loading* for a candidate cargo onto multiple vehicle compartments
- *port-to-port travel times* with link delays, speed variations, routing constraints, etc.
- *convoying*
- *facility scheduling* with cargo and vehicle handling constraints

1.6 Modeling Level of Detail

All data is table-driven from the database so that the level of detail is adjustable. Movement requirements can be specified as aggregated packages with total short tons; or as more detailed packages with short tons, measurement tons (a unit of volume), and square feet by unit and cargo category; or as individual line items with both quantity measures (tons, square feet, etc.) and dimensional limits (maximum height, etc.).

The typical level of detail used for sealift scheduling includes the following:

- individual ship characteristics, such as speed, draft, length, beam, cargo dead weight capacity
- multiple compartments and capacity measures with stow factors;
- multiple pickups and drop-offs per trip;
- shortest path calculations with routing constraints for canals;
- detailed seaport facility modeling including constraints on draft, length, beam, available berths, queuing, cargo throughput, load/unload rates;
- matching of ship/compartment/cargo/port compatibility constraints such as hazardous materials or port facilities;
- staging and special missions (Marine amphibious task forces, crane ships, etc.);
- attrition and convoying.

The typical level of detail for airlift, motor, and rail provides for:

- individual aircraft or vehicle tracking by fleet and trip (or flow analysis if desired);
- multiple compartments and capacity measures with stow factors;
- matching of vehicle/compartment/cargo/airport compatibility constraints;
- route selection based on link distances and delays including tradeoffs between refueling stops versus critical leg payloads for aircraft;
- travel time calculations including arrive/depart or takeoff/landing time, enroute refueling stops, cruising speed, link delays, and link speed limits;
- load/offload rates depending on airport facilities;
- throughput at facilities limited by arrival/departure constraints, cargo throughput limits, maximum on ground (MOG) or parking constraints, and fleet restrictions;
- vehicle availability limited by utilization rates and fleet availability.

Because the data structures and level of detail are defined in by "metadata" tables in the system, the amount of detail can be adjusted for each mode of transport as required by the study application.

1.7 Map Graphics

The transportation graphics module provides a world map display with origins, destinations, seaports, airports, and transportation network nodes/links/channels as defined from the database. The graphics provides capabilities to zoom, pan, set display options and layers, and print/plot. In addition, the scheduling model can display vehicle (ship, aircraft, etc.) location snapshots based on the detailed itineraries and the interpolation of routing paths. Currently the map graphics does require the MapInfo commercial package as the underlying graphics engine, although this is not required to use the rest of the GDAS system.

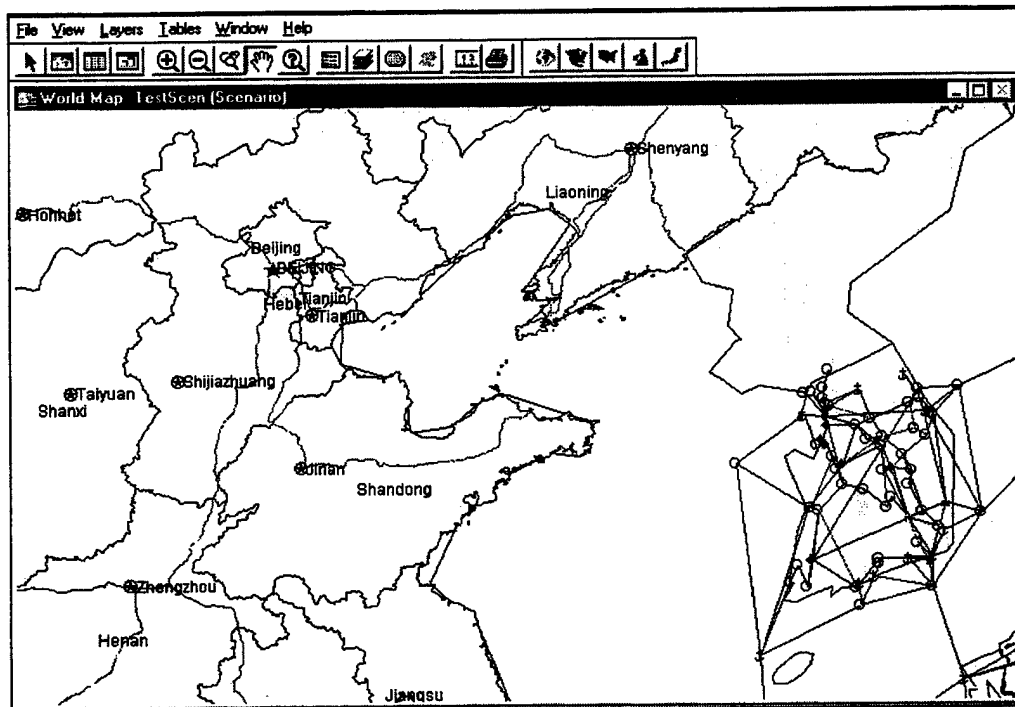


Figure 1-6. World Map Display

1.8 Current Status of GDAS

GDAS is installed at CAA, USTRANSCOM, MARAD, Stanley Associates, and others for use in ongoing studies. The current version of GDAS is a stand-alone system which fully implements planning, scheduling, and simulation for all transport modes from origin to destination. Development of an interface to the USTRANSCOM AMP system has been completed using JOPES B8 TPFDD files. CAA is using GDAS for transportation studies including Korea RSOI (Reception, Staging, and Onward Integration), SRA, and MRS-05 (Mobility Requirements Study for 2005). In addition, GDAS is currently being applied by USTRANSCOM, the DOT Volpe National Transportation Center, and Stanley Associates, Inc. for detailed modeling of the Voluntary Intermodal Sealift Agreement (VISA) between DOD and commercial sealift carriers. GDAS development continues in the areas of handling of surprise events with re-scheduling, data import, and other enhancements. GDAS has been verified by CAA in numerous test scenarios as well as data from Desert Storm and Restore Hope deployments.

2. Overview of Model Algorithms

2.1 Introduction

This Section provides a high-level overview of the modeling approach and algorithms developed for GDAS to plan, schedule, and simulate large-scale multi-modal transportation problems for DOD deployments. The primary objective of the GDAS model is to provide a detailed analysis of transportation capabilities from origin to destination given the movement requirements, the multi-modal transportation network, the available lift assets, the cargo/vehicle handling facilities, and other factors. Alternatively, GDAS can be used to determine the preferred mix and quantity of lift assets needed to meet delivery requirements. In order to evaluate the transportation system, GDAS divides the problem into planning, scheduling, and simulation components and implements algorithms appropriate for each level.

2.2 The DOD Transportation Problem

DOD deployment has unique characteristics that differ from commercial vehicle routing and scheduling applications, namely: large magnitude, high complexity, multi-modal transport, time-phased dependencies, and high time priorities versus cost.

The first characteristic is the magnitude of the problem. For large deployments, the number of scheduled vehicles can range to the tens of thousands (ships, planes, motor vehicles, rail, etc.) each with multiple trips, and the number of separately scheduled cargos can exceed a hundred thousand, each with multiple nodes for origin, destination, intermodal transfer points, and path routing. The time frame generally spans 90 to 200 days. For recent GDAS studies, the underlying transportation network includes about 700 nodes, 2000 node facilities, and 4000 transport links.

In conjunction with the scale of the transportation is complexity. DOD movements encompass all types and sizes of cargo (heavy equipment, passengers, supplies, refrigerated foods and medicines, containers, hazardous materials, ammunition, etc., ranging from personal effects to large armored vehicles), as well as all types of transportation facilities, vehicles, routing links, convoys, and resources, all with constraints on matching, availability, and throughput handling. Many requirements may have pre-assigned missions, staging locations, intermediate ports, sequencing constraints, timing priorities, and other deployment restrictions.

A third characteristic of DOD transportation is the intrinsic multi-modal nature of the deployment. DOD cargos generally move starting from CONUS origins via motor, rail, and pipeline to POEs (ports of embarkation), possibly with consolidation or assembly points; from POEs to PODs (ports of debarkation) via air or sea, possibly with intermediate ports or staging areas; and from PODs into the theater via motor, rail, and air with multiple staging or assembly points. In addition, some movements may start at prepositioned locations in the theater, at sea, or at other locations for earlier delivery, again requiring multiple modes of transport.

A fourth characteristic is the critical nature of time-phased dependencies between different DOD movements. Most of the movement requirements are not interchangeable products. The DOD scheduling process must consider the time-phased coordination of different forces, the cumulative delivery of "balanced" forces, the sequencing of combat/support/resupply movements, the retention of unit integrity, the predecessor/successor relationships of multi-modal movements, and the staging, packaging, and assembly of movements.

Another feature of DOD rapid deployments which is different from many vehicle scheduling applications is that the movements are predominantly uni-directional during the early crisis phases. The movements may travel long distances from CONUS origins to theater destinations, and delivery vehicles may have

nearly empty return trips until much later in the deployment. This characteristic can be used to tune the scheduling algorithms for faster performance on typical DOD problems.

Finally, DOD transportation applications often involve crisis responses with high time priorities and other measures of effectiveness, which may take priority over transportation costs. Nevertheless, cost criteria remain important, including tradeoffs between air and sea, use of fewer lift assets versus timeliness, efficient routing, and full loading where possible.

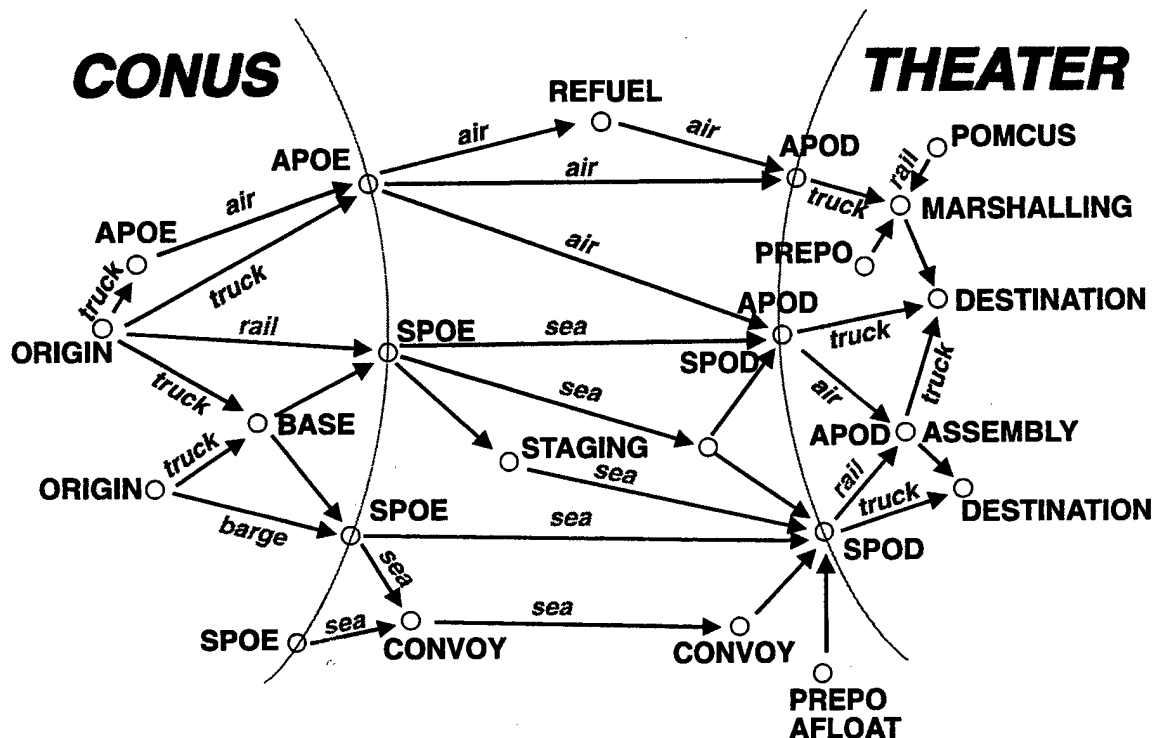


Figure 2-1. Intermodal Transportation Network

2.3 Deployment Planning Models

Because of the importance of DOD mobility, many models have been developed to analyze and simulate various aspects of deployment. Generally, the models can be classified according to the type of scheduling algorithms and the level of detail, ranging from aggregate linear programming with or without time periods, to cargo flow models using cargo quantities, or vehicle flow models allocating vehicle capacities, to individual vehicle scheduling, down to multiple trip scheduling with route insertion and multiple pickups and deliveries. The various models can also be classified by usage—long-range asset or budget planning, mid-range deliberate planning, and short-range execution planning and re-scheduling. The more detailed models generally focus on a single leg of the deployment, either CONUS (origin to POE by truck, rail, and organic), or strategic (POE to POD by air and sea), or intratheater (POD to destination or assembly area). Recently, USTRANSCOM has developed the Advanced Mobility Platform (AMP) to provide a framework for interfacing several planning models including MIDAS (a strategic model from POE to POD with vehicle flows for airlift and individual vehicles for sealift), JFAST (also a strategic model with vehicle flows for airlift and individual ship scheduling), MASS (a detailed airlift simulation model with some scheduling aspects), and ELIST (an intratheater cargo flow model). Although the AMP platform provides an integrating framework, the individual models are not fully integrated and have different data structures and inputs.

2.4 GDAS Overview and Data Structures

GDAS was designed from the beginning to be a highly detailed model for multi-modal planning, scheduling, and simulation from origin to destination encompassing all modes of transport. Figure 2-1 provides a conceptual overview of the intermodal transportation network. The relational database structures are designed to represent the complete transportation network from origin to destination using common, unified data structures for all modes of transport, including lift assets, vehicle types and compartments, facilities, transportation links, routes, movement requirements with staging and prepositioning, multiple cargo dimensions and quantity measures, and scheduling time/cost objective functions. Major data inputs are listed in Figure 2-2.

Figure 2-2. Basic Transportation Data Inputs

- Movement Requirements
- Origins, destinations, cargo categories, quantities, dimensions, time windows (read to load day, required delivery day, earliest delivery day)
- Transportation Network
- Transport modes, nodes, links, facilities, capacities, constraints
- Transport Vehicles
- Vehicles, capacities, locations, availability, characteristics
- Loading Data
- Load/unload rates, stow factors, cargo/vehicle/facility compatibility rules, cargo dimension restrictions

The database and scheduling algorithms are structured to be completely data-driven, from units of measure to transport modes and vehicle types. This permits the various scheduling algorithms in GDAS to be applied to each mode at user-adjustable levels of detail.

2.5 GDAS Scheduling Algorithms

Because of the large problem size, the GDAS strategy is to decompose the overall scheduling problem into interrelated subproblems that are solved iteratively at several levels using optimization and heuristic algorithms based on user input constraints, decision rules, and cost factors. At a high level, decision algorithms examine tradeoffs between multiple cargos and vehicles, operating in phases at an increasing level of detail, with increasingly firm decisions about the scheduling. The high level algorithms are:

- **long-range transportation planning**, which assigns ports, modes, planning fleets, cargo configurations, and target lift times, but *not* individual lift asset vehicles such as ships or planes
- **mid-term cargo/vehicle scheduling**, which assigns, sequences, and schedules (or re-schedules) specific vehicles, trips, stops, facilities, and cargo loads
- **event-driven hourly simulation**, which simulates the actual vehicle loading, unloading, facility throughput, facility vehicle handling, queuing, surprise events, etc.

The high level algorithms listed above utilize the solutions of other more localized subproblems which are solved separately with a narrow focus. These localized decision-making sub-algorithms include:

- **route insertion** for a candidate cargo assignment and insertion into an existing vehicle route
- **cargo loading** for a candidate cargo onto multiple vehicle compartments
- **port-to-port travel times** with link delays, payload variations, speed limits, route constraints, etc.

- **convoying**
- **capacity event scheduling** for facilities and nodes with cargo and vehicle handling constraints

Effective scheduling is a difficult problem, even on a small scale. By iteratively evaluating the major subproblems and efficiently solving smaller subproblems, the GDAS strategy is similar to that of human schedulers. It should be noted that human schedulers perform quite well on small-scale problems, particularly in resolving special situations and balancing competing objectives. GDAS cannot globally optimize the scheduling, but rather attempts to match the human scheduling ability on small problems and then applies this process consistently on a larger scale.

GDAS begins with an initial long-term transportation planning from origin to destination. After the initial planning, daily iterations are performed consisting of mid-term scheduling and re-scheduling using detailed route insertion, long-term planning and re-planning, and detailed current-time event simulation, as shown in

FOR EACH DAY:

PLAN	Assign ports, fleets, modes, cargo configurations, target lift times into future
SCHEDULE	Schedule cargoes and vehicle itineraries forward into the future
SIMULATE	Simulate current hourly loading, facility throughput, queues, travel time, etc.
UPDATE	Update future plans and schedules from simulation, add surprise events
ITERATE	Iterate on planning, scheduling, simulating, and updating

Figure 2-3. GDAS Transportation Planning and Scheduling Process

Figure 2-3. The high level algorithms and the localized subproblem algorithms are summarized in the paragraphs below. Additional details are provided in later sections.

2.6 High Level Algorithms

2.6.1 Transportation Planning

The transportation planning algorithm determines the preferred transport modes, POEs, PODs, target lift times, and target delivery times for each movement from origin to destination, without specifically assigning individual vehicles. The planning must account for any mode exclusions, required intermediate ports, and cargo/vehicle/facility matching constraints. GDAS uses a dynamic programming formulation for successive transportation planning of each movement requirement, with user-specified cost weightings for travel costs versus lateness. The dynamic programming is implemented using multiple states at each network node to represent all earliest arrive times for each mode of transport, each planning fleet, and each cargo configuration, allowing for changes in mode or planning fleet at each facility. The algorithm is considerably speeded up by calculating upper bounds and lower bounds from the current node states to the destination, enabling a branch and bound technique to prune many of the states. The dynamic programming algorithm itself is somewhat "optimal", in that it considers all transportation network nodes, all mode and fleet changes at POEs/PODs, all cargo configurations, all multi-modal links, and all routes (including convoy routes) for a *single* requirement. However, the underlying time calculations use approximated delays, load/unload times, and planning speeds by vehicle type, without actually assigning individual vehicles, so the state calculations are heuristic. In addition, the algorithm evaluates the movement requirements successively with an approximate look-ahead to evaluate interference effects on later cargos, so that joint vehicle and facility tradeoffs are evaluated in a moving time frame rather than all alternatives. Thus, the dynamic programming is used iteratively as a heuristic optimization technique—the transportation planning generates plans with tentative ports and target lift times, rather than detailed schedules. The actual assignment of vehicles, trips, stops, and loads is determined later in the scheduling algorithm.

One of the difficulties encountered in transportation planning is that the matching constraints between cargo types, facility capabilities, and individual transport vehicles can be very restrictive. In some cases, very few vehicles may actually be feasible for a candidate lift assignment, even though the cargo/facility/vehicle types appear to be compatible. Examples include shallow-draft seaports that exclude nearly every tanker, or airports with short runways. In addition, the planning of such movement requirements can strongly affect the availability of lift assets and facilities for other movement requirements. As a result, the transportation planning has since been extended (beyond its original intent) to evaluate individual vehicle and facility constraints and availabilities, even though the vehicle assignments are completely re-evaluated later during scheduling.

A complete transportation planning analysis is an important first step in GDAS and can consume half the run time, particularly if ports and transport modes are not pre-specified. The results represent a "cargo flow" view of the entire plan. Most of the results, however, are thrown away and only the initial transport legs are retained for subsequent scheduling, without retaining the subsequent mode/port assignments or successor legs. Later, re-planning of successor cargos to their destinations is performed on a daily basis as the detailed scheduling algorithm progresses, again retaining only the immediate successor legs. This daily re-planning approach is able to respond to the latest scheduling and simulation results, so that the preliminary planning results may be revised significantly during later time frames.

2.6.2 Cargo/Vehicle Scheduling

The vehicle scheduling algorithms are invoked each day to assign planned cargos to specific vehicles. The scheduling is limited to mid-term cargos with target lift times falling within a rolling time horizon. The vehicle scheduling output consists of updated vehicle routes and schedules, including multiple trips, pickup and delivery stops, cargo manifests, and compartment load quantities. Currently, GDAS has four scheduling models at various levels of detail:

- a quick *travel time* algorithm, which matches vehicle characteristics with cargos and facilities and estimate travel times with unconstrained vehicle availability
- a *vehicle flow* model which allocates vehicle hours based on round trip time calculations (comparable to the MIDAS and JFAST airlift models)
- a more detailed *pickup/delivery* scheduling algorithm which performs cost-based assignments of cargos to successive trips allowing multiple cargos per trip and tracking the discrete location of each vehicle on each trip, but which schedules only one POE stop and one POD stop per trip (this is suitable when POE/POD channels have total movement quantities much larger than individual vehicle capacities, such as airlift or truck, for which only the last few vehicle trips are partially loaded)
- the most detailed *multi-port* algorithm, which utilizes cost-based route insertion heuristics to assign multiple pickup and delivery, stops on each vehicle trip.

In the model, any of the scheduling algorithms can be applied to any mode of transport as desired by the user. In general, the first two flow algorithms tend to over-estimate lift capability if few vehicles or large vehicles are available, since vehicle flows are split unrealistically among different routes and the discrete trip travel times and return times are not accurately calculated. (This is the difficulty with linear programming and network flow techniques used to model aggregate ports, time periods, and large discrete vehicles such as ships—the discrete scheduling and routing difficulties are aggregated away.). For large individual vehicles such as ships, it is recommended that the last two discrete scheduling and routing algorithms be used.

One issue for computer algorithms is how to define "costs" or penalties. In GDAS, penalties are used to evaluate the basic tradeoff between vehicle usage and cargo delivery timeliness. The penalty factors can be adjusted in the database to account for vehicle travel times (\$/day), cargo lateness (\$/ton-day), initial vehicle usage (\$/use), port visits (\$/visit), etc. as shown previously in Section 5.7.5. Some of the penalty

elements are calibrated from test runs, since factors such as lateness cost represent policy decisions that are not easily quantified.

In vehicle scheduling applications, it is very easy to develop solution algorithms that run for unreasonable amounts of time even on relatively small problems. Human schedulers are quickly able to screen out many impractical transportation alternatives because they know intuitively that the associated schedules are either infeasible or too costly. Similarly, they can focus special attention on difficult constraints such as shallow draft, based on experience in a particular port. The ability to screen out infeasible solutions early and focus more extensive tradeoff calculations for promising solutions is an important technique in reducing run time for GDAS algorithms as well.

One basic technique in GDAS is to precompute cargo/vehicle/facility matching arrays, which can be quickly checked for screening out infeasible combinations. In addition, for cost-based screening, a mathematical technique known as branch and bound is implemented which uses upper and lower bounds to eliminate many alternatives. If an upper bound on the best cost is already known based on some feasible solution (usually the best candidate solution found so far), then any time a new partial solution exceeds that known cost, the new solution can be rejected immediately as unacceptable, including all derived solutions. This upper bound screening can be further accelerated using lower bounds. If tight lower bounds on the potential cost for a solution can be determined quickly (typically using direct distance calculations and travel times in GDAS), then a partial solution can be rejected early if its partial cost plus the remaining lower bound exceed the known upper bound. An additional strategy is to permit the user to set criteria for "good enough" thresholds, which can lead to immediate assignments with much shorter search times. These strategies are used throughout all GDAS algorithms and significantly reduce the run time.

Basically the vehicle scheduling algorithm evaluates a large number of candidate cargo/vehicle assignments and selects those that are most promising for scheduling. Because of the large problem size, it is impossible to evaluate all assignments and combinations of assignments. Large scale integer programming optimization strategies such as Lagrangean relaxation were not attempted for this problem size, which has thousands of vehicles and perhaps a hundred thousand stops. Specialized greedy algorithms using route insertion techniques have been widely implemented in commercial vehicle scheduling systems and have been adopted for GDAS in the detailed scheduling algorithms. The GDAS strategy is somewhat different from other search strategies in that it alternates between a "greedy cargo" perspective and a "greedy vehicle" perspective, reflecting the basic conflict between cargo timeliness and efficient vehicle usage.

In the greedy cargo perspective, the next planned cargo, sorted by target lift time and priority within a rolling time horizon, is evaluated to determine the "marginal cost" of assigning it to all possible matching vehicles. This costing uses the route insertion algorithm discussed below, in which a candidate vehicle is evaluated including its previously assigned trips, stops, and cargos if any. In evaluating the candidate assignment cost, user-specified penalties are incurred for incremental vehicle time, cargo lateness, compartment stowage, port visits, new vehicle usage versus re-use, as well as the implied lateness effects on other cargos later in the schedule (this latter requires difficult iterative calculations but the implied lateness information is very important). The least-cost candidate vehicle assignment is then selected for the cargo, all schedules are updated, and successor cargos are re-planned.

If the assigned vehicle trip is not fully loaded by a cargo, then the scheduling algorithm switches to a greedy vehicle perspective. This perspective looks at other cargos in the same POE/POD channel and time horizon, costs out the candidate assignments, and selects cargo that can be added to the vehicle with reasonable penalty costs based on detailed route insertion. This switching to a vehicle perspective has proven to be very effective because the cargo algorithm alone tends to be too myopic about efficiently using the lift assets. The greedy vehicle approach is also important for run time efficiency, since it effectively aggregates movement channels "on the fly" and focuses on a small subset of promising candidate assignments, particularly for loading many small movement requirements on a large ship.

It should be noted that updating the vehicle schedules is more complex than might be expected because of the multi-modal transportation network. For example, if a single cargo is added to a previously assigned intertheater ship schedule, this can cause delays to all other cargos on board the same ship trip. These delays then propagate to the offloading of the cargos at later PODs, which again delays the onloading of successor cargos at POEs for the next transport leg (e.g., airlift in the theater). This can lead to later delays that must be recursively propagated throughout all schedules into the future. It is important to accurately update all of the future schedules in order to evaluate the potential side effects of a candidate cargo/vehicle assignment.

2.6.3 Simulation

The event-driven hourly simulation algorithm is executed each day to accurately calculate the arrival, departure, loading, unloading, and queuing events at each facility. The detailed facility throughput calculations and vehicle queuing delays can cause the simulated event times to vary from the original scheduled times. In addition, unforeseen surprise events can be injected and, as a future addition, stochastic sampling can be applied to the event times. The simulation algorithms use a standard approach that maintains a sorted heap (priority queue) containing the next incomplete simulation event for each vehicle trip. For efficiency, only one future event is stored on the heap for each trip, since successor events on a single trip cannot occur simultaneously; and later events are added as the predecessor events are completed. This also reduces the need to update future events stored on the heap. During simulation, scheduled events are pulled from the heap and executed, with further simulation forward into time where no interference can occur. Then the final simulated times are stored, the next event is put on the heap, any delays are propagated forward, and all future schedules are updated. Simulation is suspended at the end of each day, which provides a chance for additional planning and scheduling the next day prior to additional simulation.

2.7 Localized Subproblem Algorithms

2.7.1 Route Insertion

Route insertion is an important sub-algorithm used in scheduling to evaluate candidate cargo/vehicle assignments. The basic inputs for route insertion consist of a new candidate cargo to be assigned (with its planned POE, POD, and target lift times), plus a candidate vehicle for assignment (which may already have an itinerary consisting of trips, stops, and previously assigned cargos). The objective of the route insertion is to find the least cost change in the existing vehicle itinerary so as to pickup and deliver the new candidate cargo. Run time is an important consideration since the vehicle scheduling calls route insertion many times in costing out candidate assignments. An early route insertion algorithm using dynamic programming with branch and bound was rejected because of run time.

The current route insertion in GDAS uses a search heuristic to insert the POE and POD while iterating down the previously scheduled vehicle stops. The iteration begins at an earliest feasible insertion point, which is determined by the remaining capacity on each trip as well as the current simulation status (cargos cannot be inserted before historical stops which have already been simulated). In moving down the vehicle itinerary, the candidate POE is inserted if it can be processed prior to the next stop in the trip, subject to various other insertion rules. Then the POD is inserted within the same trip with similar insertion rules. The incremental insertion cost is accumulated down the route, including delays for other cargos scheduled on the same vehicle, possibly continuing to later trips. If the load quantity is too small or the insertion cost gets too high relative to the current upper bounds, the POE insertion may need to be re-started at a later point in the route, leading to a second or third pass on POE/POD insertion. Wherever possible, bounds are used to truncate the search early. Although many variations of route insertion have been discussed in the literature, the GDAS versions are particularly efficient for the situation in which routes tend to be unidirectional with POEs separated from PODs.

2.7.2 Port-to-Port Travel Times

The port-to-port travel time algorithm determines the "best" path for a vehicle from one port facility to another for a given route type, based on maximizing the overall payload throughput per unit time. The path algorithm takes into account the travel nodes and links, the allowable link constraints, link delays, refueling requirements at allowable facilities, and (for airlift) tradeoffs between allowable payload, critical leg distance (the longest leg without refueling), and total travel time including landings and takeoffs. An additional refueling complication occurs when refueling is not permitted at the POD, in which case the path algorithm must find a recovery base for refueling. After each path optimization, the cumulative path data is computed and stored for later re-use, including travel time, delays, attrition probabilities, routing restrictions, and convoy data if relevant. This incremental routing and storage is necessary because pre-calculation of a complete distance matrix encompassing all different route types is impractical, with literally millions of records, since different vehicle types have different routing constraints and refueling tradeoffs. Thus, the path algorithm builds a computed distance matrix incrementally as needed during the scheduling process. The path algorithm is called frequently during route insertion and scheduling, so it is a major run time concern even when the cumulative port-to-port results are stored and re-used once calculated. Initially, a fast path algorithm was developed using shortest path with directional lower bounding, but this did not adequately address refueling restrictions or payload tradeoffs. A dynamic programming algorithm was later developed, with multiple states at each node representing the non-dominated arrive time and critical leg, and with upper/lower bounds for branch and bound, but this method was too slow, even when initialized with shortest paths as upper bounds. Currently, GDAS uses multiple shortest path calls with iterations on critical leg distance and refuel weighting; a unimodal two-dimensional search is used to select the best route that maximizes the payload per unit time for each route type and each port-to-port combination.

2.7.3 Cargo Loading

The cargo loading subproblem is also solved many times during the scheduling algorithm to calculate how much cargo can be loaded into multiple compartments for a candidate lift assignment. The data structures are designed to handle all modes of transport within a common framework. The loading model is also designed to permit multiple capacity constraints based on actual cargo densities, so that "averaged" payloads and stow factors need not be calibrated for a specific theater or strategic leg. Airlift payloads, in particular, can change significantly for different cargo densities and for delivery to Korea versus the Caribbean, for example. For loading purposes, each vehicle can have multiple compartments, each with multiple capacities expressed in different units of measure. For example, a fast sealift ship may be represented with three or four compartments each with stowable capacity limits on both volume and area. Aircraft may have cargo-only compartments, passenger-only compartments, and/or shared compartments, each limited by volume, area, and number of passengers. In addition, each vehicle has a total payload capacity over all compartments, and this payload may depend on the critical leg of the vehicle route. For different compartments, the different cargo types have separate constraints and penalties for loading, as well as separate stow factors that vary by compartment type and capacity units of measure.

The loading model itself uses a least stow penalty heuristic for loading a given cargo on a vehicle. For each cargo, the allowable compartments are pre-sorted in order of preference; the multiple capacity constraints are evaluated for each compartment allowing for other cargos which may be on board; and the allowable load quantities are determined based on the most constraining capacity measure. Thus, the densities of the onboard cargos determine which capacity measure is the most constraining for a given compartment, in addition to the payload limits based on critical leg tradeoffs—the particular load may weight out, cube out, or square out. The loading model returns the amount of cargo that can be loaded in each compartment as well as a stowage penalty that is used in the objective function for scheduling.

2.7.4 Capacity Event Scheduling

In addition to assigning cargo to vehicles for transportation, the scheduling algorithm must reserve capacity at facilities and nodes into the future to account for bottleneck delays. The capacity reservation process is performed using an event-based algorithm. Each facility and measure with limited capacity is modeled using a forward linked list of capacity change events. At each event, the capacity (for one or more measures) is either decreased or increased by a specific amount. When a cargo begins loading, there is an associated event that reduces available capacity; when a cargo completes loading, there is an associated event that increases available capacity. Once facility capacity is saturated, a cargo may offload at a partial rate or may be blocked entirely until resources are freed up at a later event, causing delays. Each change in load rate has a capacity event. When the events are posted, they reserve space for cargo loading and unloading, or free up space, or change a load rate. Subsequent schedule evaluations can then account for the delays at constrained facilities, and even route around the bottlenecks. The capacity event algorithm is used both for transportation planning and for scheduling, to model the node and facility capacity utilization into the future. In addition, a similar algorithm is used to reserve capacity for each planning fleet during the initial transportation planning, prior to assigning individual vehicles in scheduling.

3. Database Design Guidelines

3.1 Database

In GDAS, a scenario database represents a collection of related information describing a single scenario for transportation analysis. Each scenario database is stored in a single subdirectory under GDAS and consists of a complete set of tables and data that define the scenario characteristics for the GDAS model.

3.2 Tables

All data for GDAS is stored in tables containing rows and columns. Each table stores information about multiple objects or entities that have similar properties or attributes. Different kinds of objects are stored in different tables, e.g. a cargo record is stored in the CARGO table and a vehicle record is stored in the VEHICLE table. Some tables store "conceptual" rather than physical objects, such as a Vehicle Type which is listed in the VehType table.

3.3 Rows and Columns

Within a table, each row, or record, stores all the data about a single object and basically represents that object. Each column stores one kind of data value, or field value, for the objects. The terms row, record, object, or entity are used interchangeably. The terms column, field, attribute, or property are also used interchangeably. The row/column structure of tables is directly apparent when the initial table view is displayed, as shown in Figure 3-1 for the VehFleet table. In the figure, the left-most column is an internal record number for display purposes only; it is not editable data and is transient, since it changes depending on the sort order of the table. Three of the data columns are displayed, the Vehicle Type, the Vehicle Identifier, and the Vehicle Fleet. A fourth column, Number of Vehicles, begins on the right with "Nu".

[Esc]-Quit [Ins]-Add Delete [F2]-Post [F7]-Form Image More Help				
VehFleet Table View				
VEHFLEET	Vehicle Type	Vehicle Identifier	Vehicle Fleet	Nu^
1	10Ton	10Ton	Truck Seoul	
2	22.5Ton	22.5Ton	Truck Taegu	
3	22.5Ton	22.5Ton	Truck Taegu A	
4	34Ton	34Ton	Truck Pusan	
5	5Ton	5Ton	Truck Pusan	
6	BB-Cont	ADABELLE LYKES (C/MOD)	US Commercial	
7	BB-Cont	CAROLINA (C/MOD)	US Commercial	
8	BB-Cont	EXPORT PATRIOT (C/MOD)	US Commercial	
9	BB-Cont	GUAYAMA (C/MOD)	US Commercial	
10	BB-Cont	HUMACAO (C/MOD)	US Commercial	
11	BB-Cont	LESLIE LYKES	MSC Force	
12	BB-Cont	MASON LYKES (C/MOD)	US Commercial	
13	BB-Cont	MAYAGUEZ (C/MOD)	US Commercial	
14	BB-Cont	NUEVO SAN JUAN (C/MOD)	US Commercial	
15	BB-Cont	PRES F D ROOSEVELT (C/MOD)	US Commercial	
16	BB-Cont	PRES HOOVER (C/MOD)	US Commercial	
17	BB-Cont	PRES KENNEDY (C/MOD)	US Commercial	
18	BB-Cont	RESOLUTE (C/MOD)	US Commercial	
19	BB-Cont	S-L ACHIEVER (C/MOD)	US Commercial	
20	BB-Cont	S-L ATLANTIC (C/MOD)	US Commercial	
1 of 348				
Vehicle Fleet [F10]-Menu View				

Figure 3-1. Tabular View of the VehFleet table

3.4 Domains

Each column or field has an allowable set of values called a domain. Some domains are text, such as names or identifiers, and other domains are numeric. In Figure 3-1, the Vehicle Fleet column is text, and can store any user-defined alpha-numeric characters up to 15 characters. The Vehicle Type column also has a 15 character domain, except that for consistency the allowable values in VehFleet are restricted to those listed in the VehType lookup table (more on this later). The Number of Vehicles column has a numeric domain, consisting of non-negative integers from 0 to 32,767 (this is a "short" or two byte integer). Other domains used in GDAS include latitude and longitude, which are partially numeric and partially text with a particular format. All of the domains are defined in the Data Dictionary, and all data entries are checked immediately for consistency with the domain.

3.5 Key Fields

One of the most important operations in a database is to identify a particular record in a table, since each record represents a single object. Since records can be added or deleted or sorted, the internal record number is not a stable identifier. Instead, data values are used to identify objects. The data in a record is specific to a single object and represents that object; every record has something different about it, or else it basically becomes indistinguishable as a separate object.

The minimal set of data that uniquely identifies a record in a table is called the "key" field(s). A record is uniquely identified by the values of its "key" fields. Stated another way, no two records can have the same values in their key fields. In fact, attempting to insert a new record having the same key values as another record yields a warning in GDAS, since it may overwrite existing data about the matching record. The key field values uniquely identify or "name" the object or record, which is then further described by the non-key field values or attributes. Key fields can be text identifiers (similar to names) or numeric identifiers (often used for output tables in GDAS, such as the TRIP table). In changing a non-key field, you are describing the data about an object; in changing a key field, you are changing the name or identifier that represents an object. To insert a new object, you must identify it uniquely with the key field values.

In the VehFleet example, the key fields are the first three fields, so that any VehFleet record is uniquely identified by its Vehicle Type, Vehicle Identifier, and Vehicle Fleet values. Two records can have the same Number of Vehicles (a non-key attribute), but they must be different in at least one key field value.

Because of the importance of key fields, GDAS always places the intrinsic key fields first in a table. In addition, the table is sorted by the key fields by default. In a form view, the key fields have a background of dark blue (versus light blue or cyan for non-key fields) to emphasize the key field importance in identifying the record.

3.6 Forms

Forms in GDAS allow you to view all of the data about a single record or object. Thus, the data displayed in a form view all pertain to the object uniquely identified by the dark blue key field values for the current record. Form views are especially useful for data entry, since generally it is easier to work with one object at a time. The form view for the Vehicle Fleet table is shown in Figure 3-2. The basic fields for the VehFleet record are shown in the upper left area of the form for a Vehicle Type of C-141, Vehicle Identifier of C-141 (in this case, only one kind of C-141 vehicle is defined, so they have the same name), and a Vehicle Fleet of "McChord AFB" (this fleet name matches the Start Node in this case, but need not in all cases, since the same kind of vehicles can start out at the same node at different times).

Vehicle Type: C-141
Veh Id: C-141
Vehicle Fleet: McChord AFB
Number Vehicles: 50
Start Node: McChord AFB
Start Facility: Airport
Special Mission:
New Veh Penalty: 1
Day Available: 1
Day Returned:
Call Sign:
NISC Number:
Node Type: Airport
Theater: CONUS
Node Lat: 47 07.0N
Node Long: 122 28.0W
Geoloc: PQWY
Attr Prob %: 1
Node Gone?:
Cruise Speed: 425
Max Payld: 25
Fac Len Req: 5000
Width Req: 90
Fac Dim Req:
Capab Req:
Route Type: C-141
Utilization Rate %: 39
Arrive/Depart Time: 1
Standard Size %: 110
Time Penalty: 20
Greedy Veh Level: 1
Link Attrit Scale %: 100
Node Attrit Scale %: 100
Attrit Partial %:
Repair Days:
Replace Days:
Mission Begin:
Mission End:
Offload Delay Hrs:

77 of 348
Vehicle Fleet | [F10]-Menu | View

Figure 3-2. Form View of the VehFleet table

Form views can also display related information from other tables. The convention in GDAS forms is that data from other tables are displayed in separately boxed areas on the form, with a single line border for singly related records (used for lookup tables such as VehType in the figure), and a double line border for multiple related records (a 1 to many relationship, not shown in the VehFleet example). The data in related tables on a form still pertain to the key fields of the base table. For example, the Node area on the VehFleet form gives the Latitude and Longitude of the Start Node (McChord AFB in this case), the Vehicle Data area specifies the Cruise Speed of the Vehicle Type and Identifier (C-141 in the case), and the Vehicle Type data specifies the Arrive/Depart Time (or landing/takeoff time) for the referenced Vehicle Type (C-141 in this case). The multi-table form view makes it convenient to view and edit related data in other tables while editing the VehFleet records.

3.7 Lookups, Relationships, and Foreign Keys

As seen in the form view, the data stored in a table is often related to other tables. For example, the Start Node and Start Facility values for a VehFleet record must reference a valid Node and Facility listed in the Facility table. These “lookup” or cross reference fields ensure that the data is consistent between different tables. In relational database theory, such lookup fields from a “child” table to a “parent” table are known as foreign keys in a one-to-many relationship. The relationship is termed one-to-many since each VehFleet record, for example, has exactly one matching Facility record for its Start Node and Start Facility, whereas a Facility record can be referenced multiple times by different vehicle fleet records. The lookup table Facility is known as the parent table, and the referencing table with foreign keys such as VehFleet is known as the child table. The lookup relationship can be a single key field, as in the Special Mission field in the figure, or multiple key fields, as in the Start Node and Start Facility. The uniqueness of key fields is what makes it possible to define relationships in terms of foreign key field references.

In GDAS, the lookup tables serve as a pick list accessed using the F1 key, so that it is easy to select the matching parent record and store it in the child table being edited. In addition, all key field relationships are checked whenever record edits are posted.

In order for the key field references to make sense, you need to work in a “top down” direction for new records. This means that parent records need to be created before referencing their key fields in a child record. For example, node records need to be created in the Node table, and then facility records added for that node in the Facility table, before a vehicle fleet record in the VehFleet can be assigned to start out at the new nodes and facilities.

3.8 Data Dictionary

The Data Dictionary provides a complete definition of the tables, fields, key fields, domains, lookups, units of measures, and descriptions in the GDAS system. The online Help/Data menu provides immediate access to the Data Dictionary while you are editing tables. One of the most valuable uses of the Data Dictionary is to understand the relationships between tables so that you can work in a consistent, top-down fashion in defining new records in GDAS (e.g., for adding a new Transport Mode).

The complete Data Dictionary is provided later. An extract for the VehFleet table is shown in Figure 3-3. The first boxed area lists the 8 character table name VehFleet, its long table name "Vehicle Fleet", and a description of the table. Below the table information is a list of fields belonging to the table along with field definitions. In the field list, the first column repeats the table name, VehFleet. The second column lists the field number and field name, e.g. the first field is Vehicle Type.

User Dictionary						
VEHFLEET Vehicle Fleet		Lists the availability of vehicles by starting location, starting time, and number of vehicles				
Table	Field Name	Domain/ Lookup	Key?	In/Out	Unit Meas	Description
VEHFLEET	1 Vehicle Type	VEHDATA	Y	In		Vehicle type
VEHFLEET	2 Vehicle Identifier	VEHDATA	Y	In		Vehicle identifier for this start location
VEHFLEET	3 Vehicle Fleet	A15	Y	In		Fleet identifier for this start location
VEHFLEET	4 Number of Vehicles	Short>=0		In		Number of vehicles in the fleet for this vehicle type
VEHFLEET	5 Start Node	FACILITY		In		Home base node for this fleet and vehicle type (a vehicle returns to its home base if not otherwise assigned)
VEHFLEET	6 Start Facility	FACILITY		In		Home base facility for this fleet and vehicle type (a vehicle returns to its home base if not otherwise assigned)
VEHFLEET	7 Start Day Available	DayToHr		In	day (hr)	Day that this fleet and vehicle type are first available
VEHFLEET	8 Last Day Returned	DayToHr		In	day (hr)	Day that this fleet and vehicle type are returned to base with no more use (blank or 0 is treated as available to the end)
VEHFLEET	9 Special Mission	MISSION		In		Special mission which restricts this fleet to matching special mission movement requirements for a designated time period
VEHFLEET	10 New Vehicle Penalty	Short>=0		In	\$/new veh	Penalty for the first use of a new vehicle of this type and fleet
VEHFLEET	11 Call Sign	A4		In		International call sign of the vehicle or ship or fleet
VEHFLEET	12 NISC Number	A5		In		Naval Intelligence Security Code number of the vehicle or ship fleet

Figure 3-3. Data Dictionary Extract for the VehFleet Table

The third column is labeled as "Domain/Lookup", meaning that it displays either a domain or a lookup table. If an upper-case lookup table name is shown, then the field has a lookup, and the domain is inherited from the parent table. For example, the first two fields have a joint lookup into VehData, which means that all Vehicle Type and Vehicle Identifier combinations in the VehFleet must match the parent values in the VehData lookup table, and they are text strings or names. Similarly, the Start Node and Start Facility fields have a joint lookup to the Facility table. This means that you must create a matching node and facility in the Facility parent table before you can assign vehicles to start at that facility in the VehFleet table. The two "foreign key fields", Start Node and Start Facility in the VehFleet child table, must match the parent key fields, Facility Node and Facility Name, for a parent record in the Facility table. The lookup values are always the key fields of the parent table.

If the third column is not a lookup table, it represents a domain. For example, the Vehicle Fleet field has a domain of "A15", which means any alphanumeric text string up to 15 characters in length. This means you are free to give any name you wish to the Vehicle Fleet (no lookups are enforced). Of course, preferably the name is descriptive; in Figure 3-1 shown previously, the vehicle fleet names tend to match the start node.

The field Number of Vehicles has a Domain of "Short>=0", which means a nonnegative short integer (values between 0 and 32,767). Other typical numerical domains may incorporate ranges, such as "1,99" or

"0,99999" or "0,15". Additional ranges include "Long+/-" (any integer), "Double>=0" (any nonnegative floating point number), and "reqqn" (a nonnegative integer domain).

The fourth column shown in the Data Dictionary is labeled "Key?" and displays a "Y" if the field is a key field. For the VehFleet table, the first three fields are key fields, as indicated in the figure. GDAS always lists key fields first for each table.

The key fields of a table may themselves be lookups. In the example, the first two key fields are lookups into the parent VehData table, whereas the third key field is a domain consisting of any 15 character alphanumeric string, with no lookup. The non-key fields may also be lookups or domains.

Additional information in the Data Dictionary shows whether the field is "In" or "Out", meaning that it is either an input to the model or an output from the model. Some reference data is neither input nor output.

The Unit of Measure is indicated where appropriate. The Start Day Available field has a unit of measure indicated by "day (hr)", which means that data input is in whole days, but this is converted to hours for the hourly simulation used in the model itself. In general, the model performs all calculations in hours for higher accuracy in travel times and load rates, and to make cumulative differences in these parameters visible for sensitivity studies. Realistically, however, the data inputs (availability day, required delivery day, earliest delivery day, etc.) are not accurate even to the nearest day, so database inputs and outputs are typically stored in days rather than hours.

Finally, a description of the field is provided. All of this information is available on-line, while editing the tables, by pressing the F10 Menu key, then selecting Help/Data.

3.9 Database Hierarchy

The lookups in the database create a logical hierarchy of tables which define objects from parent to child. At the highest levels, the ultimate parent tables have few or no additional lookups, and their key fields define the very basic reference objects of the system that are rarely changed. Such basic reference tables include the transport modes in the Mode table, or the units of measure in the Measure table, or the cargo classes in the CargoCat table, or the cargo categories in the CargoCat table. At an intermediate level, the tables contain data that may be expanded for a new analysis task, such as adding a new vehicle type in the VehType table with new compartments in the VCptType table. The most frequently modified data is contained in the lower child tables, such as the available lift assets in the VehFleet table, the movement requirements and quantities in the Require and ReqQuan tables, or new intra-theater facilities in the Facility table.

The data tables can be edited in any order, but when adding new records it is best to work from top down in the logical hierarchy. For example, in the VehFleet table it is impossible to start a new vehicle fleet at a facility that does not exist yet. The fleet can be created, and assigned temporarily to some existing facility, but it cannot be assigned to a new facility until that facility is created in the Facility table.

To assist in understanding the database hierarchy, the complete set of database tree diagrams can be displayed from within the system under the Tools menu. These tree diagrams display tables arranged from parent to child. A hierarchy example starting from the Mode table is shown in Figure 3-4. Because the Mode table is basic to the entire system, its hierarchy tree is quite long and shows most of the tables. In the figure, it can be seen quickly that VehFleet looks up into VehData, which looks up into VehType, which looks up into RoutType, which looks up into the ultimate parent Mode table. The tree diagrams do not provide additional information compared with the Data Dictionary; they simply sort the tables in order of lookup hierarchy.

This depth of the hierarchy tree may look intimidating, but most of the time you change only the data at the lowest levels, and the parent tables act as basic reference tables. When editing, the lookups seem natural since the F1 Lookup key easily pops the proper values into place. The depth of the tree simply means that GDAS is completely table driven. No "hard coding" is embedded in the model to account for different modes, routing constraints, vehicle types, cargo categories, units of measure, etc. Every transportation data element and constraint is defined in the database, even to the level of the underlying transport modes and units of measure. This table-driven nature provides a great deal of flexibility in tailoring GDAS to your study requirements, either at a quick feasibility level (Ston flows), or at a very detailed level (individual unit equipment dimensions). The only parts that are "hard coded" are the scheduling and simulation algorithms themselves. Even these can be assigned by the user for each mode, based on the choices listed in the display-only table SchedTyp.

3.10 Database Design Guidelines

The following standard database design guidelines have been followed in structuring the GDAS tables.

3.10.1 Atomic Database Fields/Object Properties

Define atomic fields, i.e. subdivide fields until all internal sub-fields are explicitly separated. All fields are specified as simple domains or as lookups to other tables. This permits simple domain checks, explicit relationships, simpler queries, non-redundant data.

3.10.2 Key Fields

Every table should be keyed to uniquely identify the records. Otherwise, a query cannot distinguish which record to update, duplicate entries can occur, relationships cannot be enforced, and data checks cannot tell if a duplicate record should be retained or discarded. Key field names should be consistent throughout the database, although some variations may be permitted when multiple fields have different roles in a single table, such as From Node and To Node in the NodeLink table.

3.10.3 No Data In Key Fields

Key fields provide a naming convention for the user to easily recognize a specific record. The database and model should NOT be sensitive to the contents of a key field, since it may be changed or extended, either by design enhancements or by the user. Another way to state this is that renaming the data in a key field can be propagated automatically throughout the database with no side effects in the code itself.

3.10.4 Relationships

Define relationships as lookups from a child table to parent table keys that can be enforced by the database engine.

3.10.5 Normalization and Non-Key Data Fields

Normalize non-key data attributes to depend on the whole key and nothing but the key, i.e. put the data in the right place. Where data elements have the same key, they can be merged into single tables depending on other factors. Any data that is derived from other data should not be input by the user.

3.10.6 Repeating Column Removal

Convert repeating columns to multiple records. This provides greater flexibility, since new data can be added as records rather than needing programmer changes to add columns. Plus, summary queries can be performed.

