PARAMETRIC INVESTIGATION OF THE Na-N₂O + CO CHEMICAL LASER

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The effects of several parameters on the gain of the Na-N$_2$O+CO chemical laser system have been studied. The chemical reaction mechanism in its simplest form consists of the following reaction chain:

- $\text{Na} + \text{N}_2\text{O} \rightarrow \text{N}_2 + \text{NaO} + 21.0 \text{ kcal/mole}$
- $\text{NaO} + \text{CO} \rightarrow \text{CO}_2 + \text{Na} + 66.2 \text{ kcal/mole}$

The reaction proceeds rapidly at room temperature, accompanied by intense sodium D-line chemiluminescence. At low combustion efficiencies (10 to 20%) and an excess of N$_2$O, the system lases at 10.84 with N$_2$O as the optically active species. The diluent is helium, which is the carrier of the sodium vapor derived from thermally decomposing the easily handled NaN$_3$ powder. In a
output is designed to assist the logistics analyst in assessing shipping and port operations. Output summaries for each port include its use by each ship and the amount of cargo that entered and left the port.
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ABSTRACT

The REACT II computer program simulates port and shipping operations for movement of cargo by sealift. Port and berth characteristics, ship types and characteristics, cargo types and amounts, and shipping routes are input.

Model output consists of cargo generated and delivered by type and port, ship and port utilization, and ship operating costs. The model output is designed to assist the logistics analyst in assessing shipping and port operations. Output summaries for each port include its use by each ship and the amount of cargo that entered and left the port.

SECTION 1
INTRODUCTION

A computer simulation model known as REACT, an acronym for Requirement Evaluated Against Cargo Transportation, was developed by Research Associates Incorporated for the Integrated Sealift Study to simulate the movement of ships transporting cargo among ports. The purpose of REACT was to establish the interrelationships among the number and types of ships and their delivery patterns and schedules in sealift operations in order to satisfy time-phased cargo requirements.

As new applications arose, the REACT computer program was modified, but these changes were never fully documented. Consequently, in order to interpret REACT results accurately, it was necessary to examine these changes and to make corrections and additional revisions to meet current needs. The revised version, designated REACT II, is documented in this report in complete form. Individual modifications are not identified.

This report describes the overall operation of the model and its subroutines, its system characteristics, input, and output. A general description of the original REACT model is provided in Appendix A.

*A complete listing of references is given on page 99.
SECTION 2
SYSTEM CHARACTERISTICS

2.1 OVERVIEW

In the simulation of sealift operations with the REACT II model, cargo is generated at designated ports of embarkation (POE's). As ships arrive, the cargo is loaded and the ships then sail to destination ports where cargo is unloaded. The ships then sail to other POE's, loading and unloading cargo on their routes. The cycle continues until all the cargo has been delivered.

Since all ports cannot accommodate all types of ships and all ships cannot accommodate all types of cargo, restrictive criteria are input to the simulation model. Figure 1 represents the interrelationships of ships, ports, and cargo in the system. The intersections of two circles represent (a) cargo types that can be handled at each port, (b) cargo types that can be carried by each type of ship, and (c) ship types that can enter each port. The intersection of all three circles represents (d) ship operations that satisfy all input conditions, i.e., ships carrying acceptable cargo loading or unloading at acceptable ports.

2.2 SHIP CHARACTERISTICS

2.2.1 Ship Description

Ships are defined as specific types according to the following characteristics:

- Cargo types the ship can carry
- Cargo capacities in weight (long tons) and volume (measurement tons)
- Draft at full load (feet)
- Sustained speed (knots)
- Daily costs of operation in port and at sea (dollars)
- Transfer system(s) used, with an adjustment factor for multitransfer systems (see Cargo Handling Rates, Section 2.4.4)
Figure 1 - Interrelationships among Cargo, Ships, and Ports
• Port berthing preferences (see Berth Selection and Queue Operation, Section 2.3.2)
• Capability to change home or delivery theater when leaving the ship pool (see Ship Pool, Section 2.2.3)

Initially each ship in the system is assigned a ship type, a time at which it becomes available to transport cargo, and a routing schedule which defines the group of ports it may enter. In the simulation a ship loads only acceptable cargo destined for a port which meets the following requirements: (1) it has a facility the ship may berth at, (2) it is on the ship’s routing schedule, and (3) it has a depth greater than the ship’s draft.* The ship is loaded to 80 percent of its volume capacity unless that amount is greater than its weight capacity, in which case the ship is loaded to its weight capacity.

2.2.2 Ship Routing

The model allows three different types of ship routing. A ship assigned an itinerary travels to ports on a pre-determined route. An itinerary is defined as an ordered set of not more than ten ports. The model can accommodate ten itineraries.

Ships not assigned itineraries travel to theaters where cargo is available. A theater is a group of ports in a geographical area. A non-itinerary ship may be either an intratheater or intertheater ship. An intratheater ship travels within a theater; an intertheater ship travels between theaters.

2.2.2.1 Itinerary Shipping. Ships assigned to operate on a particular itinerary visit the specified ports in the order in which the ports are input to the itinerary. On reaching one of these ports, a ship discharges cargo identified for that port. Cargo destined for ports on the ship’s itinerary and acceptable for that ship type is loaded aboard the ship. Itinerary ships operate continuously and never enter the "ship pool."

*Although the model has the capability to examine draft, this function is not used in the present version.
2.2.2.2 Intratheater Shipping. Intratheater ships load cargo only for those ports which are in the same theater as the port generating the cargo. Therefore, when an intratheater ship enters a port and discharges any cargo aboard for that port, a search is made only for acceptable cargo to be delivered in the same theater. After this cargo, if any, is loaded, the ship heads for the nearest port for which it has cargo. If there is no cargo aboard, a check determines whether there is any intratheater cargo at any port in theater that needs to be shipped. The port which has the largest amount of such cargo becomes the next port to be visited by the ship. If there's no port with intratheater cargo, the ship joins the ship pool.

2.2.2.3 Intertheater Shipping. Ships assigned to this type of operation load