3.10.7 Separation of Inputs and Outputs

Separate input data from output data, normally in separate tables. Make sure the user is aware of which is which.

3.10.8 Data Checking

Specify data consistency rules using only domains, key field uniqueness, and key field lookups, where possible. This permits the database engine to implement many data checks directly, even when data is edited using queries.

3.10.9 Miscellaneous

GDAS uses long table names and fields names for easier understanding by new users. GDAS excludes spaces in table names, since databases like Paradox cannot handle it, but the Windows version does use title case, such as in "FacilityType". GDAS does use spaces in field names for readability, such as "Unit Description"

GDAS tries to have readable key fields, even though this can take more disk space and have slower indexing (bookkeeping is what the computer is for, and it remains fast for hundreds of thousands of records).

In any case, no algorithms or queries are permitted to depend on the specific contents of a key field; any re-naming should have no affect on results, so user changes to key fields and new entries are safe in the model. The only exception is for raw imported data from outside sources, where it is often necessary to use sub-fields and translations.

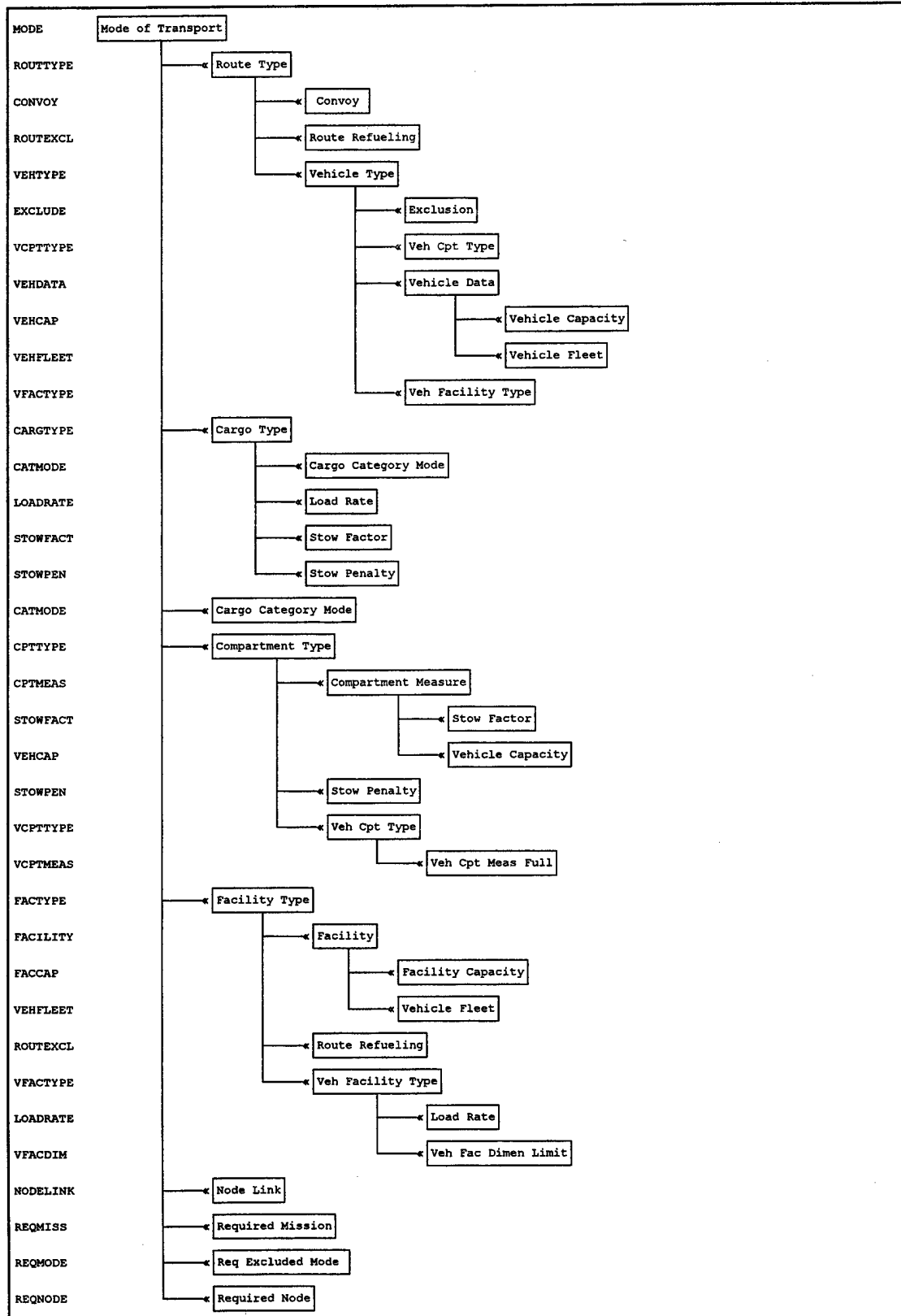


Figure 3-4. Database Tree Showing the Lookup Hierarchy from the Parent Table Mode

4. Database Tables

4.1 Data Overview

The transportation data in GDAS can be grouped as follows:

- *Transport Vehicles and Lift Assets*, which define the modes of transport, vehicle types for transporting cargo, compartment types, vehicle characteristics, and fleet availability.
- *Transportation Network Data*, which define the node locations, transport links, port facilities, and facility throughput constraints.
- *Movement Requirements*, which define the quantities to be moved, the origins and destinations, the ready to load times and required delivery times, and any required POEs, PODs, and modes.
- *Loading Characteristics*, which define the matching constraints, stow factors and load/unload rates for loading different types of cargos on different vehicle types and compartments types at different facility types.
- *Output Tables*, which represent the output schedules and detailed simulation results for vehicle trips, stops, cargos, as well as summary data such as cumulative delivery profiles.
- *Special Topics*, which define more specialized data elements for convoys, attrition, etc.

The various data tables and fields are discussed in the sections following.

4.2 Transport Vehicles and Lift Assets

Figure 4-1 on the next page provides an overview of the GDAS entities relating to transport vehicles and lift assets. Each table, or object class, is represented by a rectangle labeled with the table name. The lines connecting the tables represent one-to-many relationships, where the "crow's foot" symbol corresponds to the many side. The dashed rectangles represent tables that are generated by the model and not by user input. For example, in Figure 4-1, moving from the upper left corner down the diagonal, the basic Mode table lists the Transport Modes; each Transport Mode can have zero, one, or more Route Types which are listed in the RoutType table; each Route Type can have zero, one, or more Vehicle Types which are listed in the VehType table; each Vehicle Type can have zero, one, or more Vehicle Data records listed in the VehData table; each Vehicle Data record can have zero, one, or more Vehicle Fleets available in the VehFleet table; and each VehFleet record generates zero, one, or more distinct Vehicles in the Vehicle table after the model is run. This hierarchy defines the physical characteristics of the lift vehicles as well as their availability. In addition, there is an administrative hierarchy that can be used to restrict how the vehicles are used in planning and scheduling. Again, from the upper left, each Transport Mode in the Mode table can have zero, one, or more Planning Fleets in the PlanFlt table; each Planning Fleet can have zero, one, or more Administrative Fleets in the Fleet table; and each Fleet is associated with zero, one, or more Vehicle Fleet records in the VehFleet table. In addition, each Planning Fleet can optionally have a set of pre-scheduled Standard Stop records in the StdStop table, often used for cyclical liner operations. The various tables are discussed in the paragraphs following, with further details given in the Appendices. When studying the data structures, it is extremely helpful to review example tables such as provided with GDAS in the Sample database scenario.

Although the number of vehicle-related tables may seem large, all the data tables except the last shown in Figure 4-1 provide generic "type" data which are relatively static and do not change from run to run. For example, the transport modes and vehicle types are typically standardized for DoD OPLAN studies and

change only rarely. In fact, many models do not let you change the modes or vehicle types or compartment types at all, and it becomes difficult to define new vehicle types. In GDAS, *all* data is accessible in the database tables. In the figure, the only table which does typically change for different runs is the VehFleet table which establishes the availability of different transport vehicle lift assets.

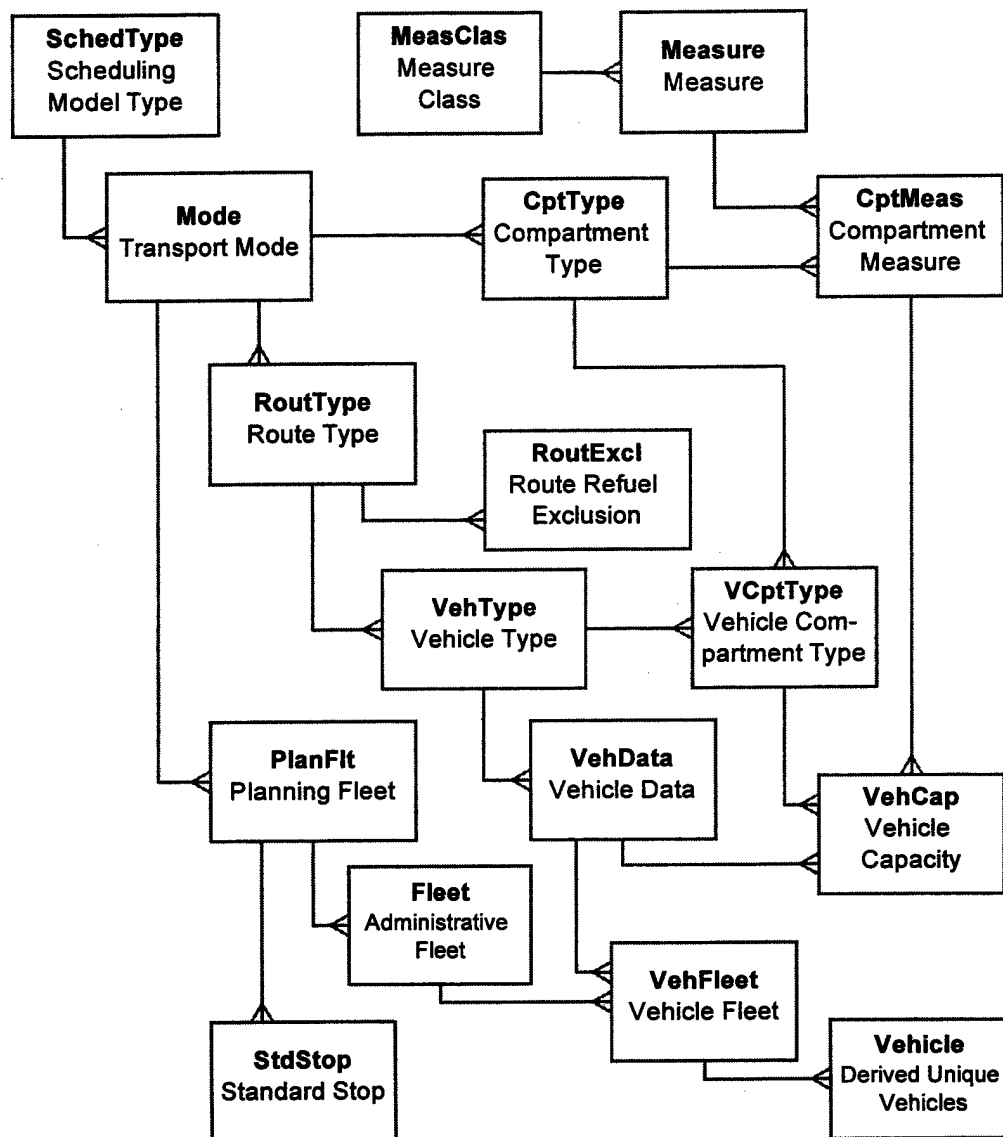


Figure 4-1. Data Tables and Relationships for Transport Vehicle Lift Assets

4.2.1 Transport Mode

The Mode table lists the transportation modes that are available for delivering cargo. Typical modes of transport include Airlift, Sealift, Truck, Rail, Pipeline, and InPlace. At a more detailed level, modes might include facility transfers such as Crane, Forklift, Containerization, etc. These modes can be created, deleted, or renamed as desired for a particular study. In GDAS, the concept of mode represents a basic partitioning of transportation links and facilities into separate sub-networks on which only the matching transport vehicles or lift assets can travel. For example, Airlift and Sealift are different modes so they cannot travel on the same network links. Similarly, if strategic airlift and theater airlift are to fly on the

same links and compete for the same airport facilities, then they must be assigned a common mode of transport such as Airlift. As discussed later, each transportation link in the network and each facility at a node are assigned a single mode of transport.

Data elements stored in the Mode table are listed in Figure 4-2.

Field Name	Description
1 Transport Mode	Name of a transport mode (e.g. Airlift, Sealift, Rail, Motor, Pipeline, Generic, etc.)
2 Scheduling Model Type	Scheduling model algorithm type used for this mode of transport
3 ASCII Code Abbreviation	ASCII code of a single upper case letter abbreviation used by the model to display on-screen activity progress (S for Sea, A for Air, etc., with lower case for planning and upper case for scheduling and simulation)
4 Letter for Model Display	Single letter for this mode, used to display progress during model execution (most useful if the letters are unique across modes)

Figure 4-2. Data Elements for the Mode Table

4.2.2 Scheduling Model Type

Each transport mode listed in the Mode table is assigned a Scheduling Model Type, which determines how GDAS performs scheduling for that mode. The available scheduling models are organized in the SchedType table by level of detail, ranging from the most detailed Multiport Algorithm to the simplest Travel Time algorithm as shown in Figure 4-3. For large discrete lift assets, such as ships, the mode detailed, multi-trip, multi-port scheduling algorithm is recommended unless the movement requirements are packaged or aggregated up to reasonably full ship loads. For aircraft, which often have capacities much smaller than a single movement requirement, the Pickup Deliver algorithm is somewhat faster but still quite detailed, tracking discrete multiple trips each with a single pickup and delivery airport, but allowing for multiple cargo loads at each POE and POD. Truck and Rail are also suitable for the Pickup Deliver model, particularly if vehicle sizes are aggregated to represent truck convoys and trains. The Vehicle Flow model allocates limited vehicle capacity and available hours to various movement channels, but does not track each vehicle location precisely over time. The Travel Time algorithm is the least detailed algorithm; it computes travel and loading times assuming unconstrained vehicle availability and determines the number of trips required. All of the scheduling algorithms take into account node and facility throughput constraints.

Scheduling Algorithm	Level of Detail	Description
Multiple Ports	Very High	Tracks each vehicle trip with multiple pickups and deliveries, schedules using detailed route insertion
Pickup Deliver	High	Tracks each vehicle trip with a single pickup and delivery, schedules new trips at the end.
Vehicle Flow	Medium	Schedules trips with limited vehicles by allocating available vehicle hours to trip cycle times without tracking individual vehicle locations.
Travel Time	Low	Performs travel time calculations and assumes sufficient vehicles are available when needed.

Figure 4-3. GDAS Scheduling Algorithms

4.2.3 Vehicle Type

Within a mode of transport, the lift assets for moving cargo are classified by Vehicle Type in the VehType table. For example, the Airlift mode typically has vehicle types such as C-141, C-5a, C-5b, C-130, B-747, etc. For sealift, typical vehicle types include Breakbulk, RORO (roll-on roll-off), Container, Fast Sealift, etc. The Vehicle Type represents a grouping of lift assets or transport vehicles that share general loading characteristics, such as type of compartments, type of facilities that can be used, matching of cargo that can

be loaded, stow factors, load/unload rates, and routing constraints. If any of these characteristics are not shared in common, then new vehicle types need to be added. Other detailed characteristics, such as speed and payload, may vary by individual vehicle within a Vehicle Type and are specified in the VehData table.

Field Name	Description
1 Vehicle Type	Vehicle type name, e.g. Breakbulk for sealift, C-17 for airlift, etc.
2 Route Type	Route type to use for this vehicle type
3 Arrive/Depart Time	Combined total additional time for node arrival and departure for this vehicle type, such as takeoff/landing time or port maneuver time (adds to travel time and reduces the average block speed, but does occur not affect facility parking)
4 Vehicle Standard Size %	Size of vehicle relative to "standard" vehicle size, may exceed 100% for larger vehicles, used for allocating facility berths or parking spaces (MOG)
5 Time Penalty	Penalty for vehicle usage per hour, used to compare with cargo lateness in the scheduling algorithm
6 Greedy Vehicle Level	Limit on the acceptable cost/benefit ratio for a greedy vehicle trying to get additional cargo immediately after an assignment
7 Link Attrit Multiplier %	Attrition adjustment multiplier applied to the link attrition or breakdown rate for this vehicle type while in transit (blank or 0 is treated as 100%)
8 Node Attrit Multiplier %	Attrition adjustment multiplier applied to the node attrition or breakdown rate for this vehicle type while at the node (blank or 0 is treated as 100%)
9 Attrit Partial Damage %	Percent of attritted or broken down vehicles which are partially damaged and can be repaired
10 Repair Days	Delay days for repair of a partially damaged vehicle, after which the vehicle continues its scheduled itinerary
11 Replace Days	Nonzero vehicle replacement time at the initial ALD node after total attrition (if blank, no replacement occurs)

Figure 4-4. Data Elements for the Vehicle Type Table (VehType).

4.2.4 Route Type

Each Vehicle Type is assigned a single Route Type from the RoutType table. A Route Type is associated with a single mode of transport and is used to determine which links a particular kind of Vehicle Type can travel on. Different Vehicle Types can generally travel on matching links that have the appropriate transport Mode, but the routes and links actually taken can be affected by critical leg/payload tradeoffs (for airlift) and canal constraints (for sealift).

In GDAS, a "route" consists of a sequence of travel links and intermediate nodes from one facility to another facility for a single mode of transport. A Route Type as listed in the RoutType table specifies the routing characteristics that determine which of several available routes is most suitable. Several route type can apply to the same mode and share the same network links, but have different routing factors such as refueling feasibility at intermediate nodes, link compatibility such as canal constraints, and payload versus critical leg distance tradeoffs. These variations in Route Type permit some vehicles to have different routes with different travel times, even though they share the same transport mode and network links.

Field Name	Units	Description
1 Route Type		Route type for computing vehicle paths
2 Transport Mode		Transport mode for this route type
3 Speed to Convert Delays	nmi/hr	Nominal routing speed which is used to convert link delays and refueling delays to equivalent distances for routing, in nautical mph
4 Range at Max Payload	nmi	Range or critical leg distance corresponding to the maximum allowed payload, in nautical miles
5 Payload Decrease %/kmi	%/1000nmi	Percent decrease in payload per 1000 nautical miles of increase in critical leg distance beyond the max payload range
6 Refuel Arrive/Depart Time	hr	Arrival and depart time delays for refueling (e.g., landing and takeoff delays)
7 Refuel Time	hr	Refueling time in the facility
8 Required Link Rating		User-definable link rating required for each link in a feasible path for this route type; for example, for sealift the Required Link Rating may represent ship draft, which cannot exceed the Link Rating (link draft) of any link on a feasible path
9 Refuel Fac Length Req	ft	Facility length required for refueling
10 Refuel Fac Width Req	ft	Facility width required for refueling
11 Refuel Fac Dimension Req	varies	Facility dimension required for refueling (e.g., draft for sea)
12 Refuel Fac Rating Req	varies	Facility rating level required for refueling (e.g., LCN or landing classification number for air, boom capacity for sea)

Figure 4-5. Data Elements for the Route Type Table (RoutType).

4.2.5 Refueling Constraints and Payload Affects

Refueling is an important consideration for vehicles such as aircraft, when range is limited and the payload may depend on the "critical leg", which is the longest travel distance between refueling points. In such cases, a tradeoff exists between refueling more frequently with higher payloads and slower travel times, versus refueling less frequently with lower payloads and faster travel times. If the Range at Max Payload exceeds the travel distance (e.g., for ships) then GDAS does not model refueling. If the Payload Decrease is zero, the range becomes a routing constraint but does not affect the allowable payload. If the Payload Decrease is nonzero, then GDAS models the payload dependencies using a piecewise linear approximation as shown in Figure 4-6. For instance, a C-5 Route Type may have the following characteristics: Range at Max Payload of 2000 miles, and Payload Decrease of 12%/kmi after exceeding the initial 2000 miles, as shown in the figure ("kmi" denotes 1000 miles). If the "critical leg" distance on one or more links between refueling points is 3000 miles, then the payload is reduced by the following calculation:

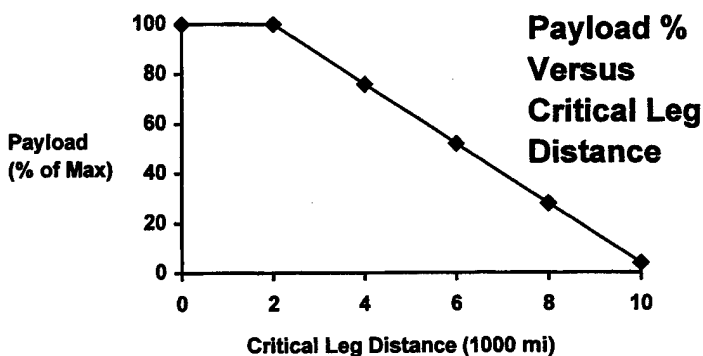


Figure 4-6. Payload Percentage Versus Critical Leg Distance Between Refueling

Payload Reduction % =

$$\begin{aligned}
 &= (\text{Critical Leg Distance} - \text{Range at Max Payload}) * (\text{Payload Decrease \% / kmi}) / (1000 \text{ mi / kmi}) \\
 &= (3000 \text{ mi} - 2000 \text{ mi}) * (12\% / \text{kmi}) / (1000 \text{ mi / kmi}) \\
 &= 12 \% \text{ reduction.}
 \end{aligned}$$

The allowable payload is therefore 88% of the maximum for traveling 3000 miles without refueling. For an empty aircraft on a return flight, the maximum range when flying empty is given by:

$$\begin{aligned}
 \text{Empty range} &= \text{Range at Max Payload} + 100\% \text{ Reduction} * (1000 \text{ mi / kmi}) / (\text{Payload Decrease \% / kmi}) \\
 &= 2000 \text{ mi} + 100\% * (1000 \text{ mi / kmi}) / (12\% / \text{kmi}) \\
 &= 10,333 \text{ mi.}
 \end{aligned}$$

It should be noted that a loaded route may be different from an unloaded empty route because the aircraft refuels more frequently on the loaded route to carry the cargo payload.

Different aircraft may have different Route Types with different refueling characteristics, so that they may travel on different routes. In determining the "best" route, GDAS evaluates alternative links, nodes, link constraints, refueling points, refueling times, landing/takeoff times, critical leg distances, and payloads to maximize the overall payload delivered per unit time. The routing algorithm is one of the more sophisticated components of the model.

For Route Types that do model refueling, various facility types can be excluded for refueling using the RoutExcl table. An additional consideration is that an aircraft may not be able to refuel at a POD based on the refuel exclusions in RoutExcl, so a recovery base must be found prior to refueling.

4.2.6 Vehicle Data

For each Vehicle Type, there can be multiple Vehicle Data records in the VehData table. Whereas the Vehicle Type defines the general routing properties, generic loading factors, and the types of compartments, the Vehicle Data record specifies the individual vehicle characteristics such as Cruising Speed, Facility Length Required, Max Cargo Load in Ston, etc. For searift, each Vehicle Data record in VehData typically represents a single unique ship, since each ship has its own unique characteristics. Thus, there may be many ships having a Vehicle Type of Breakbulk, each ship being listed in VehData with unique characteristics. For airlift, at the other extreme, each Vehicle Data record may simply correspond to the Vehicle Type itself, since all C-141 or C-5a aircraft share the same cruising speed, etc. In this case, there may be only one VehData record or a few variations for a given Vehicle Type.

Field Name	Units	Description
Vehicle Type		Vehicle type name
Vehicle Identifier		Vehicle identifier for this vehicle data
Cruising Speed	nmi/hr	Cruising speed of this vehicle, in nautical mph
Max Cargo Load	Ston	Maximum allowed cargo load over all compartments for this vehicle, in ston
Facility Length Required	Ft	Facility length required for loading and unloading
Facility Width Required	Ft	Facility width required for loading and unloading
Facility Dimension Required	Varies	Facility dimension required (user-definable, e.g., draft for sea)
Facility Rating Required	Varies	User-definable facility rating required for loading and unloading (e.g., landing classification number for air, boom capacity for sea)

Figure 4-7. Data Elements for the Vehicle Data Table (VehData).

4.2.7 Vehicle Fleet

The Vehicle Fleet records in the VehFleet table list the actual availabilities of vehicles by location, starting time, and number of vehicles. For sealift, each ship may be assigned a unique location and starting availability with the Number of Vehicles set to one. For smaller transport vehicles, numerous vehicles may be "cloned" as a fleet or squadron of vehicles that are available at a single location and starting time (this can also be done with sealift if you wish to quickly clone one or more ships). If vehicles have different starting locations or times then they must be entered as additional Vehicle Fleet records; several different Vehicle Fleet records can reference the same Vehicle Data record in the VehData table.

The Fleet table that is also shown in the figure is computed from the VehFleet table and is not entered directly. It simply lists the unique Fleet values entered into the VehFleet table. The purpose of the Fleet table is to provide a lookup for excluding fleets from specified theaters, nodes, or requirement types.

Field Name	Units	Description
Vehicle Type		Vehicle type
Vehicle Identifier		Vehicle identifier, such as ship name or aircraft squadron, for this starting location, vehicle type, and fleet
Vehicle Fleet		Fleet identifier for this starting location
Number of Vehicles		Number of vehicles in the fleet for this vehicle type
Start Scheduling Day	day (hr)	Administrative day that this fleet and vehicle type are first available for scheduling new trips, stops, and cargo
Stop Scheduling Day	day (hr)	Stop day after which this fleet and vehicle type are returned to its starting node or route with no more use (blank or 0 is treated as available through the simulation end date)
Start Node		Starting home base node for this fleet and vehicle type (a vehicle starts at and returns to its home base if not otherwise assigned)
Start Facility		Starting home base facility for this fleet and vehicle type (a vehicle starts at and returns to its home base if not otherwise assigned)
Start Route Offset	day	Offset day for this fleet and vehicle for a standard prescheduled starting route cycle
Start Route Last Day	day (hr)	Last day beyond which the prescheduled starting route is no longer cycled
Special Mission		Special mission which restricts this fleet to matching special mission movement requirements for a designated period of time
New Vehicle Penalty	\$/new veh	Penalty for the first use of a new vehicle of this type and fleet
Call Sign		International call sign or identifier of the vehicle and fleet
Other Identifier		Other identifier such as NISC (Naval Intelligence Security Code) for the vehicle and fleet
Requirement		Requirement by which this vehicle fleet is delivered (these vehicles are not available until the requirement is completely delivered)

Figure 4-8. Data Elements for the Vehicle Fleet Table (VehFleet).

4.2.8 Planning Fleet

The PlanFlt table is used to group similar sub-groups of vehicles within a Transport Mode into Planning Fleets for evaluation by the planning algorithm. This makes it possible to specify different planning fleets within a mode for tracking vehicle capacity and facility capacity during planning, since planning does not assign individual vehicles. All of the planning factors, such as Planning Speed and Planning Ton-Hour Penalty, are now consolidated in the more PlanFlt table, as summarized in the attached dictionary elements.

Previously, planning was based on modes, so that the planning algorithm selected the end-to-end modes (in addition to nodes and configurations), and passed this information to scheduling. This captures major vehicle characteristics and in many cases this approach may still be appropriate. In fact the default GDAS test scenario has one Planning Fleet for each Mode. For example, a "Sealift" planning fleet is defined for the "Sealift" mode.

More recently, the new planning algorithm adds tracking of vehicle capacity constraints, in addition to node/facility capacity. Planning still uses a cargo flow model prior to scheduling, but both the facility and vehicle capacity constraints are tracked over time as each cargo is planned for movement during specific time intervals. Planning does not assign individual vehicles using detailed multi-port itineraries, which is performed in scheduling. But planning does make alternative decisions based on the total capacity available for different units of measure, vehicle compartment capacity, and facility throughput. Because different vehicles can load different amounts of cargo, the planning process cannot simply count the number of vehicles needed. Instead, planning evaluates the amount of cargo that can be loaded, which means it must track key loading factors including multiple units of measure (Mton, SqFt, etc.), stow factors, cargo-vehicle-facility-compartment matching, and estimated timing.

Field Name	Units	Description
1 Planning Fleet		Aggregation of fleets used for planning modes, ports, cargo configurations, and prescheduled routes
2 Fleet Mode		Transport mode used by the planning fleet
3 Transport Agent		Transportation agent or company identifier for this fleet
4 Planning Speed	nmi/hr	Nominal planning speed in nautical mph or knots for planning routes and target lift dates (this is a planning speed, not a scheduling or simulation speed, and should be set to match slower vehicles)
5 Planning Delay Hours	hr	Nominal planning delay time in hours for each mode change to allow for vehicle repositioning, loading, unloading, and other delays for planning routes and target lift dates (accounts for repositioning in planning, not just load times)
6 Planning Ton-Hour Penalty	\$/hr/ton	Nominal penalty per ton per hr for transport via this vehicle type for planning routes and target lift dates
7 Plan Fleet Productivity %	% of C-mi/day	Plan fleet useful planning percent allocation or productivity %, expressed as a percent of transport lift flow capacity (Mton-mi/day, SqFt-mi/day, etc.) as contributed by the first measure of each compartment
8 Utilization Rate %	%	Vehicle effective utilization (UTE) rate expressed as a percent usage per day based on maintainability, logistics support, re-basing, non-productive use (applies to travel time only, not time in port, and cause recovery delays after trips)
9 Greedy Vehicle Wait	hr	Max wait time for evaluating additional cargo at the same POE after an assignment, used in the vehicle scheduling algorithm
10 Standard Depart Interval	day	Standard depart time interval for a prescheduled route, stored for reference only and not used to generate routes
11 Stop Arrival Tolerance	day (hr)	Time window tolerance for early or late arrival at the prescheduled stops on this route
12 Route Delay Penalty		Penalty for the delay of prescheduled stops when inserting new stops, the input value is the penalty of one day delay in cents, with increasing cost for greater delays
13 Remain On Route?	T/F	Checked or True if the prescheduled ship should stay on its prescheduled route only up through the Route Last Day, otherwise False
14 Description		Description of the prescheduled route

Figure 4-9. Data Elements for the Planning Fleet table (PlanFlt).

The planning fleets offer better control over the planning process rather than using modes alone. For example, strategic airlift and theater airlift may share the same travel links and facilities, but their capacity is assigned to very different cargo movement legs. In order for planning to see the proper allocation of airlift capacity, it may be appropriate to create two planning fleets, one for strategic airlift and one for intra-theater airlift. This avoids pooling the intra-theater airlift capacity with strategic airlift during planning, and is also useful for restricting them to specific theaters. Based on the planning fleets and their constraints, the planning algorithm then selects nodes, configurations, modes, AND planning fleets for subsequent scheduling. A similar situation occurs with multi-theater scenarios, in which different fleets of vehicles may be pre-allocated to different theaters.

As another example, the use of Fast Sealift ships may have special planning considerations different from other sealift, e.g. fast sealift may be dedicated to Army unit moves. Since planning evaluates limits on the ship capacity, it may be important to track limited Fast Sealift capacity separate from other ships during planning. Otherwise, planning does not track the use of Fast Sealift capacity as a separate lift asset distinct from other ships. The planning fleets provide additional guidance about efficiently using a limited number of special lift assets relative to high priority movements.

The use of planning fleets can increase or decrease run time. If the planning fleets have distinct constraints relative to the modes as a whole, then making planning fleets more detailed can reduce run time because capacity reservations are tracked in separate smaller lists rather than one large list for each mode. The planning fleets also reduce subsequent scheduling time, since fewer vehicle alternatives exist with each planning fleet during the scheduling process. On the other hand, the use of multiple planning fleets having similar characteristics can definitely increase planning time and unduly constrain the scheduling alternatives. In summary, the planning fleets should be used as "more detailed modes" to separate groups of vehicles that have *significantly different* deployment considerations.

4.2.9 Prescheduled Stops

Each Planning Fleet can be assigned a prescheduled stop itinerary, including cyclical liner routes that are automatically duplicated and expanded into multiple trips. Prescheduled stops are defined in the StdStop table using the data elements shown in Figure 4-10. Any prescheduled stops that are defined and associated with vehicle availability in the VehFleet table, are generated and expanded prior at the beginning of the model run and are retained in the final schedule. For example, the DOD Voluntary Intermodal Sealift Agreement (VISA) program makes uses of commercial liner routes which have preset, cyclical itineraries. Several ships in VehFleet may be assigned to the same prescheduled stops in StdStop using the Start Route Id, but with different Start Route Offset as specified in VehFleet. If the prescheduled stops are cyclical (they start and stop at the same node), then the prescheduled itinerary is automatically repeated over time until the end of the simulation, or until the Start Route Last Day specified in VehFleet.

Field Name	Description
1 Planning Fleet	Planning fleet that has prescheduled stops
2 Stop Sequence	Stop sequence number for this prescheduled planning fleet (stops are
3 Arrive Day	Arrive day offset for this prescheduled stop sequence, starting from zero (the
4 Node	Node associated with this prescheduled stop sequence number
5 Facility	Facility associated with this prescheduled stop sequence number
6 Depart Day	Depart day offset for this prescheduled stop sequence, starting from zero

Figure 4-10. Data Elements for the Standard Prescheduled Stop table (StdStop).

4.2.10 Compartment Type

A Compartment Type in the CptType table is used to represent a kind of cargo stowage capability for loading cargo on a transport vehicle. A vehicle can have multiple compartment types for loading cargo. For example, a Breakbulk ship typically has a "Deck" compartment and a "Hold" compartment, which have different cargo loading characteristics but reside on the same ship. The Compartment Type is used to define compatibility with different cargo types, units of measure for capacity calculations, and stowage factors for loading the cargo. Each Compartment Type is applicable to a single Transport Mode only, and different Compartment Types must be defined for different modes. A Compartment Type can be used on different Vehicle Types within a mode. For example, the "Deck" compartment type may be applicable to several different ship types, but if a compartment has different stow factors then it must be defined as a different Compartment Type record.

Field Name	Description
1 Compartment Type	Generic compartment type name which is associated with stow factors and vehicle capacities (e.g., Hold for ships, Outsize for aircraft, Boxcar for rail, Flatbed for motor)
2 Transport Mode	Transport mode associated with this compartment type

Figure 4-11. Data Fields for the Compartment Type table (CptType).

4.2.11 Vehicle Compartment Type

Since a vehicle can have multiple compartments, the VCptType table specifies the allowable Compartment Types for each Vehicle Type. All vehicles within a single Vehicle Type have the same Compartment Types (otherwise, a new Vehicle Type must be defined). For example, a Vehicle Type of "Breakbulk" representing breakbulk ships may have two applicable Compartment Type records, "Deck" and "Hold", as listed in the VCptType table. This means that all "Breakbulk" vehicles have the two compartment capacities listed in the VehCap table (see below), although the compartment capacity can be zero to exclude loading in those exceptions where no usable deck space exists.

Field Name	Description
1 Vehicle Type	Vehicle Type (e.g. C-5 for air; Breakbulk for sea; Van, Flatbed, Special, Refrigerated, etc. for motor; Flatcar for Rail)
2 Compartment Type	Name of an available compartment type for the vehicle type

Figure 4-12. Data Fields for the Vehicle Compartment Type Table (VcptType).

4.2.12 Compartment Measure

In order to compute the amount of cargo that can be loaded on a vehicle compartment, the capacity of the compartment must be entered in appropriate units of measure. The Compartment Measure table CptMeas is used to define which units of measure apply to each Compartment Type. A single compartment can have multiple units of measure (e.g., Mton and SqFt) either of which can be constraining depending on the volume and area density of the cargo. Depending on stow factors and the cargo quantities, one cargo may "cube out" and a different cargo may "square out" when loading the same vehicle compartment. The CptMeas table defines which measures apply. For example, a sealift "Deck" compartment may have only a single constraining unit of measure for area (SqFt), whereas an airlift "C-17" compartment may have both volume (Mton) and area (SqFt) capacity limits for the same compartment space.

The CptMeas table assigns measures to compartments based on the allowable measures in the Measure table. New measures can be defined as appropriate for use in GDAS; for example, a TEU measure can be defined to measure the capacity of "Container" compartments.

Field Name	Description
1 Compartment Type	Compartment type name used to specify stow factors for vehicle types and capacities for vehicles
2 Compartment Measure	Unit of measure for defining compartment capacity (in addition to the total Ston measure which is always used for each vehicle)

Figure 4-13. Data Fields for the Compartment Measure Table

4.2.13 Vehicle Compartment Capacity

The Vehicle Compartment Capacity table, VehCap, lists the compartment capacities for every Vehicle Data record, matching Compartment Type, and matching Compartment Measure. The user need enter only the actual capacity data. All of the records and key fields in the VehCap table are derived from the other VehData, VCptType, and CptMeas tables and are filled out automatically.

Field Name	Description
1 Vehicle Type	Vehicle type
2 Vehicle Identifier	Vehicle identifier for this vehicle data
3 Compartment Type	Compartment type for this vehicle type
4 Compartment Measure	Compartment stowage measure
5 Capacity	Stowage capacity for this vehicle compartment in the stowage measure

Figure 4-14. Data Elements for the Vehicle Capacity Table (VehCap).

4.2.14 Vehicle

The Vehicle table is derived from VehFleet and is *not* input data. The table is shown here only for reference. The GDAS scheduling model tracks each Vehicle separately, so as a first step it takes each VehFleet record and “clones” the individual vehicles based on the Number of Vehicles available. One of the outputs of the model is a complete listing of each unique Vehicle, with many of the vehicles having the same characteristics but different scheduled trips, stops, and cargos.

Field Name	Units	Description
1 Vehicle Number		Vehicle unique sequential number
2 Vehicle Type		Vehicle type
3 Vehicle Identifier		Vehicle identifier
4 Vehicle Fleet		Vehicle fleet for this vehicle
5 Attrit or Damage Day	day	Last attrit or breakdown day for this vehicle, if any
6 Replace or Repair Day	day	Last replacement or repair day for this vehicle, if any
7 Computed Course		Current course direction computed for the current date and time
8 Computed Latitude	deg min H	Current latitude computed for the current date and time
9 Computed Longitude	deg min H	Current longitude computed for the current date and time

Figure 4-15. Output Data Elements for the Vehicle Table

4.3 Transportation Network Data

Figure 4-16 provides an overview of the data tables and relationships for representing the transportation network. Once a global network is established, most of this data is again relatively stable for different studies, except when extending to intratheater analysis for a new area of the world, or when running at very

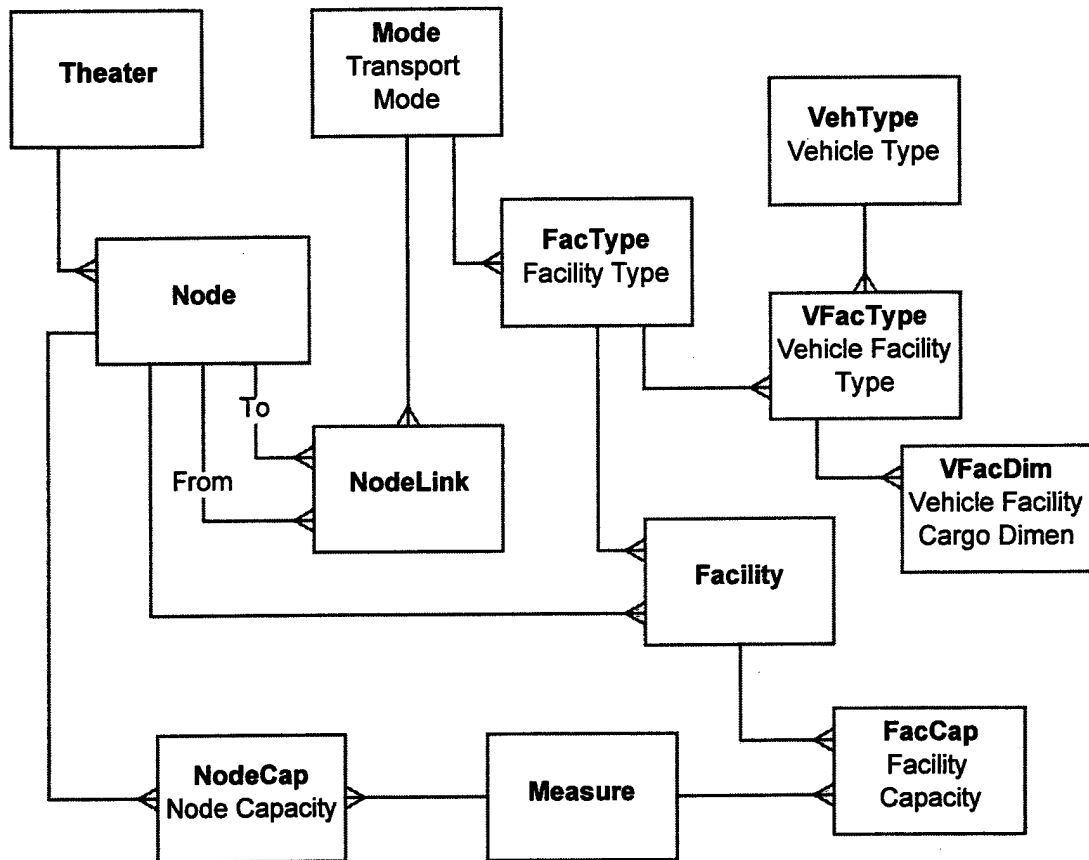


Figure 4-16. Data Tables and Relationships for Transportation Network

high level of detail with sub-networks at facilities.

4.3.1 Node

A Node is simply a location in GDAS, with a latitude and longitude. A Node may represent a port location with facilities (POE,POD,POI), an origin, a destination, a transshipment point, a turning point or waypoint, a refueling location, a canal entrance point, a staging location, an assembly point, or any other location.

Field Name	Units	Description
1 Node Name		Node name corresponding to a port, transshipment point, origin, destination, routing point etc.
2 Node Type		Node type for world map graphics display
3 Node Latitude	deg min H	Node latitude in dd mm H
4 Node Longitude	deg min H	Node longitude in ddd mm H
5 Geoloc Code		Node geoloc code, if any
6 Theater		Theater that the node is located in, if any
7 Attrit Probability %%	%%	Discrete probability of attrition or breakdown when departing this node
8 Is Node Disabled?		Yes if the node is disabled, otherwise blank

Figure 4-17. Data Elements for the Node Table

4.3.2 Node Link

A Node Link represents a transportation link from one node to another on which transport vehicles can move. Each link is assigned a single Transport Mode, so that several links may exist between the same two nodes for different transport modes. Data about the link include the From Node, To Node, Transport Mode, Link Distance (which is computed as a great circle if left blank), Added Delay Hours (e.g., for canal or other delays), Speed Change (with or against a current or wind), Speed Limit, etc. The network links are connected to form a multi-nodal route path in GDAS in the routing algorithm.

Field Name	Units	Description
1 From Node		From node name
2 To Node		To node name
3 Transport Mode		Transport mode for this link (only one link is permitted for each mode; multiple links can be created by adding nodes)
4 Is Link Disabled?		Yes if the link is available, blank otherwise
5 Link Dist	nmi	Computed link distance in miles based on great circle (can also be set by the user, but will be recalculated as the great circle distance if less than the great circle distance)
6 Added Delay Hours	hr	Delay time on this link in hours
7 Speed Change	knot	Speed change (positive for increase, negative for decrease) which is added to the transport speed on this link (for sealift an approximate calculation is to get an equivalent distance change)
8 Speed Limit	knot	Speed limit which constrains the allowable transport speed on this link (for sealift an approximated distance change is computed)
9 Link Rating		Link rating for the size of vehicles which are permitted through this link relative to the size required for a given Route Type
10 Attrit Daily Rate %%	%%/day	Attrition or breakdown rate on this link for exposure-based attrition

Figure 4-18. Data Elements for the Node Link Table (NodeLink).

4.3.3 Theater

A Theater represents a subset of nodes classified by area of the world. A Theater is assigned to each Node primarily for reporting purposes, although theater is also used to specify resupply generation factors and determine if convoying is applicable.

Field Name	Units	Description
1 Theater		Theater name
2 Mobilization M Day	day (hr)	Theater M day or begin mobilization day relative to global day 0
3 Deployment C Day	day (hr)	Theater C day or commence deployment day relative to global day 0
4 Combat D Day	day (hr)	Theater D day on which casualties and attrition begin, relative to global day 0
5 Earliest Depart Day	day (hr)	Earliest day that a vehicle can leave after exiting the POE facility before traveling towards this theater (cargo can be preloaded and the facility exited)
6 Start Planning Day	day (hr)	Day on which requirements can first start being considered for scheduling to this theater

Figure 4-19. Data Elements for the Theater Table

4.3.4 Facility

A Facility represents a loading or unloading capability at a node, for example a seaport, airport, truck terminal, or rail terminal. A node with facilities normally has more than one, such as both a truck terminal and a seaport, to permit transfer from one mode to another. All transfers of cargo onto a vehicle or off of a vehicle must occur at a facility. Origins and destinations of movement requirements must also have facilities (this is checked by GDAS). A Facility has a Facility Type, which affects which vehicle types and cargo types are compatible with the Facility and what the load/unload rates are.

Field Name	Units	Description
1 Node		Node with one or more facilities
2 Facility Name		Facility name at this node
3 Facility Type		Facility type for this facility
4 Max Vehicles Per Hour	veh/hr	Number of combined vehicle arrivals and departures which can be handled per hour in this facility during its hours of operation
5 Max Parking	veh	Maximum number of "standard" vehicles permitted in the facility at the same time, e.g. working MOG for airlift or number of berths for sealift (vehicle types are weighted by an effective factor to convert to a standard vehicle) (model scales by 100 to %)
6 Operating Hours/Day	hr/day	Operating hours per day that the facility is open
7 Facility Length	ft	Maximum length available (e.g., runway length for air, berth length for sea)
8 Facility Width	ft	Maximum width available (e.g., runway width for air, berth beam for sea)
9 Facility Dimension	varies	Maximum vehicle dimension allowed in the facility, a user-definable criterion, such as draft for sealift
10 Facility Rating	varies	Facility rating which limits the maximum allowable vehicle rating, based on a user-definable criteria (e.g., load classification number for air, boom capacity or sea)

Figure 4-20. Data Elements for the Facility Table

4.3.5 Facility Type

A Facility Type in the FacType table represents a kind of facility that can handle certain kinds of cargo and vehicle types. Each Facility Type has a single Transport Mode for which it applies, and each Facility at a node must be listed with a single Facility Type. The Facility Type affects the allowable Vehicle Types which can enter the Facility and it affects the load/unload rates for different Cargo Types.

4.3.6 Vehicle/Facility Type

The Vehicle/Facility Type records in the VFacType table specify which Vehicle Types are compatible with which Facility Types. The records and key fields are entered automatically by GDAS for all matching modes. In addition, setup and shutdown delays can be specified for vehicles entering the facility types.

Field Name	Units	Description
1 Vehicle Type		Vehicle type
2 Facility Type		Facility type with matching mode
3 Is Vehicle Excluded?	T/F	Checked or True if the vehicle type is excluded from loading and unloading cargo at this facility type, otherwise False (vehicle may still refuel unless prevented by Is Refuel Excluded? field)
4 Setup Delay	hr	Fixed setup or entrance delay time for this vehicle type while occupying this facility type (the vehicle takes parking space and the facility must be open during setup; setup delays vehicle and cargo loading/unloading)
5 Shutdown Delay	hr	Fixed shutdown or exit time for this vehicle type while occupying this facility type (the vehicle takes parking space and the facility must be open during shutdown; shutdown delays vehicle but not cargo loading or unloading)
6 Facility Visit Penalty	\$/visit	Penalty for multi-facility visits on a single trip, used in the scheduling algorithm (the first POE and POD facilities on a new trip are not penalized)

Figure 4-21. Data Elements for the Vehicle Facility Type Table (VFacType).

4.3.7 Vehicle/Facility Cargo Dimension

The Vehicle/Facility Cargo Dimension table, VFacDim, lets you set cargo dimension limits that constrain the capabilities of different Vehicle Types for loading/unloading cargo at the specified Facility Types. This table is useful only if the cargo measures include dimension limits such as Max Height or Max Length and you wish to set limits on what dimension limits are compatible with different Vehicle Types and Facility Types.

Field Name	Units	Description
1 Vehicle Type		Vehicle type with cargo dimension constraint
2 Facility Type		Matching facility type with cargo dimension constraint
3 Max Dimension Measure		Cargo dimension constraint measure (Item Height Ft, Item Weight Ston, etc.)
4 Max Cargo Dimension	ft,ston, mton, etc.	Cargo dimension limit to exclude cargo that is too big from loading on this vehicle type at this facility type

Figure 4-22. Data Elements for the Vehicle Facility Type Dimension Table (VFacDim).

4.3.8 Facility Capacity

Each Facility at a Node can be constrained by one or more throughput and storage capacities as specified in the Facility Capacity table, FacCap. Each Facility Capacity record is entered for user-specified throughput measures such as Mton/Hr, SqFt/Hr, or Ston/Hr, or storage measures such as SqFt Storage. Multiple constraint measures and capacities can be entered and enforced simultaneously for a single Facility. Note that different kinds of cargo can utilize facility capacity at different rates for different Vehicle Types (see the LoadRate table).

Field Name	Units	Description
1 Facility Node		Node with one or more facilities
2 Facility Name		Facility name at this node
3 Facility Capacity Measure		Cargo storage or throughput handling capacity measure for this facility
4 Facility Capacity	Q/hr	Hourly rate or total storage cargo handling capacity for this measure and facility at the node

Figure 4-23. Data Elements for the Facility Capacity Table (FacCap).

4.3.9 Node Capacity

Similar to Facility Capacity, each Node can be constrained by one or more throughput and storage capacities as specified in the Node Capacity table, NodeCap. The difference between a Node Capacity and a Facility Capacity is that the Node Capacity is a shared constraint applied to all facilities at the Node,

whereas the Facility Capacity applies to a single Facility only. Thus, the Node Capacity is useful when shared resources (such as stevedores or forklifts) are used for loading/unloading across multiple facilities, possibly across several modes. Each Node Capacity record is entered for user-specified throughput measures such as Mton/Hr, SqFt/Hr, or Ston/Hr, or storage measures such as SqFt Storage. Multiple constraint measures and capacities can be entered and enforced simultaneously for a single Node.

Field Name	Units	Description
1 Node Name		Node having throughput or storage limits
2 Node Capacity Measure		Unit of measure for overall cargo handling capacity at the node
3 Total Node Capacity	Q/hr	Hourly throughput rate or total storage cargo handling capacity at the node for all facilities combined

Figure 4-24. Data Elements for the Node Capacity Table (NodeCap)

4.4 Movement Requirements Data

Figure 4-25 provides an overview of the data tables and relationships for representing movement requirements. Again, most of the data is static "type" data to set up the basic cargo categories and units of measure. The primary tables that are filled in for a given study are the movement requirements (Require), their quantities (ReqQuan), and any required nodes (ReqNode).

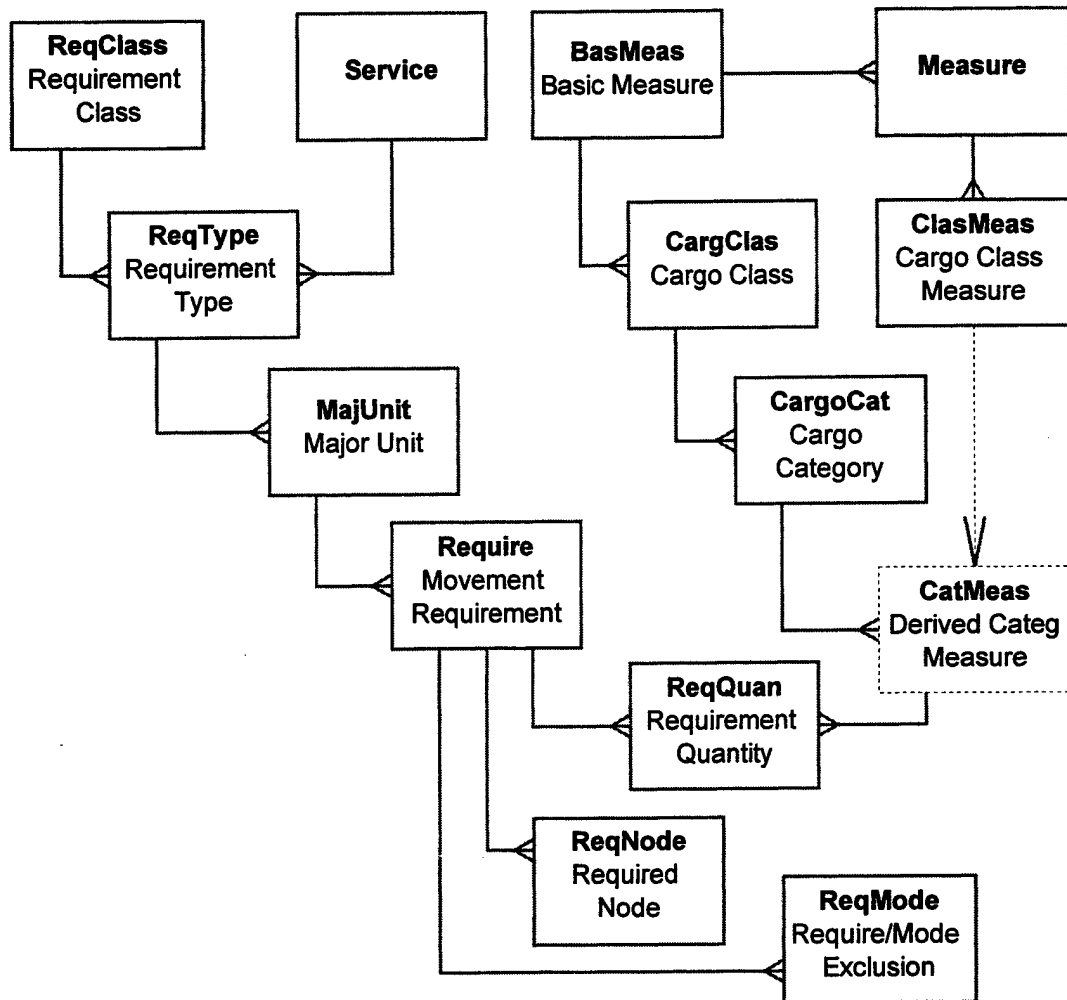


Figure 4-25. Data Tables and Relations for Movement Requirements

4.4.1 Movement Requirement

The Movement Requirement provides the basic data about what is to be moved where and when. Each Movement Requirement is listed in the Require table with a Requirement Id, an Origin node, a Destination node, a Ready to Load Day (RLD), and a Required Delivery Day (RDD). A single Movement Requirement can constitute a package of multiple items with different cargo categories.

Field Name	Units	Description
1 Requirement Id		Movement requirement or package id
2 Major Unit		Major unit associated with this movement requirement
3 Origin		Starting origin of the requirement
4 Destination		Final destination of the requirement
5 RLD	day	Ready to load day or earliest day the requirement is available at its origin
6 RDD	day	Required delivery day of the packaged requirement at its destination including time for assembly
7 EDD	day	Earliest allowed delivery day of the requirement at its destination prior to assembly
8 Computed Closure Day	day	Closure day for the requirement based on the closure minimum % requirement specified in the ReqType table
9 Priority Order		Relative priority order for this requirement as a secondary sort after the Target Lift Date (one means first priority in assigning lift assets, blank defaults to the priority order of the requirement type)

Figure 4-26. Data Elements for the Movement Requirement Table (Require).

4.4.2 Cargo Category

A Cargo Category provides the most detailed representation in GDAS of the kind of cargo to be transported. In many cases, the GDAS Cargo Category corresponds to JOPES three-digit cargo category codes, perhaps with the addition of some cargo categories for higher resolution in intratheater studies. A single Movement Requirement may incorporate multiple cargo categories as part of a unit movement package from origin to destination. Each Cargo Category uses a set of quantity measures (Mton, Ston, SqFt, Cbbls, etc.) that are applicable based on the Cargo Class as set up in the ClasMeas table.

The CargoCat table has a new field called "Discrete Load Increment". This field is used to specify a smallest increment of basic quantity size, below which the cargo cannot be split. For example if some tracked vehicle category has no vehicle which weighs less than 10 short tons, then when you place a 10 in this field, no cargo of this category will be split into any size other than a multiple of 10. If the original requirement quantity is not an even multiple of 10, there may still be a final split cargo that cannot be a multiple of 10, but when GDAS subdivides any quantity it will create a quantity which is a multiple of 10. The Discrete Load Increment is also honored when GDAS splits cargo among compartments in a multi-compartment vehicle. Thus, each compartment will hold a quantity that is an even multiple of the discrete load increment, except perhaps the last cargo assigned if the original requirement quantity does not start out as an even multiple.

Each Cargo Category can also have special ammunition handling, which requires that ammo be last-on, first-off in routing.

Field Name	Units	Description
1 Cargo Category		Cargo category which describes the kind of cargo being transported
2 Cargo Class		Cargo class (Dry, Pax, POL) which defines dimensional measures for this cargo category
3 Category Code		Four position JOPES cargo category code including heavy lift code (A0=vehicle NAT, B0=NSDA NAT, B1=NSDA outside, B2C=NSDA oversize noncont, etc.)
4 Discrete Load Increment	Q	Discrete size increment for loading this cargo, expressed in the basic unit of measure; if specified, a split cargo must be an integer multiple of the size increment
5 Configuration at Origin		Starting cargo configuration at the origin for this cargo category
6 Is Ammunition?	T/F	Checked or True if the cargo category is treated as hazardous ammunition in route sequence, i.e. it is constrained to be last on and first off in multi-port routes, otherwise False
7 Description		Description of the cargo category

Figure 4-27. Data Elements for the Cargo Category Table (CargoCat).

4.4.3 Cargo Class

The Cargo Class table, CargClas, is an abstract table that is used to identify what units of measure apply for the different cargo categories. The typical Cargo Classes in GDAS are as follows:

- “Dry”, which uses Ston, Mton, and SqFt measures
- “Pax”, which uses Pax (the number of passengers) as the only measure
- “POL”, with Cbbls as the only measure
- “TEU”, with Ston, Mton, SqFt, and TEU as measures.

Of course, these Cargo Classes can be extended or revised in the database for a particular study application. Note that in the figure, the notation “Q” refers to the Basic Quantity Measure specified in field 2.

Field Name	Units	Description
1 Cargo Class		Cargo class (Dry, Pax, POL) which defines dimensional measures for cargo
2 Basic Quantity Measure		Basic unit of measure for reporting quantity of this cargo class (ston, pax, cbbl)
3 Pounds Per Basic Quantity	lbs/Q	Pounds per unit basic quantity in the basic unit of measure, used for conversion to accumulate ston weight totals for vehicle loading or facility throughput
4 Has Accompanying Pounds?	lbs/Q	Yes if theater-dependent accompanying pounds per unit basic quantity are obtained from the THTRREQ table rather than a conversion factor (otherwise Pounds Per Basic Quantity field is used)
5 Is Pax?		Yes if the cargo class represents passengers, used to compute closure based on the MAJUNIT % closure criteria

Figure 4-28. Data Elements for the Generic Cargo Class Table (CargClas), where Q is the Basic Quantity Measure.

4.4.4 Cargo Class Measure

The Cargo Class Measure table, ClasMeas, lists which measures apply to each Cargo Class. For example, “Dry” movement requirements utilize all three units of measure for loading of cargo onto vehicles, so that the movement requirement quantities are listed using all three three measures. The Cargo Class Measures can be changed to configure GDAS for different levels of detail, ranging from highly aggregated Ston flows down to detailed line items with Max Height, Max Length, and Max Width as well as area, volume, and weight.

Once the ClasMeas table is established, GDAS automatically derives the CatMeas table, which lists the valid quantity measures for each Cargo Category. This serves as a reference lookup table in editing the Movement Requirement Quantities in ReqQuan (described in Section 4.4.6).

Field Name	Description
1 Cargo Class	Cargo class (Dry, Pax, POL) which defines dimensional measures for cargo
2 Cargo Measure	Type of measure used for specifying quantity or dimension of cargos in this cargo class

Figure 4-29. Data Elements for the Cargo Class Measure Table (ClasMeas).

4.4.5 Basic Quantity Measure

Each Cargo Class is assigned a special measure that is the Basic Quantity Measure, as shown earlier in Figure 4-28. The "Sample" database scenario assigns Ston as the basic measure for the Dry Cargo Class, Cbbl for POL Cargo Class, and Pax for Pax Cargo Class. Since the quantity measure varies, it is listed generically as Q in the Dictionary units column. The Basic Quantity Measure is used in the model to specify the discrete cargo load quantities on vehicles and is also used for most reports. In addition, the Basic Quantity Measure represents the smallest discrete size allowed for cargo splits. This property can be used to advantage to represent discrete cargo increments such as Pax, Containers, or even discrete items such as Tanks by adding the appropriate Basic Quantity Measure.

4.4.6 Movement Requirement Quantities

Each Movement Requirement has associated with it one or more Quantity records in the ReqQuan table. These Quantities specify both the Cargo Categories and the matching units of measure. For example, a single unit movement may have a Pax cargo category measured in Pax only, as well as several Dry cargo categories (containerizable breakbulk, non-containerizable outsize, etc) each measured in Ston, Mton, and SqFt quantities.

Field Name	Units	Description
1 Requirement Id		Requirement identifier for the cargo
2 Cargo Category		Cargo category, e.g. oversize containerizable vehicle, Pax, NEO, Medivac, etc.
3 Cargo Measure		Dimensional measure for this requirement and cargo category
4 Quantity	Q	Requirement category quantity or dimension in this unit of measure

Figure 4-30. Data Elements for the Requirement Quantity Table (ReqQuan).

4.4.7 Requirement Class, Requirement Type, Major Unit, Service

Several levels of aggregation are available to represent the type of movement requirements, primarily for reporting totals. Each Movement Requirement has a Major Unit in the MajUnit table, which specifies the functional type or purpose of the movement (e.g., a TPSN in the Army environment, or some other study-specific identifier). The Major Unit is used in the reporting and charting tools to display total delivery profiles with required versus delivered quantities by day. The Major Unit is also used for assigning Measure of Effectiveness in certain output reports.

Field Name	Units	Description
1 Major Unit		Major unit name for analysis of requirement closures and measures of effectiveness
2 Major Unit TPSN		Major unit Troop Program Sequence Number (TPSN) or other user-defined identifier for the major unit
3 Requirement Type		Requirement type for this major unit
4 Major Unit MOE		Measure of effectiveness (MOE) rating for this major unit (e.g., brigade count or combat power) as defined by the analyst to compute cumulative MOE delivery
5 Computed Closure Day	day	Closure day for the major unit based on both the Pax and cargo closure minimum % specified in the ReqType table
6 Closure Required Cargo %	%	Minimum percent of the cargo which must be delivered in order to calculate unit closure (if the % is never attained, closure is based on the last portion delivered)
7 Closure Required PAX %	%	Minimum percent of the passengers which must be delivered in order to calculate unit closure (if the % is never attained, closure is based on the last portion delivered)
8 Major Unit Description		Major unit description

Figure 4-31. Data Elements for the Major Unit Table (MajUnit).

At a higher level of aggregation, each Major Unit is assigned a Requirement Type in the ReqType table. The Requirement Types are used to set scheduling priorities and penalties for the model.

Field Name	Units	Description
1 Requirement Type		Requirement type or unit type
2 Requirement Class		Aggregated requirement class for calculating summary cargo delivery versus required totals for reports
3 Service		Service for this requirement type or unit type
4 Planning Horizon Days	day (hr)	Planning or look-ahead horizon in days for scheduling cargos of this requirement type prior to their target lift date
5 Assembly Delay Days	day (hr)	Additional assembly delay days needed after delivery at the destination used to calculate closure and lateness relative to the RDD
6 RLD Packaging Range	day (hr)	Packaging range for merging movements with similar Ready to Load Dates (RLDs)
7 RDD Packaging Range	day (hr)	Packaging range for merging movements with similar Required Delivery Dates (RDDs)
8 RDD Tolerance	day (hr)	Days tolerance for lateness at the destination relative to the RDD before mode planning increases delivery cost to reduce lateness
9 Max Days Late	day (hr)	Days late relative to the target delivery date beyond which a cargo is rejected in scheduling and is reported with rejection reasons, even if the penalty is acceptable
10 Cargo Lateness Penalty	.01\$/Q-day	Penalty for cargo ton-days of lateness (as compared with vehicle usage penalties) in the scheduling algorithm
11 Penalty/Benefit Cut-off	\$/	Cost cut off level above which a potential cargo assignment is rejected early in the multi-port scheduling algorithm (blank or a large value means no cutoff)
12 Early Assignment Level	\$/	Threshold penalty/benefit level below which a potential cargo/ship assignment is accepted immediately in the multi-port scheduling algorithm (a large value reduces run time but may make a selection before costing a preferred vehicle)
13 Regeneration Delay Days	day (hr)	Nonzero delay days to regenerate attritted cargo for this requirement; cargo is regenerated with the same data as the original movement (blank means no regeneration)
14 Default Priority Order		Default priority order for this requirement type if not specified for a given requirement (1 is the earliest priority order; blank is treated as no priority or as 99)
15 Minimum Cargo Load %	%	Minimum % split of a single cargo (i.e. requirement+category) for assigning to a separate non-airlift trip (not used for airlift; 100% prevents any non-airlift splitting; this is separate from the Minimum Cargo Load % and Minimum Vehicle Load % in Param)
16 Integrity Benefit	day (hr)	Wait days benefit indicating a preference for loading identical Requirement Id's onto the same vehicle trip
17 Is Resupply?		True or checked if this requirement type is dynamically ordered by other requirements in the theater, when dynamic resupply is being modeled

Figure 4-32. Data Elements for the Requirement Type Table (ReqType).

At yet a higher level of aggregation, each Requirement Type is assigned a general Requirement Class (e.g., "Unit" versus "Resupply") and a Service. The Requirement Class is used solely for summary reports and charts, such as total "Unit" requirements delivered by day. In addition, the Requirement Type is assigned a unique Service (Army, Navy, USMC, Air Force, etc.), again for reporting purposes.

4.4.8 Required Node, Require/Mode Exclusion

The Required Node records in the ReqNode table are used to pre-assign intermediate POEs and PODs for a Movement Requirement. For a given study, it may be necessary to specify the POEs and PODs based on external study inputs or staging requirements, rather than allowing the model to select POEs and PODs from Origin to Destination using the GDAS mode planning algorithm.

Field Name	Units	Description
1 Requirement Id		Movement requirement identifier with intermediate ports or staging
2 Cargo Class		Cargo class for which the required node applies
3 LAD	day (hr)	Latest arrival day at this required port node (the LAD is used to determine the order in which required nodes are visited)
4 EAD	day (hr)	Earliest arrival day at this required port node, if any
5 Required Node		Required intermediate POE/POD node or port for this movement requirement
6 Required Mode to Node		Required transport mode specified for delivery to the intermediate node, if any (blank permits the use of any mode for delivery)
7 Required Config to Node		Required configuration specified for delivery to the intermediate node, if any (blank permits the use of any configuration)
8 Stage Name		Staging deployment name if multiple requirements are staged together at this node (the STAGE record must have the same node as in REQNODE)
9 Description		Description of this intermediate node, e.g. consolidation, container stuffing, mode change, re-configuration, combat loading, etc.

Figure 4-33. Data Elements for the Required Node Table (ReqNode).

Similarly, the ReqMode table lists excluded modes for different Movement Requirements and Cargo Classes. Typically, mode exclusions depend on the Cargo Class, e.g. Dry may exclude Airlift modes (traveling on Road, Rail, and Sealift) whereas Pax may exclude Sealift (traveling on Road, Rail, and Airlift).

Field Name	Units	Description
1 Requirement Id		Movement requirement having a mode exclusion
2 Cargo Class		Cargo class for which the mode exclusion applies
3 Excluded Mode		Excluded mode for this requirement and cargo class

Figure 4-34. Data Elements for the Requirement Mode Exclusion Table (ReqMode).

4.5 Loading Characteristics

Figure 4-35 provides an overview of the data tables and relationships for loading characteristics. Most of these tables have been discussed above; only the five lower right tables are new. All of this data is generic "type" data that typically does not change for different studies.

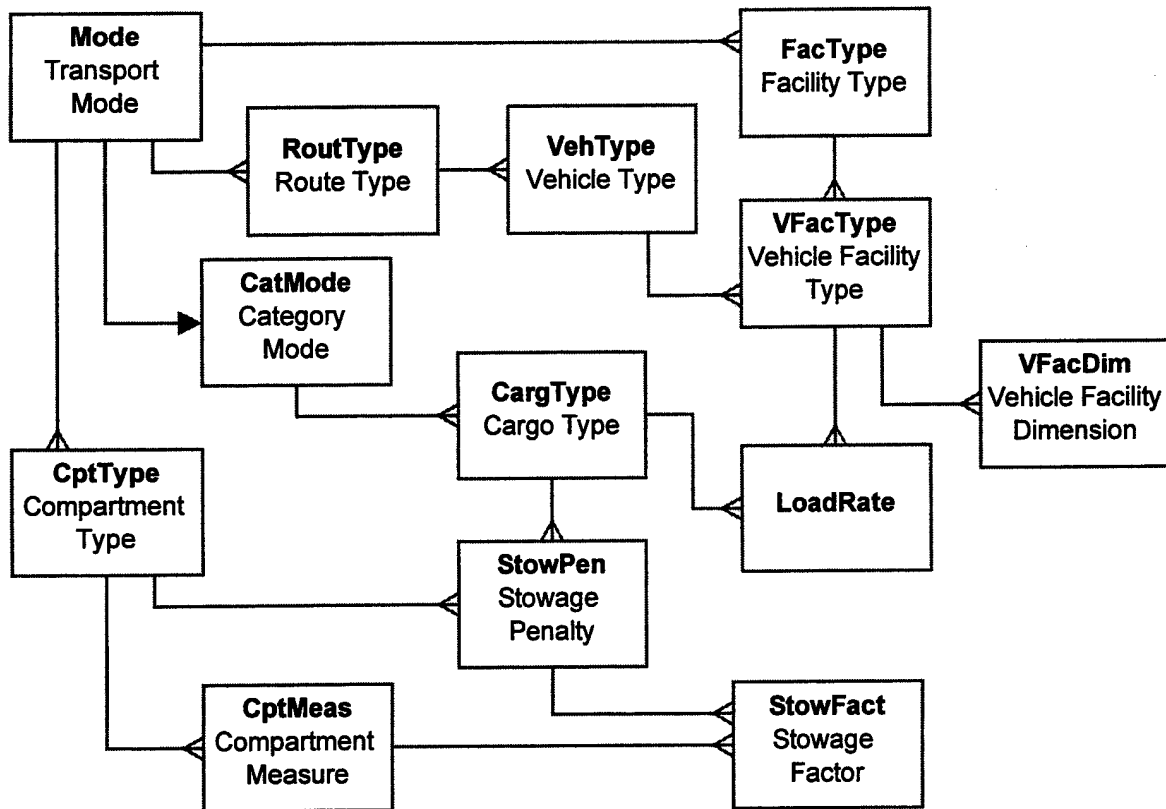


Figure 4-35. Data Tables and Relationships for Loading Characteristics

4.5.1 Cargo Type

A Cargo Type in the CargType table represents an aggregation of the Cargo Category for a specific Transport Mode. The Cargo Type is sufficient to determine the loading characteristics for a given Mode. For the Airlift mode, as an example, numerous Cargo Category records can be mapped to just four Cargo Types consisting of Bulk, Oversize, Outsize, and Pax. For the Airlift mode, only these Cargo Types are relevant in determining the loading characteristics. By expressing the loading characteristics in terms of Cargo Types rather than the more detailed Cargo Categories, far fewer stow factors, load/unload rates, and compartment matching rules need be entered.

Each Cargo Type is assigned a Cargo Class to identify which quantity measures are applicable to the Cargo Type.

Field Name	Description
1 Cargo Type	Mode-specific cargo type which groups cargo categories for a given transport mode in order to define stow factors, load rates, and load compatibility for vehicle compartments
2 Cargo Class	Cargo class (Dry, Pax, POL) for this cargo type, which defines which dimensional measures are applicable for this cargo type
3 Transport Mode	Transport mode associated with this mode-specific cargo type
4 Cargo Type Description	Description of the mode-specific cargo type

Figure 4-36. Data Elements for the Cargo Type Table (CargType).

4.5.2 Category Mode

The Category Mode table, CatMode, specifies how the Cargo Categories map to Cargo Types for each Transport Mode. The key fields and records are pre-computed by GDAS; the user need enter only the matching Cargo Type if the Cargo Category can be transported by a particular Transport Mode for a particular Cargo Configuration. Some Cargo Categories cannot be transported by some modes, for example Non-Air-Transportable (NAT) on Airlift.

Field Name	Units	Description
1 Transport Mode		Transport mode
2 Cargo Category		Cargo category which describes the kind of cargo being transported
3 Cargo Configuration		Cargo configuration status
4 Cargo Type		Cargo type used to represent this cargo category and configuration for the

Figure 4-37. Data Elements for the Category Mode Table (CatMode).

4.5.3 Stow Penalties, Stow Factors

The StowPen table specifies which Compartment Types can load which Cargo Types. Its records are also pre-generated by GDAS, and only the compatibility setting and stow penalties need be entered.

Field Name	Units	Description
1 Compartment Type		Vehicle compartment type
2 Cargo Type		Cargo type with matching transport mode for this compartment
3 Is Stow Excluded?		Yes if this cargo type is excluded from stowage in this compartment type
4 Stow Penalty	\$/Q	Stow penalty per unit basic quantity of cargo for loading into this vehicle compartment

Figure 4-38. Data Elements for the Stow Penalty Table (StowPen).

The StowFact table stores stow factors for each combination of Compartment Type, Compartment Measure, and Cargo Type. Different capacity measures (Mton, SqFt, Ston, etc.) can have different stow factors. If a stow factor is set to zero or blank for an compartment measure, then loading is excluded.

Field Name	Units	Description
1 Compartment Type		Compartment type
2 Compartment Measure		Compartment stowage measure
3 Cargo Type		Cargo type for a specific transport mode
4 Stow Factor %	Q/100C	Stow efficiency in percent for loading the cargo type in the compartment type for this measure, including basic quantity conversion if the cargo measures don't match, expressed in % Q/C (i.e., cargo quantity stowed per 100 compartment capacity measure)

Figure 4-39. Data Elements for the Stow Factor Table (StowFact).

4.5.4 Load Rates

The LoadRate table specifies the load and unload rates for different combinations of Vehicle Type, Cargo Type, and Facility Type. If a load rate or unload rate is set to zero or blank, then no loading is permitted for that combination. The Load Rate table also specifies the scale factor for utilization of facility throughput capacity. For example, some Cargo Types (such as Container) may have faster unload rates as well as lower throughput utilization for suitable Facility Types and Vehicle Types (Container ships).

Field Name	Units	Description
1 Vehicle Type		Vehicle type
2 Facility Type		Facility type at the node
3 Cargo Type		Cargo type for the transport mode
4 Hourly Load Rate	Q/hr	Hourly load rate to load this cargo category grouping on this vehicle type at this berth type expressed in the cargo basic quantity units (loading can occur only during the facility open hours)
5 Hourly Unload Rate	Q/hr	Hourly unload rate to unload this cargo category grouping on this vehicle type at this berth type expressed in the cargo basic quantity units (unloading can occur only during facility open hours)
6 Cargo Throughput Scaling	%	Cargo throughput scaling which adjusts the cargo's required facility and node throughput capacity (100% represents standard throughput scaling, 0% means the cargo does not affect throughput capacity at all, 50% means the cargo consumes half throughput)

Figure 4-40. Data Elements for the Load Rate Table (LoadRate).

4.5.5 Exclusions

The Exclude table is a powerful tool to exclude specific combinations of cargo loading based on multiple criteria.. Exclusions within the Exclude table do not apply to routing or refueling between POEs and PODs, which are accomplished through the use of the RoutType table. The Exclude table applies to loading or unloading. By entering a Requirement Type, Vehicle Fleet and Theater, for example, all loading of that Requirement Type on that Vehicle Fleet is excluded in that Theater.

If exclusions can be specified in terms of stowage constraints or cargo/vehicle/facility type matching, they should be entered using zero stow factors and/or load rates, which are more efficient than the Exclude table. For example, the VFacType table can exclude a vehicle from a facility, the StowPen table can exclude cargo types from a compartment, and the LoadRate table can exclude combinations of Vehicle Type, Facility Type, and Cargo Type. The Exclude table should be reserved for customized exclusions that cannot be represented using the standard "type" data. For example, the Exclude table is often used to prevent selected Vehicle Fleets from loading specific Requirement Types.

Field Name	Description
1 Exclusion Label	Label for a user-defined combination of factors to exclude cargo loading at POEs and unloading at PODs
2 Node Excluded for Loading	Excluded node for loading and offloading, if any (blank if not applicable, i.e., this exclusion applies to all nodes and is independent of node)
3 Facility Type Excluded	Excluded facility type for loading and offloading, if any (blank if not applicable, i.e. exclusion record applies to all facility types or is independent of facility type)
4 Requirement Type Excluded	Excluded requirement type, if any (blank if not applicable)
5 Vehicle Type Excluded	Excluded vehicle type, if any (blank if not applicable)
6 Planning Fleet Excluded	Excluded planning fleet, if any (blank if not applicable)
7 Theater Excluded	Excluded theater, if any (blank if not applicable)
8 Cargo Category Excluded	Excluded cargo category, if any (blank if not applicable)
9 Mode Excluded	Excluded transport mode, if any (blank if not applicable)

Figure 4-41. Data Elements for the Exclude Table.

4.6 Basic Data Table Outputs

The primary outputs of the GDAS simulation model are the vehicle schedules and the cargo loads. The basic database tables which store this data are shown in the diagonal boxes with solid lines in Figure 4-42.

Other directly related input tables are shown in boxes with dashed lines. The basic table hierarchy along the diagonal shows that each Vehicle can make multiple Trips; each Trip can have multiple pickup and delivery Stops at node facilities; each Stop can have multiple Cargos for loading or unloading; and each Cargo can have multiple Cargo Loads on different Vehicle Compartments.

Unlike the database input tables, the basic model output data tables are keyed on an arbitrary record number identifier. Thus vehicles, trips, stops, and cargos are each identified by a unique number.

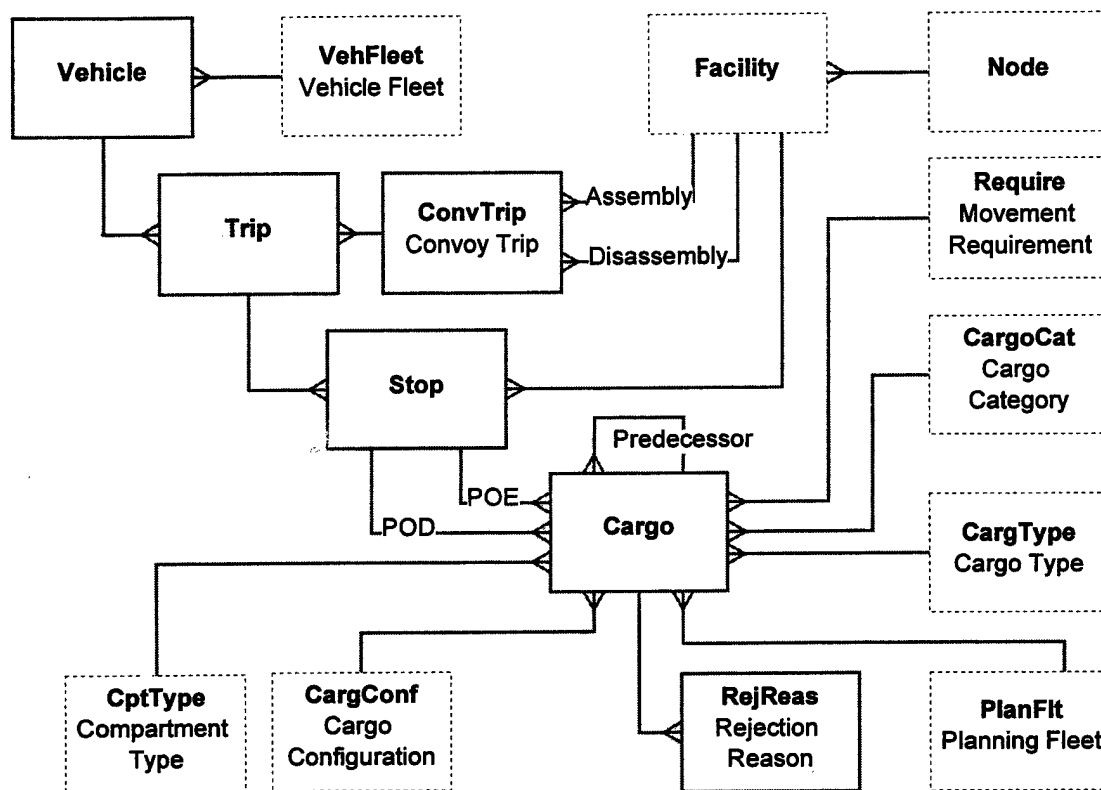


Figure 4-42. Basic GDAS Output Tables for Vehicle Schedules and Cargos

4.6.1 Vehicle

The Vehicle table is derived from the VehFleet table and is an output, not an input. The GDAS scheduling model tracks each Vehicle separately, so as a first step it takes each VehFleet record and “clones” the individual vehicles based on the Number of Vehicles available. One of the outputs of the model is a complete listing of each unique Vehicle with its unique Vehicle Number. Many of these vehicles have the same characteristics (as specified in the VehFleet, VehData, and VehType tables) but are scheduled on different trips, stops, and cargos.

Field Name	Units	Description
Vehicle Number		Vehicle unique sequential number
Vehicle Type		Vehicle type
Vehicle Identifier		Vehicle identifier
Vehicle Fleet		Vehicle fleet for this vehicle
Computed Latitude	deg min H	Current latitude computed for the current date and time in the Param table
Computed Longitude	deg min H	Current longitude computed for the current date and time in the Param table

Figure 4-43. Output Data Elements for the Vehicle Table.

4.6.2 Trip

A Trip in GDAS is defined as a sequence of two or more port Stops in which the Vehicle starts out empty, travels to multiple pickup and delivery ports, and finishes empty with no cargo onboard. Thus, a Trip represents a voyage for sealift or a flight for airlift. Each trip has an itinerary consisting of at least two Stops.

Field Name	Description
1 Trip Number	Trip number
2 Vehicle	Vehicle assigned to this trip
3 Convoy Trip Number	Convoy trip number this voyage is assigned to, if any (if a trip has multiple convoys between different stops, only the last convoy trip is stored here)
4 Number of Vehicle Trips	Number of vehicle trips assigned to this trip

Figure 4-44. Output Data Elements for the Trip Table.

4.6.3 Stop

A Stop represents a POE or POD port visit on a trip. A Stop occurs at a single Facility in which a Vehicle performs loading or unloading of cargos, but not both. (If a trip has both loading and unloading at a single port, multiple Stop records are created at that port.) Each stop has one or more Cargos for loading or unloading. Each Cargo has exactly two stops, one for loading and one for unloading.

A Stop has an arrival and departure time, which is tracked by hour in the model but stored as Days in the database. This permits the model to evaluate the cumulative effects of hourly differences such as load rates, but the output schedules are reported by Day consistent with the accuracy of the data inputs. Currently, all of the data inputs for Ready to Load Day (RLD), Required Delivery Day (RDD), Vehicle Start Day, etc. are accurate only to the nearest day, not to the hour.

Field Name	Units	Description
1 Stop Number		Unique stop number for this port or node facility visit
2 Arrive Day	day	Arrive day at the stop port if a facility is available (the actual arrive day can be delayed further by facility constraints)
3 Node		Node at which the stop is made
4 Facility Name		Port or node facility at which the stop is made, if node is an airport or seaport
5 Depart Day	day	Depart day from the stop port
6 Is Unload?		"Yes" flag to indicate that a stop is for unloading, otherwise blank
7 Hours Wait for Facility	hr	Hours vehicle spent waiting for port facilities and throughput capacity to arrive or depart
8 Trip Number		Trip number associated with this stop

Figure 4-45. Output Data Elements for the Stop Table

4.6.4 Cargo

A Cargo represents all or part of a single Movement Requirement and Cargo Category that is loaded onto one Vehicle Trip. A Cargo is associated with a unique Movement Requirement, Cargo Category, and Cargo Type. The Quantity of the Cargo is specified in the Basic Quantity Measure (Ston, Cbbl, Pax, TEU, etc.) for its Cargo Category. Each Cargo is loaded into one Vehicle Compartment at one POE Stop and unloaded at one POD Stop, possibly in conjunction with other Cargos at the same Stop or on the same Trip. Each Cargo has one Predecessor Cargo for the previous Transport Mode, except for the initial pickup at the Origin Node. Each Cargo can be split into one or more Successor Cargos for the next Transport Mode, except for the final delivery to the Destination Node. Successors are identified from Predecessor linkages.

Field Name	Units	Description
1 Cargo Number		Cargo or shipment number
2 Requirement Id		Requirement identifier for this cargo
3 Cargo Category		Cargo category which describes the kind of cargo being transported
4 Cargo Configuration		Cargo configuration which is used to package the cargo for transport on one or more modes
5 Cargo Type		Cargo type for this cargo
6 Load Stop Number		Load stop number for this cargo (in the model after planning prior to scheduling, this is the node number)
7 Unload Stop Number		Unload stop number for this cargo (in the model after planning prior to scheduling, this is the node number)
8 Cargo Basic Quantity	Q	Cargo quantity in the basic unit of measure for its cargo class (ston, pax, cbbl)
9 Compartment Type		Vehicle compartment into which this cargo was loaded
10 Begin Load Day	day (hr)	Day that the cargo begins loading (in the model prior to simulation, this is the earliest possible load time based on RLD or predecessor cargo or earliest theater depart minus 10)
11 End Load Day	day (hr)	Day that the cargo completes loading (in the model prior to simulation this is the target lift time or planned begin load time)
12 Begin Unload Day	day (hr)	Day that the cargo begins offloading (in the model prior to simulation, this is also the earliest possible unload time based on EDD for final destination cargos)
13 End Unload Day	day (hr)	Day that the cargo is scheduled to complete offloading (this is updated during planning, scheduling, and simulation)
14 Is Attritted?	T/F	Checked or True if the cargo is attritted in the last run results, otherwise False
15 Attrit Probability %%	%%	Calculated cumulative probability of attrition (in %% or ten thousandths) for the cargo based on its route and schedule and including the probability of attrition of prior cargos
16 Cargo Predecessor		Unique predecessor cargo which immediately precedes this cargo and carries the same requirement (zero for an origin cargo)
17 Cargo Split Id		Cargo split identifier consisting of the Requirement Id as prefix, followed by each successive Cargo Number which precedes this Cargo Number
18 Planning Fleet		Planning fleet selected by mode planning to move the cargo
19 Is Final?	T/F	Checked or True if cargo is the last leg to the final destination
20 Order Number		An order number that is assigned if the cargo is a resupply record, matching an order in RptSupSt

Figure 4-46. Output Data Elements for the Cargo Table

4.6.5 Rejection Reason

Some Cargos may not be successfully planned or scheduled by the GDAS model. These Cargos are listed in the Rejection Reason table, RejReas, together with a list of rejection reasons and frequency. This is extremely useful in identifying data problems or scenario difficulties which prevent successful delivery.

Field Name	Description
1 Cargo Number	Cargo number that is delayed or rejected
2 Rejection Type	Rejection reason type
3 Rejection Count	Count of rejections for this cargo and rejection reason type

Figure 4-47. Output Data Elements for the Rejection Reason Table (RejReas).

4.6.6 Convoy Trip

GDAS has the ability to model convoy operations between Theaters, normally used for Sealift. If conveying is performed, then several Vehicle Trips may be assigned to a single Convoy Trip with its associated escorts. These Convoy Trips are listed in the ConvTrip table.

4.6.7 Generation of Reports

Numerous other derived tables are generated to provide both summary and detail reports. The detail reports include Vehicle Stop Itineraries (RptStop), Vehicle Stop Itineraries with Cargo (RptVeh), Facility Cargo Arrivals (RptFacil), Movement Requirement Cargos (RptReq), and Cargo Predecessor/Successor Linkages (RptCargo). Many of the summary reports provide daily total profiles, including Vehicles in Use (RptVehDy), Required versus Delivered Cargo Totals (RptTotal by Major Unit, RptTotS by Requirement Class), Daily Facility Throughput Capacity (RptFCap), Daily Facility Vehicle Handling (RptFVeh), and Daily Measures of Effectiveness (RptMoe, RptMoeS). For example, Figure 4-48 lists the fields for the Required Versus Delivered Total Report Table (RptTotal).

Field Name	Units	Description
1 Theater		Theater
2 Major Unit		Major unit for this total delivery record
3 Cargo Measure		Cargo quantity measure (ston, pax, cbbl, mton, sq ft)
4 Delivery Day	day	Delivery day
5 Daily Quantity Required	Q	Incremental quantity required on this day
6 Daily Quantity Delivered	Q	Incremental quantity delivered on this day
7 Cumulative Required	Q	Cumulative quantity required by this day
8 Cumulative Delivered	Q	Cumulative quantity delivered by this day
9 Daily % Required	%	Incremental % of total major unit quantity required on this day
10 Daily % Delivered	%	Incremental % of total major unit quantity delivered on this day
11 Cumulative % Required	%	Cumulative % of total major unit quantity required by this day
12 Cumulative % Delivered	%	Cumulative % of total major unit quantity delivered by this day

Figure 4-48. Output Data Fields for the Required Versus Delivered Total Report Table (RptTotal).

4.7 Special Topics

Many special transportation issues and constraints can be addressed in GDAS using additional data tables which have not been addressed in the basic discussion above. These special topics and their related tables/fields can be reviewed in GDAS using the Inputs/Dictionary Topics menu. Such special topics include conveying, attrition, closure calculations, map graphics, special missions, and penalties/priorities. The related data elements for a topic may be stored across several different tables, depending on the database entities that are affected. For example, attrition rates for time-dependent exposure are defined on links in the NodeLink table, whereas probabilities for discrete attrition are defined at nodes in the Node table, and attrition adjustment factors are defined by vehicle type in the VehType table.

4.7.1 Conveying

In both the planning and scheduling phases, conveying is implemented as part of the underlying node/link routing procedures. When a cargo is considered for loading on a conveyable vehicle, the POE and POD is

known, and the vehicle makes the convoy decision based on the policy parameters in the Param table and the Convoy table. The convoy assembly and disassembly nodes must be in different theaters in traveling from origin to destination. Other features that affect convoying include the ship speed (VehData table), the Max Speed Convoyed (Param table) and the Convoy Begin Day (Convoy table) and the Max Diversion Distance.

During simulation, the number of escorts available for each convoy route are tracked to determine the actual convoy departure times. Attrition calculations for convoys are handled using the normal method, taking into account the (possibly different) link attrition rates and node attrition probabilities specified for the convoy routes. Returning ships also use the convoy route and therefore incur convoy delays.

The convoys created in the model are output to the ConvTrip table which identifies each trip in the Trip table that participated in the convoy.

Table	Field	Key?	Domain or Lookup	Units	Description
CONVOY	Convoy Assembly Node	Yes	FACILITY		Assembly node for ships and escorts on this convoy route (normally in the origin theater)
CONVOY	Assembly Facility	Yes	FACILITY		Assembly facility for ships and escorts on this convoy route
CONVOY	Convoy Disassembly Node	Yes	FACILITY		Final disassembly node for ships and escorts on this convoy route (normally in the destination theater)
CONVOY	Disassembly Facility	Yes	FACILITY		Final disassembly facility for ships and escorts on this convoy route
CONVOY	Convoy Route Type		ROUTTYPE		Convoy route type which can accommodate all ships in the convoy
CONVOY	Convoy Speed		1,99	knot	Speed at which all convoy ships travel on this convoy route
CONVOY	Convoy Delay Hours		HoursDelay	hr	Additional convoy transit delay time in hours for management operations, diversions, assembly and disassembly operations, etc. after the convoy assembly day and before the convoy disassembly
CONVOY	Convoy Interval Days		DaysDelayToHr	day	Minimum time interval in days between scheduled convoy departures
CONVOY	Convoy Min Vehicles		0,999		Minimum number of ships permitted in a convoy trip
CONVOY	Convoy Max Vehicles		0,999		Maximum number of ships permitted in a convoy trip
CONVOY	Max Vehicle Wait Days		DaysDelayToHr	day	Maximum ship waiting time to assemble a minimum size convoy beyond which the ship sails independently
CONVOY	Link Attrit Multiplier %		%	%	Convoy link attrition multiplier for ships in this convoy
CONVOY	Node Attrit Multiplier %		%	%	Convoy node attrition multiplier for ships in this convoy
Param	Scenario Name	Yes	A8		Scenario short name and directory name
Param	Do Convoying?		Yesflag		Yes if convoying is to be performed using the CONVOY table, blank otherwise
Param	Do Convoy At Intervals?		Yesflag		Yes if convoys are to be scheduled at regular intervals independent of convoy size (convoys can then be scheduled more efficiently)
Param	Convoy Begin Day		DayToHr	day (hr)	Day that convoy operations begin
Param	Max Speed Convoyed		1,99	knot	Max speed limit above which ships are not convoyed and instead travel independently
Param	Max Convoy Diversion		Short>=0	nmi	Max diversion distance above which ships are not convoyed and instead travel independently

Figure 4-49. Input Data Tables and Fields Related to Convoying.

Table	Field	Domain or Lookup	Units	Description
CONVTRIP	Convoy Trip Number	Record# Vehicle		Convoy trip number
CONVTRIP	Convoy Assembly Node	CONVOY		Assembly node for this convoy trip
CONVTRIP	Assembly Facility	CONVOY		Assembly facility for this convoy trip
CONVTRIP	Convoy Disassembly Node	CONVOY		Final disassembly node for ships and escorts on this convoy trip
CONVTRIP	Disassembly Facility	CONVOY		Final disassembly facility for ships and escorts on this convoy trip
CONVTRIP	Convoy Assembly Day	DayToHr	day (hr)	Depart day of the convoy at the assembly point
CONVTRIP	Convoy Disassembly Day	DayToHr	day (hr)	Depart day of the ships in the convoy at the disassembly point
CONVTRIP	Convoy Size	1,99		Number of ships in the convoy
CONVTRIP	Number of Escorts	1,99		Number of escorts in the convoy
TRIP	Trip Number	Record# BigStop		Trip number
TRIP	Convoy Trip Number	CONVTRIP		Convoy trip number this voyage is assigned to, if any (if a trip has multiple convoys between different stops, only the last convoy trip is stored here)

Figure 4-50. Output Data Tables and Fields Related to Convoying.

4.7.2 Attrition

In GDAS, the travel routes and distances between ports for each ship and aircraft are expressed in terms of nodes and links on an intermodal transportation network. The general approach for attrition is to decompose the overall attrition effects into individual attrition submodels at each air and sea port and on each travel link between ports. By associating attrition rates with each port and link separately, the analyst has tremendous flexibility to define the geographic level of detail by adding links or changing individual link probabilities. In addition, the time variation capability of GDAS provides the capability to change any or all attrition rates over time. For modeling flexibility, the attrition factors for links represent exposure rates (i.e., slower travel times yield greater attrition), whereas the attrition factors for nodes represent discrete probabilities per visit. The attrition rates can be scaled by aircraft or ship type to represent different protection, detection, or vulnerability characteristics.

An example of the attrition probability calculations is provided below:

Formulas

link attrition probability =

$$1 - \exp(-(\text{link attrition rate/day}) * (\text{travel time in days}))$$

node attrition probability =

(discrete node attrition probability applied when leaving the node)

Sample Data

cargo moves via "Airlift" on a single link from "Charleston" to "Jacksonville"

link data: link distance = 180 mi

link delay = 2 hr

travel speed = 450 mph

link attrit rate = 200 %%/day = .2/day ("%%" denotes a % of a % or .0001)

node data: discrete node attrition probability of 10% at "Charleston"

Sample Attrition Calculations

travel time

$$180 \text{ mi} / 450 \text{ mph} + 2 \text{ hr} = 2.4 \text{ hr} = .1 \text{ day}$$

link attrition probability =

$$= 1 - \exp(-.2/\text{day} * .1 \text{ day})$$

$$= 1 - \exp(-.02)$$

$$= .0198 \quad (\text{or } \sim 2\%)$$

node attrition probability = .1 (or 10%)

total probability of attrition

$$= 1 - (\text{probability of not being attrited})$$

$$= 1 - (\text{probability of no node attrition}) * (\text{probability of no link attrition})$$

$$= 1 - (1 - \text{node attrit probability}) * (1 - \text{link attrit probability})$$

$$= 1 - (.9) * (.9802)$$

$$= .1178 \quad (1178 \text{ %% is stored in the database, where "%%" is a \% of a \% or .0001})$$

During simulation, the future model will attrit vehicles using the input attrition data, removing attritted vehicles from the scheduling problem after completion of the voyage (i.e., after cargo has been off-loaded at the POD), and identifying the cargo loaded on the attritted vehicle. The attritted cargo is still recorded in the database with delivery and closure dates as if it had not been on the attritted vehicle. Queries and reports can be generated to display the attritted cargos for any given run.

An "expected value" form of the attrition calculation is available for analyzing the results of a single run. After completion of a simulation run, a "conditional expected value" calculation processes all cargo delivered during the simulation (including the cargo on attritted vehicles) using the attrition rates which were effective on the links at the time the cargo moved from POE to POD. This conditional expected value determines the probability of attrition for each cargo and calculates the expected amount of cargo that is delivered based on the node/link route and itinerary of each cargo.

Table	Field	Key?	Domain or Lookup	Units	Description
CONVOY	Convoy Assembly Node	Yes	FACILITY		Assembly node for ships and escorts on this convoy route (normally in the origin theater)
CONVOY	Assembly Facility	Yes	FACILITY		Assembly facility for ships and escorts on this convoy route
CONVOY	Convoy Disassembly Node	Yes	FACILITY		Final disassembly node for ships and escorts on this convoy route (normally in the destination theater)
CONVOY	Disassembly Facility	Yes	FACILITY		Final disassembly facility for ships and escorts on this convoy route
CONVOY	Link Attrit Multiplier %		%	%	Convoy link attrition multiplier for ships in this convoy
CONVOY	Node Attrit Multiplier %		%	%	Convoy node attrition multiplier for ships in this convoy
NODE	Node Name	Yes	A15		Node name corresponding to a port, transshipment point, origin, destination, routing point etc.
NODE	Attrit Probability %%		0,9999	%%	Discrete probability of attrition or breakdown when departing this node
NODELINK	From Node	Yes	NODE		From node name
NODELINK	To Node	Yes	NODE		To node name
NODELINK	Transport Mode	Yes	MODE		Transport mode for this link (only one link is permitted for each mode; multiple links can be created by adding nodes)
NODELINK	Attrit Daily Rate %%		0,9999	%%/day	Attrition or breakdown rate on this link for exposure-based attrition
Param	Scenario Name	Yes	A8		Scenario short name and directory name
Param	Do Attrition?		Yesflag		Yes if attrition or breakdown is to be performed, blank otherwise
Param	Random Number Seed		Short>=0		Random number seed for stochastic simulations including attrition
ReqType	Requirement Type	Yes	A15		Requirement type or unit type
ReqType	Regeneration Delay Days		DaysDelayToHr	day (hr)	Nonzero delay days to regenerate attritted cargo for this requirement; cargo is regenerated with the same data as the original movement (blank means no regeneration)
VEHTYPE	Vehicle Type	Yes	SHAPE		Vehicle type name, e.g. Breakbulk for sealift, C-17 for airlift, etc.
VEHTYPE	Link Attrit Multiplier %		%	%	Attrition adjustment multiplier applied to the link attrition or breakdown rate for this vehicle type while in transit (blank or 0 is treated as 100%)
VEHTYPE	Node Attrit Multiplier %		%	%	Attrition adjustment multiplier applied to the node attrition or breakdown rate for this vehicle type while at the node (blank or 0 is treated as 100%)

Figure 4-51. Input Data Tables and Fields Related to Attrition (%% denotes a % of a % or .0001).

Table	Field	Key?	Domain or Lookup	Units	Description
Cargo	Cargo Number	Yes	Record# BigStop		Cargo or shipment number
Cargo	Is Attritted?		Yesflag		Yes if the cargo is attritted in the last run results, blank otherwise
Cargo	Attrit Probability %%		0,9999	%%	Calculated cumulative probability of attrition (in %% or ten thousandths) for the cargo based on its route and schedule and including the probability of attrition of prior cargos
RPTREQ	Requirement Id	Yes	Require		Movement requirement or package id
RPTREQ	Basic Quantity Measure	Yes	MEASURE		Basic unit of measure for reporting (ston, pax, cbb)
RPTREQ	Cargo Number	Yes	Cargo		Cargo or shipment number
RPTREQ	Is Attritted?		Yesflag		Yes if the cargo is attritted in the last run results, blank otherwise
RPTREQ	Attrit Probability %%		0,9999	%%	Calculated cumulative probability of attrition (in %% or ten thousandths) for the cargo based on its route and schedule and including the attrition of predecessor cargos
RPTREQ	Expected Quantity		reqqn		Expected delivery quantity for display, computed as the cargo quantity times the attrition probability
VEHICLE	Vehicle Number	Yes	Record# Vehicle		Vehicle unique sequential number
VEHICLE	Attrit or Damage Day		DayToHr	day (hr)	Last attrit or breakdown day for this vehicle, if any

Figure 4-52. Output Data Tables and Fields Related to Attrition (%% denotes a % of a % or .0001).

4.7.3 Closure Calculations

Database tables and fields related to closure calculations are listed in Figure 4-53. A unit is considered "closed" when the specified Closure Required Cargo % and the Closure Required Pax % arrive at the destination. If the required percentages are set to 100%, then all of the units requirements must be delivered to count as closed.

Table	Field	Key?	Domain or Lookup	InOut	Units	Description
CARGCLAS	Cargo Class	Yes	A15	Input		Cargo class (Dry, Pax, POL) which defines dimensional measures for cargo
CARGCLAS	Is Pax?		Yesflag	Input		Yes if the cargo class represents passengers, used to compute closure based on the MAJUNIT % closure criteria
MAJUNIT	Major Unit	Yes	A20	Input		Major unit name for analysis of requirement closures and measures of effectiveness
MAJUNIT	Computed Closure Day		DayToHr	Output	day (hr)	Closure day for the major unit based on both the Pax and cargo closure minimum % specified in the ReqType table
MAJUNIT	Closure Required Cargo %		%	Input	%	Minimum percent of the cargo which must be delivered in order to calculate unit closure (if the % is never attained, closure is based on the last portion delivered)
MAJUNIT	Closure Required PAX %		%	Input	%	Minimum percent of the passengers which must be delivered in order to calculate unit closure (if the % is never attained, closure is based on the last portion delivered)
ReqType	Requirement Type	Yes	A15	Input		Requirement type or unit type
ReqType	Assembly Delay Days		DaysDelayToHr	Input	day (hr)	Additional assembly delay days needed after delivery at the destination used to calculate closure and lateness relative to the RDD
Require	Requirement Id	Yes	A15	Output		Movement requirement or package id
Require	Computed Closure Day		DayToHr	Output	day (hr)	Closure day for the requirement based on the closure minimum % requirement specified in the ReqType table
RPTREQ	Requirement Id	Yes	Require	Output		Movement requirement or package id
RPTREQ	Basic Quantity Measure	Yes	MEASURE	Output		Basic unit of measure for reporting (ston, pax, cbb1)
RPTREQ	Cargo Number	Yes	Cargo	Output		Cargo or shipment number
RPTREQ	Computed Closure Day		DayToHr	Output	day	Closure day for the requirement based on the closure minimum % requirement specified in the ReqType table

Figure 4-53. Data Tables and Fields Related to Closure Calculations.

4.7.4 Map Graphics

Data tables and fields related to the world map graphics are listed in Figure 4-54. All aspects of the drawing display can be controlled, including layers, colors, shapes, and sizes. In general, these parameters can be left at their defaults unless a particular graphical effect is desired.

Table	Field	Is Key?	Domain or Lookup	Description
MapColor	1 Color	Yes	A15	Name of the color for mapping
MapColor	2 Red Intensity	No	Byte $\geq$ 0	Red intensity for the color
MapColor	3 Green Intensity	No	Byte $\geq$ 0	Green intensity for the color
MapColor	4 Blue Intensity	No	Byte $\geq$ 0	Blue intensity for the color
MapFont	1 Font Name	Yes	A50	Windows Font (or MapInfo Helvetica, Courier, Times)
MapFStyl	1 Font Style	Yes	A25	Name of Font style
MapFStyl	2 Style Value	No	Short $\geq$ 0	MapInfo value for this Font style
MapLayer	1 Layer ID	Yes	Table Any Case	The unique layer ID (generated as a table in the mapping application)
MapLayer	2 Layer Label	No	Menu Item	Layer description used in the mapping application menus
MapLayer	3 Map Table	No	MapTable	Lookup into the MapTable table for the original table
MapLayer	4 Layer Value	No	A255	The Layer Field value for this layer
MapLayer	5 Begin Off	No	Boolean	True if the layer display should be off initially
MapLayer	6 Symbol Type	No	MapSymbol	The mapping symbol shape or line type
MapLayer	7 Symbol Color	No	MapColor	The color of the symbol
MapLayer	8 Symbol Size	No	0,48	The point size of the node symbol or line width
MapLayer	9 Symbol Min Scale	No	Short $\geq$ 0	The minimum scale (closest in) for which this layer is displayed, express as width of view in miles
MapLayer	10 Symbol Max Scale	No	Short $\geq$ 0	The maximum scale (farthest out) for which this layer is displayed, expressed as width of view in miles
MapLayer	11 Label Font	No	MapFont	The font type for the layers labels
MapLayer	12 Label Style	No	MapFStyl	The font style for the layer labels
MapLayer	13 Label Color	No	MapColor	The font color for the layer labels
MapLayer	14 Label Size	No	Short $\geq$ 0	The font point size for the layer labels
MapLayer	15 Label Min Scale	No	Short $\geq$ 0	The minimum scale for which the label is displayed, expressed as width of image in miles
MapLayer	16 Label Max Scale	No	Short $\geq$ 0	The maximum scale for which the label is displayed, expressed as width of image in miles
MapLine	1 Line	Yes	A25	A line type
MapLine	2 Line Value	No	Byte $\geq$ 0	The MapInfo numeric value for this line type
MapNode	1 Node Name	Yes	Node	Node name or location extracted from NODE for the world map display
MapNode	2 Node Type	No	NodeType	Node type for world map graphics display
MapNode	3 Node Latitude	No	Lat	Node latitude (positive is North, negative is South)
MapNode	4 Node Longitude	No	Lon	Node longitude (positive is East, negative is West)
MapNode	5 Is Node Disabled?	No	Boolean	Checked or True if the node is disabled, otherwise False
MapShape	1 Shape	Yes	A25	A shape type
MapShape	2 Character Value	No	Byte $\geq$ 0	The MapInfo numeric value for this symbol shape
MapShape	3 Font Name	No	MapFont	The font name of a symbol shape
MapShape	4 Font Style	No	MapFStyl	The font style for this symbol shape and character value
MapSymbol	1 Map Type	Yes	MapType	The type of mapping display appropriate for the symbol (Node or Link)
MapSymbol	2 Symbol	Yes	A25	A symbol available for the mapping levels, either a shape for nodes or a line type for links
MapType	1 Map Type	Yes	A10	Available mapping display types
Node	2 Node Type	No	NodeType	Node type for world map graphics display
Node	3 Node Latitude	No	Lat	Node latitude (positive is North, negative is South)
Node	4 Node Longitude	No	Lon	Node longitude (positive is East, negative is West)

NodeType	1 Node Type	Yes	A15	Node type for world map display
Param	3 Vehicle Snapshot Day	No	simendday	Current day used to interpolate vehicle locations for the world map display
Param	4 Vehicle Snapshot Hour	No	Hour	Current hour used to interpolate vehicle locations for the world map display
Vehicle	8 Computed Latitude	No	Lat	Current latitude computed for the current date and time (positive is North, negative is South)
Vehicle	9 Computed Longitude	No	Lon	Current longitude computed for the current date and time (positive is East, negative is West)

Figure 4-54. Data Tables and Fields Related to World Map Graphics.

4.7.5 Planning and Scheduling Penalties and Priorities

The mode planning process routes a movement requirement from an assigned starting node (either the initial origin, or an intermediate origin which represents the end node of a previously scheduled cargo) through the transportation network to its final destination, possibly through several modes of transportation. The planning process uses notional travel times and delays set in the Mode table, without treating individual vehicle assignments. The planning methodology uses a node-oriented shortest path type algorithm as a outer framework, but actually uses forward-reaching dynamic programming to evaluate alternate states at each node since multiple penalty criteria must be evaluated as well as linking dependencies to other scheduled cargo.

The planning process uses the same types of penalty factors for cargo delivery timeliness as scheduling, but relies on generic vehicle use penalties specified for each transportation mode in the Mode table. Once the preferred transportation network path has been identified by the dynamic programming algorithm, back-tracking is used from the destination RDD to set a Target Lift Date (TLD).

Scheduling evaluates each candidate lift vehicle with preliminary screening tests to ensure that the cargo and vehicle are compatible, the vehicle can visit the cargo ports, and that special mission considerations are compatible. If the vehicle passes the screening tests, then a more detailed route insertion algorithm is executed to select load and unload stops in the vehicle route and to estimate marginal insertion penalties for the entire vehicle itinerary. Finally, the vehicle with the least cost/benefit ratio is selected for assignment.

The scheduling then performs a different perspective in which it evaluates other promising cargo assignments for the same vehicle from the same POE port. The candidate cargos are evaluated using the same insertion algorithm and penalties as before, but only those cargo/vehicle assignments with marginal cost/benefit less than the value of the Cost/Benefit Threshold in the Reqtype table for that Requirement Type, are immediately assigned to the vehicle. This second evaluation allows a quicker load out of the vehicle and improves the overall efficiency of the scheduler.

Table	Field	Domain or Lookup	Description
Param	7 Do Static Resupply?	Boolean	True if static resupply requirement generation is to be performed (can be set False to re-use the dynamic resupply computed from a prior run)
Param	17 Personnel Lead Days	DaysDelayToHr	Earliest lead time that personnel can arrive prior to other cargo in the same requirement
PlanFlt	6 Planning Ton-Hour Penalty	1,999	Nominal penalty per ton per hr for transport via this vehicle type for planning routes and target lift dates
PlanFlt	12 Route Delay Penalty	Short $\geq$ 0	Penalty for the delay of prescheduled stops when inserting new stops, the input value is the penalty of one day delay in cents, with increasing cost for greater delays
ReqType	4 Planning Horizon Days	DaysDelayToHr	Planning or look-ahead horizon in days for scheduling cargos of this requirement type prior to their target lift date
ReqType	8 RDD Tolerance	DaysDelayToHr	Days tolerance for lateness at the destination relative to the RDD before mode planning increases delivery cost to reduce lateness
ReqType	9 Max Days Late	DaysDelayToHr	Days late relative to the target delivery date beyond which a cargo is rejected in scheduling and is reported with rejection reasons, even if the penalty is acceptable
ReqType	10 Cargo Lateness Penalty	0,100	Penalty for cargo ton-days of lateness (as compared with vehicle usage penalties) in the scheduling algorithm
ReqType	11 Penalty/Benefit Cut-off	Long $\geq$ 1	Cost cut off level above which a potential cargo assignment is rejected early in the multi-port scheduling algorithm (blank or a large value means no cutoff)
ReqType	12 Early Assignment Level	Short $\geq$ 0	Threshold penalty/benefit level below which a potential cargo/ship assignment is accepted immediately in the multi-port scheduling algorithm (a large value reduces run time but may make a selection before costing a preferred vehicle)
ReqType	14 Default Priority Order	1,99	Default priority order for this requirement type if not specified for a given requirement (1 is the earliest priority order; blank is treated as no priority or as 99)
ReqType	16 Integrity Benefit	DaysDelayToHr	Wait days benefit indicating a preference for loading identical Requirement Id's onto the same vehicle trip
Require	7 EDD	DayToHr	Earliest allowed delivery day of the requirement at its destination prior to assembly
Require	9 Priority Order	1,99	Relative priority order for this requirement as a secondary sort after the Target Lift Date (one means first priority in assigning lift assets, blank defaults to the priority order of the requirement type)
StowPen	4 Stow Penalty	Short $\geq$ 0	Stow penalty per unit basic quantity of cargo for loading into this vehicle compartment
SuppReq	8 Priority Order	1,99	Scheduling priority order when generation movement requirements for resupply
VehFleet	12 New Vehicle Penalty	Short $\geq$ 0	Penalty for the first use of a new vehicle of this type and fleet
VehType	5 Time Penalty	0,999	Penalty for vehicle usage per hour, used to compare with cargo lateness in the scheduling algorithm
VehType	6 Greedy Vehicle Level	Short $\geq$ 0	Limit on the acceptable cost/benefit ratio for a greedy vehicle trying to get additional cargo immediately after an assignment
VFacType	6 Facility Visit Penalty	Short $\geq$ 0	Penalty for multi-facility visits on a single trip, used in the scheduling algorithm (the first POE and POD facilities on a new trip are not penalized)

Figure 4-55. Data Tables and Fields Related to Penalties and Priorities.

4.7.6 Special Missions

Special missions permit the explicit assignment of certain vehicles or vehicle fleets to certain movement requirements for a specified period of time. Data tables and fields related to special missions are listed in Figure 4-56.

Table	Field	Is Key?	Domain or Lookup	Description
Mission	1 Special Mission	Yes	A15	Name of a special mission, e.g. Marine amphibious task force, or crane ship, or other mission
Mission	2 Mission Begin Day	No	DayToHr	Begin day that a designated special mission ship or fleet is restricted to matching special-mission requirements only
Mission	3 Mission End Day	No	DayToHr	End day that a designated special mission ship or fleet is restricted to matching special-mission requirements only
Mission	4 Delay Hours After Offload	No	HoursDelay	Additional delay hours in the depart time after offload of special mission cargo at its ultimate destination node (delays the vehicle at the stop, not the cargo delivery)
ReqMiss	1 Requirement Id	Yes	Require	Movement requirement having a special mission
ReqMiss	2 Cargo Class	Yes	CargClas	Cargo class to which the special mission applies (Dry, Pax, etc.)
ReqMiss	3 Mode	Yes	Mode	Transport mode to which the special mission applies
ReqMiss	4 Special Mission	No	Mission	Special mission for this requirement, cargo class, and transport mode
VehFleet	1 Vehicle Type	Yes	VehData	Vehicle type
VehFleet	2 Vehicle Identifier	Yes	VehData	Vehicle identifier, such as ship name or aircraft squadron, for this starting location, vehicle type, and fleet
VehFleet	3 Vehicle Fleet	Yes	FleetVehTypeFleet	Fleet identifier for this starting location
VehFleet	11 Special Mission	No	Mission	Special mission which restricts this fleet to matching special mission movement requirements for a designated period of time

Figure 4-56. Data Tables and Fields Related to Special Missions.

4.7.7 Prescheduled Stops

As discussed previously, each Planning Fleet can be assigned a prescheduled stop itinerary, including cyclical liner routes that are automatically duplicated and expanded into multiple trips. This automatic replication saves considerable data entry for multiple cycles and vehicles. Any prescheduled stops that are defined for the Planning Fleet, as listed in the StdStop table for that fleet, are generated and expanded prior at the beginning of the model run and are retained in the final schedule. For example, the DOD Voluntary Intermodal Sealift Agreement (VISA) program makes use of commercial liner routes which have preset, cyclical itineraries. Each prescheduled itinerary is listed as a separate Planning Fleet and assigned cyclical stops in the StdStop table.

All of the ships in a given Planning Fleet are assigned to the same prescheduled stops in StdStop, if they exist. However, the individual ships on a route are typically given different Start Route Offset as specified in VehFleet. For example, in a liner operation one ship may arrive and depart each week, so the Standard Depart Interval is one week and the individual ship Start Route Offsets differ by a week. If the prescheduled stops are cyclical (they start and stop at the same node), then the prescheduled itineraries are automatically repeated over time until the end of the simulation, or until the Start Route Last Day specified in VehFleet. The data tables and fields related to prescheduled stops are shown in Figure 4-57.

Table	#	Field Name	Is Key?	Domain	Units	Description
PlanFlt	1	Planning Fleet	Yes	A15		Aggregation of fleets used for planning modes, ports, cargo configurations, and prescheduled routes
PlanFlt	10	Standard Depart Interval	No	Short>=1	day	Standard depart time interval for a prescheduled route, stored for reference only and not used to generate routes
PlanFlt	11	Stop Arrival Tolerance	No	DaysDelayToHr	day (hr)	Time window tolerance for early or late arrival at the prescheduled stops on this route
PlanFlt	12	Route Delay Penalty	No	Short>=0		Penalty for the delay of prescheduled stops when inserting new stops, the input value is the penalty of one day delay in cents, with increasing cost for greater delays
PlanFlt	13	Remain On Route?	No	Boolean	T/F	Checked or True if the prescheduled ship should stay on its prescheduled route only up through the Route Last Day, otherwise False
PlanFlt	14	Description	No	A50		Description of the prescheduled route
StdStop	1	Planning Fleet	Yes	PlanFlt		Planning fleet that has prescheduled stops
StdStop	2	Stop Sequence	Yes	Short>=1		Stop sequence number for this prescheduled planning fleet (stops are assumed to repeat cyclically if the first and last stop have the same node and facility)
StdStop	3	Arrive Day	No	DayToHr	day (hr)	Arrive day offset for this prescheduled stop sequence, starting from zero (the actual stop time is depends on the offset in VEHFLEET and the number of iterations)
StdStop	4	Node	No	Facility		Node associated with this prescheduled stop sequence number
StdStop	5	Facility	No	Facility		Facility associated with this prescheduled stop sequence number
StdStop	6	Depart Day	No	DayToHr	day (hr)	Depart day offset for this prescheduled stop sequence, starting from zero
VehFleet	1	Vehicle Type	Yes	VehData		Vehicle type
VehFleet	2	Vehicle Identifier	Yes	VehData		Vehicle identifier, such as ship name or aircraft squadron, for this starting location, vehicle type, and fleet
VehFleet	3	Vehicle Fleet	Yes	FleetVehType		Fleet identifier for this starting location
VehFleet	9	Start Route Offset	No	-99,999	day	Offset day for this fleet and vehicle for a standard prescheduled starting route cycle
VehFleet	10	Start Route Last Day	No	DayToHr	day (hr)	Last day beyond which the prescheduled starting route is no longer cycled

Figure 4-57. Data Tables and Fields Related to Prescheduled Stops.

An example is helpful to understand the relationships. Suppose a commercial sealift carrier has a liner route called TransPacific using ships named Zeltec, Gateway, Brave Bull, Hornsby, and Adams. The prescheduled stop sequence for the TransPacific route is entered in the StdStop table as shown in Figure 4-58. Note that it is a cyclical route (starts and ends at Seattle), with relative Arrive Day and Depart Day starting at day 0.

Planning Fleet	Stop Sequence	Arrive Day	Node	Facility	Depart Day
TransPacific	1	0	Seattle	Container	2
TransPacific	2	4	Oakland	Container	6
TransPacific	3	10	Honolulu	Container	11
TransPacific	4	19	Guam	Container	20
TransPacific	5	23	Kaohsiung	Container	25
TransPacific	6	35	Seattle	Container	37

Figure 4-58. Prescheduled Liner Route Example

For this route, the ships are assigned to start weekly, 7 days apart. This is specified by setting the Start Route Offset to be 7 days apart for each ship in the VehFleet table. The offset is relative to the 0 Arrive Day for the first stop in Seattle indicated in the standard route in StdStop. If the Start Route Offset numbers are set to values greater than 0, then it would take 28 simulation days before the last vehicle entered the simulation. By assigning negative offsets, each 7 days less than the predecessor ship, the ships can all be underway at various ports in the route when the simulation starts on day 1, as follows:

Vehicle Identifier	Start Route Offset
Zeltec	1
Gateway	-6
Brave Bull	-13
Hornsby	-20
Adams	-27

Figure 4-59. Negative Starting Route Offset for Ships Arriving Every 7 Days.

In this way, all vehicles are in route no later than day 8. Note it is a good idea to wait until all vehicles have made their first stop at a Node before scheduling any cargo to be picked up by them. In addition, the model does not simulate day 0, so the next port have day 0 is the first stop in the simulation.

4.7.8 Static and Dynamic Resupply Generation

GDAS can now generate resupply requirements and schedule them in the global transportation network, based on when units arrive and how much they consume resupply from inventory. The new resupply features are invoked by entering data into several new tables, namely SuppCons (Supply Consumption Rate), SupStore (Supply Storage Inventory), SuppReq (Supply Requirement), and SupQuan (Supply Quantity Density). When you leave these tables empty, GDAS operates as before without any automatic resupply generation. When resupply is generated, GDAS reports the results of dynamic resupply activities in a new report table named RptSupSt (Report Supply Storage). Additional outputs include dynamically generated resupply orders in the Require and ReqQuan tables, as well as scheduled resupply cargos in the Cargo table. Tables and data related to dynamic and static resupply generation are listed in Figure 4-60 and discussed in the paragraphs following.

Table	#	Field Name	Is Key?	Domain	Units	Description
Param	1	Scenario Name	Yes	A8		Scenario short name and directory name
Param	6	Do Dynamic	No	Boolean	T/F	Checked or True if dynamic resupply generation is to
Param	7	Do Static Resupply?	No	Boolean		True if static resupply requirement generation is to be
Param	8	Static Order Interval	No	1,99	day (hr)	Aggregation interval for computing resupply order
ReqType	1	Requirement Type	Yes	A15		Requirement type or unit type
ReqType	17	Is Resupply?	No	Boolean		True or checked if this requirement type is
Require	1	Requirement Id	Yes	A15		Movement requirement or package id
Require	10	Supply Requirement	No	SuppReq		Supply requirement identifier in the SUPPREQ table,
SuppCons	1	Consuming Req	Yes	ReqType		Requirement type that consumes resupply in the
SuppCons	2	Consumption	Yes	Theater		Destination theater in which consumption occurs
SuppCons	3	Consuming Cargo	Yes	CargoCat		Consuming cargo category for estimating consumption
SuppCons	4	Cargo Category	Yes	CargoCat		Supply cargo category that is stored at an inventory
SuppCons	5	Supply	No	0,999	Q/(1000)	Daily consumption rate expressed as supply basic
SuppCons	6	Accompany Days of	No	Byte>=0	Q/(1000)	Accompanying supply quantity in days of supply for
SuppReq	1	Supply Requirement	Yes	A15		Supply requirement identifier for static and dynamic
SuppReq	2	Supply Source Node	No	Node		Resupply origin node
SuppReq	3	Supply Category	No	SupStore		Resupply cargo category
SuppReq	4	Supply Storage	No	SupStore		Resupply storage node or terminal storage location
SuppReq	5	Supply Major Unit	No	MajUnit		Resupply major unit, which has a requirement type
SuppReq	6	Supply Availability	No	DayToHr	day (hr)	Earliest time that resupply can be ordered from this
SuppReq	7	Supply Delivery	No	DayToHr	day (hr)	Notional resupply delivery time or lead time, usually
SuppReq	8	Priority Order	No	1,99		Scheduling priority order when generation movement
SupQuan	1	Supply Requirement	Yes	SuppReq		Supply requirement identifier matching a record in
SupQuan	2	Unit of Measure	Yes	MeasCargQuan		Unit of measure for the resupply category
SupQuan	3	Quantity	No	Long>=0	Q	Relative quantity of resupply in the unit of measure,
SupStore	1	Supply Cargo	Yes	CargoCat		Supply cargo category that is stored at an inventory
SupStore	2	Supply Storage	Yes	Node		Resupply storage node or terminal storage location
SupStore	3	Prepositioned Stock	No	reqqn	Q	Quantity of reserved stock prepositioned at this supply
SupStore	4	Stock Safety Level	No	reqqn	Q	Minimum safe stockpile level, which is used to
SupStore	5	Stock Order To	No	reqqn	Q	Target stockpile level to reorder to when orders are
SupStore	6	Min Order Quantity	No	Long>=1	Q	Minimum order quantity for this supply category in

Figure 4-60. Tables and Fields Related to Resupply Generation.

SuppCons. This table contains the resupply consumption rates. The key fields represent the consumption rate as a function of : the consuming Requirement Type, the Consuming Cargo Category, the Consumption Theater, and the Consumed Cargo Category. Note that any kind of Cargo Category can consume multiple kinds of any other Cargo Category. The consumption rate is measured in basic quantity consumed, per 1000 consuming basic quantity units, per day. For example, if a 5 ton vehicle, measured in basic quantity units of Stons, consumes 1 barrel of POL per day, then the arrival of a cargo containing 1000 Stons of vehicles will begin to consume 200 barrels of POL per day. If you set GDAS to measure POL in basic units of hundreds of barrels per day (CBBL) then you would enter 2 as the consumption rate in the SuppCons table. The Accompany Days of Supply field tells GDAS to add extra resupply to the theater inventory when the consuming requirements arrive at their destinations. When this value is large, you will see the inventory increase on the same day that cargos arrive, at the same time they begin to consume resupply.

SupStore. Each record in the SupStore table describes a storage terminal or inventory location for a consumable cargo category. The Prepositioned Stock represents the amount of cargo at the storage node on the day the scenario begins. The inventory policy for the Supply Storage Node storing a Supply Cargo Category is controlled by the values for Stock Safety Level, Stock Order to Level, and Minimum Order Quantity. When GDAS forecasts that the inventory will go below the safety level within the currently estimated lead-time for shipment, based on the current in-theater consumption rate, GDAS orders enough cargo to bring the inventory up to the Order to Level. GDAS will not order any less than the Minimum Order Quantity. The size of the Order will also be a multiple of the new Discrete Load Increment specified in the CargoCat table.

SuppReq/SupQuan. These tables are analogous to the Require and ReqQuan tables, except that they are “templates” for ordering new resupply requirements. For each resupply cargo category, these tables tell GDAS where the cargo will come from, where it will go to, when it can be available, and an initial estimate of the order lead time used for initial static resupply calculations (the lead time is re-calculated dynamically in GDAS). SupQuan defines relative quantities in appropriate units of measure; the absolute quantities are not important, only the ratios. GDAS derives density ratios from these quantities when generating resupply orders.

ReqType. A new field called “Is Resupply?” has been added to this table. GDAS-generated resupply cargo must have an administrative Requirement Type that is distinct from non-resupply cargo. Such requirements will be overwritten on each simulation run, as GDAS recreates new orders and shipments to sustain inventory in the theater.

Some Cargo Categories can serve as both unit cargo and resupply. For example, roadable vehicles may be included in unit movements, but they can also be re-ordered in the form of resupply or replacements based on unit consumption rates. GDAS uses the Cargo Category to evaluate physical characteristics of the cargo (e.g., in CatMode); it uses the ReqType of the movement to define administrative handling characteristics. This is why the Is Resupply? Field is in the ReqType table. You must set “Is Resupply?” to “Yes” for resupply requirement types that GDAS will generate. Since a resupply requirement type depends on the Major Unit, you need to make sure that all consumed SuppReq records are associated with Major Units that have Requirement Types with the “Is Resupply?” flag set. In addition, you should not specify your own input movement requirements using these same Major Units, since GDAS will overwrite these.

Param. This Param table has three new fields. The “Do Static Resupply?”, if set to Yes, tells GDAS to create static Require and ReqQuan resupply records from the SuppReq and SupQuan tables based on the original unit RDD's. GDAS examines the input movements in Require and ReqQuan, along with the consumption rates in SuppCons, to compute initial static resupply movements over the simulation time horizon. These static requirements are used for initial planning, prior to dynamic ordering and inventory in the theater. The “Static Order Interval” represents an interval of days and tells GDAS how to aggregate resupply quantities for the static calculation.

The “Do Dynamic Resupply?” field, if set to Yes, tells GDAS to create resupply cargos dynamically as needed, based on the consumption rates when the consuming cargos actually arrive.

If “Do Static Resupply?” is blank, GDAS will create resupply cargos from any resupply requirements that are already generated. This feature can be used to feed the dynamic requirements from one run into GDAS as static calculations for the next run. If the “Do Dynamic Resupply?” field is blank, then no dynamic orders are generated as units arrive, and no inventory tracking is performed in the simulation. Instead, the static resupply calculations can be used. And if both fields are blank, then neither static nor dynamic resupply is generated by GDAS just as before, and the SuppReq and SupStore tables are ignored.

RptSupSt. This new output table contains the inventory history for each SupStore inventory location, for each day of the plan. From RptSupSt you can generate charts showing inventory on hand, quantity on order, and cumulative demand rate for each inventory location and cargo category in SupStore, for each day of the plan. SupStore also reports the estimated lead time and the order number if a reorder occurs. The estimated lead-time is the lead-time GDAS uses to dynamically order and schedule a resupply requirement. The order number links the changes in inventory to specific resupply cargos that are generated in the Cargo table. These resupply cargos are matched to generated order records in the Require table, so that all lateness calculations and delivery profiles remain accurate. The dynamic resupply movements do affect both lateness and the delivery profiles.

Appendix A

Summary of Tables

Database Type Reference

Table	Label	Table Edit Type	Description
LateClassExtra	Extra Lateness Classifications	Constant Hide	Stores the standard lateness classifications that are always appended to the RptLate lateness summary report
MapColor	Mapping Colors	Edit	Lists the available colors for mapping objects (shapes and lines)
MapFile	Map File Paths	Edit	Lists the world map file paths
MapFont	Mapping Fonts	Edit	Lists the available fonts for mapping labels
MapFStyl	Mapping Font Styles	Edit	Lists the font styles for mapping labels
MapLine	Mapping Line Types	Constant NoEdit	Lists the available line symbols for map links
MapShape	Mapping Shape Types	Edit	Lists the available shape symbols for map nodes using installed Windows fonts
MapSymbol	Map Layer Display Symbols	Derive	Lists the shape and line symbols by mapping type available for the MapLayer symbols.
MapType	Mapping Table Types	Constant NoEdit	Lists the fundamental mapping table types (Node or Link)
MeasClas	Measure Class	Constant NoEdit	Defines the measurement classes (e.g. Cargo Quantity, Max Cargo Item Dimension, Vehicles Per Day, MOG or # Berths, Vehicle Dimension,
RejType	Rejection Type	Constant NoEdit	Lists the available delay reason types
SchedTyp	Scheduling Type	Constant NoEdit	Lists the scheduling model algorithm types
VaryDist	Vary Distribution	Constant NoEdit	Stochastic or parametric distribution types for sampling data
VaryParD	Vary Parametric Data	Display Only	Lists allowable tables and data fields for users to vary either parametrically or as time variations
VarySavD	Vary Storable Data	Future	Lists the allowable tables and fields which can be saved over multiple parametric or stochastic runs

Database Type Scenario

Table	Label	Table Edit Type	Description
BasMeas	Basic Measure	Edit	Lists basic measures for reporting primary cargo quantities (Ston, Cbbl, Pax); each cargo class has a basic measure used for quantity splits
CargClas	Cargo Class	Edit	Lists the major cargo classes (e.g., Dry, PAX, POL) that define which dimensional measures are applicable to each cargo category and cargo
CargConf	Cargo Configuration	Edit	Lists the cargo configurations used to containerize, package, or modify cargo for transport, and sets the time rate for configuration
CargoCat	Cargo Category	Edit	Lists the cargo categories which specifies the kind of cargo at the most detailed level, often based on JOPES three-position cargo category plus
CargType	Cargo Type	Edit	Lists the cargo types, which define kinds of cargo affecting stow factors, load rates, and load compatibility for a specific mode of
CatGroup	Category Group for Charts	Edit	Defines groupings of cargo categories which can be used to selectively display total quantities in delivery profile charts
CatMeas	Category Measure	Derive	Lists the dimensional measures applicable to each cargo category; generated automatically from the CLASMEAS table to provide a
CatMode	Cargo Category Mode	Keys Full	Lists the conversion of cargo categories to mode-specific cargo types which define stow factors and load rates for each vehicle type
ClasMeas	Cargo Class Measure	Edit	Lists the major classes of cargo and what quantity measures are applicable
Convoy	Convoy	Edit	Specifies information about convoy routes which are to be used for sealift when traveling between the assembly node theater and the
CptMeas	Compartment Measure	Edit	Lists the measures for defining compartment capacity
CptType	Compartment Type	Edit	Defines vehicle compartment types
Exclude	Exclusion	Edit	Sets user-definable exclusions for cargo loading, based on various combinations of factors such as Mode, Vehicle Type, Cargo Category,
FacCap	Facility Capacity	Edit	Specifies facility limits and constraints on cargo throughput for different facility measures
Facility	Facility	Edit	Lists port facilities at nodes
FacType	Facility Type	Edit	Lists the available facility or berth types which are used to define load rates at port facilities
Fleet	Administrative Fleet	Edit	Identifies groups of vehicles with common administrative characteristics for vehicle availability.

LateClass	Late Days Groups	Edit	Defines groups by days late for the RptLate lateness summary report
LinkCap	Node Link Capacity	Edit	Defines the capacity for constrained links and units of measure
LoadRate	Load Rate	Keys Computed	Specifies transfer rates for loading and unloading
MajUnit	Major Unit	Edit	Lists each major unit, which in GDAS is a grouping of requirements, either unit or non-unit, used to display delivery profiles and compute
MapLayer	Mapping Layer Specs	Update	Sets mapping layer characteristics such as color and symbol which can be edited by the user
MapTable	Mapping Table Specs	Hide	Defines the map table specifications
Measure	Measure	Edit	Lists the types of dimensional measures used to define cargo, vehicle compartments, or node facilities
Mission	Mission	Edit	Lists special missions such as TACS, AFOE, etc.
Mode	Mode of Transport	Edit	Lists transportation modes (air, sea, motor, organic, rail, intratheater air, etc.)
Node	Node	Edit	Lists nodes and locations for all ports, origins, destinations, transshipment points, and routing points
NodeCap	Node Capacity	Edit	Defines total throughput at each node for all facilities at the node
NodeLink	Node Link	Edit	Lists single leg links between nodes for transportation
NodeType	Node Type for Mapping	Edit	Lists the node types for world map display
Param	Parameter	Modify	Sets parameters for the scheduling model
PlanFlt	Planning Fleet	Edit	Lists the fleet aggregations used for planning modes, ports, cargo configurations, and pre-scheduled routes
PlnFltTr	Plan Fleet Transfer	Keys Full	Specifies the allowable fleet to fleet transfers
ReqClass	Requirement Class	Edit	Lists the aggregated requirement classes for calculating summary cargo delivery versus required totals for reports
ReqFleet	Required Fleet	Edit	Defines the allowable fleets by mode for a requirement type, if the requirement type is restricted to certain fleets
ReqImprv	Dynamic FacCap Change	Edit	Defines how the delivery of a requirement improves facility throughput

ReqLag	Requirement Link Lag	Edit	Defines timing links between delivery of independent and dependent requirements
ReqMiss	Required Mission	Edit	Lists special missions for requirements, cargo classes, and modes
ReqMode	Excluded Mode by Req	Edit	Lists excluded modes for specific requirements and cargo classes
ReqNImpr	Dynamic NodeCap Change	Edit	Defines how the delivery of a requirement improves node throughput
ReqNode	Required Node	Edit	Lists required intermediate POE or POD nodes or ports for movement requirements with specified staging, POE/POD time frames, and mode
ReqQuan	Requirement Quantity	Edit	Provides quantity data for each movement requirement and cargo category
ReqRet	Requirement Return	Future	Lists requirement return or transfer days, if any, for removing requirements from a theater and eliminating its supply consumption and
ReqType	Requirement Type	Edit	Provides data about requirement types or unit types
Require	Requirement to Move	Edit	Provides information about each movement requirement or package
RoutExcl	Route Exclusion	Edit	Lists excluded facility types for refueling on the various route types
RoutType	Route Type	Edit	Provides route type data for determining vehicle paths, including refueling range, refueling facility requirements, and payload versus
Service	Service	Edit	Lists the U.S. military services
Stage	Stage Location	Future	Lists the staging deployments which have predecessor and successor requirements
StdStop	Standard Stop	Edit	Defines the stop sequence for standard prescheduled routes used in vehicle initialization; the stops repeat cyclically if the first node and
StowFact	Stow Factor	Keys Computed	Specifies the stow factor for each combination of compartment type and cargo type
StowPen	Stow Penalty	Keys Computed	Lists combinations of compartment types and cargo types along with stow penalties
SuppCons	Supply Consumption	Future	Specifies standard daily consumption rates of resupply for consuming requirements
SuppReq	Supply Requirements	Edit	Lists the information needed to generate static and dynamic resupply requirements
SupQuan	Supply Quantities	Keys Computed	Lists the units of measure and relative quantities as density information for generating resupply movements

SupStore	Supply Destination	Edit	Provides data about resupply storage terminals in the theater
Theater	Theater	Edit	Provides data about the theaters
ThtrReq	Theater Require Type	Keys Full	Provides data about passenger weights by theater and requirement type
TimeVary	Time Variation	Edit	Specifies data which changes over time (derived from user inputs in the associated data tables, should not be edited directly)
VaryPar	Vary Parameter	Future	Specifies data elements to be varied parametrically
VarySave	Vary Save Data	Future	Defines data to be saved across multiple runs when data elements have parameter variations or sampling distributions
VaryStat	Vary Sampled Data	Future	Lists tables and data elements which are sampled from a stochastic distribution taking as mean the database value
VCptType	Veh Cpt Type	Edit	Lists the compartments available for each vehicle type
VehCap	Vehicle Capacity	Keys Computed	Defines load capacities for each vehicle identifier, compartment, and unit of measure
VehData	Vehicle Data	Edit	Provides detailed characteristics about each kind of vehicle identified in the system
VehFleet	Vehicle Availability Fleet	Edit	Lists the availability of vehicles by starting location or route, starting time for scheduling, and number of vehicles
VehType	Vehicle Type	Edit	Lists vehicle types by transport mode
VFacDim	Vehicle Dimension Limit	Edit	Sets cargo dimension limits for loading onto vehicle types at facility types
VFacType	Vehicle Facility Type	Keys Computed	Lists matchings of vehicle types and facility types for loading/unloading cargo

Database Type Tpfdd

Table	Label	Table Edit Type	Description
ACrgType	JOPES Air Cargo Type	Edit	Lists the JOPES air cargo types (Bulk, Oversize, etc.) and their maximum dimensions
AggCat	Aggr Cargo Category	Edit	Provides translations for aggregating cargo category
AggMajun	Aggr Major Unit	Edit	Provides translations for aggregating major unit
AggMode	Aggr Required Mode	Edit	Provides translations for aggregating required transport mode
AggNode	Aggr Node	Edit	Provides translations for aggregating node location
CCC	JOPES Cargo Cat Code	Edit	Lists the three character JOPES cargo category codes
CCC1	JOPES Cargo Cat Pos1	Edit	Lists the first position of the JOPES cargo category code, which defines the kind of cargo
CCC2	JOPES Cargo Cat Pos2	Edit	Lists the second position of the JOPES cargo category code, which defines the airlift cargo type and the unit class (Unit Equip, Acc Supply,
CCC3	JOPES Cargo Cat Pos3	Edit	Lists the third position of the JOPES cargo category code, which defines containerizability
CCC4	Custom Cargo Cat 4	Edit	Lists a customizable fourth position cargo category code, which specifies user-definable cargo item dimensions
ClassifC	JOPES Classif Code	Edit	Lists the JOPES security classification codes
CntrType	Container Type	Edit	Lists the containerizability types corresponding to the third position of the JOPES Cargo Category Code
CntrySt	JOPES Country State	Edit	Lists the JOPES country state codes and names
CrgDtLvl	JOPES Crg Detail Lev	Edit	Lists the JOPES TUCHA and TPFDD cargo detail levels
DelReas	NonUnit Delay Reason	Edit	Lists the JOPES codes for non-unit intermediate stop delay reasons
DelType	Unit Delay Type	Edit	Lists the JOPES codes for unit intermediate stop delay type, either total force or force increments
Deploylc	JOPES Deploy Indic	Edit	Lists the JOPES deployment indicator codes which characterize deployability

DischCfg	JOPES Discharge Code	Edit	Lists the JOPES discharge constraint codes
FIC	JOPES Force Indicate	Edit	Lists the JOPES force indicator codes
FuelType	Fuel Type Code	Edit	Lists the JOPES fuel types
GeoDate	Geoloc Date	Edit	Stores the geoloc file date
Geoloc	Geolocation	Edit	Stores the imported geoloc data from the JOPES Geofile
HeavLift	JOPES Heavy Lift	Edit	Lists the JOPES heavy lift codes
Import	Import Specification	Edit	Provides table, record, and field specifications for importing data from external databases
InstType	Installation Type	Edit	Lists the JOPES Geolocation installation type codes
LoadCfg	JOPES Load Config	Edit	Lists the JOPES load configuration codes
LogCode	JOPES Logistics Code	Edit	Lists the JOPES Geolocation logistics planning codes
MajCat	Major Cargo Category	Edit	Lists the major cargo categories corresponding to the first position of the JOPES cargo category code
Mode_Src	JOPES Mode & Source	Edit	Lists the JOPES transport mode and source code combinations
ModeCode	JOPES Move Type Code	Edit	Lists the JOPES transport mode codes
NUMoveTp	JOPES Non Unit Type	Edit	Lists the JOPES non-unit type movement codes
NURecTyp	Non Unit Record Type	Edit	Lists the JOPES TPFDD non-unit record types for Pax and Cargo
OrgCode	JOPES Organization	Edit	Lists the JOPES organization and service codes
PIC	JOPES Parent Indicat	Edit	Lists the JOPES parent indicator codes which describe subordinate splitting
PoiLoc	JOPES POI Location	Edit	Lists the JOPES intermediate port location codes
RecCode	JOPES Record Indicat	Edit	Lists the JOPES record indicator codes

StopCode	JOPES Stop Code	Edit	Lists the JOPES stop reason codes
SupClas1	JOPES Supply Class 1	Edit	Lists the JOPES major supply class code in position 1
SupClass	JOPES Supply Class	Edit	Lists the JOPES two-character supply class and subclass codes
TpId	TPFDD Ident	Edit	Stores the imported TPFDD Identifier record
TpNonUnit	TPFDD Non Unit	Edit	Stores the imported TPFDD Non Unit cargo and pax records
TpSrfCat	TPFDD SRF Category	Edit	Stores the imported TPFDD SRF category records for non-standard units
TpSrfDet	TPFDD SRF Detail	Edit	Stores the imported TPFDD SRF detail records for non-standard units
TpSrfId	TPFDD SRF Ident	Edit	Stores the imported TPFDD SRF identifier records for non-standard units
TpUnit	TPFDD Unit	Edit	Stores the imported TPFDD standard force unit records
TranpSrc	JOPES Trnsprt Source	Edit	Lists the JOPES transport source providing organization codes (MSC, MTMC, etc.)
Translat	Translation Table	Edit	Defines translations based on direct conversions, translation tables, or function mappings for importing data from external databases
TuCat	TUCHA F2 Category	Edit	Stores the imported TUCHA F2 cargo category quantities for standard unit types
TuDate	TUCHA Date	Edit	Stores the imported TUCHA date
TuDet	TUCHA F3 Detail	Edit	Stores the imported TUCHA F3 detail cargo quantities and dimensions for standard unit types
TuOldUtc	TUCHA AB Total	Edit	Stores the imported TUCHA AB records containing updated UTC status, often cancelled
TuUtc	TUCHA UTCs and Air	Edit	Stores the imported TUCHA ABF1 UTC records, including total air cargo type quantities
ULC	UNIT Level Code	Edit	Lists the JOPES unit level codes
UnitClas	JOPES Unit Class	Edit	Lists the JOPES unit classifications (Unit Equip, Acc Supply, Organic)
UnitStat	JOPES Unit Status	Edit	Lists the JOPES unit status codes (active, canceled)

UtcFunct	JOPES UTC Function	Edit	Lists the JOPES Unit Type Code functional area which is the first position of the Unit Type Code
UtcSubst	UTC Substitution	Edit	Lists the Unit Type Code substitutions for standard units that have no match in the TUCHA data

Appendix B

Data Dictionary

The Data Dictionary provides a complete definition of the tables, fields, key fields, domains, lookups, units of measures, and descriptions in the GDAS system. The online Help/Data menu provides immediate access to the Data Dictionary while you are editing tables. One of the most valuable uses of the Data Dictionary is to understand the relationships between tables so that you can work in a consistent, top-down fashion in defining new records in GDAS (e.g., for adding a new Transport Mode).

The complete Data Dictionary is provided in the pages following. An extract for the VehFleet table is shown in the figure. The first boxed lists the 8 character table name VehFleet, its long table name Vehicle Fleet, and a description of the table. Below the table information is a list of fields belonging to the table along with field definitions. In the field list, the first column repeats the table name, VehFleet. The second column lists the field number and field name, e.g. the first field is Vehicle Type.

VEHFLEET Vehicle Fleet		Lists the availability of vehicles by starting location, starting time, and number of vehicles				
------------------------	--	--	--	--	--	--

Table	Field Name	Domain/ Lookup	Key?	In/Out	Unit Meas	Description
VEHFLEET	1 Vehicle Type	VEHDATA	Y	In		Vehicle type
VEHFLEET	2 Vehicle Identifier	VEHDATA	Y	In		Vehicle identifier for this start location
VEHFLEET	3 Vehicle Fleet	A15	Y	In		Fleet identifier for this start location
VEHFLEET	4 Number of Vehicles	Short>=0		In		Number of vehicles in the fleet for this vehicle type
VEHFLEET	5 Start Node	FACILITY		In		Home base node for this fleet and vehicle type (a vehicle returns to its home base if not otherwise assigned)
VEHFLEET	6 Start Facility	FACILITY		In		Home base facility for this fleet and vehicle type (a vehicle returns to its home base if not otherwise assigned)
VEHFLEET	7 Start Day Available	DayToHr		In	day (hr)	Day that this fleet and vehicle type are first available
VEHFLEET	8 Last Day Returned	DayToHr		In	day (hr)	Day that this fleet and vehicle type are returned to base with no more use (blank or 0 is treated as available to the end)
VEHFLEET	9 Special Mission	MISSION		In		Special mission which restricts this fleet to matching special mission movement requirements for a designated time period
VEHFLEET	10 New Vehicle Penalty	Short>=0		In	\$/new veh	Penalty for the first use of a new vehicle of this type and fleet
VEHFLEET	11 Call Sign	A4		In		International call sign of the vehicle or ship or fleet
VEHFLEET	12 NISC Number	A5		In		Naval Intelligence Security Code number of the vehicle or ship fleet

Figure B-1. Data Dictionary Extract for the VehFleet Table

The third column is labeled as Domain/Lookup, meaning that it displays either a domain or a lookup table. If an upper-case lookup table name is shown, then the field has a lookup, and the domain is inherited from the parent table. For example, the first two fields have a joint lookup into VehData, which means that all Vehicle Type and Vehicle Identifier combinations in the VehFleet must match the parent values in the VehData lookup table, and they are text strings or names. Similarly, the Start Node and Start Facility fields have a joint lookup to the Facility table. This means that you must create a matching node and facility in the Facility parent table before you can assign vehicles to start at that facility in the VehFleet table. The two foreign key fields, Start Node and Start Facility in the VehFleet child table, must match the parent key fields, Facility Node and Facility Name, for a parent record in the Facility table. The lookup values are always the key fields of the parent table.

If the third column is not a lookup table, it represents a domain. For example, the Vehicle Fleet field has a domain of A15, which means any alphanumeric text string up to 15 characters in length. This means you are free to give any name you wish

to the Vehicle Fleet (no lookups are enforced). Of course, preferably the name is descriptive; in the figure, the vehicle fleet names tend to match the start node.

The field Number of Vehicles has a Domain of Short ≥ 0 , which means a nonnegative short integer (values between 0 and 32,767). Other typical numerical domains may incorporate ranges, such as 1,99 or 0,99999 or 0,15. Additional ranges include Long+/- (any integer), Double ≥ 0 (any nonnegative floating point number), and reqqn (a nonnegative domain sized for requirement quantities).

The fourth column shown in the Data Dictionary is labeled Key? and displays a Y if the field is a key field. For the VehFleet table, the first three fields are key fields, as indicated in the figure. GDAS always lists key fields first for each table.

The key fields of a table may themselves be lookups. In the example, the first two key fields are lookups into the parent VehData table, whereas the third key field is a domain consisting of any 15 character alphanumeric string, with no lookup. The non-key fields may also be lookups or domains.

Additional information in the Data Dictionary shows whether the field is In or Out, meaning that it is either an input to the model or an output from the model. Some reference data is neither input nor output.

The Unit of Measure is indicated where appropriate. The Start Day Available field has a unit of measure indicated by day (hr), which means that data input is in whole days, but this is converted to hours for the hourly simulation used in the model itself. In general, the model performs all calculations in hours for higher accuracy in travel times and load rates, and to make cumulative differences in these parameters visible for sensitivity studies. Realistically, however, the data inputs (availability day, required delivery day, earliest delivery day, etc.) are not accurate even to the nearest day, so database inputs and outputs are typically stored in days rather than hours.

Finally, a description of the field is provided. All of this information is available on-line, while editing the tables, by pressing the F10 Menu key, then selecting Help/Data.

Directory Type: Reference

MEASCLAS Measure Class	Edit Limits Constant No	Defines the measurement classes (e.g. Cargo Quantity, Max Cargo Item Dimension, Vehicles Per Day, MOG or # Berths, Vehicle Dimension, etc.)
---------------------------	----------------------------	---

#	K?	Field Name	Model	Datatype	Domain	Lookup	B	V	Unit	Meas	Description
1	Y	Measure Class			A15						Measure class defining the area of applicability of different measures (e.g., Cargo Quantity, Dimension Limit, Vehicles/Day, Max Vehicles, Throughput, Storage)
2		Description			A100						General description of the measure class

MODEL RPT Model Report	Edit Limits Constant No	Allows the user to specify which reports to generate from model outputs
---------------------------	----------------------------	---

#	K?	Field Name	Model	Datatype	Domain	Lookup	B	V	Unit	Meas	Description
1	Y	Report Table			TABLE						Lists the custom report tables that have queries to be generated after the model has been executed
2		Report Table Description			A40						Description of the Custom report table

REJTYPE Rejection Type	Edit Limits Constant No	Lists the available delay reason types
---------------------------	----------------------------	--

#	K?	Field Name	Model	Datatype	Domain	Lookup	B	V	Unit	Meas	Description
1	Y	Rejection Type			A15						Rejection reason type
2		Description			A50						Description of the rejection type

SCHEDTYP Scheduling Type	Edit Limits Constant No	Lists the scheduling model algorithm types
-----------------------------	----------------------------	--

#	K?	Field Name	Model	Datatype	Domain	Lookup	B	V	Unit	Meas	Description
1	Y	Scheduling Model Type			A15						Scheduling model algorithm type
2		Level of Detail			A10						Level of detail for the scheduling algorithm
3		Description			A150						Brief description of the scheduling algorithm

VARYDIST Vary Distribution	Edit Limits Constant No	Stochastic or parametric distribution types for sampling data
-------------------------------	----------------------------	---

#	K?	Field Name	Model	Datatype	Domain	Lookup	B	V	Unit	Meas	Description
1	Y	Distribution Type			A15						Stochastic data sampling distribution type

VARYPAR Vary Parametric Data	Edit Limits Constant No	Lists allowable tables and data fields for users to vary either parametrically or as time variations
---------------------------------	----------------------------	--

#	K?	Field Name	Model	Datatype	Domain	Lookup	B	V	Unit	Meas	Description
1	Y	Table to Vary			A8						Table name which can be varied
2	Y	Field to Vary			A25						Field name which can be varied
3		Description			A255						Data field description

VARYSAVD Vary Storable Data	Edit Limits Constant No	Lists the allowable tables and fields which can be saved over multiple parametric or stochastic runs
--------------------------------	----------------------------	--

#	K?	Field Name	Model	Datatype	Domain	Lookup	B	V	Unit	Meas	Description
1	Y	Table to Save			A8						Table name which has data that can be saved over multiple sensitivity runs
2	Y	Field to Save			A25						Nonkey data element which can be saved over sensitivity sampling runs
3		Description			A255						Data field description

Directory Type: Scenario

AGENTLEG Agent Route Mapping		Edit Limits	Selects the standard routes for each agent for map display			
#	K? Field Name	Model	Datatype	Domain	Lookup	B V Unit Meas Description
1	Y From Node			NODE		From node extracted from STDSTOP for the world map display
2	Y To Node			NODE		To node extracted from STDSTOP for the world map display
3	Y Transport Agent			A15		Transportation agent or company identifier for the fleet
4	Y Planning Fleet			PLANFLT		Standard prescheduled route identifier
5	Standard Depart Interval			Short>=1	day	Standard depart time interval for a prescheduled route

BASMEAS Basic Measure		Edit Limits	Lists basic measures for reporting primary cargo quantities (Ston, Cbbl, Pax); each cargo class has a basic measure used for quantity splits			
#	K? Field Name	Model	Datatype	Domain	Lookup	B V Unit Meas Description
1	Y Basic Quantity Measure	basemeas		MEASURE		Basic unit of measure for reporting cargo quantities (ston, cbbl, pax)
2		baseqreq		Long>=0		Q Basic quantity required accumulated for closure calculations for the current major unit
3		baseqndel		Long>=0		Q Basic quantity delivered accumulated for closure calculations for the current major unit

CARGCLAS Cargo Class		Edit Limits	Lists the major cargo classes (e.g., Dry, PAX, POL) that define which dimensional measures are applicable to each cargo category and cargo type			
#	K? Field Name	Model	Datatype	Domain	Lookup	B V Unit Meas Description
1	Y Cargo Class			A15		Cargo class (Dry, Pax, POL) which defines dimensional measures for cargo
2	Basic Quantity Measure			BASMEAS	Yes	Basic unit of measure for reporting quantity of this cargo class (ston, pax, cbbl)
3	Pounds Per Basic Quantity lbsperqn			Long>=0	Yes	lbs/Q Pounds per unit basic quantity in the basic unit of measure, used for conversion to accumulate short ton weight totals for vehicle loading or facility throughput
4	Has Accompanying Pounds?	hasaccomplbs		Yesflag		Yes if theater-dependent accompanying pounds per unit basic quantity are obtained from the THTRREQ table rather than a conversion factor (otherwise Pounds Per Basic Quantity field is used)
5	Is Pax?	ispax		Yesflag		Yes if the cargo class represents passengers, used to compute closure based on the MAJUNIT % closure criteria
6		basmeas		MEASURE		Basic unit of measure record number in the MEASURE table
7		firstclasmeas		CLASMEAS		First measure associated with this cargo class
8		basqnoffset		0,99		Offset of the basic quantity measure relative to the first quantity measure of this cargo class

CARGCONF Cargo Configuration		Edit Limits	Lists the cargo configurations used to containerize, package, or modify cargo for transport, and sets the time rate for configuration			
#	K? Field Name	Model	Datatype	Domain	Lookup	B V Unit Meas Description
1	Y Cargo Configuration			A15		Cargo configuration which is used to package the cargo for transport on one or more modes
2	Configuration Rate	cfgrt		Short>=0		Q/hr Rate at which cargo can be configured when changing configuration
3	Deconfiguration Rate	uncfgrt		Short>=0		Q/hr Rate at which cargo can first be un-configured when changing configuration

CARGO Cargo		Edit Limits	Lists cargo derived from a single movement requirement and cargo category, which is loaded on a single trip, vehicle, and compartment			
#	K? Field Name	Model	Datatype	Domain	Lookup	B V Unit Meas Description
1	Y Cargo Number			Record#	BigSt	Cargo or shipment number
2	Requirement Id	crgreq		REQUIRE		Requirement identifier for this cargo
3	Cargo Category	crgcat		CARGOCAT		Cargo category which describes the kind of cargo being transported
4	Cargo Configuration	crgcfg		CARGCONF		Cargo configuration which is used to package the cargo for transport on one or more modes
5	Cargo Type	crgtyp		CARGTYPE		Cargo type for this cargo
6	Load Stop Number	ldstp		STOP		Load stop number for this cargo (in the model after planning prior to scheduling, this is the node number)
7	Unload Stop Number	uldstp		STOP		Unload stop number for this cargo (in the model after planning prior to scheduling,

Directory Type: Scenario

CARGO		Edit Limits	Lists cargo derived from a single movement requirement and cargo category, which is loaded on a single trip, vehicle, and compartment			
Cargo		Output				
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas Description
8	Cargo Basic Quantity	crgqn	reqqn		Q	this is the node number) Cargo quantity in the basic unit of measure for its cargo class (ston, pax, cbbl)
9	Compartment Type	crgcpt	CPTTYPE			Vehicle compartment into which this cargo was loaded
10	Begin Load Day	begld	DayToHr		day (hr)	Day that the cargo begins loading (in the model prior to simulation, this is the earliest possible load time based on RLD or predecessor cargo or earliest theater depart minus 10)
11	End Load Day	endld	DayToHr		day (hr)	Day that the cargo completes loading (in the model prior to simulation this is the target lift time or planned begin load time)
12	Begin Unload Day	beguld	DayToHr		day (hr)	Day that the cargo begins offloading (in the model prior to simulation, this is also the earliest possible unload time based on EDD for final destination cargos)
13	End Unload Day	enduld	DayToHr		day (hr)	Day that the cargo is scheduled to complete offloading (this is updated during planning, scheduling, and simulation)
14	Is Attritted?	iscrgattr	Yesflag			Yes if the cargo is attritted in the last run results, blank otherwise
15	Attrit Probability %	crgattrprob	0,9999		%%	Calculated cumulative probability of attrition (in % or ten thousandths) for the cargo based on its route and schedule and including the probability of attrition of prior cargos
16	Cargo Predecessor	crgpred	CARGO			Unique predecessor cargo which immediately precedes this cargo and carries the same requirement (zero for an origin cargo)
17	Planning Fleet	planning_fleet	PLANFLT			Planning fleet selected by mode planning to move the cargo
18	Is Final?	isfinal	Yesflag			Yes if the cargo is a final leg to the requirement ultimate destination
19	Order Number	cargo_order	Long>=0			An order number that is assigned if the cargo is a resupply record, matching an order in RPTSUPST
20		nextcrgld	CARGO			After scheduling, next cargo at the same load stop; before scheduling, next cargo planned at the same POE node; after rejection, next cargo rejected; each cargo is always on 1 of 3 lists: LISTnodecrg(poenode), LISTcrg(poestop), or LISTcrgreject
21		nextcrguld	CARGO			Next cargo at the same unload stop after scheduling
22		crgstatus	0,9			Cargo status: WAITING=waiting for scheduling; REJECTED=rejected either in planning (crgtyp=0) or in scheduling (crgtyp>0); SCHEDULED=scheduled but not yet simulated; POESIM=loading at POE began simulation; PODSIM=unloading at POD began simulation
23		listcrgsucc	CARGO			List of successor cargos which immediately follow this predecessor cargo and which carry the same requirement
24		nextcrgsucc	CARGO			Next successor cargo with the same predecessor cargo
25		crgdue	DayToHr		hr	Planned time that the cargo is due to be delivered
26		iscrgreplanned	Yesflag			Yes if the cargo previously failed scheduling and was replanned
27		nextcrgonboard	CARGO			Next pointer for LISTcrgonboard and LISTcrgclose in final closure and attrition
28		quan_unloaded	reqqn			Basic quantity unloaded used for tracking simultaneous unload and load
29		quan_reloaded	reqqn			Basic quantity of a successor of this cargo onloaded used for tracking simultaneous load and unload
30		load_delay	HoursDelay		hr	Hours of loading delay due to facility throughput capacity
31		unld_delay	HoursDelay		hr	Hours of unloading delay due to facility throughput capacity
32		time_to_go	HoursDelay		hr	Estimated hours of travel to reach the requirement destination
33		nextmlistcargo	CARGO			Next pointer for the multicriteria list of cargos ready for scheduling
34		cargo_cbr	Long+/-		\$/Q	Cargo cost benefit ratio for sorting the greedy vehicle list of cargos
35		is_resupply_pattern	Boolean			Flag to identify representative resupply cargos
36		nextsupstorecargo	CARGO			Next pointer for when the cargo is representative for a supply storage node

CARGOCAT Cargo Category		Edit Limits	Lists the cargo categories which specifies the kind of cargo at the most detailed level, often based on JOPEs three-position cargo category plus heavy lift code				
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit	Meas Description
1 Y	Cargo Category			A15			Cargo category which describes the kind of cargo being transported
2	Cargo Class	catclas		CARGCLAS	Yes		Cargo class (Dry, Pax, POL) which defines dimensional measures for this cargo category
3	Category Code			A4			Four position JOPEs cargo category code including heavy lift code (A0=vehicle NAT, B0=NSDA NAT, B1=NSDA outside, B2C=NSDA oversize noncont, etc.)
4	Discrete Load Increment	cat_min_split_size		Long>=1	Yes Q		Discrete size increment for loading this cargo, expressed in the basic unit of measure; if specified, a split cargo must be an integer multiple of the size increment
5	Configuration at Origin	configorig		CARGCONF	Yes		Starting cargo configuration at the origin for this cargo category
6	Is Ammunition?	cat_is_ammo		Yesflag			Yes if the cargo category is treated as hazardous ammunition in route sequence, i.e. it is constrained to be last on and first off in multi-port routes
7	Description			A100			Description of the cargo category
8		firstcatmeas		CATMEAS			First measure for this cargo category in the CATMEAS table
9		listexcrgeat		EXCLUDE			List of exclusions for this cargo category, if any
10		firstsupstore		SUPSTORE			First supply theater record for this cargo category

CARGTYPE Cargo Type		Edit Limits	Lists the cargo types, which define kinds of cargo affecting stow factors, load rates, and load compatibility for a specific mode of transport				
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit	Meas Description
1 Y	Cargo Type			A15			Mode-specific cargo type which groups cargo categories for a given transport mode in order to define stow factors, load rates, and load compatibility for vehicle compartments
2	Cargo Class	crgtypclas		CARGCLAS	Yes		Cargo class (Dry, Pax, POL) which defines dimensional measures for this cargo type
3	Transport Mode	crgmod		MODE	Yes		Transport mode associated with this mode-specific cargo type
4	Cargo Type Description			A100			Description of the mode-specific cargo type
5		liststowpen		STOWPEN			List of STOWPEN records and associated compartment types in preferred order for this cargo type
6		crgtypoffset		CARGTYPE			Cargo type offset within its mode of transport for direct access of stow factors and stow penalties

CATMEAS Category Measure		Edit Limits	Lists the dimensional measures applicable to each cargo category; generated automatically from the CLASMEAS table to provide a lookup for REQUAN quantities				
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit	Meas Description
1 Y	Cargo Category	catmeascat		CARGOCAT			Cargo category which describes the kind of cargo being transported
2 Y	Cargo Measure	catmeasmeas		MEASURE			Name of a measure (basic or nonbasic) for specifying cargo quantity or dimensions

CATMODE Cargo Category Mode		Edit Limits	Lists the conversion of cargo categories to mode-specific cargo types which define stow factors and load rates for each vehicle type				
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit	Meas Description
1 Y	Transport Mode			MODE			Transport mode
2 Y	Cargo Category			CARGOCAT			Cargo category which describes the kind of cargo being transported
3 Y	Cargo Configuration			CARGCONF			Cargo configuration status
4	Cargo Type	catmodcrgtyp		CARGTYPE			Cargo type used to represent this cargo category and configuration for the specified transport mode (leave cargo type blank if the transport mode cannot carry the category or configuration, e.g. NSDA via Airlift)

CLASMEAS Cargo Class Measure		Edit Limits	Lists the major classes of cargo and what quantity measures are applicable				
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit	Meas Description
1 Y	Cargo Class			CARGCLAS			Cargo class (Dry, Pax, POL) which is associated with specific quantity measures
2 Y	Cargo Measure	cclasmeas		MEASURE			Type of measure used for specifying quantity of cargos in this cargo class

Directory Type: Scenario

CONSRATE Consumption Rate		Edit Limits Output	Contains the computed static consumption rate for units at destinations			
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas Description
1	Y Unit Destination			NODE		Destination node for a requirement type that consumes resupply
2	Y Consumed Cargo Category	supstore_record		SUPSTORE		Supply cargo type that is consumed by other requirements at their destination
3	Supply Storage Node			SUPSTORE		Supply storage node or terminal
4		consumption_rate		Long>=0		Total current consumption rate for all requirement types consuming the supply type at this destination
5		consumed_cargocat		CARGOCAT		Cargo category consumed

CONVOY Convoy		Edit Limits Output	Specifies information about convoy routes which are to be used for sealift when traveling between the assembly node theater and the disassembly node theater			
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas Description
1	Y Convoy Assembly Node	cnvyassfac		FACILITY		Assembly node for ships and escorts on this convoy route (normally in the origin theater)
2	Y Assembly Facility			FACILITY		Assembly facility for ships and escorts on this convoy route
3	Y Convoy Disassembly Node	cnvydisfac		FACILITY		Final disassembly node for ships and escorts on this convoy route (normally in the destination theater)
4	Y Disassembly Facility			FACILITY		Final disassembly facility for ships and escorts on this convoy route
5	Convoy Route Type	cnvyroudtype		ROUTTYPE	Yes	Convoy route type which can accommodate all ships in the convoy
6	Convoy Vehicle Per Escort	escortships		1,999	Yes	Number of ships handled by each escort (used to compute the number of escorts)
7	Convoy Speed	cnvyspeed		1,999	Yes	Speed at which all convoy ships travel on this convoy route, in nautical mph
8	Convoy Delay Hours	cnvydel		HoursDelay		hr Additional convoy transit delay time in hours for management operations, diversions, assembly and disassembly operations, etc. after the convoy assembly day and before the convoy disassembly
9	Convoy Interval Days	cnvyinterval		DaysDelayToHr	Yes	day Minimum time interval in days between scheduled convoy departures
10	Convoy Min Vehicles	cnvyminships		0,999		Minimum number of ships permitted in a convoy trip
11	Convoy Max Vehicles	cnvymaxships		0,999		Maximum number of ships permitted in a convoy trip
12	Max Vehicle Wait Days	cnvymaxwait		DaysDelayToHr		day Maximum ship waiting time to assemble a minimum size convoy beyond which the ship sails independently
13	Link Attrit Multiplier %	cnvylinkattrmult		%		% Convoy link attrition multiplier for ships in this convoy
14	Node Attrit Multiplier %	cnvynodeattrmult		%		% Convoy node attrition multiplier for ships in this convoy
15		cnvyattr		Short>=0		% Precomputed discrete attrition for a convoy from assembly to disassembly including both node and link attrition factors
16		cnvytime		HoursDelay		hr Precomputed convoy travel time from assembly to disassembly including link delays, link distances at convoy speed, and additional convoy delay time
17		listcnvytrip		TRIP		List of trips in the next convoy trip currently being assembled
18		cnvylastsent		CONVTRIP		Last convoy trip scheduled for departure at this convoy location
19		cnvybuildup		CONVTRIP		Current convoy trip being accumulated prior to reaching the minimum size and being scheduled for departure

CONVTRIP Convoy Trip		Edit Limits Output	Stores information about convoy trips			
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas Description
1	Y Convoy Trip Number			Record#	Vehic	Convoy trip number
2	Convoy Assembly Node	cnvy		CONVOY		Assembly node for this convoy trip
3	Assembly Facility			CONVOY		Assembly facility for this convoy trip
4	Convoy Disassembly Node			CONVOY		Final disassembly node for ships and escorts on this convoy trip
5	Disassembly Facility			CONVOY		Final disassembly facility for ships and escorts on this convoy trip
6	Convoy Assembly Day	cnvyadep		DayToHr		day (hr) Depart day of the convoy at the assembly point
7	Convoy Disassembly Day	cnvyddep		DayToHr		day (hr) Depart day of the ships in the convoy at the disassembly point
8	Convoy Size	cnvysize		1,99		Number of ships in the convoy
9	Number of Escorts	cnvyescrts		1,99		Number of escorts in the convoy

Directory Type: Scenario

CPTMEAS Compartment Measure		Edit Limits	Lists the measures for defining compartment capacity			
#	K?	Field Name	Model	Datatype	Domain Lookup	B V Unit Meas Description
1	Y	Compartment Type			CPTTYPE	Compartment type name used to specify stow factors for vehicle types and capacities for vehicles
2	Y	Compartment Measure	meas		MEASURE	Unit of measure for defining compartment capacity (in addition to the total ston measure which is always used for each vehicle)
3			firststowfact		STOWFACT	First stow factor for this compartment type and measure

CPTTYPE Compartment Type		Edit Limits	Defines vehicle compartment types					
#	K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas	Description
1	Y	Compartment Type			A15			Generic compartment type name which is associated with stow factors and vehicle capacities (e.g., Hold for ships, Outsize for aircraft, Boxcar for rail, Flatbed for motor)
2		Transport Mode	cptmod		MODE	Yes		Transport mode associated with this compartment type
3			firstcptmeas		CPTMEAS			First compartment measure for defining compartment capacity
4			cptldqn		reqqn		Q	Cargo quantity which could be loaded on each compartment for the current insertion cargo
5			cptbestqn		reqqn		Q	Quantity of the best cargo so far which can be loaded on each compartment
6			firststowpen		STOWPEN			First stow penalty record for this compartment type

EXCLUDE Exclusion		Edit Limits	Sets user-definable exclusions for cargo loading, based on various combinations of factors such as Mode, Vehicle Type, Cargo Category, Planning Fleet, Node, Theater, and					
#	K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas	Description
1	Y	Exclusion Label			A15			Label for a user-defined combination of factors to exclude cargo loading at POEs and unloading at PODs
2		Node Excluded for Loading	exnode		NODE			Excluded node for loading and offloading, if any (blank if not applicable, i.e., this exclusion applies to all nodes and is independent of node)
3		Facility Type Excluded	exfactyp		FACTYPE			Excluded facility type for loading and offloading, if any (blank if not applicable, i.e. exclusion record applies to all facility types or is independent of facility type)
4		Requirement Type Excluded	exreqtyp		REQTYPE			Excluded requirement type, if any (blank if not applicable)
5		Vehicle Type Excluded	exvehtyp		VEHTYPE			Excluded vehicle type, if any (blank if not applicable)
6		Planning Fleet Excluded	exfleet		PLANFLT			Excluded planning fleet, if any (blank if not applicable)
7		Theater Excluded	exthttr		THEATER			Excluded theater, if any (blank if not applicable)
8		Cargo Category Excluded	excrgcat		CARGOCAT			Excluded cargo category, if any (blank if not applicable)
9		Mode Excluded	exmode		MODE			Excluded transport mode, if any (blank if not applicable)
10			excount		0,7			Computed count of nonzero secondary fields in this exclusion record (each exclusion has at least one nonzero primary field)
11			nextexnode		EXCLUDE			Next exclusion for the same node
12			nextexfactyp		EXCLUDE			Next exclusion for the same facility
13			nextexreqtyp		EXCLUDE			Next exclusion for the same requirement type
14			nextexvehtyp		EXCLUDE			Next exclusion for the same vehicle type
15			nextexfleet		EXCLUDE			Next exclusion for the same fleet
16			nextexthttr		EXCLUDE			Next exclusion for the same theater
17			nextexcrgcat		EXCLUDE			Next exclusion for the same cargo category
18			nextexmode		EXCLUDE			Next exclusion for the same mode

FACCAP Facility Capacity		Edit Limits	Specifies facility limits and constraints on cargo throughput for different facility measures				
#	K?	Field Name	Model	Datatype	Domain Lookup	B V Unit Meas	Description
1	Y	Facility Node			FACILITY		Node with one or more facilities
2	Y	Facility Name			FACILITY		Facility name at this node
3	Y	Facility Capacity Measure	facmeas		MEASURE		Cargo storage or throughput handling capacity measure for this facility
4		Facility Capacity	faccap		faccap	Q or Q/hr	Hourly rate or total storage cargo handling capacity for this measure and facility at

Directory Type: Scenario

FACCAP Facility Capacity		Edit Limits	Specifies facility limits and constraints on cargo throughput for different facility measures				
#	K?	Field Name	Model	Datatype	Domain	Lookup	B V Unit Meas Description
5			faccapstor		faccap		Q the node Remaining storage capacity if the measure is storage
6			faccapsathrs		HoursDelay		hr Start hour on the current day when this facility storage capacity measure became saturated (0 if unsaturated)

FACILITY Facility		Edit Limits	Lists port facilities at nodes						
#	K?	Field Name	Model	Datatype	Domain	Lookup	B V	Unit Meas	Description
1	Y	Node	facnode		NODE				Node with one or more facilities
2	Y	Facility Name			A15				Facility name at this node
3		Facility Type	factyp		FACTYPE		Yes		Facility type for this facility
4		Max Vehicles Per Hour	facvph		facvph			veh/hr	Number of combined vehicle arrivals and departures which can be handled per hour in this facility during its hours of operation
5		Max Parking	facpark		Short>=0			veh	Maximum number of "standard" vehicles permitted in the facility at the same time, e.g. working MOG for airlift or number of berths for sealift (vehicle types are weighted by an effective factor to convert to a standard vehicle) (model scales by 100 to %)
6		Operating Hours/Day	fachpd		0,24			hr/day	Operating hours per day that the facility is open
7		Facility Length	faclen		Short>=0			ft	Maximum length available (e.g., runway length for air, berth length for sea)
8		Facility Width	facwid		0,999			ft	Maximum width available (e.g., runway width for air, berth beam for sea)
9		Facility Dimension	facdim		0,999			varies	Maximum vehicle dimension allowed in the facility, a user-definable criterion, such as draft for sealift
10		Facility Rating	facrating		Short>=0			varies	Facility rating which limits the maximum allowable vehicle rating, based on a user-definable criteria (e.g., load classification number for air, boom capacity or sea)
11			facvphused		facvph			veh/hr	Number of arrivals and departures used up at the facility for the current hour
12			firstfaccap		FACCAP				First facility measure constraint for this facility
13			fachrpt		FACCAPHR				First record in the FACCAPHR table, if any, for this facility on the current simulation day
14			facstoroffset		MEASURE				Offset for the first FACCAP record for storage relative to the first record
15			facthrupoffset		MEASURE				Offset for the first FACCAP record for throughput relative to the first record
16			facparkusedpc		Long>=0			%	Number of "standard" vehicle parking spaces used in the facility for the current facility hour, expressed in percent
17			faccurtime		Time				Last simulation transaction time for this facility
18			currptfveh		RPTFVEH				Last RptFVeh report record tracking vehicle throughput for this facility
19			isfacinuse		Yesflag				True if the facility is in use for vehicle flow simulation
20			listfacevent		FACEVENT				Pointer to the list of events for this facility in deposition order
21			predfacevent		FACEVENT				Pointer to the last begin pred used by the subtract capacity function

FACTYPE Facility Type		Edit Limits	Lists the available facility or berth types which are used to define load rates at port facilities						
#	K?	Field Name	Model	Datatype	Domain	Lookup	B V	Unit Meas	Description
1	Y	Facility Type			A15				Facility or berth type name for airports or seaports or other mode facilities (e.g. Container Ammo for sealift, or Airport Wide Body for airlift)
2		Transport Mode	facmode		MODE		Yes		Transport mode for this facility or berth type
3			listexfactyp		EXCLUDE				List of exclusions or constraints for this facility type, if any
4			factypoffset		FACTYPE				Facility type offset within its mode of transport

Directory Type: Scenario

FLEET Administrative Fleet		Edit Limits	Identifies groups of vehicles with common administrative characteristics for vehicle availability.						
#	K?	Field Name	Model	Datatype	Domain	Lookup	B V	Unit Meas	Description
1	Y	Fleet			A15				Fleet name
2		Planning Fleet	planflt		PLANFLT		Yes		Planning fleet to which this fleet belongs
3		Vehicle Capacity Percent	fleetvehcappc		0,100		Yes %		Percent of each lift vehicle which is available, applied uniformly across all vehicles in the Fleet

LATECLAS Lateness Class		Edit Limits	Defines lateness classifications for the RPTLATE lateness summary report (e.g. On Time, Within 1 Day Late, Total Scheduled, Total Unscheduled, etc.)						
#	K?	Field Name	Model	Datatype	Domain	Lookup	B V	Unit Meas	Description
1	Y	Lateness Class			Lateness Clas				Lateness classification for reporting lateness summaries (e.g., Ontime, Scheduled, Unscheduled, Within 1 Day Late, etc.)
2		Days Late	lateclasdays		DaysDelayToHr		Yes day		Maximum days late allowed for inclusion in this lateness classification

LINKCAP Node Link Capacity		Edit Limits	Defines the capacity for constrained links and units of measure						
#	K?	Field Name	Model	Datatype	Domain	Lookup	B V	Unit Meas	Description
1	Y	From Node			NODELINK				From node for this link with link capacity
2	Y	To Node			NODELINK				To node for this link with link capacity
3	Y	Transport Mode			NODELINK				Transport mode for this link with link capacity
4	Y	Link Capacity Measure	linkcap_measure		MEASURE				Unit of measure for this link capacity
5		Link Capacity Limit	nodelink_capacity		Long>=0			Q/h	Limit on cargo throughput capacity for this link
6			firstlinkcap_event		LNKEVENT				First event for this capacitated link

LOADRATE Load Rate		Edit Limits Keys Comput	Specifies transfer rates for loading and unloading						
#	K?	Field Name	Model	Datatype	Domain	Lookup	B V	Unit Meas	Description
1	Y	Vehicle Type			VFACTYPE				Vehicle type
2	Y	Facility Type			VFACTYPE				Facility type at the node
3	Y	Cargo Type	ldratecrgtyp		CARGTYPE				Cargo type for the transport mode
4		Hourly Load Rate	ldrate		Short>=0			Q/hr	Hourly load rate to load this cargo category grouping on this vehicle type at this berth type expressed in the cargo basic quantity units (loading can occur only during the facility open hours)
5		Hourly Unload Rate	uldrate		Short>=0			Q/hr	Hourly unload rate to unload this cargo category grouping on this vehicle type at this berth type expressed in the cargo basic quantity units (unloading can occur only during facility open hours)
6		Cargo Throughput Scaling	thruputscale		Byte>=0		Yes %		Cargo throughput scaling which adjusts the cargo's required facility and node throughput capacity (100% represents standard throughput scaling, 0% means the cargo does not affect throughput capacity at all, 50% means the cargo consumes half throughput)

MAJUNIT Major Unit		Edit Limits	Lists each major unit, which in GDAS is a grouping of requirements, either unit or non-unit, used to display delivery profiles and compute overall closure times for related						
#	K?	Field Name	Model	Datatype	Domain	Lookup	B V	Unit Meas	Description
1	Y	Major Unit			A20				Major unit name for analysis of requirement closures and measures of effectiveness
2		Requirement Type	majunitreqtyp		REQTYPE		Yes		Requirement type for this major unit
3		Major Unit MOE	majunitmoe		0,150				Measure of effectiveness (MOE) rating for this major unit (e.g., brigade count or combat power) as defined by the analyst to compute cumulative MOE delivery
4		Computed Closure Day	majunitclose		DayToHr			day (hr)	Closure day for the major unit based on both the Pax and cargo closure minimum % specified in the MajUnit table
5		Closure Required Cargo %	majunitcrgclose		%			%	Minimum percent of the cargo which must be delivered in order to calculate unit closure (if the % is never attained, closure is based on the last portion delivered)
6		Closure Required PAX %	majunitpaxclose		%			%	Minimum percent of the passengers which must be delivered in order to calculate unit closure (if the % is never attained, closure is based on the last portion delivered)
7		Major Unit Description			A50				Major unit description

Directory Type: Scenario

MAPPLAYER Mapping Layer Specs	Edit Limits	Sets mapping layer characteristics such as color and symbol which can be edited by the user				
---	-------------	---	--	--	--	--

#	K?	Field Name	Model	Datatype	Domain	Lookup	B	V	Unit	Meas	Description
1	Y	Layer ID			Table	Any	Cas				The unique layer ID (generated as a table in the mapping application)
2		Layer Label			Menu	Item		Yes			Layer description used in the mapping application menus
3		Map Table			MAPTABLE			Yes			Lookup into the MapTable table for the original table
4		Layer Value			A255			Ye			The Layer Field value for this layer (may be blank only if the table is all on one layer)
5		Begin Off			A3						Yes if the layer display should be off initially
6		Symbol Type			A25MAPSHAPE						The mapping symbol shape or line type
7		Symbol Color			MAPCOLOR						The color of the symbol
8		Symbol Size			0,48						The point size of the node symbol or line width
9		Symbol Min Scale			Short>=0				mi		The minimum scale (closest in) for which this layer is displayed, express as width of view in miles
10		Symbol Max Scale			Short>=0				mi		The maximum scale (farthest out) for which this layer is displayed, expressed as width of view in miles
11		Label Font			MAPFONT						The font type for the layers labels
12		Label Style			MAPFSTYL						The font style for the layer labels
13		Label Color			MAPCOLOR						The font color for the layer labels
14		Label Size			Short>=0						The font point size for the layer labels
15		Label Min Scale			Short>=0				mi		The minimum scale for which the label is displayed, expressed as width of image in miles
16		Label Max Scale			Short>=0				mi		The maximum scale for which the label is displayed, expressed as width of image in miles

MAPLINK Map Link	Edit Limits	Lists route links extracted from NODELINK for the world map display				
----------------------------	-------------	---	--	--	--	--

#	K?	Field Name	Model	Datatype	Domain	Lookup	B	V	Unit	Meas	Description
1	Y	From Node			NODELINK						From node extracted from NodeLink for the world map display
2	Y	To Node			NODELINK						To node extracted from NodeLink for the world map display
3	Y	Transport Mode			NODELINK						Transport mode for this link (only one link is permitted for each mode; multiple links can be created by adding nodes)
4		Is Link Disabled?			Yesflag						Yes if the link is available, blank otherwise

MAPNODE Map Node	Edit Limits	Lists nodes and locations extracted from NODE for the world map display				
----------------------------	-------------	---	--	--	--	--

#	K?	Field Name	Model	Datatype	Domain	Lookup	B	V	Unit	Meas	Description	
1	Y	Node Name			NODE						Node name or location extracted from NODE for the world map display	
2		Node Type			NODETYPE						Node type for world map graphics display	
3		Node Latitude			Lat			Yes	deg	min	H	Node latitude in dd mm H
4		Node Longitude			Lon			Yes	deg	min	H	Node longitude in ddd mm H
5		Is Node Disabled?			Yesflag							Yes if the node is disabled, otherwise blank

MAPREQ Map Req Channels	Edit Limits Output	Summarizes requirement quantities by origin/destination channel for mapping				
-----------------------------------	-----------------------	---	--	--	--	--

#	K?	Field Name	Model	Datatype	Domain	Lookup	B	V	Unit	Meas	Description
1	Y	Origin			NODE						Origin of this flow channel
2	Y	Destination			NODE						Destination of this flow channel
3	Y	Cargo Measure			BASMEAS						Basic cargo quantity measure
4		Total Quantity			Double>=0				Q		Total quantity for this flow channel and basic measure

MAPTABLE Mapping Table Specs	Edit Limits Hide	Defines the map table specifications				
--	---------------------	--------------------------------------	--	--	--	--

#	K?	Field Name	Model	Datatype	Domain	Lookup	B	V	Unit	Meas	Description
1	Y	Map Table			TABLE						The name of a mapping source table
2		Map Type			MAPTYPE			Yes			The type of mapping display for this table (Node or Link)
3		Number Keys			1,7						The number of keys is the source node table
4		Parent Table			MAPTABLE						The node source table for link mapping tables
5		Browse Table			TABLE						A table with additional browse information about the records in the map table (this table have initial keys matching Map Table)

Directory Type: Scenario

MAPTABLE Mapping Table Specs		Edit Limits Hide	Defines the map table specifications			
#	K?	Field Name	Model	Datatype	Domain Lookup	B V Unit Meas Description
6		Browse File			A12	A report file with additional browse information about the records (this report must have searchable text with matching key field values, with multiple key field strings separated by commas)
7		Chart Table			TABLE	A table with charting information, first keys must match the mapping table, followed by an optional key field for crosstab headings (such as Product), followed by a key field such as Date for the x axis, followed by a chart value
8		Layer Field			A25	The layer selection field for the mapping table (blank if the entire table is plotted on one layer)
9		Latitude Field			A25	The latitude field for a node table
10		Longitude Field			A25	The longitude field for a node table
11		Picture Field			A25	The picture name field for a node table
12		Label Field			A25	The label field for the mapping table
13		Is Disabled Field			A25	Field which determines if this object is disabled
14		Remove Reverse Links			Yesflag	Yes for a map link table for which reverse links are to be removed, otherwise blank
15		Subset Table			TABLE	The table to be used for subset values, with the first keys matching the Map Table, and an additional key representing disjoint subsets (e.g. location date)
16		Subset Field			A25	The dynamic subsetting field for the mapping table

MAPTHRU Map Node Thrupt		Edit Limits Output	Summarizes node daily throughput quantities for map chart display			
#	K?	Field Name	Model	Datatype	Domain Lookup	B V Unit Meas Description
1	Y	Node			NODE	Node for map throughput chart
2	Y	Measure			MEASURE	Cargo quantity measure for throughput chart
3	Y	Day			simendday	Day for map throughput chart
4		Quantity			Double>=0	Total throughput quantity for this node, day, and quantity measure

MAPVEH Map Vehicle		Edit Limits Output	Lists vehicles extracted from VEHICLE for the world map display			
#	K?	Field Name	Model	Datatype	Domain Lookup	B V Unit Meas Description
1	Y	Vehicle Number			VEHICLE	Vehicle unique sequential number extracted from the VEHICLE table for the map display
2		Vehicle Type			VEHFLEET	Vehicle type
3		Vehicle Identifier			VEHFLEET	Vehicle identifier
4		Vehicle Fleet			VEHFLEET	Vehicle fleet for this vehicle
5		Mode			MODE	Transport mode for this vehicle
6		Latitude Computed			Lat	deg min H Current latitude computed for the current date and time
7		Longitude Computed			Lon	deg min H Current longitude computed for the current date and time

MEASURE Measure		Edit Limits	Lists the types of dimensional measures used to define cargo, vehicle compartments, or node facilities			
#	K?	Field Name	Model	Datatype	Domain Lookup	B V Unit Meas Description
1	Y	Measure Type			A15	Type of measure used for describing cargo, vehicle compartments, or node facilities (e.g., Ston, Mton, Sq Ft, CBbl, Max Ft., Max Item Ston, etc.)
2		Measure Class	measclas		MEASCLAS	Yes Measure class for this measure type
3		Matching Cargo Measure	meascrgmeas		MEASURE	Yes Matching cargo measure which is used for calculating constraints using this constraint measure
4		Unit of Measure			A25	Unit of measure for this type of measure
5			basicmeas		BASMEAS	Basic measure corresponding to this measure, if any
6			measrptmeas		RPTMEAS	The matching record in RPTMEAS corresponding to this measure, if any

MISSION Mission		Edit Limits	Lists special missions such as TACS, AFOE, etc.			
#	K?	Field Name	Model	Datatype	Domain Lookup	B V Unit Meas Description
1	Y	Special Mission			A15	Name of a special mission, e.g. Marine amphibious task force, or crane ship, or other mission
2		Mission Begin Day	missbeg		DayToHr	day (hr) Begin day that a designated special mission ship or fleet is restricted to matching

Directory Type: Scenario

MISSION Mission	Edit Limits	Lists special missions such as TACS, AFOE, etc.				
--------------------	-------------	---	--	--	--	--

#	K?	Field Name	Model	Datatype	Domain	Lookup	B	V	Unit	Meas	Description
3		Mission End Day		missend	DayToHr				day	(hr)	special-mission requirements only End day that a designated special mission ship or fleet is restricted to matching special-mission requirements only
4		Delay Hours After Offload		missdelay	HoursDelay				hr		Additional delay hours in the depart time after offload of special mission cargo at its ultimate destination node (delays the vehicle at the stop, not the cargo delivery)

MODE Mode of Transport	Edit Limits	Lists transportation modes (air, sea, motor, organic, rail, intratheater air, etc.)				
---------------------------	-------------	---	--	--	--	--

#	K?	Field Name	Model	Datatype	Domain	Lookup	B	V	Unit	Meas	Description
1	Y	Transport Mode			A15						Name of a transport mode (e.g. Airlift, Sealift, Rail, Motor, Pipeline, Generic, etc.)
2		Scheduling Model Type		schedtype	SCHEDTYP			Yes			Scheduling model algorithm type used for this mode of transport
3		ASCII Code Abbreviation		modechar	ASCII	Upper					ASCII code of a single upper case letter abbreviation used by the model to display on-screen activity progress (S for Sea, A for Air, etc., with lower case for planning and upper case for scheduling and simulation)
4				listexmode	EXCLUDE						List of exclusions for this mode, if any
5				listvehetype	VEHETYPE						List of vehicle types for this mode
6				maxrange	Short	>=0					Max empty range and max link distance over all vehicles of this mode
7				cancnv	Boolean						Flag that is set to TRUE if a mode can convoy, FALSE otherwise
8				hasmission	Boolean						Flag that is set to TRUE for the current mode if the requirement has a mission
9				listmodefleet	PLANFLT						List of planning fleets for this mode

NODE Node	Edit Limits	Lists nodes and locations for all ports, origins, destinations, transshipment points, and routing points				
--------------	-------------	--	--	--	--	--

#	K?	Field Name	Model	Datatype	Domain	Lookup	B	V	Unit	Meas	Description
1	Y	Node Name			A15						Node name corresponding to a port, transshipment point, origin, destination, routing point etc.
2		Node Type			NODETYPE						Node type for world map graphics display
3		Node Latitude		nodelat	Lat			Yes	deg	min	H
4		Node Longitude		nodeelon	Lon			Yes	deg	min	H
5		Geoloc Code		nodegeoloc	A4						Node geoloc code, if any
6		Theater		nodethr	THEATER			Yes			Theater that the node is located in, if any
7		Attrit Probability %		nodeattr	0,9999				%		Discrete probability of attrition or breakdown when departing this node
8		Is Node Disabled?		isnodegone	Yesflag						Yes if the node is disabled, otherwise blank
9				firstlink	NODELINK						Node first link
10				firstfac	FACILITY						Node first facility
11				firstnodecap	NODECAP						First node throughput in the NODETHRU table, if any
12				listexnode	EXCLUDE						List of exclusions for this node, if any
13				nodehrptr	NODCAPHR						First record in the NODCAPHR table, if any, for this node on the current simulation day
14				nodehpd	0,24						Node operating hours per day based on the maximum facility hours at the node
15				nodestoroffset	MEASURE						Offset for the first NODECAP record for storage relative to the first record
16				nodethrupoffset	MEASURE						Offset for the first NODECAP record for throughput relative to the first record
17				firstconvoy	CONVOY						Node first convoy record (currently not input in Preprocessor because of file limits)
18				prednode	NODE						Predecessor node in the shortest spanning tree algorithm in NetTool
19				label	Long	>=0					Distance from the root in the NetTool shortest spanning tree algorithm
20				join_label	Boolean						Temporary flag for finding the common root of two nodes in the NetTool spanning tree algorithm
21				listlink	NODELINK						List of links at the node in NetTool
22				listnodevent	NODEVENT						Pointer to list of nodevent records for this node
23				listcargo	CARGO						List pointer for the multicriteria list of cargos, paralleling mheapcargo
24				nextnode	NODE						Next pointer for the list of nodes
25				prednodevent	NODEVENT						Pointer to the last begin pred nodevent record accessed by the subtract capacity function

Directory Type: Scenario

NODE Node		Edit Limits	Lists nodes and locations for all ports, origins, destinations, transshipment points, and routing points			
#	K?	Field Name	Model	Datatype	Domain Lookup	B V Unit Meas Description
26			firstconstrate	CONSRATE		First supply consumption rate for this node

NODE2 Shadow Node		Edit Limits Display Onl	Provides a shadow copy of the NODE table for form and report linkages			
#	K?	Field Name	Model	Datatype	Domain Lookup	B V Unit Meas Description
1	Y	Node Name		NODE		Node name corresponding to a port, transshipment point, origin, destination, routing point etc.
2		Node Type		NODETYPE		Node type for world map graphics display
3		Node Latitude		Lat	Yes deg min H	Node latitude in dd mm H
4		Node Longitude		Lon	Yes deg min H	Node longitude in ddd mm H
5		Geoloc Code		A4		Node geoloc code, if any
6		Theater		THEATER	Yes	Theater that the node is located in, if any
7		Attrit Probability %		0,9999	%	Discrete probability of attrition or breakdown when departing this node
8		Is Node Disabled?		Yesflag		Yes if the node is disabled, otherwise blank

NODECAP Node Capacity		Edit Limits	Defines total throughput at each node for all facilities at the node			
#	K?	Field Name	Model	Datatype	Domain Lookup	B V Unit Meas Description
1	Y	Node Name	thrupnode	NODE		Node having throughput or storage limits
2	Y	Node Capacity Measure	nodemeas	MEASURE		Unit of measure for overall cargo handling capacity at the node
3		Total Node Capacity	nodecap	nodecap		Hourly throughput rate or total storage cargo handling capacity at the node for all facilities combined
4			nodecapstor	nodecap	Q	Remaining storage capacity if the measure is storage
5			nodecapsathrs	HoursDelay	hr	Start hour on the current day for which this facility storage capacity measure became saturated (0 if unsaturated)

NODELINK Node Link		Edit Limits	Lists single leg links between nodes for transportation			
#	K?	Field Name	Model	Datatype	Domain Lookup	B V Unit Meas Description
1	Y	From Node		NODE		From node name
2	Y	To Node	linktonode	NODE		To node name
3	Y	Transport Mode	linkmode	MODE		Transport mode for this link (only one link is permitted for each mode; multiple links can be created by adding nodes)
4		Is Link Disabled?	islinkgone	Yesflag		Yes if the link is disabled and unavailable, blank otherwise
5		Link Dist	linkdist	Short>=0		Link distance in nautical miles, computed by the model based on great circle if 0, or can also be set by the user (but will be recalculated as the great circle distance if less than the great circle distance)
6		Added Delay Hours	linkdelay	HoursDelay	hr	Delay time on this link in hours
7		Speed Change	linkspeedincr	-99,999	nmi/hr	Speed change (positive for increase, negative for decrease) which is added to the transport speed on this link (for seallift an approximate calculation is to get an equivalent distance change), in nautical mph
8		Speed Limit	linkspeedlim	1,999	nmi/hr	Speed limit which constrains the allowable transport speed on this link (for seallift an approximated distance change is computed), in nautical mph
9		Link Rating	linkrating	0,9999		User-definable link rating which limits the size of vehicles that are permitted through this link, based on their Route Type; for example, the Link Rating may represent maximum canal draft, excluding deep draft ships
10		Attrit Daily Rate %	linkattr	0,9999	%/day	Attrition or breakdown rate on this link for exposure-based attrition
11			is_barrier	Boolean		Boolean flag set to one if a link is an obstacle rather than a transport path, zero otherwise
12			nextlink	NODELINK		Next link at the same node in NetTool
13			track_count	Short>=0		Count of the number of times a link has appeared in a route
14			firstlinkcap	LINKCAP		First pointer to a link capacity record
15			listlnkevent	LNKEVENT		List pointer to list of events for this link, if any

Directory Type: Scenario

NODETYPE Shape		Edit Limits	Lists the node types for world map display				
# K?	Field Name	Model Datatype	Domain	Lookup	B/V	Unit Meas	Description
1	Y Node Type		A15				Node type for world map display
PARAM Parameter		Edit Limits Modify	Sets parameters for the scheduling model				
# K?	Field Name	Model Datatype	Domain	Lookup	B/V	Unit Meas	Description
1	Y Scenario Name		A8				Scenario short name and directory name
2	Scenario Description		A50				Scenario description
3	Vehicle Snapshot Day	currday	simendday			day	Current day used to interpolate vehicle locations for the world map display
4	Vehicle Snapshot Hour	currrhr	Hour			hour	Current hour used to interpolate vehicle locations for the world map display
5	Security Classification		CLASSIF				Security classification level of the data
6	Last Simulation Day	simendday	simendday		Yes	day	Last day to simulate
7	Do Dynamic Resupply?	dodynres	Yesflag				Yes if dynamic resupply generation is to be performed in the model
8	Do Static Resupply?	dostatres	Yesflag				Yes if static resupply requirement generation is to be performed (can be left blank to re-use the dynamic resupply computed from a prior run)
9	Static Order Interval	order_interval	1,99			day (hr)	Aggregation interval for computing resupply order quantities
10	Do Convoying?	docnvy	Yesflag				Yes if convoying is to be performed using the CONVOY table, blank otherwise
11	Do Convoy At Intervals?	docnvyinterval	Yesflag				Yes if convoys are to be scheduled at regular intervals independent of convoy size (convoys can then be scheduled more efficiently)
12	Convoy Begin Day	cnvybeg	DayToHr			day (hr)	Day that convoy operations begin
13	Max Speed Convoyed	cnvymaxspeed	1,99		Yes	nmi/hr	Max speed limit above which ships are not convoyed and instead travel independently, in nautical mph
14	Max Convoy Diversion	cnvymaxdivert	Short>=0		Yes	nmi	Max diversion distance above which ships are not convoyed and instead travel independently, in nautical miles
15	Do Attrition?	doattrit	Yesflag				Yes if attrition or breakdown is to be performed, blank otherwise
16	Do Parameter Vary?	doparam	Yesflag				Yes if parametric variations are to be performed, blank otherwise
17	Number of Stochastic Runs	nstatruns	0,99				Number of runs if stochastic simulation is performed using probability distributions
18	Personnel Lead Days	prsnleadtim	DaysDelayToHr			day (hr)	Earliest lead time that personnel can arrive prior to other cargo in the same requirement
19	Random Number Seed	seed	Short>=0				Random number seed for stochastic simulations including attrition
20	Minimum Vehicle Load %	vehminpc	%			%	Minimum percent of the total vehicle compartment capacity which must be filled to be worth assigning a cargo, unless the Minimum Cargo Load % below is satisfied
21	Minimum Cargo Load %	crgminpc	%			%	Minimum percent of a cargo which must be loadable to be worth assigning a cargo to a vehicle, unless the Minimum Vehicle Load % above is satisfied
22	Do Balanced Forces?	balance_forces	Yesflag				Flag to dynamically replace reqtype priority with percent delivered
23		totncrg	Long>=0				Total number of cargos to be planned, used in displaying progress on screen
24		nrofcpt	CPTTYPE				Number of compartments for the current vehicle type with capacities stored in VCPTMEAS
25		curday	0,999			day	Current day in the simulation model (not converted to hours)
26		tvstartrec	TIMEVARY				Current starting record in the TIMEVARY table for updating the next set of time variations
27		maxnomspeed	Long>=0			nmi/hr	Max planning mode speed for calculating lower bounds, in nautical mph
28		mintonmipen	Long>=0			mils/ton/n	Max ton-mile penalty scaled by 1000 (in mils/ton/mi) used for mode planning lower bounds (equals min of 1000*nompen/nomspeed over all modes)
29		simend	DayToHr			hr	Simulation ending hour for the model, including an extra shutdown day
30		cnvyminspeed	Short>=0			nmi/hr	Required minimum speed for ships to convoy (computed as the max convoy speed), in nautical mph
31		listcrgonboard	CARGO				List of cargos onboard the current trip in expected value attrition calculations
32		listcrgreject	CARGO				List of rejected cargos which could not be scheduled
33		curdayfirstthr	DayToHr			day (hr)	First hour of the current simulation day
34		tottons	Long>=0			ston	Total requirement tonnage used for the onscreen display of progress (including

PARAM Parameter		Edit Limits Modify	Sets parameters for the scheduling model				
#	K? Field Name	Model	Datatype	Domain	Lookup	B V	Unit Meas Description
35			totintransit	Long>=0			ston other basic measures converted to stons) Total intransit tonnage used for the onscreen display of progress (including other basic measures converted to stons)
36			totdelivered	Long>=0			ston Total delivered tonnage used for the onscreen display of progress (including other basic measures converted to stons)
37			listcrgflow	CARGO			List of vehicle flow cargo's which have been partially scheduled
38			listnode	NODE			List of nodes with cargos ready for scheduling, sorted by the earliest scheduling priority of cargos at each node
39			listgreedyveh	CARGO			List of cargos suitable for loading on a greedy vehicle
40			last_resupply_order	Long>=0			Last resupply order number saved for snapshot restarts

PLANFLT Planning Fleet		Edit Limits	Lists the fleet aggregations used for planning modes, ports, cargo configurations, and pre-scheduled routes				
#	K? Field Name	Model	Datatype	Domain	Lookup	B V	Unit Meas Description
1	Y Planning Fleet			A15			Aggregation of fleets used for planning modes, ports, cargo configurations, and prescheduled routes
2	Fleet Mode	fleetmode		MODE		Yes	Transport mode used by the planning fleet
3	Transport Agent			A15		Yes	Transportation agent or company identifier for this fleet
4	Planning Speed	nomspeed		1,999		Yes	nmi/hr Nominal planning speed in nautical mph or knots for planning routes and target lift dates (this is a planning speed, not a scheduling or simulation speed, and should be set to match slower vehicles)
5	Planning Delay Hours	nomdelay		HoursDelay			hr Nominal planning delay time in hours for each mode change to allow for vehicle repositioning, loading, unloading, and other delays for planning routes and target lift dates (accounts for repositioning in planning, not just load times)
6	Planning Ton-Hour Penalty	nompen		1,999		Yes	\$/hr/ton Nominal penalty per ton per hr for transport via this vehicle type for planning routes and target lift dates
7	Plan Fleet Productivity %			Float 0,100			% of C-mi/ Plan fleet useful planning percent allocation or productivity %, expressed as a percent of transport lift flow capacity (Mton-mi/day, SqFt-mi/day, etc.) as contributed by the first measure of each compartment
8	Utilization Rate %	vuterate		1,100			% Vehicle effective utilization (UTE) rate expressed as a percent usage per day based on maintainability, logistics support, re- basing, non-productive use (applies to travel time only, not time in port, and cause recovery delays after trips)
9	Greedy Vehicle Wait	maxwaittime		HoursDelay			hr Max wait time for evaluating additional cargo at the same POE after an assignment, used in the vehicle scheduling algorithm
10	Standard Depart Interval			Short>=1			day Standard depart time interval for a prescheduled route, stored for reference only and not used to generate routes
11	Stop Arrival Tolerance	route_tolerance		DaysDelayToHr			day Time window tolerance for early or late arrival at the prescheduled stops on this route
12	Route Delay Penalty	route_delay_penalty		Short>=0			Penalty for the delay of prescheduled stops when inserting new stops, the input value is the penalty of one day delay in cents, with increasing cost for greater delays
13	Remain On Route?	remain_on_route		Yesflag			Yes if the prescheduled ship should stay on its prescheduled route only up through the Route Last Day
14	Description			A50			Description of the prescheduled route
15		nextmodefleet		PLANFLT			Next fleet in list of fleets for a mode
16		firstplnfltcp		PLNFLTCP			First matching record in the table of capacities for this planning fleet
17		listflevent		PFLEVENT			List of capacity usage events for this fleet
18		listexfleet		EXCLUDE			List of exclusions for this planning fleet, if any
19		skip_planflt		Boolean			Planing fleet flag to skip evaluation used in mode planning
20		has_vehicle		Boolean			Flag that is true if the planning fleet has vehicles
21		predflevent		PFLEVENT			Pointer into the list of events to make list scans take less time
22		origin_depart_time		DayToHr			Estimated latest time that a vehicle from

Directory Type: Scenario

PLANFLT Planning Fleet		Edit Limits	Lists the fleet aggregations used for planning modes, ports, cargo configurations, and pre-scheduled routes			
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas Description
23	planflt_start		DayToHr			the current planning fleet can leave the origin last hour when its mode isn't adjacent to the origin The minimum start schedule time for all vehfleets for this planflt record
PLNFLTCP Plan Fleet Capacity		Edit Limits	Stores the allocated throughput capacity for each planning fleet for use in mode and port selection, as calculated from the percent allocation in PlanFLT			
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas Description
1 Y	Planning Fleet			PLANFLT		Planning fleet
2 Y	Compartment Measure	fleetcapmeasure		MEASURE		Unit of measure for the dynamic capacity constraint for this fleet
3	Allocated Fleet Capacity	fleetcapacity		Long>=0	Yes	mton-mi/hr Dynamic vehicle capacity allocated for the planning fleet, measured in compartment capacity times speed throughput units, such as mton-mi/hr, sqft-mi/hr, etc.
4		fleetsimremain		Long+/-		Fleet dynamic throughput capacity available for simulation, may go negative temporarily since trips are not interrupted in mid-route
5		fleetsimflag		Boolean		Fleet simulation flag used in the model
PLNFLTTR Plan Fleet Transfer		Edit Limits	Specifies the allowable fleet to fleet transfers			
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas Description
1 Y	From Planning Fleet			PLANFLT		The from planning fleet in a fleet to fleet transfer
2 Y	To Planning Fleet			PLANFLT		The to planning fleet in a fleet to fleet transfer
3	Allow Cargo Transfers?	allow_transfers		Yesflag		Marked Yes if the model should allow cargo transfers between the fleets
REJREAS Rejection Reason		Edit Limits	Lists cargos delayed and a count of candidate vehicle rejections by vehicle type			
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas Description
1 Y	Cargo Number	rejcrj		CARGO		Cargo number that is delayed or rejected
2 Y	Rejection Type			REJTYPE		Rejection reason type
3	Rejection Count	rejcount		Short>=0		Count of rejections for this cargo and rejection reason type
REQCLASS Requirement Class		Edit Limits	Lists the aggregated requirement classes for calculating summary cargo delivery versus required totals for reports			
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas Description
1 Y	Requirement Class			A15		Aggregated requirement class for calculating summary cargo delivery versus required totals for reports
REQFAC Req Facility Change		Edit Limits	Calculated table listing the facilities that a requirement improves			
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas Description
1 Y	Requirement			REQUIRE		A requirement which modifies the facility capacity when delivered
2 Y	Node	reqfacility		FACILITY		The target node whose facility capacity changes after complete delivery of the requirement
3 Y	Facility			FACILITY		The target facility whose capacity changes after complete delivery of the requirement
4		firstreqimprv		REQIMPRV		First pointer to the improvements associated with this requirement and facility
REQFLEET Required Fleet		Edit Limits	Defines the allowable fleets by mode for a requirement type, if the requirement type is restricted to certain fleets			
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas Description
1 Y	Requirement Type			REQTYPE		Requirement type which has restricted allowable fleets
2 Y	Transport Mode	reqfleetmode		MODE		Transport mode with restricted fleets
3 Y	Allowable Planning Fleet	reqfleet		PLANFLT		Allowable planning fleet for this requirement type and transport mode

REQIMPRV Req Pac Cap Change		Edit Limits	Defines how the delivery of a requirement improves facility throughput			
# K?	Field Name	Model Datatype	Domain Lookup	B V	Unit Meas	Description
1	Y Requirement		REQUIRE			A requirement which modifies the facility capacity when delivered
2	Y Node		FACCAP			The target node whose facility capacity changes after complete delivery of the requirement
3	Y Facility		FACCAP			The target facility whose capacity changes after complete delivery of the requirement
4	Y Throughput Measure		FACCAP			A throughput measure whose capacity is changed after complete delivery of the requirement
5	Throughput Change	faccap_change	Long>=0			The amount of throughput change at this facility in the appropriate units of measure
6		faccap_change_meas	MEASURE			The throughput measure record in the MEASURE table

REQLAG Requirement Link Lag		Edit Limits	Defines timing links between delivery of independent and dependent requirements			
# K?	Field Name	Model Datatype	Domain Lookup	B V	Unit Meas	Description
1	Y Dependent Req Id	dependent_req	REQUIRE			Dependent requirement identifier whose delivery must come after delivery of one or more independent requirements
2	Y Independent Req Id	independent_req	REQUIRE			Independent requirement identifier whose delivery must come before delivery of one or more dependent requirements
3	Min Lag Days	reqminlag	DaysDelayToHr		day (hr)	Minimum lag time after the predecessor requirement is delivered before which the successor requirement should not be delivered
4	Target Lag Days	reqlag	DaysDelayToHr		day (hr)	Target lag time after the predecessor requirement is delivered before which the successor requirement should not be delivered

REQMISS Required Mission		Edit Limits	Lists special missions for requirements, cargo classes, and modes			
# K?	Field Name	Model Datatype	Domain Lookup	B V	Unit Meas	Description
1	Y Requirement Id		REQUIRE			Movement requirement having a special mission
2	Y Cargo Class	reqmissclas	CARGCLAS			Cargo class to which the special mission applies (Dry, Pax, etc.)
3	Y Mode	reqmissmode	MODE			Transport mode to which the special mission applies
4	Special Mission	reqmiss	MISSION	Yes		Special mission for this requirement, cargo class, and transport mode

REQMODE Required Mode		Edit Limits	Lists excluded modes for specific requirements and cargo classes			
# K?	Field Name	Model Datatype	Domain Lookup	B V	Unit Meas	Description
1	Y Requirement Id		REQUIRE			Movement requirement having a mode exclusion
2	Y Cargo Class	reqmodeclas	CARGCLAS			Cargo class for which the mode exclusion applies
3	Y Excluded Mode	reqmodeexcl	MODE			Excluded mode for this requirement and cargo class

REQNIMPR Req Node Cap Change		Edit Limits	Defines how the delivery of a requirement improves node throughput			
# K?	Field Name	Model Datatype	Domain Lookup	B V	Unit Meas	Description
1	Y Requirement		REQUIRE			A requirement which modifies the node capacity after arrival
2	Y Node		NODECAP			The target node whose capacity changes after complete delivery of the associated requirement
3	Y Throughput Measure		NODECAP			A throughput measure whose capacity is changed after complete delivery of the requirement
4	Throughput Change	nodecap_change	Long>=0			The amount of throughput change at this facility in the appropriate units of measure
5		nodecap_change_meas	MEASURE			A throughput measure record in the MEASURE table

Directory Type: Scenario

REQNODE Required Node		Edit Limits	Lists required intermediate POE or POD nodes or ports for movement requirements with specified staging, POE/POD time frames, and mode of transport if desired				
#	K? Field Name	Model	Datatype	Domain	Lookup	B V Unit Meas	Description
1	Y Requirement Id			REQUIRE			Movement requirement identifier with intermediate ports or staging
2	Y Cargo Class	reqnodeclas		CARGCLAS			Cargo class for which the required node applies
3	Y LAD	reqlatetim		DayToHr		day (hr)	Latest arrival day at this required port node (the LAD is used to determine the order in which required nodes are visited)
4	EAD	reqearlytim		DayToHr		day (hr)	Earliest arrival day at this required port node, if any
5	Required Node	reqnode		NODE	Yes		Required intermediate POE/POD node or port for this movement requirement
6	Required Mode to Node	reqnodemode		MODE			Required transport mode specified for delivery to the intermediate node, if any (blank permits the use of any mode for delivery)
7	Required Config to Node	reqnodecfg		CARGCONF			Required configuration specified for delivery to the intermediate node, if any (blank permits the use of any configuration)
8	Stage Name	reqstage		STAGE			Staging deployment name if multiple requirements are staged together at this node (the STAGE record must have the same node as in REQNODE)
9	Description			A50			Description of this intermediate node, e.g. consolidation, container stuffing, mode change, re-configuration, combat loading, etc.

REQNOIM Req Node Improved		Edit Limits Output	Calculated list of requirements which improve node throughput				
#	K? Field Name	Model	Datatype	Domain	Lookup	B V Unit Meas	Description
1	Y Requirement			REQUIRE			A requirement which modifies the node capacity when fully delivered
2	Y Node	reqnode_improved		NODE			The target node whose capacity changes after complete delivery of the requirement
3		firstreqnoimpr		REQNIMPR			First pointer to the node improvements associated with this requirement

REQQUAN Requirement Quantity		Edit Limits	Provides quantity data for each movement requirement and cargo category				
#	K? Field Name	Model	Datatype	Domain	Lookup	B V Unit Meas	Description
1	Y Requirement Id			REQUIRE			Requirement identifier for the cargo
2	Y Cargo Category	reqcatmeas		CATMEAS			Cargo category which describes the kind of cargo being transported
3	Y Cargo Measure			CATMEAS			Dimensional measure for this requirement and cargo category
4	Quantity	reqqn		reqqn	Yes	Q	Requirement category quantity or dimension in this unit of measure
5		heapreqcat		REQQUAN			Heap sort order for this requirement quantity prior to mode planning

REQRET Requirement Return		Edit Limits	Lists requirement return or transfer days, if any, for removing requirements from a theater and eliminating its supply consumption and pax regeneration				
#	K? Field Name	Model	Datatype	Domain	Lookup	B V Unit Meas	Description
1	Y Requirement Id			REQUIRE			Requirement identifier that is returned or leaves the theater after delivery
2	Return Day	reqret		DayToHr		day (hr)	Requirement return day or departure day when it leaves the theater

REQTYPE Requirement Type		Edit Limits	Provides data about requirement types or unit types				
#	K? Field Name	Model	Datatype	Domain	Lookup	B V Unit Meas	Description
1	Y Requirement Type			A15			Requirement type or unit type
2	Requirement Class	reqclas		REQCLASS	Yes		Aggregated requirement class for calculating summary cargo delivery versus required totals for reports
3	Service	reqservice		SERVICE	Yes		Service for this requirement type or unit type
4	Planning Horizon Days	reqlook		DaysDelayToHr		day (hr)	Planning or look-ahead horizon in days for scheduling cargos of this requirement type prior to their target lift date
5	Assembly Delay Days	reqassdel		DaysDelayToHr		day (hr)	Additional assembly delay days needed after delivery at the destination used to calculate closure and lateness relative to the RDD
6	RLD Packaging Range			DayToHr		day (hr)	Packaging range for merging movements with similar Ready to Load Dates (RLDs)

Directory Type: Scenario

REQTYPE Requirement Type		Edit Limits	Provides data about requirement types or unit types				
# K?	Field Name	Model Datatype	Domain	Lookup	B V	Unit Meas	Description
7	RDD Packaging Range		DayToHr			day (hr)	Packaging range for merging movements with similar Required Delivery Dates (RDDs)
8	RDD Tolerance	rddtol	DaysDelayToHr			day (hr)	Days tolerance for lateness at the destination relative to the RDD before mode planning increases delivery cost to reduce lateness
9	Max Days Late	maxlateness	DaysDelayToHr	Yes		day (hr)	Days late relative to the target delivery date beyond which a cargo is rejected in scheduling and is reported with rejection reasons, even if the penalty is acceptable
10	Cargo Lateness Penalty	reqlatepen	0,100			.01\$/Q-day	Penalty for cargo ton-days of lateness (as compared with vehicle usage penalties) in the scheduling algorithm
11	Penalty/Benefit Cut-off	reqcutoff	Long>=1			\$/	Cost cut off level above which a potential cargo assignment is rejected early in the multi-port scheduling algorithm (blank or a large value means no cutoff)
12	Early Assignment Level	reqthresh	Short>=0			\$/	Threshold penalty/benefit level below which a potential cargo/ship assignment is accepted immediately in the multi-port scheduling algorithm (a large value reduces run time but may make a selection before costing a preferred vehicle)
13	Regeneration Delay Days	regendel	DaysDelayToHr			day (hr)	Nonzero delay days to regenerate attritted cargo for this requirement; cargo is regenerated with the same data as the original movement (blank means no regeneration)
14	Default Priority Order	reqtyporder	1,99				Default priority order for this requirement type if not specified for a given requirement (1 is the earliest priority order; blank is treated as no priority or as 99)
15	Minimum Cargo Load %	reqminld	%			%	Minimum % split of a single cargo (i.e. requirement+category) for assigning to a separate non-airlift trip (not used for airlift; 100% prevents any non-airlift splitting; this is separate from the Minimum Cargo Load % and Minimum Vehicle Load % in PARAM)
16	Integrity Benefit	integrity_benefit	DaysDelayToHr			day (hr)	Wait days benefit indicating a preference for loading identical Requirement Id's onto the same vehicle trip
17	Is Resupply?	is_resupply	Yesflag				Yes if this requirement type is dynamically ordered by other requirements in the theater, when dynamic resupply is being modeled
18		firstsuppcons	SUPPCONS				First consumption rate for this requirement type
19		listexreqtyp	EXCLUDE				List of exclusions for this requirement type, if any
20		firstreqfleet	REQFLEET				First allowable requirement fleet record for this requirement type

REQUIRE Requirement to Move		Edit Limits	Provides information about each movement requirement or package				
# K?	Field Name	Model Datatype	Domain	Lookup	B V	Unit Meas	Description
1 Y	Requirement Id		A15				Movement requirement or package id
2	Major Unit	reqmajunit	MAJUNIT		Yes		Major unit associated with this movement requirement
3	Origin	reqorig	NODE		Yes		Starting origin of the requirement
4	Destination	reqdest	NODE		Yes		Final destination of the requirement
5	RLD	readytim	DayToHr			day (hr)	Ready to load day or earliest day the requirement is available at its origin
6	RDD	reqdeltim	DayToHr			day (hr)	Required delivery day of the packaged requirement at its destination including time for assembly
7	EDD	earlydel	DayToHr			day (hr)	Earliest allowed delivery day of the requirement at its destination prior to assembly
8	Computed Closure Day	close	DayToHr			day (hr)	Closure day for the requirement based on the closure minimum % requirement specified in the MajUnit table
9	Priority Order	reqpriority	1,99				Relative priority order for this requirement as a secondary sort after the Target Lift Date (one means first priority in assigning lift assets, blank defaults to the priority order of the requirement type)
10	Supply Requirement Id		SUPPREQ				Supply requirement identifier in the SUPPREQ table, when this requirement has been generated as either static or dynamic resupply
11		reqtotal	Long>=0				Total quantity for this requirement

REQUIRE Requirement to Move		Edit Limits	Provides information about each movement requirement or package						
#	K?	Field Name	Model	Datatype	Domain	Lookup	B V	Unit Meas	Description
12			listcrgclose		CARGO				Initially a list of requirement lag links with different predecessors for this successor; at the end, a list of terminal cargos arriving at the final destination sorted in order of end unload day for computing closure of the requirement
13			firstreqmode		REQMODE				First requirement excluded mode
14			firstreqmiss		REQMISS				First requirement special mission
15			firstreqquan		REQQUAN				First cargo for this requirement
16			firstreqlag		REQLAG				First successor requirement with a lag relative to this predecessor requirement
17			firstreqnode		REQNODE				First required node or port stop for this movement requirement
18			firstreqret		REQRET				First (and only) return day for this movement requirement
19			firstreqcat		REQCAT				First requirement category pair for this movement requirement
20			firstreqfac		REQFAC				First requirement facility improvement pair for this requirement
21			running_total		Long>=0			quantity	A running total of cargo quantities delivered for this requirement
22			listreqvflt		VEHFLEET				List of lift assets delivered with the requirement
23			firstreqnoim		REQNOIM				First requirement node improvement pair for this requirement

ROUTE Route Distances		Edit Limits Output	Outputs a summary distance matrix calculated by the model and used during scheduling						
#	K?	Field Name	Model	Datatype	Domain	Lookup	B V	Unit Meas	Description
1	Y	Route From Node	route_from_node		NODE		Yes		Beginning node for the computed port-to-port route distance
2	Y	Route To Node	route_to_node		NODE		Yes		Ending node for the computed port-to-port route distance
3	Y	Route Type	route_type		ROUTTYPE		Yes		The type of route
4	Y	Vehicle Is Empty?	vehicle_is_empty		Yesflag				Yes if the route is computed using an empty vehicle (such routes are computed separately only if the vehicle has a payload that depends on critical leg)
5		Distance	route_distance		Short>=0			nmi	The route distance in nautical miles
6		Total Delay	route_delay		HoursDelay			hours	The additional route delay in hours, including the cumulative effects of individual link delays, refueling stops, link speed limits, and link speed changes
7		Critical Leg	route_critical_leg		Short>=0			nmi	The critical leg distance, which is the longest distance between refueling stops (including recovery legs if refueling is excluded at the POD), in nautical miles
8		Payload Percentage	route_payload		%			%	The percentage of the total cargo payload listed in VehData that is permitted associated on this route based on the critical leg distance
9		Attrit Daily Rate	route_attrition		Short>=0			%%/day	The effective overall attrition rates of the route, based on the probability convolution of the individual link attrition rates
10		Attrit Probability	route_probability		0,9999			%%	The cumulative probability of discrete attrition on this route based on the node attrition probabilities
11			route_convoy		CONVOY				Convoy record, if any, associated with this route
12			nextroute		ROUTE				Next pointer for lists of routes
13			firstroutecap		ROUTECAP				First pointer to a group of pointers to capacitated links for this route

ROUTEEXCL Route Exclusion		Edit Limits	Lists excluded facility types for refueling on the various route types						
#	K?	Field Name	Model	Datatype	Domain	Lookup	B V	Unit Meas	Description
1	Y	Route Type			ROUTTYPE				Route type for computing vehicle paths
2	Y	Excluded Refuel Fac Type	routeexcl		FACTYPE				Excluded facility type for refueling on the route type

ROUTELINK Route Links Used		Edit Limits Output	Lists the links used by routes in the RouteOut distance matrix						
#	K?	Field Name	Model	Datatype	Domain	Lookup	B V	Unit Meas	Description
1	Y	Link From Node	route_link		NODELINK		Yes		From node for this transport link which is used by the routes listed in RouteOut
2	Y	Link To Node			NODELINK		Yes		To node for this transport link which is used by the routes listed in RouteOut
3	Y	Link Mode			NODELINK		Yes		Transport mode for this route link

Directory Type: Scenario

ROUTTYPE Route Type		Edit Limits	Provides route type data for determining vehicle paths, including refueling range, refueling facility requirements, and payload versus critical leg				
# K?	Field Name	Model Datatype	Domain	Lookup	B/V	Unit Meas	Description
1 Y	Route Type		A15				Route type for computing vehicle paths
2	Transport Mode	rtmode	MODE		Yes		Transport mode for this route type
3	Speed to Convert Delays	rtspd	1,999		Yes	nmi/hr	Nominal routing speed which is used to convert link delays and refueling delays to equivalent distances for routing, in nautical mph
4	Range at Max Payload	rng	Short>=1			nmi	Range or critical leg distance corresponding to the maximum allowed payload, in nautical miles
5	Payload Decrease %/kmi	rngchg	0,999			%/1000nmi	Percent decrease in payload per 1000 nautical miles of increase in critical leg distance beyond the max payload range
6	Refuel Arrive/Depart Time	refuelarrdeptim	Hour			hr	Arrival and depart time delays for refueling (e.g., landing and takeoff delays)
7	Refuel Time	refueltim	HoursDelay			hr	Refueling time in the facility
8	Required Link Rating	rtlinkrating	0,9999				User-definable link rating required for each link in a feasible path for this route type; for example, for sealift the Required Link Rating may represent ship draft, which cannot exceed the Link Rating (link draft) of any link on a feasible path
9	Refuel Fac Length Req.	refuelllen	Short>=0			ft	Facility length required for refueling
10	Refuel Fac Width Req.	refuelwid	0,999			ft	Facility width required for refueling
11	Refuel Fac Dimension Req.	refuelldim	0,999			varies	Facility dimension required for refueling (e.g., draft for sea)
12	Refuel Fac Rating Req.	refuelrating	Short>=0			varies	Facility rating level required for refueling (e.g., LCN or landing classification number for air, boom capacity for sea)
13		firstroutexcl	ROUTEXCL				First facility type exclusion for refueling on this route type
14		emptrng	Short>=0				Max empty vehicle range calculated from the payload decrease down to zero payload
15		refueltottim	HoursDelay			hr	Total refuel time including arrive and depart time

RPTCARGO Cargo Link		Edit Limits Output	Lists multi-modal cargo movements from origin to destination based on predecessor/successor relationships				
# K?	Field Name	Model Datatype	Domain	Lookup	B/V	Unit Meas	Description
1 Y	Cargo Split Id		A50				Cargo split identifier for this report
2	Cargo Number		CARGO				Cargo or shipment number
3	Requirement Id		REQUIRE				Movement requirement or package id
4	Cargo Category		CARGOCAT				Cargo category which describes the kind of cargo being transported
5	Cargo Configuration		CARGCONF				Cargo configuration which is used to package the cargo for transport on one or more modes
6	Cargo Type		CARGTYPE				Mode-specific cargo type which groups cargo categories for a given transport mode in order to define stow factors, load rates, and load compatibility for vehicle compartments
7	Cargo Basic Quantity		reqqn			Q	Cargo quantity in the basic unit of measure for its cargo class (ston, pax, cbbl)
8	Begin Load Day		DayToHr			day	Day that the cargo begins loading (in the model, this is also the earliest possible load time based on RLD or predecessor cargo or earliest theater depart, until the cargo is simulated)
9	End Load Day		DayToHr			day	Day that the cargo completes loading
10	Begin Unload Day		DayToHr			day	Day that the cargo begins offloading (in the model, this is also the earliest possible unload time until the cargo is simulated)
11	End Unload Day		DayToHr			day	Day that the cargo completes offloading (in the model, this is also crgtdd, the Target Delivery Date until the cargo is scheduled)
12	Cargo Predecessor		CARGO				Unique predecessor cargo which immediately precedes this cargo and carries the same requirement (zero for an origin cargo)
13	Arrive POE		DayToHr			day	Day cargo arrives at POE
14	POE		FACILITY				POE node
15	POE Facility		FACILITY				POE facility name
16	Depart POE		DayToHr			day	Day cargo departs POE
17	Arrive POD		DayToHr			day	Day cargo arrives at POD
18	POD		FACILITY				POD node
19	POD Facility		FACILITY				POD facility name
20	Depart POD		DayToHr			day	Day cargo departs POD
21	Vehicle		VEHICLE				Vehicle assigned to this trip
22	Number of Vehicle Trips		Long>=0				Number of vehicle trips assigned to this trip

Directory Type: Scenario

RPTFACIL Report Facility		Edit Limits Output	Provides a report on facility cargo loading and offloading combining the Facility, Stop, Cargo, Trip tables						
#	K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit	Meas	Description
1	Y	Facility Node			FACILITY				Node with one or more facilities
2	Y	Facility Name			FACILITY				Facility name at this node
3	Y	Stop Number			STOP				Unique stop number for this port or node facility visit
4	Y	Cargo Number			CARGO				Cargo or shipment number
5		Facility Type			FACTYPE				Facility type for this facility (if blank, this facility can handle all transport modes for which no facility is defined)
6		Max Vehicles Per Hour			facvph		veh/hr		Maximum combined vehicle arrivals and departures per hour which can be handled in this facility during its hours of operation
7		Max Parking			Short>=0		veh		Maximum number of "standard" vehicles permitted in the facility at the same time, e.g. MOG for airlift or number of berths for sealift (vehicle types may weighted by an equivalence factor to convert to a standard vehicle)
8		Operating Hours/Day			0,24		hr/day		Operating hours per day that the facility is open
9		Arrive Day			DayToHr		day (hr)		Arrive day at the stop port
10		Depart Day			DayToHr		day (hr)		Depart day from the stop port
11		Is Unload?			Yesflag				"Yes" flag to indicate that a stop is for unloading, otherwise blank
12		Hours Wait for Facility			HoursDelay		hr		Hours vehicle spent waiting for port facilities
13		Trip Number			TRIP				First stop arrive day of the trip associated with this stop
14		Vehicle			VEHICLE				Aircraft assigned to this trip (flight) if airlift
15		Requirement Id			REQUIRE				Requirement identifier for this cargo
16		Cargo Category			CARGOCAT				Cargo category which describes the kind of cargo being transported
17		Cargo Type			CARGTYPE				Cargo type for this cargo
18		Cargo Basic Quantity			reqqn		Q		Cargo quantity in the basic unit of measure for its cargo class (ston, pax, cbbl)
19		Basic Quantity Measure			MEASURE				Cargo quantity basic measure (ston, pax, cbbl)
20		Begin Load or Unload Day			DayToHr		day (hr)		Day that the cargo begins loading or unloading at the stop
21		End Load or Unload Day			DayToHr		day (hr)		Day that the cargo ends loading or unloading at the stop
22		Cargo Predecessor			CARGO				Unique predecessor cargo which immediately precedes this cargo and carries the same requirement (zero for an origin cargo)

RPTFCAP Report Facility Cap		Edit Limits Output	Provides a summary of facility capacity status over time						
#	K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit	Meas	Description
1	Y	Facility Node	rptfcap		FACCAP				Node with one or more facilities
2	Y	Facility Name			FACCAP				Facility name at this node
3	Y	Facility Capacity Measure			FACCAP				Throughput measure for this facility (ston throughput, ston storage, etc.)
4	Y	Day	rptfcapday		simendday		day (hr)		Day at which a change in facility resources or capacity changes
5		Daily Capacity Available	rptfcapavl		Long>=0		Q		Daily total capacity available summed over all hours of operation for throughput, or ending capacity for storage
6		Daily Capacity Used	rptfcapused		Long>=0		Q		Daily total capacity utilized summed over all hours of operation for throughput, or ending stored capacity for storage
7		Hours at Saturation	rptfcapsat		0,24		hr		Number of hours in the day during which this facility capacity measure is saturated

RPTFVEH		Edit Limits	Provides a summary of facility vehicle throughput over time						
Report Facility Veh		Output							
#	K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit	Meas	Description
1	Y	Facility Node	rptfvehfac		FACILITY				Node with one or more facilities
2	Y	Facility Name			FACILITY				Facility name at this node
3	Y	Facility Capacity Measure	rptfvehmeas		MEASCLAS				Vehicle throughput measure class for this facility (number of "standard" vehicle parking spaces, vehicles per hour, etc.)
4	Y	Day	rptfvehday		simendday		day (hr)		Day at which a change in facility resources or capacity changes
5		Max Available Capacity	rptfvehavail		Long>=0		Q		Daily total capacity available summed over all hours of operation
6		Utilized Capacity	rptfvehutil		Long>=0		Q		Daily total capacity utilized summed over all hours of operation
7		Hours at Saturation	rptfvehsat		0,24		hr		Number of hours in the day during which this facility is saturated, based on which capacity was limiting

Directory Type: Scenario

RPTLATE Report Lateness		Edit Limits Output	Summarizes delivery lateness for each theater and basic quantity measure					
#	K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas	Description
1	Y	Theater			THEATER			Theater name
2	Y	Basic Quantity Measure			BASMEAS			Basic quantity unit of measure (ston, pax, cbbl)
3	Y	Lateness Class			LATECLAS			Lateness classification for reporting summary lateness (e.g., Ontime, Scheduled, Unscheduled, Within 1 Day Late, etc.)
4		Total Quantity		totqn	Long>=0		Q	Total quantity for the theater, basic measure, and lateness classification
5		Total %		totpc	%		%	Total quantity percent for the theater, basic measure, and lateness classification

RPTMEAS Report Cargo Meas		Edit Limits Output	Lists the user-selected cargo quantity measures to be used in the RPTTOTAL and RPTTOTS cargo delivery reports, selected from RPTMEASU					
#	K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas	Description
1	Y	Cargo Report Measure		rptmeas	RPTMEASU			User-selected cargo quantity measures used for the RptMoe and RptTotal delivery profile reports
2		Select			A1			Selection checkmark

RPTMEASU Report Cargo Measure Hide		Edit Limits Output	Lists the available cargo quantity measures for the RPTTOTAL and RPTTOTS cargo delivery reports, extracted from CATMEAS					
#	K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas	Description
1	Y	Cargo Report Measure			MEASURE			Available cargo quantity measures for the RptMoe and RptTotal delivery profile reports

RPTMOE Report MOE		Edit Limits Output	Stores the cumulative combat effectiveness MOE profile delivered over time for each theater and Major Unit					
#	K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas	Description
1	Y	Theater			THEATER			Theater
2	Y	Major Unit			MAJUNIT			Major unit
3	Y	Delivery Day			simendday		day	Delivery day
4		Cumulative MOE Required		cummoereq	Short>=0		moe	Cumulative MOE quantity required by this day based on the MOE rating for each major unit in the MAJUNIT table
5		Cumulative MOE Delivered		cummoedel	Short>=0		moe	Cumulative MOE quantity delivered by this day based on the MOE rating for each major unit in the MAJUNIT table

RPTMOES Report MOE Summary		Edit Limits Output	Stores the cumulative combat effectiveness MOE profile delivered over time for each theater summarized by Requirement Class					
#	K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas	Description
1	Y	Theater			THEATER			Theater
2	Y	Requirement Class			REQCLASS			Aggregated requirement class for computing summary MOEs
3	Y	Delivery Day			simendday		day	Delivery day
4		Cumulative MOE Required		cummoereqsum	Short>=0		moe	Cumulative MOE quantity required by this day based on the MOE rating for each major unit in the MAJUNIT table
5		Cumulative MOE Delivered		cummoedelsum	Short>=0		moe	Cumulative MOE quantity delivered by this day based on the MOE rating for each major unit in the MAJUNIT table

RPTREQ Report Requirement		Edit Limits Output	Provides calculated summary data for cargo requirement reports					
#	K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas	Description
1	Y	Requirement Id			REQUIRE			Movement requirement or package id
2	Y	Basic Quantity Measure			MEASURE			Basic unit of measure for reporting (ston, pax, cbbl)
3	Y	Cargo Number			CARGO			Cargo or shipment number or package id
4		Major Unit			MAJUNIT			Major unit associated with this movement requirement
5		Require Total Quantity			reqqn		Q	Summation of the total REQQUAN quantity field for each Requirement
6		Origin			NODE			Starting origin of the requirement
7		Destination			NODE			Final destination of the requirement
8		RLD			DayToHr		day	Ready to load day or earliest day the requirement is available at its origin
9		RDD			DayToHr		day	Required delivery day of the packaged requirement at its destination (may be adjusted from the original CINC RDD)
10		EDD			DayToHr		day	Earliest allowed delivery day of the requirement at its destination
11		Computed Closure Day			DayToHr		day	Closure day for the requirement based on the closure minimum % requirement specified

Directory Type: Scenario

RPTREQ Report Requirement		Edit Limits Output	Provides calculated summary data for cargo requirement reports				
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit	Meas Description
12	Priority Order			1,99			in the REQTYPE table Relative priority order for this requirement as a secondary sort after the Target Lift Date (one means first priority in assigning lift assets, blank defaults to the priority order of the requirement type)
13	Delay Days			DaysDelayToHr		day	Assembly delay days to assist in determining the Days Late when added to the Unload Day
14	Cargo Category			CARGOCAT			Cargo category which describes the kind of cargo being transported
15	Cargo Type			CARGTYPE			Cargo type for this cargo
16	Cargo Basic Quantity			reqqn		Q	Cargo quantity in the basic unit of measure for its cargo class (ston, pax, cbbl)
17	Cargo % of Requirement			%		%	Cargo quantity as a percent of the total requirement quantity for this basic measure
18	Begin Load Day			DayToHr		day	Day that the cargo begins loading (in the model, this is also crgtld, the Target Lift Day until the cargo is scheduled)
19	End Load Day			DayToHr		day	Day that the cargo completes loading
20	Begin Unload Day			DayToHr		day	Day that the cargo begins offloading
21	End Unload Day			DayToHr		day	Day that the cargo completes offloading (in the model, this is also crgtdd, the Target Delivery Date until the cargo is scheduled)
22	Is Attritted?			Yesflag			Yes if the cargo is attritted in the last run results, blank otherwise
23	Attrit Probability %			0,9999		%	Calculated cumulative probability of attrition (in % or ten thousandths) for the cargo based on its route and schedule and including the attrition of predecessor cargos
24	Cargo Predecessor			CARGO			Unique predecessor cargo which immediately precedes this cargo and carries the same requirement (zero for an origin cargo)
25	Expected Quantity			reqqn		Q	Expected delivery quantity for display, computed as the cargo quantity times the attrition probability
26	Days Late			DaysDelayToHr		day	Days late for this cargo
RPTSTOP Report Stops		Edit Limits Output	Lists the vehicle stop itinerary				
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit	Meas Description
1	Y Stop Number			STOP			Stop number
2	Vehicle Number			VEHICLE			Vehicle for this stop
3	Trip			TRIP			Trip for this stop
4	Trip Start Day			DayToHr		day	Trip start day (first arrive day), used for sorting
RPTSUPST Daily Supply Storage Output		Edit Limits Output	Reports the daily inventory levels at each supply storage site, as well as periodic order quantities				
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit	Meas Description
1	Y Supply Category		rpt_supply_store	SUPSTORE			Supply cargo category which ordered and stored at a terminal by the dynamic resupply model
2	Y Supply Node			SUPSTORE			Storage node or terminal where the supply cargo is inventoried
3	Y Day		rpt_supply_day	simendday		day (hr)	Day on which the inventory has been tracked
4	Quantity On Hand		inventory	Long+/-		Q	Inventory level for this day
5	Quantity On Order		on_order	Long>=0		Q	Running total of the amount that has been ordered but not delivered as of this day
6	Order Daily Demand		demand_rate	Long>=0		Q/KCat/Day	Daily demand in effect on this day based on prior arrivals
7	Order Lead Time		lead_time	DayToHr		day (hr)	Estimated lead time used on this day
8	Quantity Ordered		quantity_ordered	Long>=0		Q	Basic quantity of resupply ordered on this day, if any
9	Order Number		order_number	Long>=0			Order number if a resupply order is placed on this day
RPTTOTAL Report Total Daily		Edit Limits Output	Stores the daily requirements delivery profile by Major Unit to the destination from the model results				
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit	Meas Description
1	Y Theater			THEATER			Theater
2	Y Major Unit			MAJUNIT			Major unit for this total delivery record
3	Y Cargo Measure			RPTMEAS			Cargo quantity measure
4	Y Delivery Day			simendday		day	Delivery day
5	Daily Quantity Required		dayqnreq	Long>=0		Q	Incremental quantity required on this day
6	Daily Quantity Delivered		dayqndel	Long>=0		Q	Incremental quantity delivered on this day
7	Cumulative Required		cumqnreq	Long>=0		Q	Cumulative quantity required by this day
8	Cumulative Delivered		cumqndel	Long>=0		Q	Cumulative quantity delivered by this day

Directory Type: Scenario

RPTTOTAL Report Total Daily	Edit Limits Output	Stores the daily requirements delivery profile by Major Unit to the destination from the model results
--------------------------------	-----------------------	--

#	K?	Field Name	Model	Datatype	Domain	Lookup	B/V	Unit	Meas	Description
9		Daily % Required	dayperreq		%			%		Incremental % of total major unit quantity required on this day
10		Daily % Delivered	dayperdel		%			%		Incremental % of total major unit quantity delivered on this day
11		Cumulative % Required	cumperreq		%			%		Cumulative % of total major unit quantity required by this day
12		Cumulative % Delivered	cumperdel		%			%		Cumulative % of total major unit quantity delivered by this day

RPTTOTS Report Total Summary	Edit Limits Output	Stores the daily requirements delivery profile summarized by Requirement Class to the destination from the model results
---------------------------------	-----------------------	--

#	K?	Field Name	Model	Datatype	Domain	Lookup	B/V	Unit	Meas	Description
1	Y	Theater			THEATER					Theater
2	Y	Requirement Class			REQCLASS					Aggregated requirement class for calculating summary cargo delivery versus required totals for reports
3	Y	Cargo Measure			RPTMEAS					Cargo quantity measure
4	Y	Delivery Day			simendday			day		Delivery day
5		Daily Quantity Required	dayqnregsum		Long>=0			Q		Incremental quantity required on this day
6		Daily Quantity Delivered	dayqndelsum		Long>=0			Q		Incremental quantity delivered on this day
7		Cumulative Required	cumqnregsum		Long>=0			Q		Cumulative quantity required by this day
8		Cumulative Delivered	cumqndelsum		Long>=0			Q		Cumulative quantity delivered by this day
9		Daily % Required	dayreqpersum		%			%		Incremental % of total major unit quantity required on this day
10		Daily % Delivered	daydelpersum		%			%		Incremental % of total major unit quantity delivered on this day
11		Cumulative % Required	cumreqpersum		%			%		Cumulative % of total major unit quantity required by this day
12		Cumulative % Delivered	cumdelpersum		%			%		Cumulative % of total major unit quantity delivered by this day

RPTVEH Report Vehicle Loads	Edit Limits Output	Provides vehicle itineraries with detailed cargo loads
--------------------------------	-----------------------	--

#	K?	Field Name	Model	Datatype	Domain	Lookup	B/V	Unit	Meas	Description
1	Y	Vehicle Number			VEHICLE					Aircraft sequential number
2	Y	Trip Number			TRIP					Trip number
3	Y	Stop Number			STOP					Unique stop number for this port or node facility visit
4	Y	Cargo Number			CARGO					Cargo or shipment number
5	Y	Compartment Type			CPTMEAS					Compartment type for the vehicle
6	Y	Compartment Measure			CPTMEAS					Compartment capacity unit of measure
7		Vehicle Type			VEHFLEET					Vehicle type
8		Vehicle Identifier			VEHFLEET					Vehicle identifier
9		Vehicle Fleet			VEHFLEET					Vehicle fleet
10		Is Unload?			Yesflag					"Yes" flag to indicate that a stop is for unloading, otherwise blank
11		Cargo Category			CARGOCAT					Cargo category which describes the kind of cargo being transported
12		Cargo Type			CARGTYPE					Cargo type for this cargo
13		Cargo Basic Quantity			reqqn			Q		Cargo quantity in the basic unit of measure for its cargo class (ston, pax, cbbl)
14		Cargo Basic Measure			BASMEAS					Cargo quantity basic measure (ston, pax, cbbl)
15		Begin Load or Unload Day			DayToHr			day	(hr)	Day that the cargo begins loading or unloading at the stop
16		End Load or Unload Day			DayToHr			day	(hr)	Day that the cargo ends loading or unloading at the stop
17		Compartment Capacity			Long>=0			mt, cbl, pax		Compartment stowage capacity in this unit of measure
18		Compartment % Load			0,150			%		Percent of compartment capacity loaded in the compartment measure
19		Compartment Load			Long+/-			C		Total quantity of cargo loaded in the compartment expressed in the compartment measure, accounting for stow factors (negative for offload stops for report sorting)

RPTVEHDY Report Vehicle Daily	Edit Limits Output	Provides a summary of vehicles in use by day
----------------------------------	-----------------------	--

#	K?	Field Name	Model	Datatype	Domain	Lookup	B/V	Unit	Meas	Description
1	Y	Vehicle Type			VEHTYPE					Vehicle type
2	Y	Day			simendday			day		Day of simulation
3		Transport Mode	vtranmode		MODE					Transport mode for this vehicle type
4		Total Vehicles	vtot		Short>=0					Total number of vehicles allocated for this vehicle type (in some cases the vehicles used may exceed this if simulation delays cause vehicles to extend their scheduled trips beyond the originally planned return day)

Directory Type: Scenario

RPTVEHDY Report Vehicle Daily Output		Edit Limits	Provides a summary of vehicles in use by day			
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas Description
5	Total Vehicles Used	vused		Short>=0		Number of vehicles in use, i.e. in transit or in port or in queue (sum of the next three fields)
6	Vehicles In Transit	vtransit		Short>=0		Number of vehicles in transit for this vehicle type
7	Vehicles In Port	vport		Short>=0		Number of vehicles loading or unloading in port for this vehicle type
8	Vehicles In Queue	vqueue		Short>=0		Number of vehicles in facility queues for this vehicle type
9	Vehicles In Slack	vslack		Short>=0		Number of vehicles carrying cargo but in waiting, e.g. for more cargo to be available or for the theater earliest depart day

RPTVTYPE Report Vehicle Type		Edit Limits	Provides a summary of vehicle type utilization			
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas Description
1 Y	Vehicle Type			VCPTTYPE		Vehicle type
2 Y	Compartment Type			VCPTTYPE		Compartment type
3	Transport Mode	rptvehmode		MODE		Transport mode
4	Total Vehicles	rptvehtot		Short>=0		Total number of vehicles available for this vehicle type
5	Total Vehicles Used	rptvehused		Short>=0		Number of vehicles used for this vehicle type
6	Total Days Loaded	rptvehlim		Long>=0		days Total vehicle-days of travel while carrying cargo, excluding empty legs
7	Total Travel Miles	rptvehdist		Long>=0		nmi Total vehicle-miles traveled for this vehicle type while carrying cargo, excluding empty legs
8	Number of Trips	rptvehtrips		Long>=0		Total number of vehicle trips for this vehicle type
9	Avge Peak % Loaded	rptvehpkld		Long>=0		% Average over all trips of the vehicle compartment peak % loaded (in each trip, the peak is over the trip and over all measures in the compartment, including the vehicle payload for the critical leg)

SERVICE Service		Edit Limits	Lists the U.S. military services			
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas Description
1 Y	Service			A15		Name of the military service

STAGE Stage Location		Edit Limits	Lists the staging deployments which have predecessor and successor requirements			
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas Description
1 Y	Stage Name			A15		Name given to the staging deployment
2	Stage Node	stagenode		NODE	Yes	Node or port at which staging occurs
3	Stage Latest Depart Day	stagelatedep		DayToHr		day (hr) Latest depart day for this staging after which requirements may proceed independently without visiting the staging node
4	Stage Earliest Depart Day	stageearlydep		DayToHr		day (hr) Earliest depart day for this staging
5	Delay Hours at Node	reqdel		HoursDelay		hr Delay hours at the intermediated node for consolidation, assembly, etc.
6		stagedep		DayToHr		day (hr) Estimated target departure time from this staging node

STDSTOP Standard Stop		Edit Limits	Defines the stop sequence for standard prescheduled routes used in vehicle initialization; the stops repeat cyclically if the first node and facility match the last			
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas Description
1 Y	Planning Fleet			PLANFLT		Standard prescheduled route identifier
2 Y	Stop Sequence			Short>=1		Stop sequence number for this prescheduled planning fleet (stops are assumed to repeat cyclically if the first and last stop have the same node and facility)
3	Arrive Day			DayToHr	Yes	day (hr) Arrive day offset for this prescheduled stop sequence, starting from zero (the actual stop time is depends on the offset in VEHFLEET and the number of iterations)
4	Node			FACILITY	Yes	Node associated with this prescheduled stop sequence number
5	Facility			FACILITY		Facility associated with this prescheduled stop sequence number
6	Depart Day			DayToHr	Yes	day (hr) Depart day offset for this prescheduled stop sequence, starting from zero

Directory Type: Scenario

STOP Stop		Edit Limits Output	Provides itinerary data for each node or port stop visit on each trip (voyage, flight, etc.)				
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit	Meas Description
1 Y	Stop Number			Record#	BigSt		Unique stop number for this port or node facility visit
2	Arrive Day	stparr		DayToHr		Yes	day (hr) Arrive day at the stop port if a facility is available (the actual arrive day can be delayed further by facility constraints)
3	Node	stpfac		FACILITY		Yes	Node at which the stop is made
4	Facility Name			FACILITY			Port or node facility at which the stop is made, if node is an airport or seaport
5	Depart Day	stpdep		DayToHr		Yes	day (hr) Depart day from the stop port
6	Is Unload?	isstpuld		Yesflag			Yes if a stop is for unloading, otherwise blank
7	Hours Wait for Facility	stpwaitfac		HoursDelay		hr	Hours vehicle spent waiting for port facilities and throughput capacity to arrive or depart
8	Trip Number	stptrip		TRIP			Trip number associated with this stop
9		listcrg		CARGO			List of cargos at the stop (>carglddy,>crgulddy)
10		nextstop		STOP			Next stop for the same trip in arrive day order
11		stpstatus		0,3			Stop status set to STOPNOTARRIVED, STOPARRIVED, or STOPDEPARTED depending on whether the stop has not yet arrived, has arrived, or has departed in simulation
12		stop_is_ammo		Boolean			True if the stop has ammunition cargo, otherwise False
13		stop_due		DayToHr			Time that a prescheduled stop is due when a vehicle has a Starting Route, set to the Last Simulation Day for other stops
14		stop_delay		Short+/-		hr	Delay to a stop arrival due to link congestion on the route used to arrive at the stop

STOP2 Shadow Stop		Edit Limits Output	Provides a shadow copy of the STOP table for form and report linkages				
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit	Meas Description
1 Y	Stop Number			STOP			Unique stop number for this port or node facility visit
2	Arrive Day			DayToHr		day	(hr) Arrive day at the stop port
3	Node			FACILITY			Node at which the stop is made
4	Facility Name			FACILITY			Port or node facility at which the stop is made, if node is an airport or seaport
5	Depart Day			DayToHr		day	(hr) Depart day from the stop port
6	Is Unload?			Yesflag			"Yes" flag to indicate that a stop is for unloading, otherwise blank
7	Hours Wait for Facility			HoursDelay		hr	Hours vehicle spent waiting for port facilities
8	Trip Number			TRIP			First stop arrive day of the trip associated with this stop

STOWFACT Stow Factor		Edit Limits Keys Comput	Specifies the stow factor for each combination of compartment type and cargo type				
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit	Meas Description
1 Y	Compartment Type			CPTMEAS			Compartment type
2 Y	Compartment Measure			CPTMEAS			Compartment stowage measure
3 Y	Cargo Type			CARGTYPE			Cargo type for a specific transport mode
4	Stow Factor %	stowfact		StowFactor		Q/100C	or Stow efficiency in percent for loading the cargo type in the compartment type for this measure, including basic quantity conversion if the cargo measures don't match, expressed in % Q/C (i.e., cargo quantity stowed per 100 compartment capacity measure)
5		qnoffset		MEASURE			Offset for this cargo type (or its cargo category) relative to its first measure in order to match this compartment measure (normally ranges from 0 to NMEASURE-1; an offset of NMEASURE indicates no cargo measure matches the compartment measure)
6		stowfactpen		STOWPEN			STOWPEN record matching this stow factor

STOWPEN Stow Penalty		Edit Limits Keys Comput	Lists combinations of compartment types and cargo types along with stow penalties				
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit	Meas Description
1 Y	Compartment Type	stowcpttyp		CPTTYPE			Vehicle compartment type
2 Y	Cargo Type	stowcrgtyp		CARGTYPE			Cargo type with matching transport mode
3	Is Stow Excluded?	isnostow		Yesflag			Yes if this cargo type is excluded from stowage in this compartment type
4	Stow Penalty	stowpen		Short>=0		\$/Q	Stow penalty per unit basic quantity of cargo for loading into this vehicle

STOWPEN Stow Penalty		Edit Limits Keys Comput	Lists combinations of compartment types and cargo types along with stow penalties			
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas Description
5		nextstowpen		STOWPEN		compartment Next stow penalty record for this cargo type sorted in order of increasing stow penalty

SUPPCONS Supply Consumption		Edit Limits	Specifies standard daily consumption rates of resupply for consuming requirements			
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas Description
1	Y Consuming Req Type			REQTYPE		Requirement type that consumes resupply in the theater
2	Y Consumption Theater	supcons_theater		THEATER		Destination theater in which consumption occurs
3	Y Consuming Cargo Category	supconscat		CARGOCAT		Consuming cargo category for estimating consumption
4	Y Cargo Category Consumed	supcatcons		CARGOCAT		Supply cargo category that is stored at an inventory site
5	Supply Consumption Rate	supdemrate		0,999		Q/(1000Q)/ Daily consumption rate expressed as supply basic quantity per thousand basic quantity of the consuming category after arrival at its destination in the theater
6	Accompany Days of Supply	supaccomp		Byte>=0		Q/(1000Q) Accompanying supply quantity in days of supply for this consuming requirement type

SUPPREQ Supply Requirements		Edit Limits	Lists the information needed to generate static and dynamic resupply requirements			
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas Description
1	Y Supply Requirement ID			A15		Supply requirement identifier for static and dynamic resupply generation
2	Supply Source Node			NODE	Yes	Resupply origin node
3	Supply Category			SUPSTORE	Yes	Resupply cargo category
4	Supply Storage Node			SUPSTORE	Yes	Resupply storage node or terminal storage location
5	Supply Major Unit			MAJUNIT	Yes	Resupply major unit, which has a requirement type that is resupply
6	Supply Availability Date			DayToHr	Yes	day (hr) Earliest time that resupply can be ordered from this requirement
7	Supply Delivery Time			DayToHr	Yes	day (hr) Notional resupply delivery time or lead time, usually initially for generating static orders and recomputed for dynamic resupply
8	Priority Order			1,99		Scheduling priority order when generation movement requirements for resupply

SUPQUAN Supply Quantities		Edit Limits	Lists the units of measure and relative quantities as density information for generating resupply movements			
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas Description
1	Y Supply Requirement ID			SUPPREQ		Supply requirement identifier matching a record in SUPPREQ
2	Y Unit of Measure			MEASURE		Unit of measure for the resupply category
3	Quantity			Long>=0	Yes	Q Relative quantity of resupply in the unit of measure, used to scale order quantities with consistent density ratios

SUPSTORE Supply Destination		Edit Limits	Provides data about resupply storage terminals in the theater			
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas Description
1	Y Supply Cargo Category			CARGOCAT		Supply cargo category that is stored at an inventory site
2	Y Supply Storage Node	supstorage_node		NODE		Resupply storage node or terminal storage location
3	Prepositioned Stock	supstorestock		reqqn		Q Quantity of reserved stock prepositioned at this supply storage node
4	Stock Safety Level	supreorder		reqqn		Q Minimum safe stockpile level, which is used to reordered supply when the inventory level is projected to fall below this level at the current estimated lead time and consumption rate
5	Stock Order To Level	suporderto		reqqn		Q Target stockpile level to reorder to when orders are placed
6	Min Order Quantity	supminorder		Long>=1	Yes	Q Minimum order quantity for this supply category in this theater
8		supleadtim		DayToHr		day (hr) Estimated supply lead time based on the best supplier
9		sup_demand		Long>=0		Demand for estimating inventory position in reorder calculations
10		sup_onhand		Long+/-		Q Amount of inventory on hand, can be negative for back order warnings

Directory Type: Scenario

SUPSTORE Supply Destination		Edit Limits	Provides data about resupply storage terminals in the theater			
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas Description
11		sup_intransit		Long>=0		Total basic quantity in transit
12		listsupstorecarg		CARGO		List of representative cargos for this supstore
THEATER Theater		Edit Limits	Provides data about the theaters			
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas Description
1	Y Theater			A15		Theater name
2	Mobilization M Day			DayToHr	day	Theater M day or begin mobilization day relative to global day 0
3	Deployment C Day			DayToHr	day	Theater C day or commence deployment day relative to global day 0
4	Combat D Day			DayToHr	day	Theater D day on which casualties and attrition begin, relative to global day 0
5	Earliest Depart Day	earlydep		DayToHr	day (hr)	Earliest day that a vehicle can leave after exiting the POE facility before traveling towards this theater (cargo can be preloaded and the facility exited)
6	Start Planning Day	thtrbegplan		DayToHr	day (hr)	Day on which requirements can first start being considered for scheduling to this theater
7		listexthttr		EXCLUDE		List of exclusions for this theater, if any
THTRREQ Theater Require Type Keys Full		Edit Limits	Provides data about passenger weights by theater and requirement type			
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas Description
1	Y Theater			THEATER		Theater name
2	Y Requirement Type			REQTYPE		Requirement or unit type
3	Pax Weight	thtrpaxwt		1,999	Yes	lbs/Pax Weight in pounds of each passenger and his carry-on gear for vehicle payload/weight calculations (does not affect facility throughput)
4	Accompanying Gear	thtracmpywt		Short>=0		lbs/Pax Weight in pounds of non-carry-on accompanying gear per passenger for both facility throughput and vehicle payload calculations
5		thtreq_total		Long>=0		basic unit Total quantity required for this theater and requirement type, accumulated as of the current simulation time plus planning horizon
6		thtreq_delivered		Long>=0		basic unit Cumulative delivered for this theater and requirement type, as of the current simulation time
7		thtreq_estimated		Long>=0		basic unit Cumulative estimated quantity of scheduled cargo for this theater and requirement type, forecasted into the future as of the Planning Horizon
TIMEVARY Time Variation		Edit Limits	Specifies data which changes over time (derived from user inputs in the associated data tables, should not be edited directly)			
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas Description
1	Y Change Day	tvtim		0,999		day Day on which change occurs (not DayToHr domain, leave as days)
2	Y Table to Vary			VARYPARD		Table name which has a datatype that changes over time
3	Y Field to Vary			VARYPARD		Nonkey descriptive datatype which changes over time
4	Y Key Field Values			A100		Key field value(s) stored as a single text string using . as a field delimiter
5	New Value	tvvalue		Long+/-	Yes	varies New numeric value of the datatype which takes effect on the change day (for Yes flag fields, the new value is stored as 1 for Yes, otherwise blank or 0)
6	Computed Model Datatype	tvdatatype		A20MODDAT	Ye	Computed model datatype name for the changed data
7	Computed Record Number	tvrecnum		Short>=0	Ye	Computed record number of the changed record
TRIP Trip		Edit Limits	Lists the trips (voyages, flights, etc.) and the assigned vehicles			
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas Description
1	Y Trip Number			Record#	BigSt	Trip number
2	Vehicle	tripvehicle		VEHICLE		Vehicle assigned to this trip
3	Convoy Trip Number	tripcnvy		CONVTRIP		Convoy trip number this voyage is assigned to, if any (if a trip has multiple convoys between different stops, only the last convoy trip is stored here)

Directory Type: Scenario

TRIP Trip		Edit Limits Output	Lists the trips (voyages, flights, etc.) and the assigned vehicles				
# K?	Field Name	Model Datatype	Domain	Lookup	B V	Unit Meas	Description
4	Number of Vehicle Trips	tripnumveh	Long>=0				Number of vehicle trips assigned to this trip
5		nexttrip	TRIP				Next trip (voyage, flight, etc.) for the same vehicle
6		liststop	STOP				List of stops in this trip sorted by arrive day
7		curstp	STOP				Current simulate stop of the trip, either in process or most recently completed (0 if the trip has not yet begun simulation at all)
8		curcrg	CARGO				Current cargo ready for loading/unloading at the current simulation stop of the trip (0 if all cargos at the curstop are completed but the next stop cannot be started yet because the vehicle is exiting or in transit)
9		curedep	DayToHr			day (hr)	Current largest early depart time over all cargos at the stop currently being simulated (used for special missions or theater earliest depart and may delay the ship departure after all cargo is loaded and the facility is departed)
10		curqn	Long>=0			Q	Current quantity remaining for loading or unloading the current cargo
11		curtriptime	Long>=0			day (hr*10	Arrive time for simulation of the current or next stop of this trip, used for sorting the trip heap; now multiplied by 10000 and added to original stop arrive time to maintain original schedule order
12		heaptrip	TRIP				Priority queue of trips heap-sorted in order of the arrive day of the trip current simulation stop (the end of the heap is also used to store unfinished trips simulated on the current day prior to putting them back on the heap)
13		curfac	FACILITY				Current facility for the current simulation stop
14		nextcnvytrip	TRIP				Next trip in the current convoy buildup being prepared for scheduling

VARYPAR Vary Parameter		Edit Limits Display Onl	Specifies data elements to be varied parametrically				
# K?	Field Name	Model Datatype	Domain	Lookup	B V	Unit Meas	Description
1	Y Table to Vary		VARYPAR				Table with parameter to vary
2	Y Field to Vary		VARYPAR				Parameter to vary
3	Y Key Field Values		A100				Key field value(s) stored as a single text string using . as a field delimiter
4	Start Value	vpstartval	Long>=0			Yes	Starting value for the parameter variation (Yes/blank values input as 1/0)
5	Increment	vpinc	Short>=1			Yes	Incremental value for the parameter variation
6	Number of runs	vpnumruns	1,99			Yes	Number of runs for the parameter variation
7	Computed Model Datatype	vpdattyp	A20MODDAT			Ye	Computed model datatype name for data to be varied parametrically
8	Computed Record Number	vprecnum	Short>=0			Ye	Computed record number to be varied parametrically

VARYRUN Vary Output Run		Edit Limits Output	Stores saved values from a sensitivity run				
# K?	Field Name	Model Datatype	Domain	Lookup	B V	Unit Meas	Description
1	Y Run	runnum	Record#	VehCp			Sequential run number
2	Y Table	runsave	VARYSAVE				Table with the nominal value
3	Y Field		VARYSAVE				Name of the parameter
4	Y Key Field Values		VARYSAVE				Key field value(s) stored as a single text string using . as a field delimiter
5	Field Value	runval	Long>=0				Value of the saved parameter

VARYSAVE Vary Save Data		Edit Limits	Defines data to be saved across multiple runs when data elements have parameter variations or sampling distributions				
# K?	Field Name	Model Datatype	Domain	Lookup	B V	Unit Meas	Description
1	Y Table to Save		VARYSTAT				Table name which has data to be saved over multiple sensitivity runs
2	Y Field to Save		VARYSTAT				Nonkey data element which is to be saved over multiple sensitivity runs
3	Y Key Field Values		A100				Key field value(s) stored as a single text string using . as a field delimiter
4	Computed Model Datatype	savedattyp	A20MODDAT			Ye	Computed model datatype number for sampled data
5	Computed Record Number	saverec	Short>=0			Ye	Computed record number of the sampled data

Directory Type: Scenario

VARYSTAT Vary Sampled Data		Edit Limits	Lists tables and data elements which are sampled from a stochastic distribution taking as mean the database value			
#	K?	Field Name	Model	Datatype	Domain Lookup	B V Unit Meas Description
1	Y	Table to Sample			VARYPARD	Table name which has a datatype sampled from a stochastic or parametric distribution
2	Y	Field to Sample			VARYPARD	Nonkey descriptive datatype which has a sampling distribution
3		Distribution Type	vsdistyp		VARYDIST	Yes varies Sampling distribution type for the data (positive values only)
4		Distribution Parameter	vdistpar		Long>=0	Distribution parameter which defines the sampling distribution together with the mean or median as derived from the database value
5		Number of Runs	vdistrun		1,100	Yes Number of runs for this stochastic datatype
6		Computed Model Datatype	vstatdattyp		A20MODDAT	Yes Computed model datatype name for sampled data

VCPTTYPE Veh Cpt Type		Edit Limits	Lists the compartments available for each vehicle type			
#	K?	Field Name	Model	Datatype	Domain Lookup	B V Unit Meas Description
1	Y	Vehicle Type			VEHTYPE	Vehicle Type (e.g. C-5 for air; Breakbulk for sea; Van, Flatbed, Special, Refrigerated, etc. for motor; Flatcar for Rail)
2	Y	Compartment Type	cpttyp		CPTTYPE	Name of an available compartment type for the vehicle type

VEHCAP Vehicle Capacity		Edit Limits	Defines load capacities for each vehicle identifier, compartment, and unit of measure			
		Keys	Comput			
#	K?	Field Name	Model	Datatype	Domain Lookup	B V Unit Meas Description
1	Y	Vehicle Type			VEHDATA	Vehicle type
2	Y	Vehicle Identifier			VEHDATA	Vehicle identifier for this vehicle data
3	Y	Compartment Type			CPTMEAS	Compartment type for this vehicle type
4	Y	Compartment Measure			CPTMEAS	Compartment stowage measure
5		Capacity	vcptcap		VehCap	Yes mt,cbl,pax Stowage capacity allowed for this vehicle compartment and measure
6			vcpttype		VCPTTYPE	Vehicle and compartment type matching this capacity record

VEHDATA Vehicle Data		Edit Limits	Provides detailed characteristics about each kind of vehicle identified in the system			
#	K?	Field Name	Model	Datatype	Domain Lookup	B V Unit Meas Description
1	Y	Vehicle Type		vtype	VEHTYPE	Vehicle type name
2	Y	Vehicle Identifier			A25	Vehicle identifier for this vehicle data
3		Cruising Speed	vspeed		1,999	Yes nmi/hr Cruising speed of this vehicle, in nautical mph
4		Max Cargo Load	vmaxld		VehMaxLd	Yes ston Maximum allowed cargo load over all compartments for this vehicle, in ston
5		Facility Length Required	vfaclen		Short>=0	ft Facility length required for loading and unloading
6		Facility Width Required	vfacwid		0,999	ft Facility width required for loading and unloading
7		Facility Dimension Req.	vfacdim		0,999	varies Facility dimension required (e.g., draft for sea) for loading and unloading
8		Facility Rating Required	vfacrating		Short>=0	varies User-definable facility rating required for loading and unloading (e.g., landing classification number for air, boom capacity for sea)
9			firstvehcap		VEHCAP	First vehicle compartment capacity for this vehicle identifier
10			firstvehfleet		VEHFLEET	First vehicle availability record for this vehicle identifier

VEHFLEET Vehicle Fleet		Edit Limits	Lists the availability of vehicles by starting location or route, starting time for scheduling, and number of vehicles			
#	K?	Field Name	Model	Datatype	Domain Lookup	B V Unit Meas Description
1	Y	Vehicle Type	vehdata		VEHDATA	Vehicle type
2	Y	Vehicle Identifier			VEHDATA	Vehicle identifier for this starting location
3	Y	Vehicle Fleet	flt		FLEET	Yes Fleet identifier for this starting location
4		Number of Vehicles	numveh		Short>=0	Number of vehicles in the fleet for this vehicle type
5		Start Scheduling Day	start_schedule		DayToHr	day (hr) Administrative day that this fleet and vehicle type are first available for scheduling new trips, stops, and cargo
6		Stop Scheduling Day	fltret		DayToHr	day (hr) Stop day after which this fleet and vehicle type are returned to its starting node or route with no more use (blank or 0 is treated as available through the simulation)

Directory Type: Scenario

VEHFLEET Vehicle Fleet		Edit Limits	Lists the availability of vehicles by starting location or route, starting time for scheduling, and number of vehicles				
# K?	Field Name	Model	Datatype	Domain	Lookup	B V	Unit Meas Description
7	Start Node	startfac		FACILITY			end date) Starting home base node for this fleet and vehicle type (a vehicle starts at and returns to its home base if not otherwise assigned)
8	Start Facility			FACILITY			Starting home base facility for this fleet and vehicle type (a vehicle starts at and returns to its home base if not otherwise assigned)
9	Start Route Offset			-99,999		day	Offset day for this fleet and vehicle for a standard prescheduled starting route cycle
10	Start Route Last Day	last_presched_day		DayToHr		day	Last day beyond which the prescheduled starting route is no longer cycled
11	Special Mission	fltmiss		MISSION			Special mission which restricts this fleet to matching special mission movement requirements for a designated period of time
12	New Vehicle Penalty	newvehpen		Short>=0			Penalty for the first use of a new vehicle of this type and fleet
13	Call Sign			A15			International call sign or identifier of the vehicle and fleet
14	Other Identifier			A15			Other identifier such as NISC (Naval Intelligence Security Code) for the vehicle and fleet
15	Requirement	vehfleet_require		REQUIRE			Requirement by which this vehicle fleet is delivered (these vehicles are not available until the requirement is completely delivered)
16		firstvehicle		VEHICLE			Lookup into the vehicle table
17		fltlaststp		STOP			Fleet last stop for the current day for the aggregated vehicle flow scheduling algorithm
18		fltusetime		HoursDelay			Fleet usage time in the Vehicle Flow scheduling algorithm
19		cndpoefac		FACILITY			Candidate POE facility for this vehicle fleet assignment
20		cndpodfac		FACILITY			Candidate POD facility for this vehicle fleet assignment
21		cndcritleg		Short>=0			Critical leg from POE to POD for this vehicle fleet candidate assignment
22		nextreqvflt		VEHFLEET			Next pointer to list of lift assets delivered with a requirement
23		startday		DayToHr		day	Physical start day that this vehicle and fleet can first appear in the plan
24		vehfleet_load		Long>=0		basic meas	Quantity carried by a vehicle fleet in mode planning
25		load_is_current		Boolean			Flag that the vehfleet load value is current

VEHICLE Vehicle		Edit Limits Output	Tracks status and location of each unique vehicle				
# K?	Field Name	Model	Datatype	Domain	Lookup	B V	Unit Meas Description
1 Y	Vehicle Number			Record# Vehic			Vehicle unique sequential number
2	Vehicle Type	vehflt		VEHFLEET		Yes	Vehicle type
3	Vehicle Identifier			VEHFLEET			Vehicle identifier
4	Vehicle Fleet			VEHFLEET			Vehicle fleet for this vehicle
5	Attrit or Damage Day	vehattr		DayToHr		day (hr)	Last attrit or breakdown day for this vehicle, if any
6	Replace or Repair Day	vehrep		DayToHr		day (hr)	Last replacement or repair day for this vehicle, if any
7	Computed Course	vcourse		Degree		Deg	Current course direction computed for the current date and time
8	Computed Latitude	vlat		Lat		deg min H	Current latitude computed for the current date and time
9	Computed Longitude	vlon		Lon		deg min H	Current longitude computed for the current date and time
10		listtrip		TRIP			List of trips for this vehicle
11		insbegstp		STOP			Earliest insertion stop at the end of a trip after which cargo insertion into a vehicle route can begin

VEHTYPE Vehicle Type		Edit Limits	Lists vehicle types by transport mode				
# K?	Field Name	Model	Datatype	Domain	Lookup	B V	Unit Meas Description
1 Y	Vehicle Type			A15			Vehicle type name, e.g. Breakbulk for sealift, C-17 for airlift, etc.
2	Route Type	vrouttype		ROUTTYPE		Yes	Route type to use for this vehicle type
3	Arrive/Depart Time	varrdeptim		Hour		hr	Combined total additional time for node arrival and departure for this vehicle type, such as takeoff/landing time or port maneuver time (adds to travel time and

VEHTYPE Vehicle Type		Edit Limits	Lists vehicle types by transport mode				
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas	Description
4	Vehicle Standard Size %	vehsizepc		0,9999	Yes	%	reduces the average block speed, but does occur not affect facility parking) Size of vehicle relative to "standard" vehicle size, may exceed 100% for larger vehicles, used for allocating facility berths or parking spaces (MOG)
5	Time Penalty	vtimpen		0,999	Yes	\$/hr	Penalty for vehicle usage per hour, used to compare with cargo lateness in the scheduling algorithm
6	Greedy Vehicle Level	vokcbr		Short>=0	Yes	\$/%	Limit on the acceptable cost/benefit ratio for a greedy vehicle trying to get additional cargo immediately after an assignment
7	Link Attrit Multiplier %	vlinkattrmult		%		%	Attrition adjustment multiplier applied to the link attrition or breakdown rate for this vehicle type while in transit (blank or 0 is treated as 100%)
8	Node Attrit Multiplier %	vnodeattrmult		%		%	Attrition adjustment multiplier applied to the node attrition or breakdown rate for this vehicle type while at the node (blank or 0 is treated as 100%)
9	Attrit Partial Damage %	vattrpart		%		%	Percent of attritted or broken down vehicles which are partially damaged and can be repaired
10	Repair Days	vrepair		DaysDelayToHr		day (hr)	Delay days for repair of a partially damaged vehicle, after which the vehicle continues its scheduled itinerary
11	Replace Days	vreplace		DaysDelayToHr		day (hr)	Nonzero vehicle replacement time at the initial ALD node after total attrition (if blank, no replacement occurs)
12		firstvcpttyp		VCPTTYPE			First vehicle compartment type for this vehicle type
13		firstvfactyp		VFACTYPE			First facility type for this vehicle type
14		listexvehtyp		EXCLUDE			List of exclusions for this vehicle type, if any
15		firstvehdata		VEHDATA			First vehicle data record matching this vehicle type, if any
16		nextvehetype		VEHTYPE			Next vehicle type for the same mode
17		vmode		MODE			Transport mode of this vehicle type

VFACDIM Veh Fac Dimen Limit		Edit Limits	Sets cargo dimension limits for loading onto vehicle types at facility types				
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas	Description
1	Y Vehicle Type			VFACTYPE			Vehicle type with cargo dimension constraint
2	Y Facility Type			VFACTYPE			Matching facility type with cargo dimension constraint
3	Y Max Dimension Measure	vfacmeas		MEASURE			Cargo dimension constraint measure (Item Height Ft, Item Weight Ston, etc.)
4	Max Cargo Dimension	vfacmaxdim		Long>=0		ft,ston	Cargo dimension limit to exclude cargo that is too big from loading on this vehicle type at this facility type

VFACTYPE Veh Facility Type		Edit Limits	Lists matchings of vehicle types and facility types for loading/unloading cargo				
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas	Description
1	Y Vehicle Type			VEHTYPE			Vehicle type
2	Y Facility Type	vfactyp		FAC TYPE			Facility type with matching mode
3	Is Vehicle Excluded?	isvfacexcl		Yesflag			Yes if the vehicle type is excluded from loading and unloading cargo at this facility type, blank otherwise (vehicle may still refuel unless prevented by Is Refuel Excluded? field)
4	Setup Delay	vfacsetupdel		HoursDelay		hr	Fixed setup or entrance delay time for this vehicle type while occupying this facility type (the vehicle takes parking space and the facility must be open during setup; setup delays vehicle and cargo loading/unloading)
5	Shutdown Delay	vfacshutdndel		HoursDelay		hr	Fixed shutdown or exit time for this vehicle type while occupying this facility type (the vehicle takes parking space and the facility must be open during shutdown; shutdown delays vehicle but not cargo loading or unloading)
6	Facility Visit Penalty	vfacpen		Short>=0		\$/visit	Penalty for multi-facility visits on a single trip, used in the scheduling algorithm (the first POE and POD facilities on a new trip are not penalized)
7		firstloadrate		LOADRATE			First load rate for this vehicle type and facility type

Directory Type: Scenario

VFACTYPE Veh Facility Type		Edit Limits Keys Comput	Lists matchings of vehicle types and facility types for loading/unloading cargo						
#	K?	Field Name	Model	Datatype	Domain	Lookup	B V	Unit Meas	Description
8			firstvfacdim		VFACDIM				First vehicle type/facility type dimension limit in VFACDIM

Directory Type: System

DIRLIST Directory Listing	Edit Limits Update	Lists the available user databases in the system
------------------------------	-----------------------	--

#	K?	Field Name	Model	Datatype	Domain	Lookup	B	V	Unit	Meas	Description
1	Y	Directory Type			DIRTYPE						The name of the directory type
2	Y	Subdirectory			A8						An existing 8-character subdirectory name for this directory type (multiple subdirectories may exist some directory types, but all lookups must refer only to the same subdirectory or to the Refer subdirectory)
3		Classification			CLASSIF						Classification if any for this directory
4		Remarks			A255						Remark or comment for this directory

MAPDIR Map Data Directories	Edit Limits Hide	Lists the valid mapping directories computed by the system
--------------------------------	---------------------	--

#	K?	Field Name	Model	Datatype	Domain	Lookup	B	V	Unit	Meas	Description
1	Y	Name			A25						Name of a database directory (could be: "dirlist->subdir+(dirtype)")
2		Path			A255			Yes			The full path of the directory where the mapping files reside
3		Comments			A255						Additional information about this directory (from dirlist comments)

PCEXPORT PC Export Table	Edit Limits Display Onl	Lists the table being exported in PC Export and provides a shell for actions on the exported data updates
-----------------------------	----------------------------	---

#	K?	Field Name	Model	Datatype	Domain	Lookup	B	V	Unit	Meas	Description
1	Y	Export Table			TABLE						Table currently being exported

PROBLEM Data Problems	Edit Limits Output	Lists problems, errors, and warnings accumulated by the data checks
--------------------------	-----------------------	---

#	K?	Field Name	Model	Datatype	Domain	Lookup	B	V	Unit	Meas	Description
1	Y	Directory			A40						Directory of the table which has a data problem
2	Y	Table			A8						Table name which has a data problem
3	Y	Record			Long>=0						Record number which has a data problem
4	Y	Field			A25						Field name which has a data problem
5	Y	Description			A150						Description of the data problem

Directory Type: Tpfdd

ACRGTYPE JOPES Air Cargo Type Update	Edit Limits	Lists the JOPES air cargo types (Bulk, Oversize, etc.) and their maximum dimensions
---	-------------	---

#	K?	Field Name	Model	Datatype	Domain	Lookup	B	V	Unit	Meas	Description
1	Y	Air Cargo Type Label			A3						Air cargo type label for the second position of the cargo category code
2		Air Cargo Type			A10						JOPES air cargo type such as Bulk, Oversize, etc.
3		Max Length Inches			Short>=1			Yes	In		Maximum length in inches for this air cargo type
4		Max Width Inches			Short>=1			Yes	In		Maximum width in inches for this air cargo type
5		Max Height Inches			Short>=1			Yes	In		Maximum height in inches for this air cargo type
6		Description			A100						Air cargo type description

AGGCAT Aggr Cargo Category	Edit Limits	Provides translations for aggregating cargo category
-------------------------------	-------------	--

#	K?	Field Name	Model	Datatype	Domain	Lookup	B	V	Unit	Meas	Description
1	Y	Cargo Category			A15						Cargo category which describes the kind of cargo being transported
2		Cargo Category Name			A15			Yes			Short cargo category name for use in GDAS
3		Cargo Category Code			CCC						JOPES three-character cargo category code describing cargo characteristics
4		Cargo Category Code 4			CCC4						Customized cargo category code 4 or JOPES heavy lift and dimension code
5		Heavy Lift Code			HEAVLIFT						JOPES heavy lift code for standard cargo category
6		Max Length Inches			Short>=1				In		Maximum length in inches for this cargo category based on matching Air Cargo Type in ACRGTYPE, Cargo Category Position 3 in CCC3, and Cargo Category Position 4 in CCC4
7		Max Width Inches			Short>=1				In		Maximum width in inches for this cargo category based on matching Air Cargo Type in ACRGTYPE, Cargo Category Position 3 in CCC3, and Cargo Category Position 4 in CCC4
8		Max Height Inches			Short>=1				In		Maximum height in inches for this cargo category based on matching Air Cargo Type in ACRGTYPE, Cargo Category Position 3 in CCC3, and Cargo Category Position 4 in CCC4
9		Max Weight Ston			Short>=1				Ston		Maximum weight in short tons for this cargo category based on matching Air Cargo Type in ACRGTYPE, Cargo Category Position 3 in CCC3, and Cargo Category Position 4 in CCC4
10		Major Category Label			MAJCAT						Major cargo category label corresponding to the first position of the JOPES cargo category code
11		Air Cargo Type Label			ACRGTYPE						Air cargo type label for this second position cargo category code
12		Unit Class Label			UNITCLAS						Unit equipment classification short label (Ue,Ac,Nu) for the second position of the cargo category code
13		Containerizability Label			CNTRTYPE						Containerizability type corresponding to the third position of the cargo category code
14		Cargo Category Code 1			CCC1						First position of the JOPES cargo category defining the kind of cargo
15		Cargo Category Code 2			CCC2						Second position of the JOPES cargo category defining the air cargo type and the unit class
16		Cargo Category Code 3			CCC3						Third position of the JOPES cargo category defining cargo containerizability
17		Description			A100						Unit level code description
18		Aggregated Cargo Category			A15						Aggregated cargo category for exporting to a scenario database

AGGMAJUN Aggr Major Unit	Edit Limits	Provides translations for aggregating major unit
-----------------------------	-------------	--

#	K?	Field Name	Model	Datatype	Domain	Lookup	B	V	Unit	Meas	Description
1	Y	Major Unit			A20						Major unit name for analysis of requirement closures and measures of effectiveness
2		Unit Type Code			A5TUUTC						Matching unit type code for this major unit
3		Unit Type Function			UTCFUNCT						Unit type code first position which represents the functional area of the unit
4		Unit Level Code			ULC						Unit level code which categorizes the type of unit according to stratum, echelon, or control concentration
5		Deployment Indicator Code			DEPLOYIC						JOPES deployment indicator code which characterizes deployability
6		Service Code			ORGCODE						JOPES service code or organization
7		Unit Type Short Name			A15						Unit type short name
8		Unit Type Name			A55						Unit type name
9		Non Unit Move Type Code			NUMOVETP						Non-unit type movement code
10		Using Organization			ORGCODE						Non-unit using organization for a non-unit movement

Directory Type: Tpfdd

AGGMAJUN Aggr Major Unit		Edit Limits	Provides translations for aggregating major unit			
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas Description
11	Supply Class Code			SUPCLAS1		Non-unit JOPES supply class major code which categorizes the kind of cargo
12	Aggregated Major Unit			A20		Aggregated major unit for export to a scenario database
13	Aggregated RLD Interval			Short>=0	day	Aggregate RLD interval for aggregating the day, for example 5 means every 5 days
14	Aggregated RDD Interval			Short>=0	day	Aggregate RDD interval for aggregating the day, for example 5 means every 5 days
15	Aggregated EDD Interval			Short>=0	day	Aggregate EDD interval for aggregating the day, for example 5 means every 5 days
16	Aggregated LAD Interval			Short>=0	day	Aggregate LAD interval for aggregating the day, for example 5 means every 5 days
17	Aggregated RLD Offset			Short>=0	day	Aggregate RLD offset within the aggregation interval, for example 2 means the assigned day is 2 plus the start of the interval
18	Aggregated RDD Offset			Short>=0	day	Aggregate RDD offset within the aggregation interval, for example 2 means the assigned day is 2 plus the start of the interval
19	Aggregated EDD Offset			Short>=0	day	Aggregate EDD offset within the aggregation interval, for example 2 means the assigned day is 2 plus the start of the interval
20	Aggregated LAD Offset			Short>=0	day	Aggregate LAD offset within the aggregation interval, for example 2 means the assigned day is 2 plus the start of the interval
21	Keep Req Id Unique?			Yesflag		Yes if unique Requirement Id is to be maintained during aggregation, blank if requirements can be aggregated when all data elements match and quantities can be totaled by category

AGGMODE Aggr Required Mode		Edit Limits	Provides translations for aggregating required transport mode			
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas Description
1	Y Required Mode			A15		Required transport mode
2	Transport Mode Code			MODE_SRC		Transport mode code
3	Transport Source Code			MODE_SRC		Transportation source providing organization code
4	Aggregated Required Mode			A15		Aggregated mode for export to a scenario database
5	Description			A100		Unit level code description

AGGNODE Aggr Node		Edit Limits	Provides translations for aggregating node location			
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas Description
1	Y Node		aggnode	A15		Detailed node representing an origin, destination, POE, POD, POI, etc.
2	Geolocation Name			A17	Yes	Geolocation name
3	Installation Type Code			INSTTYPE	Yes	JOPES geolocation installation type code
4	Country State Code			CNTRYST	Yes	JOPES country/state code
5	Country State Short Name			A5	Yes	JOPES country/state short name
6	Latitude		aggnodelat	Lat	Yes	deg min H Latitude of the geolocation
7	Longitude		aggnodelong	Lon	Yes	deg min H Longitude of the geolocation
8	Country State Long Name			A15	Yes	JOPES country/state long name
9	Area Responsibility Code			ORGCODE		JOPES area responsibility code identifying a unified or specified command
10	Army Location Code			A5		Army location code
11	Aggregated Node		aggnodeagg	A15		Aggregated node for export to a scenario database
12	Computed Node Deviation		aggnodedist	Short>=0	nmi	Computed great circle deviation distance from the detailed node to the aggregated node, in nautical miles

CCC JOPES Cargo Cat Code		Edit Limits	Lists the three character JOPES cargo category codes			
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas Description
1	Y Cargo Category Code			A3		JOPES three-character cargo category code describing cargo characteristics
2	Cargo Category Name			A15	Yes	Short cargo category name for use in GDAS
3	Major Category Label			MAJCAT	Yes	Major cargo category label corresponding to the first position of the JOPES cargo category code
4	Air Cargo Type Label			ACRGTYPE	Yes	Air cargo type label for this second position cargo category code
5	Unit Class Label			UNITCLAS	Yes	Unit equipment classification label (Ue, Ac, Nu) for this second position cargo category code
6	Containerizability Label			CNTRTYPE	Yes	Containerizability type corresponding to the third position of the cargo category code

CCC JOPES Cargo Cat Code		Edit Limits	Lists the three character JOPES cargo category codes					
# K?	Field Name	Model	Datatype	Domain	Lookup	B V	Unit Meas	Description
7	Cargo Category Code 1			CCC1		Yes		First position of the JOPES cargo category defining the kind of cargo
8	Cargo Category Code 2			CCC2		Yes		Second position of the JOPES cargo category defining the air cargo type and the unit class
9	Cargo Category Code 3			CCC3		Yes		Third position of the JOPES cargo category defining cargo containerizability
10	Average Mton Per Ston			Double>=0			Mton/Ston	Computed average Mton per Ston ratio for this cargo category based on the TUCHA records in the TUCAT table
11	Average SqFt Per Ston			Double>=0			SqFt/Ston	Computed average SqFt per Ston ratio for this cargo category based on the TUCHA records in the TUCAT table
12	Average SqFt Per Mton			Double>=0			SqFt/Mton	Computed average SqFt per Mton ratio for this cargo category based on the TUCHA records in the TUCAT table
13	Description			A100				Description of the cargo category
CCC1 JOPES Cargo Cat Pos1		Edit Limits	Lists the first position of the JOPES cargo category code, which defines the kind of cargo					
# K?	Field Name	Model	Datatype	Domain	Lookup	B V	Unit Meas	Description
1	Y Cargo Category Code 1			A1				First position of the JOPES cargo category code, defining the kind of cargo
2	Major Category Label			MAJCAT		Yes		Major cargo category label corresponding to the first position of the JOPES cargo category code
3	Description			A30				Description for the first position of the JOPES cargo category code
CCC2 JOPES Cargo Cat Pos2		Edit Limits	Lists the second position of the JOPES cargo category code, which defines the airlift cargo type and the unit class (Unit Equip, Acc Supply, Non Unit)					
# K?	Field Name	Model	Datatype	Domain	Lookup	B V	Unit Meas	Description
1	Y Cargo Category Code 2			A1				Second position of the JOPES cargo category code, defining the air cargo type and the unit class
2	Air Cargo Type Label			ACRGTYPE		Yes		Air cargo type label for this second position cargo category code
3	Unit Class Label			UNITCLAS		Yes		Unit equipment classification label (Ue, Ac, Nu) for this second position cargo category code
CCC3 JOPES Cargo Cat Pos3		Edit Limits	Lists the third position of the JOPES cargo category code, which defines containerizability					
# K?	Field Name	Model	Datatype	Domain	Lookup	B V	Unit Meas	Description
1	Y Cargo Category Code 3			A1				Third position of the JOPES cargo category code, defining the cargo containerizability
2	Containerizability Label			CNTRTYPE		Yes		Containerizability type corresponding to the third position of the cargo category code
3	Description			A35				Description for the third position of the JOPES cargo category code, defining the cargo containerizability
4	Max Length Inches			Short>=1		Yes	In	Maximum length in inches
5	Max Width Inches			Short>=1		Yes	In	Maximum width in inches
6	Max Height Inches			Short>=1		Yes	In	Maximum height in inches
7	Max Weight Ston			Short>=1		Yes	Ston	Maximum weight in short tons
CCC4 Custom Cargo Cat 4		Edit Limits	Lists a customizable fourth position cargo category code, which specifies user-definable cargo item dimensions					
# K?	Field Name	Model	Datatype	Domain	Lookup	B V	Unit Meas	Description
1	Y Cargo Category Code 4			A10				Customizable cargo category code position 4 which defines dimension limits for detailed cargo items
2	Max Length Inches			Short>=1		Yes	In	Maximum length in inches
3	Max Width Inches			Short>=1		Yes	In	Maximum width in inches
4	Max Height Inches			Short>=1		Yes	In	Maximum height in inches
5	Max Weight Ston			Item Ston		Yes	Ston	Maximum weight in short tons
6	Description			A100				Description of the customizable cargo category code
CLASSIFC JOPES Classif Code		Edit Limits	Lists the JOPES security classification codes					
# K?	Field Name	Model	Datatype	Domain	Lookup	B V	Unit Meas	Description
1	Y Security Classif Code			A1				JOPES security classification code
2	Security Classification			A12				JOPES security classification label

Directory Type: Tpfdd

CNTRTYPE Container Type	Edit Limits	Lists the containerizability types corresponding to the third position of the JOPES Cargo Category Code				
----------------------------	-------------	---	--	--	--	--

#	K?	Field Name	Model	Datatype	Domain	Lookup	B	V	Unit	Meas	Description
1	Y	Containerizability Label			A4						Containerizability type corresponding to the third position of the cargo category code
2		Description			A35						Description of the containerizability type

CNTRYST JOPES Country State	Edit Limits	Lists the JOPES country state codes and names				
--------------------------------	-------------	---	--	--	--	--

#	K?	Field Name	Model	Datatype	Domain	Lookup	B	V	Unit	Meas	Description
1	Y	Country State Code			A2						JOPES country/state code
2		Country State Short Name			A5			Yes			JOPES country/state short name
3		Country State Long Name			A15			Yes			JOPES country/state long name
4		GSA State Code			A2						GSA state code
5		Navy Ocean Area Code			A2						Navy ocean area code, if any

CRGDTLVL JOPES Crg Detail Lev	Edit Limits	Lists the JOPES TUCHA and TPFDD cargo detail levels				
----------------------------------	-------------	---	--	--	--	--

#	K?	Field Name	Model	Datatype	Domain	Lookup	B	V	Unit	Meas	Description
1	Y	Level of Detail			A1						JOPES cargo detail level number for TUCHA and TPFDD data
2		TUCHA Record Type			A4						TUCHA record type code matching this level of detail
3		Cargo Level of Detail			A25						JOPES cargo detail level for TUCHA and TPFDD data
4		Description			A60						Description of the JOPES cargo detail level for TUCHA and TPFDD data

DATATEST Data Test Procedures Display Onl	Edit Limits	Lists the available data test and checking procedures for selection				
--	-------------	---	--	--	--	--

#	K?	Field Name	Model	Datatype	Domain	Lookup	B	V	Unit	Meas	Description
1	Y	Test Type			A15						Type or applicability of the data test procedure
2	Y	Table			TABLE						Target table for the data test
3	Y	Data Test			A30						Data test or checking procedure name which is applied to the target table
4		Last Run Date			Date						Last run date for this data test or checking procedure
5		Test Severity			A20						Data test severity level
6		Description			A255						Description of this data test or checking procedure
7		Procedure			PAL						Procedure or query specification for this data test or checking procedure

DELREAS NonUnit Delay Reason	Edit Limits	Lists the JOPES codes for non-unit intermediate stop delay reasons				
---------------------------------	-------------	--	--	--	--	--

#	K?	Field Name	Model	Datatype	Domain	Lookup	B	V	Unit	Meas	Description
1	Y	Non Unit POI Delay Reason			A1						JOPES code for non-unit port of intermediate (POI) stop delay reason
2		Description			A40						Description of the non-unit intermediate stop delay reason

DELTYPE Unit Delay Type	Edit Limits	Lists the JOPES codes for unit intermediate stop delay type, either total force or force increments				
----------------------------	-------------	---	--	--	--	--

#	K?	Field Name	Model	Datatype	Domain	Lookup	B	V	Unit	Meas	Description
1	Y	Unit POI Delay Type			A1						JOPES code for unit port of intermediate (POI) stop delay type, either total force or increments
2		Description			A60						Description of the unit intermediate stop delay type

DEPLOYIC JOPES Deploy Indic	Edit Limits	Lists the JOPES deployment indicator codes which characterize deployability				
--------------------------------	-------------	---	--	--	--	--

#	K?	Field Name	Model	Datatype	Domain	Lookup	B	V	Unit	Meas	Description
1	Y	Deployment Indicator Code			A1						JOPES deployment indicator code which characterizes deployability
2		Deployment Label			A20						Short label for the JOPES deployment indicator code which characterizes deployability
3		Description			A100						Description of the JOPES deployment indicator code which characterizes deployability

Directory Type: Tpfdd

DISCHCFG JOPES Discharge Code	Edit Limits	Lists the JOPES discharge constraint codes
----------------------------------	-------------	--

#	K?	Field Name	Model	Datatype	Domain	Lookup	B	V	Unit	Meas	Description
1	Y	Discharge Constraint Code			A2						JOPES discharge constraint code
2		Discharge Constraint			A50						JOPES discharge constraint

FIC JOPES Force Indicate	Edit Limits	Lists the JOPES force indicator codes
-----------------------------	-------------	---------------------------------------

#	K?	Field Name	Model	Datatype	Domain	Lookup	B	V	Unit	Meas	Description
1	Y	Force Indicator Code			0,9						JOPES force indicator code
2		Description			A70						Description of the force indicator code

FUELTYPE Fuel Type Code	Edit Limits	Lists the JOPES fuel types
----------------------------	-------------	----------------------------

#	K?	Field Name	Model	Datatype	Domain	Lookup	B	V	Unit	Meas	Description
1	Y	Fuel Type Code			A3						JOPES fuel type code
2		Description			A50						Fuel type description or nomenclature

GEODATE Geoloc Date	Edit Limits	Stores the geoloc file date
------------------------	-------------	-----------------------------

#	K?	Field Name	Model	Datatype	Domain	Lookup	B	V	Unit	Meas	Description
1	Y	Geoloc File Date			Date						Date of the last imported geoloc file

GEOLOC Geolocation	Edit Limits	Stores the imported geoloc data from the JOPES Geofile
-----------------------	-------------	--

#	K?	Field Name	Model	Datatype	Domain	Lookup	B	V	Unit	Meas	Description
1	Y	Geoloc			A4						JOPES geoloc code for a geographic location
2		Geolocation Name			A17			Yes			Geolocation name
3		Installation Type Code			INSTTYPE			Yes			Installation type code which identifies the type of installation
4		Country State Code			CNTRYST			Yes			Country/state code which identifies the geo-political area or state
5		Country State Short Name			A5			Yes			Country/state short name
6		Province Code			A3						Province code identifying the political subdivision of the country or state
7		Province Name			A14						Province name identifying the political subdivision of the country or state
8		Tactical Zone			A2						Tactical zone code which identifies the military tactical zone
9		Latitude			Lat			Yes	deg	min H	Latitude of the geolocation
10		Longitude			Lon			Yes	deg	min H	Longitude of the geolocation
11		Logistic Planning Code			LOGCODE			Yes			Logistic planning code for military use
12		Prime Geoloc			GEOLOC			Yes			Prime geolocation code for grouping at a location
13		Record Owner			A6						Unit identification code (UIC) of the organization responsible for reporting the data on this record
14		ICAO			A4						International Civil Aviation Organization Code used to identify airports
15		GSA State Code			A2						General Services Administration (GSA) state code in the U.S.
16		GSA City Code			A4						General Services Administration (GSA) state city in the U.S.
17		GSA County Code			A3						General Services Administration (GSA) county code in the U.S.
18		Date Record Changed			Date			Yes			Date record was last changed
19		Date Record Created			Date			Yes			Date record was first created
20		Date Geoloc Cancelled			Date						Date this geoloc was cancelled
21		Country State Long Name			A15			Yes			Country/state long name
22		Area Responsibility Code			ORGCODE						JOPES area responsibility code identifying a unified or specified command
23		Record Status Code			A1						Record status code, A indicates active, C indicates cancelled
24		Security Classification			CLASSIFC						Security classification for this record
25		Army Location Code			A5						Army location code
26		Navy Ocean Area Code			A2						Navy ocean area code

HEAVLIFT JOPES Heavy Lift	Edit Limits	Lists the JOPES heavy lift codes
------------------------------	-------------	----------------------------------

#	K?	Field Name	Model	Datatype	Domain	Lookup	B	V	Unit	Meas	Description
1	Y	Heavy Lift Code			A1						JOPES heavy lift and dimension code
2		Length Max Inches			Short>=1			Yes	In		Maximum length dimension in inches for this heavy lift code
3		Weight Max Ston			Short>=1			Yes	Ston		Maximum weight in short tons for this heavy lift code

Directory Type: Tpfdd

IMPORT Import Specification		Edit Limits	Provides table, record, and field specifications for importing data from external databases					
#	K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas	Description
1	Y	Import Type			A15			Import type which corresponds to a single data file for importing
2	Y	Target Table			TABLE			Target table that receives the imported and translated data
3	Y	Record Variation			A15			Import name which specifies one type of import for the ASCII file
4	Y	Field Name			A25			Target field that receives the imported and translated data
5		Blanks Allowed?			A1			Yes if blanks are allowed, blank otherwise (should be blank for all key fields)
6		Updates Allowed?			A1			Yes if updates are allowed to existing records with matching key fields, no if original data is not to be changed
7		Start Column			Short>=0			Starting column in the input record for the ASCII characters to be translated
8		Stop Column			Short>=0			Stop column in the input record for the ASCII characters to be translated
9		Start Line			Short>=0			First line number in the ASCII file for this import type to process
10		Stop Line			Short>=0			Last line number in the ASCII file for this import type to process
11		Translation Name			A20			Translation name, if any, for converting the input ASCII string to an output datatype (blank means no translation performed; "@TABLENAME" indicates a table-driven translation; *FUNCTION means call a function)
12		Comment			A50			Comment, if any, describing this import record

INSTTYPE Installation Type		Edit Limits	Lists the JOPES Geolocation installation type codes					
#	K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas	Description
1	Y	Installation Type Code			A3			JOPES geolocation installation type code
2		Installation Type			A30			JOPES geolocation installation type

LOADCFG JOPES Load Config		Edit Limits	Lists the JOPES load configuration codes					
#	K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas	Description
1	Y	Load Configuration Code			A1			JOPES load configuration code
2		Load Configuration			A40			JOPES load configuration description

LOGCODE JOPES Logistics Code		Edit Limits	Lists the JOPES Geolocation logistics planning codes					
#	K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas	Description
1	Y	Logistics Planning Code			A2			JOPES geolocation logistics planning code
2		Description			A30			Description of the JOPES geolocation logistics planning code

MAJCAT Major Cargo Category		Edit Limits	Lists the major cargo categories corresponding to the first position of the JOPES cargo category code					
#	K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas	Description
1	Y	Major Category Label			A4			Major cargo category label corresponding to the first position of the JOPES cargo category code
2		Description			A30			Description of the major cargo category

MODECODE JOPES Move Type Code		Edit Limits	Lists the JOPES transport mode codes					
#	K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas	Description
1	Y	Mode Code			A1			JOPES transport mode code
2		Transport Mode			A15			Transport mode

MODE_SRC JOPES Mode & Source		Edit Limits	Lists the JOPES transport mode and source code combinations					
#	K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas	Description
1	Y	Transport Mode Code			MODECODE			Transport mode code
2	Y	Transport Source Code			TRANPSRC			Transport source providing organization code
3		Description			A100			Description of this transport mode and transportation providing organization

Directory Type: Tpfdd

MREQNODE Merged Req Node	Edit Limits Output	Lists detailed required intermediate POE or POD nodes or ports prior to aggregation for movement requirements having POE/POD nodes and modes
-----------------------------	-----------------------	--

#	K?	Field Name	Model	Datatype	Domain	Lookup	B	V	Unit	Meas	Description
1	Y	Requirement Id			MREQUIRE						Movement requirement identifier with intermediate ports or staging
2	Y	Cargo Class			A15						Cargo class for which the required node applies
3	Y	LAD			DayToHr				day	(hr)	Latest arrival day at this required port node (the LAD is used to determine the order in which required nodes are visited)
4		EAD			DayToHr				day	(hr)	Earliest arrival day at this required port node, if any
5		Required Node			A15AGGNODE		Yes				Required intermediate POE/POD node or port for this movement requirement
6		Required Mode to Node			A15AGGMODE						Required transport mode specified for delivery to the intermediate node, if any (blank permits the use of any mode for delivery)
7		Required Config to Node			A15						Required configuration specified for delivery to the intermediate node, if any (blank permits the use of any configuration)
8		Stage Name			A15						Staging deployment name if multiple requirements are staged together at this node (the STAGE record must have the same node as in REQNODE)
9		Description			A50						Description of this intermediate node, e.g. consolidation, container stuffing, mode change, re-configuration, combat loading, etc.

MREQQUAN Merged Req Quantity	Edit Limits Output	Provides detailed quantity data prior to aggregation for each movement requirement and cargo category for export to scenario directories
---------------------------------	-----------------------	--

#	K?	Field Name	Model	Datatype	Domain	Lookup	B	V	Unit	Meas	Description
1	Y	Requirement Id			MREQUIRE						Requirement identifier for the cargo
2	Y	Cargo Category			A15AGGCAT						Cargo category which describes the kind of cargo being transported
3	Y	Cargo Measure			A15						Dimensional measure for this requirement and cargo category
4		Quantity			Double	>=0		Yes	Q		Requirement category quantity or dimension in this unit of measure

MREQUIRE Merged Requirement	Edit Limits Output	Provides detailed information prior to aggregation for each movement requirement or package for export to scenario directories
--------------------------------	-----------------------	--

#	K?	Field Name	Model	Datatype	Domain	Lookup	B	V	Unit	Meas	Description
1	Y	Requirement Id			A15						Movement requirement or package id
2		Major Unit			A20AGGMAJUN		Yes				Major unit associated with this movement requirement
3		Origin			A15AGGNODE		Yes				Starting origin of the requirement
4		Destination			A15AGGNODE		Yes				Final destination of the requirement
5		RLD			DayToHr				day	(hr)	Ready to load day or earliest day the requirement is available at its origin
6		RDD			DayToHr				day	(hr)	Required delivery day of the packaged requirement at its destination including time for assembly
7		EDD			DayToHr				day	(hr)	Earliest allowed delivery day of the requirement at its destination prior to assembly
8		Computed Closure Day			DayToHr				day	(hr)	Closure day for the requirement based on the closure minimum & requirement specified in the REQTYPE table
9		Priority Order			1,99						Relative priority order for this requirement as a secondary sort after the Target Lift Date (one means first priority in assigning lift assets, blank defaults to the priority order of the requirement type)
10		Aggregated Requirement Id			A15						Aggregated requirement identifier for export to a scenario database

NUMOVETP JOPES Non Unit Type	Edit Limits	Lists the JOPES non-unit type movement codes
---------------------------------	-------------	--

#	K?	Field Name	Model	Datatype	Domain	Lookup	B	V	Unit	Meas	Description
1	Y	Non Unit Move Type Code			A1						Non-unit movement type code
2		Cargo or Pax			A5						Cargo or pax indicator for this non-unit movement type code
3		Movement Type Label			A13						Non-unit movement type label, also used as the default Aggregated Major Unit in AGGMAJUN for non-unit movements
4		Non Unit Movement Type			A40						Non-unit movement type

NURECTYP Non Unit Record Type		Edit Limits	Lists the JOPES TPFDD non-unit record types for Pax and Cargo			
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas Description
1	Y Non Unit Cargo/Pax Code			A1		TPFDD non-unit record type code (G or J)
2	Non Unit Cargo/Pax			A10		TPFDD non-unit record type code (Cargo or Pax)

ORGCODE JOPES Organization		Edit Limits	Lists the JOPES organization and service codes			
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas Description
1	Y Organization Code			A1		JOPES organization or service code
2	Force Providing Org			A25		Force providing organization or service
3	Non Unit Cargo Prov Org			A25		Non-unit cargo providing organization or service
4	Non Unit Person Prov Org			A25		Non-unit personnel providing organization or service
5	Service or Using Org			A25		Using organization of service
6	OPLAN Id Min			A5		Minimum possible OPLAN identifier for this service or force organization
7	OPLAN Id Max			A5		Maximum possible OPLAN identifier for this service or force organization
8	ULN Force Id Min			A1		Minimum possible Unit Line Number (ULN) and force module identifier for this service or organization
9	ULN Force Id Max			A1		Maximum possible Unit Line Number (ULN) and force module identifier for this service or organization
10	CIN or PIN Min			A5		Minimum possible Cargo Item Number (CIN) or Personnel Item Number (PIN) assignment for this service or organization
11	CIN or PIN Max			A5		Maximum possible Cargo Item Number (CIN) or Personnel Item Number (PIN) assignment for this service or organization

PIC JOPES Parent Indicat		Edit Limits	Lists the JOPES parent indicator codes which describe subordinate splitting			
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas Description
1	Y Parent Indicator Code			A1		JOPES parent indicator code for describing subordinate splitting
2	Description			A25		Description for this parent indicator code for describing subordinate splitting

POILOC JOPES POI Location		Edit Limits	Lists the JOPES intermediate port location codes			
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas Description
1	Y POI Location Order Code			A1		Port of intermediate debarkation (POI) location code
2	POI Location Order			A15		Intermediate port location description

RECCODE JOPES Record Indicat		Edit Limits	Lists the JOPES record indicator codes			
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas Description
1	Y Record Completion Code			A1		TUCHA record indicator code indicating F2 and F3 counts
2	Record Completion Status			A30		TUCHA record indicator code indicating F2 and F3 counts

STOPCODE JOPES Stop Code		Edit Limits	Lists the JOPES stop reason codes			
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas Description
1	Y Stop Code			A1		JOPES stop reason code
2	Stop Description			A15		JOPES stop reason description

SUPCLAS1 JOPES Supply Class 1		Edit Limits	Lists the JOPES major supply class code in position 1			
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas Description
1	Y Supply Class Code			A1		JOPES supply class major code which categorizes the kind of cargo
2	Supply Class Label			A20		Major supply class descriptive label
3	Description			A40		JOPES supply class major category

Directory Type: Tpfdd

SUPCLASS JOPES Supply Class		Edit Limits	Lists the JOPES two-character supply class and subclass codes							
#	K?	Field Name	Model	Datatype	Domain	Lookup	B V	Unit	Meas	Description
1	Y	Supply Class/Subclass			A2					JOPES supply class and subclass code which categorize the kind of cargo
2		Supply Class Code			SUPCLAS1		Yes			JOPES supply class major code which categorizes the kind of cargo
3		Description			A50					Supply class and subclass description
TPID TPFDD Ident		Edit Limits	Stores the imported TPFDD Identifier record							
#	K?	Field Name	Model	Datatype	Domain	Lookup	B V	Unit	Meas	Description
1	Y	OPLAN			A5					Operations plan number
2		Force Record Count			Long>=0					Count of the total number of force or unit records in the TPFDD
3		Non Unit Record Count			Long>=0					Count of the total number of supply or non unit records in the TPFDD
4		Last Sector Address			Long>=0					Sector number of the last record in the TPFDD file
TPNONUNT TPFDD Non Unit		Edit Limits	Stores the imported TPFDD Non Unit cargo and pax records							
#	K?	Field Name	Model	Datatype	Domain	Lookup	B V	Unit	Meas	Description
1	Y	OPLAN			TPID					Operations plan number
2	Y	Movement Id			A7					Movement identifier consisting of the using organization, the movement type code, and the sequence number concatenated together
3		Using Organization			ORGCODE					Code identifying the service or activity that will use this nonunit related cargo or personnel
4		Movement Type Code			NUMOVETP					Movement code type that categorizes the functional use of the cargo/personnel
5		Sequence Number			Long>=0					Sequencing number that uniquely identifies this record with a using organization and movement type
6		Non Unit Cargo/Pax Code			NURECTYP					Record type
7		Origin Geoloc			GEOLOC		Yes			Origin geoloc code
8		Origin Country State			CNTRYST					Origin country/state code
9		POE Geoloc			GEOLOC					POE geoloc code
10		POE Country State			A2					POE country/state code
11		POE ALD			Short+/-			day		POE available to load date (ALD)
12		Computed POD EDD			Short+/-			day		The computed earliest delivery day (EDD) the unit could possibly arrive at the POD based on the POE ALD
13		POE Preferred Mode			MODE_SRC					Preferred mode of transport to the POE
14		POE Preferred Source			MODE_SRC					Preferred organizational source of transport to the POE
15		POE Alt Geoloc			GEOLOC					POE alternate geoloc code
16		POE Alt Country State			A2					POE alternate country/state
17		POD Geoloc			GEOLOC					POD geoloc code
18		POD Country State			CNTRYST					POD country/state code
19		POD EAD			Short+/-			day		POD earliest arrival date (EAD)
20		POD LAD			Short+/-			day		Latest arrival date (LAD) by which the requirement must arrive and complete unloading at the POD
21		POD Closure Day			Short+/-			day		POD feasible arrival date (FAD) by which the requirement completes unloading at the POD
22		POD Preferred Mode			MODE_SRC					Preferred mode of transport to the POD
23		POD Preferred Source			MODE_SRC					Preferred organizational source of transport to the POD
24		POD Alt Geoloc			GEOLOC					POD alternate geoloc code
25		POD Alt Country State			A2					POD alternate country/state
26		Dest Geoloc			GEOLOC		Yes			Destination geoloc code
27		Dest Country State			CNTRYST					Destination country/state code
28		Dest RDD			Short+/-		Yes	day		Required delivery day (RDD) by which the requirement must arrive and complete unloading at the destination
29		Dest Preferred Mode			MODE_SRC					Preferred mode of transport to the destination
30		Dest Preferred Source			MODE_SRC					Preferred organizational source of transport to the destination
31		Pax Needing Transport			Long>=0			Pax		Number of personnel requiring non-organic transport when this requirement moves
32		Cargo Category Code			CCC		Yes			JOPES three-character cargo category code describing cargo characteristics
33		Cargo Category Code 1			CCC1		Yes			First position of the JOPES cargo category code, defining the kind of cargo
34		Cargo Category Code 2			CCC2		Yes			Second position of the JOPES cargo category code, defining the air cargo type and the unit class
35		Cargo Category Code 3			CCC3		Yes			Third position of the JOPES cargo category code, defining the cargo containerizability
36		Heavy Lift Code			HEAVLIFT		Yes			Heavy lift category code corresponding to

Directory Type: Tpfdd

TPNONUNT TPFDD Non Unit		Edit Limits	Stores the imported TPFDD Non Unit cargo and pax records				
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas	Description
37	Supply Class Code			SUPCLAS1			the heaviest item and the largest item dimension
38	Supply Class/Subclass			SUPCLASS			JOPEs supply class major code which categorizes the kind of cargo
39	Area SqFt			Double>=0	Yes	SqFt	JOPEs supply class and subclass code which categorize the kind of cargo
40	Weight Ston			Double>=0	Yes	Ston	Cargo area in square feet
41	Volume Mton			Double>=0	Yes	Mton	Cargo weight in short tons
42	Bulk POL Cbbl			Double>=0	Yes	CBbl	Cargo volume in measurement tons
43	Project Code			A3			Cargo bulk petroleum, oil, and lubrication (POL) in hundreds of barrels
44	Date Created			Date			Project code used to identify special projects
45	Date Last Changed			Date			Date this record was created
46	Providing Organization			ORGCODE			Date this record was last changed
47	Fuel Type Code			FUELTYPE			Providing organization or activity that is responsible for providing the cargo or personnel from this requirement
48	POI Reason			DELREAS			Fuel type code
49	POI Geoloc			GEOLOC			Reason for intermediate stop delay
50	POI Country State			CNTRYST			Port of intermediate (POI) location geoloc code
51	POI Preferred Mode			MODE_SRC			Intermediate port country/state code
52	POI Preferred Source			MODE_SRC			Preferred mode of transport to the intermediate location
53	POI Days Delay			Short>=0		day	Preferred organizational source of transport to the intermediate location
54	POI Location Order Code			POILOC			Days delay at the intermediate location
55	Description			A15			Code describing the location of the intermediate port relative to the POE and POD

TPSRFCAT TPFDD SRF Category		Edit Limits	Stores the imported TPFDD SRF category records for non-standard units				
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas	Description
1 Y	OPLAN			TPUNIT			Operations plan number
2 Y	Unit Line Number			TPUNIT			Concatenated force identifier or Unit Line Number (ULN) consisting of the force requirement number, fragmentation code, and insertion code
3 Y	Cargo Category Code			CCC			JOPEs three-character cargo category code describing cargo characteristics
4	Cargo Category Code 1			CCC1	Yes		First position of the JOPEs cargo category code, defining the kind of cargo
5	Cargo Category Code 2			CCC2	Yes		Second position of the JOPEs cargo category code, defining the air cargo type and the unit class
6	Cargo Category Code 3			CCC3	Yes		Third position of the JOPEs cargo category code, defining the cargo containerizability
7	Area SqFt			Double>=0	Yes	SqFt	Cargo area in square feet
8	Weight Ston			Double>=0	Yes	Ston	Cargo weight in short tons
9	Volume Mton			Double>=0	Yes	Mton	Cargo volume in measurement tons
10	Bulk POL Cbbl			Double>=0	Yes	CBbl	Cargo bulk petroleum, oil, and lubrication (POL) in hundreds of barrels
11	Heavy Lift Code			HEAVLIFT	Yes		Cargo bulk petroleum, oil, and lubrication (POL) in hundreds of barrels
12	Actual Detail Records			Short>=0			Heavy lift category code corresponding to the heaviest item and the largest item dimension
13	Required Detail Records			Short>=0			Actual number of detail records
14	Is Aggregated Flag			A1			Required number of detail records
15	Date Last Changed			Date			Aggregation code, where 1 indicates that the cargo category quantities represent totals of the detail records

TPSRFDET TPFDD SRF Detail		Edit Limits	Stores the imported TPFDD SRF detail records for non-standard units				
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas	Description
1 Y	OPLAN			TPSRFCAT			Operations plan number
2 Y	Unit Line Number			TPSRFCAT			Concatenated force identifier or Unit Line Number (ULN) consisting of the force requirement number, fragmentation code, and insertion code
3 Y	Cargo Category Code			TPSRFCAT			JOPEs three character cargo category code defining the kind of cargo
4 Y	Record Id			Short>=0			Record identifier number or line number
5	Cargo Category Code 1			CCC1	Yes		First position of the JOPEs cargo category code, defining the kind of cargo
6	Cargo Category Code 2			CCC2	Yes		Second position of the JOPEs cargo category code, defining the air cargo type and the

TPSRFDET TPFDD SRF Detail		Edit Limits	Stores the imported TPFDD SRF detail records for non-standard units				
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas	Description
7	Cargo Category Code 3			CCC3	Yes		unit class Third position of the JOPES cargo category code, defining the cargo containerizability
8	Cargo Description			A14			Equipment name or description
9	Length Inches			Short>=1	Yes	In	Cargo length in inches of one piece of equipment described by this record
10	Width Inches			Short>=1	Yes	In	Cargo width in inches of one piece of equipment described by this record
11	Height Inches			Short>=1	Yes	In	Cargo height in inches of one piece of equipment described by this record
12	Area SqFt			Double>=0	Yes	SqFt	Cargo area in square feet of one piece of equipment described by this record
13	Number of Pieces			Short>=1	Yes		Number of pieces of the item of equipment described by this record
14	Weight Ston			Item Ston	Yes	Ston	Cargo weight in short tons of one piece of equipment described by this record
15	Volume Mton			Double>=0	Yes	Mton	Cargo volume in measurement tons of one piece of equipment described by this record
16	Date Last Changed			Date			Date this record was last changed

TPSRFID TPFDD SRF Ident		Edit Limits	Stores the imported TPFDD SRF identifier records for non-standard units				
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas	Description
1	Y OPLAN			TPID			Operations plan number, which should match the OPLAN Number in the TPID table
2	OPLAN Date			A18			Date assigned to the OPLAN
3	OPLAN Classification			A19			Operations plan security classification
4	OPLAN Identification			A40			Operations plan identification
5	Task Organization			A50			Task organization for this OPLAN
6	Objective Area			A40			Primary objective area of this OPLAN
7	OPLAN Change Number			A2			Operations plan change number
8	Operations Concept			A255			Brief concept of operations for this OPLAN
9	Operations Concept More			A150			Continuation of the concept of operations for this OPLAN
10	First Available FRN			A3			First available force requirement number (FRN)
11	Last Available FRN			A3			Last available force requirement number (FRN)
12	Last Reserved FRN			A3			Last reserved force requirement number (FRN)
13	Agency FRN Ranges			A200			Force requirement numbers reserved for this OPLAN
14	Total Number SRF Records			Long>=0			Total number of Summary Reference File (SRF) records in this TPFDD
15	OPLAN Owner UIC			A6			Unit Identification Code (UIC) of the owner of the data in this OPLAN
16	Date Created			Date			Date this record was created
17	Date Last Changed			Date			Date this record was last changed
18	Force Select Counter			Long>=0			Force select counter which tracks the number of records created during building and maintenance
19	OPLAN TUCHA Date			A18			TUCHA date matching this OPLAN (often left blank, otherwise should match the date in the TUID table)

TPUNIT TPFDD Unit		Edit Limits	Stores the imported TPFDD standard force unit records					
#	K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas	Description
1	Y	OPLAN			TPID			Operations plan number
2	Y	Unit Line Number			A7			Concatenated force identifier or Unit Line Number (ULN) consisting of the force requirement number, fragmentation code, and insertion code
3		Force Requirement Number			A5	Yes		Force requirement number, part of the Unit Line Number
4		Force Fragmentation Code			A1			Fragmentation code, part of the Unit Line Number
5		Force Insertion Code			A1			Insertion code, part of the Unit Line Number
6		Providing Organization			ORGCODE			Providing organization or activity that is responsible for providing the cargo or personnel from this requirement
7		Service Code			ORGCODE	Yes		JOPES service code or organization
8		Unit Type Code			TUUTC	Yes		Unit type code, with the first position representing the functional area
9		Unit Type Function			UTCFUNCT	Yes		Unit type code first position which represents the functional area of the unit
10		Unit Level Code			ULC	Yes		Unit level code which categorizes the type of unit according to stratum, echelon, or control concentration
11		Force Description			A31	Yes		Force description

TPUNIT TPFDD Unit		Edit Limits	Stores the imported TPFDD standard force unit records							
#	K?	Field Name	Model	Datatype	Domain	Lookup	B V	Unit	Meas	Description
12		TPSN or Other Force Desc			A5					Service specific force description code or Troop Program Sequence Number (TPSN) for the Army
13		Force Indicator Code			FIC		Yes			Force indicator code which defines whether this unit movement data is standard with TUCHA quantities or non-standard with SRF quantities
14		Parent Indicator Code			PIC					Parent indicator code which indicates whether the unit represents a parent, with or without subordinate splits
15		Unit Id Code			A6					Unit Identification Code (UIC) assigned as the actual unit to fill this force requirement
16		Unit Name			A30					Unit name assigned to fill this force requirement
17		Unit Source			A11					Unit source assigned to fill this force requirement
18		Project Code			A3					Project code used to identify special projects
19		Authorized Personnel			Long>=0			Pax		Authorized wartime strength or personnel
20		Pax Needing Transport			Long>=0			Pax		Number of personnel requiring non-organic transport when this requirement moves
21		Bulk Weight Ston			Double>=0		Yes	Ston		Bulk weight in short tons
22		Bulk Volume Mton			Double>=0		Yes	Mton		Bulk volume in measurement tons
23		Oversize Weight Ston			Double>=0		Yes	Ston		Oversize weight in short tons
24		Oversize Volume Mton			Double>=0		Yes	Mton		Oversize weight in short tons
25		Outsize Weight Ston			Double>=0		Yes	Ston		Outsize weight in short tons
26		Outsize Volume Mton			Double>=0		Yes	Mton		Outsize volume in measurement tons
27		NAT Weight Ston			Double>=0		Yes	Ston		Non air transportable cargo weight in short tons
28		NAT Volume Mton			Double>=0		Yes	Mton		Non air transportable cargo volume in measurement tons
29		Bulk POL Cbbl			Double>=0			Cbbl		Cargo bulk petroleum, oil, and lubrication (POL) in hundreds of barrels
30		Actual Cargo Categories			Short>=0					Actual number of cargo categories associated with the requirement
31		Required Cargo Categories			Short>=0					Required number of cargo categories associated with the requirement
32		Standard Force Desc Flag			A1					TUCHA status indicator for which a value of X indicates the force description is not to be changed by the TUCHA value
33		Origin Geoloc			GEOLOC		Yes			Origin geoloc code
34		Origin Country State			CNTRYST					Origin country/state code
35		Unit RLD			Short+/-			day		Unit ready to load day (RLD)
36		POE Geoloc			GEOLOC					POE geoloc code
37		POE Country State			A2					POE country/state code
38		POE ALD			Short+/-			day		POE available to load date (ALD)
39		Computed POD EDD			Short+/-			day		The computed earliest delivery day (EDD) the unit could possibly arrive at the POD based on the POE ALD
40		POE Preferred Mode			MODE_SRC					Preferred mode of transport to the POE
41		POE Preferred Source			MODE_SRC					Preferred organizational source of transport to the POE
42		POE Alt Geoloc			GEOLOC					POE alternate geoloc code
43		POE Alt Country State			A2					POE alternate country/state
44		POI Geoloc			GEOLOC					Port of intermediate (POI) location geoloc code
45		POI Country State			A2					Intermediate country/state
46		POI Preferred Mode			MODE_SRC					Preferred mode of transport to the intermediate location
47		POI Preferred Source			MODE_SRC					Preferred organizational source of transport to the intermediate location
48		POI Days Delay			Short>=0			day		Days delay at the intermediate location
49		POI Delay Type			DELTYPE					Intermediate delay type, with T indicating entire force delay at POI and F indicating incremental portions of the forces
50		POI Location Order Code			POILOC					Code describing the location of the intermediate port relative to the POE and POD
51		POI Load Configuration			LOADCFG					Intermediate load configuration
52		POI Discharge Constraint			DISCHCFG					Intermediate discharge constraint
53		POD Geoloc			GEOLOC					POD geoloc code
54		POD Country State			CNTRYST					POD country/state code
55		POD EAD			Short+/-			day		POD earliest arrival date (EAD)
56		POD LAD			Short+/-			day		Latest arrival date (LAD) by which the requirement must arrive and complete unloading at the POD
57		POD Closure Day			Short+/-			day		POD feasible arrival date (FAD) by which the requirement completes unloading at the POD
58		POD Projected Days Late			Short>=0			day		Projected days late at the POD
59		POD Preferred Mode			MODE_SRC					Preferred mode of transport to the POD
60		POD Preferred Source			MODE_SRC					Preferred organizational source of transport to the POD
61		POD Load Configuration			LOADCFG					POD load configuration

Directory Type: Tpfdd

TPUNIT TPFDD Unit		Edit Limits	Stores the imported TPFDD standard force unit records			
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas Description
62	POD Discharge Constraint			DISCHCFG		POD discharge constraints
63	POD Alt Geoloc			GEOLOC		POD alternate geoloc code
64	POD Alt Country State			A2		POD alternate country/state
65	POD Arr Priority Sequence			Short>=0		Desired arrival priority sequence (001-999) for arrival at the POD
66	Priority Add On Sequence			A1		Priority add-on sequence to insert a unit into the desired arrival sequence
67	Dest Geoloc			GEOLOC	Yes	Destination geoloc code
68	Dest Country State			CNTRYST		Destination country/state code
69	Dest RDD			Short+/-	Yes day	Required delivery day (RDD) by which the requirement must arrive and complete unloading at the destination
70	Dest Preferred Mode			MODE_SRC		Preferred mode of transport to the destination
71	Dest Preferred Source			MODE_SRC		Preferred organizational source of transport to the destination
72	Dest Load Configuration			LOADCFG		Destination load configuration
73	Dest Discharge Constraint			DISCHCFG		Destination discharge constraint
74	Sea Support Geoloc			GEOLOC		Desired geoloc for delivery of nonunit general cargo by sealift
75	Sea Support Country State			A2		Desired country/state for delivery of nonunit general cargo by sealift
76	Air Support Geoloc			GEOLOC		Desired geoloc for delivery of nonunit general cargo by airlift
77	Air Support Country State			A2		Desired country/state for delivery of nonunit general cargo by airlift
78	POL Supply Geoloc			GEOLOC		Desired geoloc for delivery of nonunit POL
79	POL Supply Country State			A2		Desired country/state for delivery of nonunit POL
80	Ammo Supply Geoloc			GEOLOC		Desired geoloc for delivery of nonunit ammunition
81	Ammo Supply Country State			A2		Desired country/state for delivery of nonunit ammunition
82	FRG Force Select Number			Long>=0		Unique sequence number assigned to each force record
83	Date Created			Date		Date this record was created
84	Date Last Changed			Date		Date this record was last changed
85	Critical Employment Flag			A1		Critical employment indicator flag which is non-blank when the force is essential to the mission
86	CINC RDD			Short+/-	day	Required delivery date of the CINC at the destination
87	Gaining Command Code			A5		Gaining command code
TRANSPSRC JOPES Trnsprt Source		Edit Limits	Lists the JOPES transport source providing organization codes (MSC, MTMC, etc.)			
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas Description
1	Y Transport Source Code			A1		Transportation source providing organization code
2	Transport Source			A15		Transportation source providing organization short name
3	Description			A100		Description of the transportation source providing organization
TRANSLAT Translation Table		Edit Limits	Defines translations based on direct conversions, translation tables, or function mappings for importing data from external databases			
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas Description
1	Y Translation Name			A20		Name of translation (reference Import table)
2	Y Input Data			A25		Spec for input data
3	Translated Data			A25		Spec for translated data
TUCAT TUCHA F2 Category		Edit Limits	Stores the imported TUCHA F2 cargo category quantities for standard unit types			
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas Description
1	Y Unit Type Code			TUUTC		Unit type code, with the first position representing the functional area
2	Y Cargo Category Code			CCC		JOPES three-character cargo category code describing cargo characteristics
3	Unit Type Function			UTCFCUNCT	Yes	Unit type code first position which represents the functional area of the unit
4	Cargo Category Code 1			CCC1	Yes	First position of the JOPES cargo category code, defining the kind of cargo
5	Cargo Category Code 2			CCC2	Yes	Second position of the JOPES cargo category code, defining the air cargo type and the unit class
6	Cargo Category Code 3			CCC3	Yes	Third position of the JOPES cargo category code, defining the cargo containerizability
7	Security Classification			CLASSIFC		Security classification for this record

Directory Type: Tpfdd

TUCAT TUCHA F2 Category		Edit Limits	Stores the imported TUCHA F2 cargo category quantities for standard unit types				
#	K? Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas	Description
8	Heavy Lift Code			HEAVLIFT	Yes		Heavy lift category code corresponding to the heaviest item and the largest item dimension
9	Is Aggregated Flag			A1			F2 aggregation code, where 1 indicates that the F2 cargo category quantities represent totals of the F3 detail records
10	Area SqFt			Double>=0	Yes	SqFt	Cargo square feet
11	Weight Ston			Double>=0	Yes	Ston	Cargo weight in short tons
12	Volume Mton			Double>=0	Yes	Mton	Cargo cube measurement tons
13	Bulk POL Cbbl			Double>=0		Cbbl	Cargo bulk petroleum, oil, and lubrication (POL) in hundreds of barrels
14	Required Detail Records			Short>=0			Required number of F3 detail records
15	Actual Detail Records			Short>=0			Actual number of F3 detail records

TUDATE TUCHA Date		Edit Limits	Stores the imported TUCHA date					
#	K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas	Description
1	Y	TUCHA Date			Date			TUCHA date, which is the date of last update

TUDET TUCHA F3 Detail		Edit Limits	Stores the imported TUCHA F3 detail cargo quantities and dimensions for standard unit types					
#	K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas	Description
1	Y	Unit Type Code			TUCAT			Unit type code, with the first position representing the functional area
2	Y	Cargo Category Code			TUCAT			JOPEs three character cargo category code defining the kind of cargo
3	Y	Record Id			Short>=0			Record identifier number or line number
4		Unit Type Function			UTCFUNCT	Yes		Unit type code first position which represents the functional area of the unit
5		Cargo Category Code 1			CCC1	Yes		First position of the JOPEs cargo category code, defining the kind of cargo
6		Cargo Category Code 2			CCC2	Yes		Second position of the JOPEs cargo category code, defining the air cargo type and the unit class
7		Cargo Category Code 3			CCC3	Yes		Third position of the JOPEs cargo category code, defining the cargo containerizability
8		Security Classification			CLASSIFC			Security classification for this record
9		Cargo Description			A14			Equipment name or description
10		Length Inches			Short>=1	Yes	In	Cargo length in inches of one piece of equipment described by this record
11		Width Inches			Short>=1	Yes	In	Cargo width in inches of one piece of equipment described by this record
12		Height Inches			Short>=1	Yes	In	Cargo height in inches of one piece of equipment described by this record
13		Area SqFt			Short>=0	Yes	SqFt	Cargo area in square feet of one piece of equipment described by this record
14		Number of Pieces			Short>=1	Yes		Number of pieces of the item of equipment described by this record
15		Weight Ston			Item Ston	Yes	Ston	Cargo weight in short tons of one piece of equipment described by this record
16		Volume Mton			Double>=0	Yes	Mton	Cargo volume in measurement tons of one piece of equipment described by this record

TUOLDUTC TUCHA AB Total		Edit Limits	Stores the imported TUCHA AB records containing updated UTC status, often cancelled					
#	K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas	Description
1	Y	Unit Type Code			A5			Unit type code having a status change (usually being cancelled), with the first position representing the functional area
2		Unit Type Function			UTCFUNCT	Yes		Unit type code first position which represents the functional area of the unit
3		Unit Level Code			ULC			Unit level code which categorizes the type of unit according to stratum, echelon, or control concentration
4		Deployment Indicator Code			DEPLOYIC			JOPEs deployment indicator code which characterizes deployability
5		Service Code			ORGCODE	Yes		JOPEs service code or organization
6		Security Classification			CLASSIFC			Security classification for this record
7		Unit Type Short Name			A15	Yes		Unit type short name
8		Unit Type Status			UNITSTAT	Yes		Unit type status code, where A indicates active, C indicates cancelled
9		Unit Type Name			A55	Yes		Unit type name
10		Originator Unit Id			A6			Originator's unit identification code (UIC)
11		Date Created			Date			Date this record was created
12		Date Last Changed			Date			Date this record was last changed
13		Authorized Personnel			Long>=0		Pax	Authorized wartime strength for personnel
14		Date Cancelled			Date			Date this record was cancelled
15		Reference Document			A19			Reference document that authorizes the type

TUOLDUTC TUCHA AB Total		Edit Limits	Stores the imported TUCHA AB records containing updated UTC status, often cancelled			
#	K?	Field Name	Model	Datatype	Domain Lookup	B V Unit Meas Description

16		UTC Replaced			A5	organization or contains its characteristics Replacement unit type code
----	--	--------------	--	--	----	--

TUUTC TUCHA UTCs and Air		Edit Limits	Stores the imported TUCHA ABF1 UTC records, including total air cargo type quantities			
#	K?	Field Name	Model	Datatype	Domain Lookup	B V Unit Meas Description

1	Y	Unit Type Code			A5	Unit type code, with the first position representing the functional area
2		Unit Type Function			UTCFUNCT	Yes Unit type code first position which represents the functional area of the unit
3		Unit Level Code			ULC	Yes Unit level code which categorizes the type of unit according to stratum, echelon, or control concentration
4		Deployment Indicator Code			DEPLOYIC	Yes JOPES deployment indicator code which characterizes deployability
5		Service Code			ORGCODE	Yes JOPES service code or organization
6		Security Classification			CLASSIFC	Yes Security classification for this record
7		Unit Type Short Name			A15	Yes Unit type short name
8		Record Completion Code			RECCODE	Record completion indicator code
9		Unit Type Status			UNITSTAT	Unit type status code, where A indicates active, C indicates cancelled
10		F1 Security Classif			CLASSIFC	Security classification
11		Unit Type Name			A55	Yes Unit type name
12		Originator Unit Id			A6	Originator's unit identification code (UIC)
13		Date Created			Date	Date this record was created
14		Date Last Changed			Date	Date this record was last changed
15		Authorized Personnel			Long>=0	Pax Authorized wartime strength for personnel
16		Pax Needing Transport			Long>=0	Pax Pax/non-organic transport
17		Required Cargo Categories			Short>=0	Required cargo categories
18		Actual Cargo Categories			Short>=0	Actual cargo categories
19		Reference Document			A19	Reference document that authorizes the type organization or contains its characteristics
20		UTC Replaced			A5	Replacement unit type code
21		Bulk Weight Ston			Double>=0	Yes Ston Bulk weight in short tons
22		Bulk Volume Mton			Double>=0	Yes Mton Bulk volume in measurement tons
23		Oversize Weight Ston			Double>=0	Yes Ston Oversize weight in short tons
24		Oversize Volume Mton			Double>=0	Yes Mton Oversize weight in short tons
25		Outsize Weight Ston			Double>=0	Yes Ston Outsize weight in short tons
26		Outsize Volume Mton			Double>=0	Yes Mton Outsize volume in measurement tons
27		NAT Weight Ston			Double>=0	Yes Ston Non air transportable cargo weight in short tons
28		NAT Volume Mton			Double>=0	Yes Mton Non air transportable cargo volume in measurement tons
29		Bulk POL Cbbl			Double>=0	Cbbl Cargo bulk petroleum, oil, and lubrication (POL) in hundreds of barrels

ULC UNIT Level Code		Edit Limits	Lists the JOPES unit level codes			
#	K?	Field Name	Model	Datatype	Domain Lookup	B V Unit Meas Description

1	Y	Unit Level Code			A3	Unit level code which categorizes the type of unit according to stratum, echelon, or control concentration
2		Description			A35	Unit level code description

UNITCLAS JOPES Unit Class		Edit Limits	Lists the JOPES unit classifications (Unit Equip, Acc Supply, Organic)			
#	K?	Field Name	Model	Datatype	Domain Lookup	B V Unit Meas Description

1	Y	Unit Class Label			A2	Unit equipment classification short label (Ue,Ac,Nu) for the second position of the cargo category code
2		Unit Classification			A15	Unit equipment classification (Unit Equip, Acc Supply, Non Unit)

UNITSTAT JOPES Unit Status		Edit Limits	Lists the JOPES unit status codes (active, canceled)			
#	K?	Field Name	Model	Datatype	Domain Lookup	B V Unit Meas Description

1	Y	Unit Status Code			A1	Unit status code, where A indicates active, C indicates cancelled
2		Unit Status			A10	JOPES unit status description

Directory Type: Tpfdd

UPDATEDT Dictionary Update		Edit Limits Hide	Stores the latest update date for table structures in this directory			
# K?	Field Name	Model Datatype	Domain Lookup	B V	Unit Meas	Description
1 Y	Dictionary Update Date		Date			Latest date for updating the dictionary table structures using the UPDATE specifications

UTC FUNCT JOPES UTC Function		Edit Limits	Lists the JOPES Unit Type Code functional area which is the first position of the Unit Type Code			
# K?	Field Name	Model Datatype	Domain Lookup	B V	Unit Meas	Description
1 Y	UTC Functional Code		A1			Unit Type Code (UTC) first position functional area code
2	Unit Functional Area		A18			Unit type functional area, also used as the default Major Unit aggregation in AGGMAJUN
3	Description		A50			Unit type functional area description

UTCSUBST UTC Substitution		Edit Limits	Lists the Unit Type Code substitutions for standard units that have no match in the TUCHA data			
# K?	Field Name	Model Datatype	Domain Lookup	B V	Unit Meas	Description
1 Y	OPLAN		TPUNIT			Operations plan number
2 Y	Unit Line Number		TPUNIT			Concatenated force identifier or Unit Line Number (ULN) which has an unmatched Unit Type Code (UTC)
3	Substitute Unit Type Code		TUUTC			Substitute Unit Type Code which does have a match in the TUCHA TUUTC table

XREQNODE Export Req Node		Edit Limits Output	Lists aggregated required intermediate POE or POD nodes or ports for export to scenario directories			
# K?	Field Name	Model Datatype	Domain Lookup	B V	Unit Meas	Description
1 Y	Requirement Id		XREQUIRE			Movement requirement identifier with intermediate ports or staging
2 Y	Cargo Class		A15			Cargo class for which the required node applies
3 Y	LAD		DayToHr		day (hr)	Latest arrival day at this required port node (the LAD is used to determine the order in which required nodes are visited)
4	EAD		DayToHr		day (hr)	Earliest arrival day at this required port node, if any
5	Required Node		A15	Yes		Required intermediate POE/POD node or port for this movement requirement
6	Required Mode to Node		A15			Required transport mode specified for delivery to the intermediate node, if any (blank permits the use of any mode for delivery)
7	Required Config to Node		A15			Required configuration specified for delivery to the intermediate node, if any (blank permits the use of any configuration)
8	Stage Name		A15			Staging deployment name if multiple requirements are staged together at this node (the STAGE record must have the same node as in REQNODE)
9	Description		A50			Description of this intermediate node, e.g. consolidation, container stuffing, mode change, re-configuration, combat loading, etc.

XREQQUAN Export Req Quantity		Edit Limits Output	Provides aggregated quantity data for each movement requirement and cargo category for export to scenario directories			
# K?	Field Name	Model Datatype	Domain Lookup	B V	Unit Meas	Description
1 Y	Requirement Id		XREQUIRE			Requirement identifier for the cargo
2 Y	Cargo Category		A15			Cargo category which describes the kind of cargo being transported
3 Y	Cargo Measure		A15			Dimensional measure for this requirement and cargo category
4	Quantity		reqqn	Yes	Q	Requirement category quantity or dimension in this unit of measure

XREQUIRE Export Requirement		Edit Limits Output	Provides aggregated information about each movement requirement or package for export to scenario directories			
# K?	Field Name	Model Datatype	Domain Lookup	B V	Unit Meas	Description
1 Y	Requirement Id		A15			Movement requirement or package id
2	Major Unit		A20	Yes		Major unit associated with this movement requirement
3	Origin		A15	Yes		Starting origin of the requirement
4	Destination		A15	Yes		Final destination of the requirement
5	RLD		DayToHr		day (hr)	Ready to load day or earliest day the requirement is available at its origin

Directory Type: Tpfdd

XREQUIRE Export Requirement		Edit Limits Output	Provides aggregated information about each movement requirement or package for export to scenario directories						
#	K?	Field Name	Model	Datatype	Domain	Lookup	B V	Unit Meas	Description
6		RDD			DayToHr			day (hr)	Required delivery day of the packaged requirement at its destination including time for assembly
7		EDD			DayToHr			day (hr)	Earliest allowed delivery day of the requirement at its destination prior to assembly
8		Computed Closure Day			DayToHr			day (hr)	Closure day for the requirement based on the closure minimum % requirement specified in the REQTYPE table
9		Priority Order			1,99				Relative priority order for this requirement as a secondary sort after the Target Lift Date (one means first priority in assigning lift assets, blank defaults to the priority order of the requirement type)

Directory Type: Model

CANDIDAT Candidate	Edit Limits Model Only	Lists candidate vehicle assignments sorted into heap order according to increasing cost/benefit ratio				
# K?	Field Name	Model Datatype	Domain	Lookup	B V Unit Meas	Description
1 Y	Candidate		Record#	Vehic		Heap sort position or priority sequence order (first index is least)
2		heapcnd	CANDIDAT			Heap position for this vehicle or cargo scheduling candidate
3		cbratio	Long>=0			Vehicle cost/benefit ratio for cargo assignment, used to sort the heap
CMEASFUL Class Measure Full	Edit Limits Model Only	Stores in the model the matching class measure record in CLASMEAS, if any, for every full combination of cargo class and measure				
# K?	Field Name	Model Datatype	Domain	Lookup	B V Unit Meas	Description
1 Y	Cargo Class		CARGCLAS			Cargo class
2 Y	Measure		MEASURE			Measure
3		clasmeas	CLASMEAS			Matching cargo class/measure record in CLASMEAS, if any, for this cargo class and measure combination
CONVTHTR Convoy Theater	Edit Limits Model Only	Lists which pairs of theaters have convoys				
# K?	Field Name	Model Datatype	Domain	Lookup	B V Unit Meas	Description
1 Y	From Theater		THEATER			From theater
2 Y	To Theater		THEATER			To theater
3	Has Convoy?	hascnvy	Boolean			Flag that is 1 if a convoy record travels between the theaters, 0 otherwise
CRGVTYPE CARGOxVehicle Types	Edit Limits Model Only	Stores the first matching STOWPEN record in the model for feasible combinations of cargo type and vehicle type				
# K?	Field Name	Model Datatype	Domain	Lookup	B V Unit Meas	Description
1 Y	Cargo Type		CARGTYPE			Cargo type which describes the kind of cargo being transported
2 Y	Vehicle Type		VEHTYPE			Vehicle Type
3		crgvstowpen	STOWPEN			First feasible Stowage Penalty record for this cargo type and vehicle type, or zero if the combination is infeasible
FACCAPHR Facility Capacity Hr	Edit Limits Model Only	Stores the remaining available capacity for each facility, capacity measure, and hour of operation (rebuild each simulation day)				
# K?	Field Name	Model Datatype	Domain	Lookup	B V Unit Meas	Description
1 Y	Facility Node		Record#	Vehic		Node with capacity constraints
2 Y	Facility Name		FACCAP			Facility with capacity constraints
3 Y	Facility Capacity Measure		FACCAP			Cargo storage or throughput capacity measure for this facility and/or node
4 Y	Operating Hour		0,24		hr	Operating hour at the facility or node
5	Remaining Hourly Capacity faccaprem		Long>=0		Q	Remaining storage or throughput capacity for this measure and facility type for a single hour of operation
FACEVENT Facility Capac Event	Edit Limits Model Only	Stores all facility capacity events for the FACILITY table with capacities from the FACCAP table				
# K?	Field Name	Model Datatype	Domain	Lookup	B V Unit Meas	Description
1 Y	Capacity Event Number		Record#	BigSt Yes		Facility capacity event number
2	Capacity Event Time	capeventime	Long>=0		Yes Hours	The time at which the facility capacity event occurs
3		firstcapremain	FACREM			The first matching record for multiple matching capacity remaining measures
4		nextcapevent	FACEVENT			List next pointer for the list of capacity events
FACREM Capacity Remaining	Edit Limits Model Only	Stores remaining capacities for multiple measures associated with each facility capacity event				
# K?	Field Name	Model Datatype	Domain	Lookup	B V Unit Meas	Description
1 Y	Capacity Remaining Number		Record#	BigSt Yes		Record number for the capacity remaining quantity
2	Capacity Remaining	capremain	Long>=0		Q	Facility event capacity remaining for a particular measure
FROMROUT From Node Route	Edit Limits Model Only	Full table for routelists with key fields of From Node, Route Type, and Is Empty				
# K?	Field Name	Model Datatype	Domain	Lookup	B V Unit Meas	Description
1 Y	From Node		NODE			From node for storing route list pointers
2 Y	Route Type		ROUTTYPE			Route type for storing route list pointers
3 Y	Vehicle is Empty		Boolean			Empty vehicle indicator for distinguishing

Directory Type: Model

FROMROUT From Node Route		Edit Limits Model Only	Full table for routelists with key fields of From Node, Route Type, and Is Empty				
# K?	Field Name	Model	Datatype	Domain	Lookup	B V	Unit Meas Description
4			listroute	ROUTE			refueling route types List pointer to a list of tonode routes of this type and fromnode
LNKEVENT Node Link Event		Edit Limits Model Only	Stores the usage events at links with constrained capacity				
# K?	Field Name	Model	Datatype	Domain	Lookup	B V	Unit Meas Description
1	Y Link Event Number			Record#	BigSt		Link event number for link capacity events
2	Link Event Time		lnkevent_time	Long>=0			Time at which the link event occurs
3			firstlnkcapremain	LNKREM			The first in the group of remaining capacities for this link event
4			nextlnkevent	LNKEVENT			The next link event in the list of link events
LNKREM Link Capacity Remain		Edit Limits Model Only	Stores the remaining capacities for a link events in the various units of measure				
# K?	Field Name	Model	Datatype	Domain	Lookup	B V	Unit Meas Description
1	Y Link Remaining Number			Record#	BigSt		Record number for indexing link capacity remaining amounts
2	Link Capacity Remaining		lnkreman	Long>=0			The amount of link capacity remaining for some link event
NODCAPHR Node Capacity Hr		Edit Limits Model Only	Stores the remaining available capacity for each node, capacity measure, and hour of operation (rebuilt each simulation day)				
# K?	Field Name	Model	Datatype	Domain	Lookup	B V	Unit Meas Description
1	Y Node Name			Record#	Vehic		Node name with loading or unloading facilities
2	Y Node Capacity Measure			NODECAP			Unit of measure for overall cargo handling capacity at the node
3	Y Operating Hour			0,24		hr	Operating hour at the node
4	Remaining Hourly Capacity		nodecaprem	Long>=0		Q	Remaining throughput or storage for this measure and node for a single hour of operation
NODEVENT Node Capacity Event		Edit Limits Model Only	Stores all node capacity events for the NODE table with capacities from the NODECAP table				
# K?	Field Name	Model	Datatype	Domain	Lookup	B V	Unit Meas Description
1	Y Node Event Number			Record#	BigSt	Yes	Node capacity event number
2	Node Event Time		nodeventime	Long>=0		Yes Hours	The time the node capacity event occurs
3			firstnodremain	NODREM			The first matching remaining capacity record for multiple measures
4			nextnodevent	NODEVENT			List next pointer for the list of node capacity events
NODREM Node Cap Remaining		Edit Limits Model Only	Stores remaining capacities for multiple measures associated with each node capacity event				
# K?	Field Name	Model	Datatype	Domain	Lookup	B V	Unit Meas Description
1	Y Node Capacity Rem Id			Record#	BigSt	Yes	Node capacity remaining record number
2	Node Capacity Remaining		nodremain	Long>=0		Q	The node remaining capacity for a given unit of measure
NODSTATE Node State		Edit Limits Model Only	Defines multiple dynamic programming states at each node, used in mode planning and routing with refueling				
# K?	Field Name	Model	Datatype	Domain	Lookup	B V	Unit Meas Description
1	Y State Node			NODE			Node state number generated for port/mode/fleet/configuration planning using dynamic programming
2	Y State Fleet			PLANFLT			Transport fleet associated with this state
3	Y State Configuration			CARGCONF			Cargo configuration associated with this state
4			stpred	NODSTATE			Predecessor state in reaching this state
5			stpredlink	Short>=0			The link used to travel from the predecessor state to the this state (in some cases this is a notional "convoy" link >NLINK)
6			stcost	Long>=0			Current cumulative cost of the state, including its lower bound to the destination
7			heapmodeplan	NODSTATE			Candidate queue of preferred states for processing in the state optimization algorithm
8			onmodeplanheap	Short>=0			Status indicator and pivot count for candidate states on the preferred/deferred queues in the state optimization algorithm

Directory Type: Model

NODSTATE Node State		Edit Limits Model Only	Defines multiple dynamic programming states at each node, used in mode planning and routing with refueling			
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas Description
9			sttime	Short>=0		Absolute time assigned to the state
10			state_vehfleet	VEHFLEET		The record in the VehFleet table, if any, which was used to move the cargo to this state
11			state_poestate	NODSTATE		The nodstate record representing the poe for this vehfleet movement
12			state_pfdelay	Short>=0		The delay due to planning fleet capacity due to this transition
PFLEVENT Fleet Event		Edit Limits Model Only	Lists the fleet capacity events			
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas Description
1	Y Fleet Event Number			Record# BigSt		A number to provide a key for this table
2	Fleet Event Time		fleventime	Long>=0		The time the event occurs
3			firstfleetrem	PLNFLTRM		First in the group of fleet capacity remaining records for this event
4			nextflevent	PFLEVENT		Next pointer for the list of fleet events
PLNFLTRM Plan Fleet Cap Rem		Edit Limits Model Only	Lists the capacities remaining for associated fleet events			
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas Description
1	Y Fleet Remaining Number			Record# BigSt		Fleet capacity remaining record number
2	Fleet Capacity Remaining		fleetcaprem	Long>=0		The amount of fleet capacity remaining
POEFAC POE Plan Facility		Edit Limits Model Only	Stores poe facilities used by each fleet and configuration combination			
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas Description
1	Y POE Fleet			PLANFLT		Planning fleet used to move from a POE node during planning
2	Y POE Config			CARGCONF		Cargo configuration carried by the fleet
3			poefac	FACILITY		Facility used by the fleet and configuration combination (the extra record NFACILITY+1 is specified if facility is undetermined)
4			poevehdata	VEHDATA		Matching record in the VehData table used at the POE in planning
5			poevehfleet	VEHFLEET		Matching record in the VehFleet table used at the POE in planning
6			poedelay	HoursDelay		Delay occurring at the facility for the cargo using this fleet and configuration
7			data_is_current	Boolean		Flag to mark that the poefac data is current
REQCAT Requirement Category		Edit Limits Model Only	Each record has information about a requirement and cargocategory that doesn't depend on measure.			
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas Description
1	Y Requirement Id			Record# BigSt		The requirement identifier
2	Y Cargo Category		reqcat	CARGOCAT		A cargo category associated with this requirement
3			reqqntot	Long>=0	Q	The total amount of cargo for this category in its basic unit of measure
4			firstreqcatquan	REQQUAN		First requirement quantity for this requirement and category pair
ROUTECAP Route Capacity		Edit Limits Model Only	Lists the capacitated link used by each route			
# K?	Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas Description
1	Y From Node			Record# BigSt		Route from node
2	Y To Node			ROUTE		Route to node
3	Y Route Type			ROUTE		Route type
4	Y Vehicle Is Empty			ROUTE		Flag for empty versus loaded travel
5	Y Link Capacity From Node		routeap_link	NODELINK		From node of the matching capacitated link used by this route
6	Y Link Capacity To Node			NODELINK		To node of the matching capacitated link used by this route
7	Y Link Capacity Mode			NODELINK		Transport mode of the matching capacitated link used by this route
8	Route Cap Offset		routeap_offset	Long>=0	nmi	Distance to the end of the route or to the next capacitated link, in nautical miles

Directory Type: Model

RTSTATE Routing Node State		Edit Limits Model Only	Stores dynamic programming states for shortest path routing				
#	K? Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas	Description
1	Y Route State			Record#	BigSt	Yes	Routing node number but can be extended to include post-destination refueling recovery bases
2			rtcost	Long	>=0		Cumulative cost plus lower bound of achieving this state
3			rtpred	RTSTATE			Predecessor state in reaching this state
4			rtpredlink	Short	>=0		The link used to travel from the predecessor state to this state
5			heaproute	RTSTATE			Priority queue of routing states for the dynamic programming algorithm
6			onrouteheap	Short	>=0		On queue status index for this routing state
7			rtrange	Long	>=0		Cumulative distance since the last refueling

UNITMEAS Major Unit Measure		Edit Limits Model Only	Lists whether a major unit has requirement quantities using a reporting measure				
#	K? Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas	Description
1	Y Major Unit			MAJUNIT			Major unit
2	Y Cargo Measure			RPTMEAS			Cargo quantity measure (ston, pax, cbbl, mton, sq ft)
3	Is Major Unit Measure?	ismajunitmeas		Yesflag			Flag set to True if the major unit has requirement quantities which utilize this reporting measure

VCPTFULL Veh Cpt Type Full		Edit Limits Model Only	Stores in the model the first matching compartment/measure in VCPTMEAS, if any, for each full combination of vehicle type and compartment type				
#	K? Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas	Description
1	Y Vehicle Type			VEHTYPE			Vehicle Type
2	Y Compartment Type			CPTTYPE			Name of an available compartment type for the vehicle type
3		vcptmeas		VCPTMEAS			First matching compartment/measure record in VCPTMEAS, if any, for this vehicle/compartment type (zero if the compartment type does not exist on this vehicle type)

VCPTMEAS Veh Cpt Meas Full		Edit Limits Model Only	Accumulates compartment measure quantities for a single vehicle during route insertion in the model (also tracks total vehicle tonnage in the extra dummy record)				
#	K? Field Name	Model	Datatype	Domain Lookup	B V	Unit Meas	Description
1	Y Vehicle/Cpt/Meas Number			Record#	VehCp		Compartment/measure record number for a single vehicle
2	Vehicle Type			VCPTTYPE			Vehicle type for the current vehicle
3	Compartment Type			VCPTTYPE			Vehicle compartment type for the current vehicle
4	Compartment Measure			MEASURE			Compartment measure
5		cptcurqn		Long	>=0	Q	Running total of the compartment measure quantity after leaving the predecessor stop on its way to the insertion stop (extra record is used for total vehicle capacity, so cannot size by vcptcap alone)
6		cptmaxqn		Long	>=0	Q	Maximum compartment load encountered on vehicle during insertion of a new cargo
7		cptpoeqn		Long	>=0	Q	Total of the vehicle compartment load prior to the inserted POE stop (used to try later on POE insertion)
8		cptpoemaxqn		Long	>=0	Q	Max compartment load encountered prior to the inserted POE stop (used to try later on POE insertion)
9		cptcap		Long	>=0	Q	Capacity of the vehicle compartment in this measure

Directory Type: Reference

CLASSIF Classification		Edit Limits	Lists the various security classification levels			
#	K?	Field Name	Model Datatype	Domain Lookup	B V Unit Meas	Description
1	Y	Security Classification		A12		Classification level
2		Security Classif Code		A1		Classification abbreviation
MAPCOLOR Mapping Colors		Edit Limits	Lists the available colors for mapping objects (shapes and lines)			
#	K?	Field Name	Model Datatype	Domain Lookup	B V Unit Meas	Description
1	Y	Color		A15		Name of the color for mapping
2		Red Intensity		Byte>=0	Yes	Red intensity for the color
3		Green Intensity		Byte>=0	Yes	Green intensity for the color
4		Blue Intensity		Byte>=0	Yes	Blue intensity for the color
MAPFILE Map File Paths		Edit Limits	Lists the world map file paths			
#	K?	Field Name	Model Datatype	Domain Lookup	B V Unit Meas	Description
1	Y	Map Name		A20		Short name for the world map
2		Map Drive		A1		Drive letter for the map data (may be a CDROM), updates the workspace file if changed
3		Map Workspace File		A50	Yes	Full path or path relative to Mapapp for the world map .wor workspace startup file, usually in Mapapp and not on the map drive itself
4		Description		A50	Yes	Description of the world map
5		Application Title		A50	Yes	Title displayed at the top of the application window as a whole
6		Map Window Title		A50	Yes	Title for the world map window within the application window
7		Map Browse Table		A50		Full or relative path without drive letter to a general map browse table (MapInfo *.tab file) located on the map data drive, blank if none
MAPFONT Mapping Fonts		Edit Limits	Lists the available fonts for mapping labels			
#	K?	Field Name	Model Datatype	Domain Lookup	B V Unit Meas	Description
1	Y	Font Name		A50		Windows Font (or MapInfo Helvetica, Courier, Times)
MAPFSTYL Mapping Font Styles		Edit Limits	Lists the font styles for mapping labels			
#	K?	Field Name	Model Datatype	Domain Lookup	B V Unit Meas	Description
1	Y	Font Style		A25		Name of Font style
2		Style Value		Short>=0	Yes	MapInfo value for this Font style
MAPLINE Mapping Line Types		Edit Limits Constant No	Lists the available line symbols for map links			
#	K?	Field Name	Model Datatype	Domain Lookup	B V Unit Meas	Description
1	Y	Line		A25		A line type
2		Line Value		Byte>=0		The MapInfo numeric value for this line type
MAPSHAPE Mapping Shape Types		Edit Limits	Lists the available shape symbols for map nodes using installed Windows fonts			
#	K?	Field Name	Model Datatype	Domain Lookup	B V Unit Meas	Description
1	Y	Shape		A25		A shape type
2		Character Value		Byte>=0		The MapInfo numeric value for this symbol shape
3		Font Name		MAPFONT	Yes	The font name of a symbol shape
4		Font Style		MAPFSTYL	Yes	The font style for this symbol shape and character value
MAPTYPE Mapping Table Types		Edit Limits Constant No	Lists the fundamental mapping table types (Node or Link)			
#	K?	Field Name	Model Datatype	Domain Lookup	B V Unit Meas	Description
1	Y	Map Type		A10		Available mapping display types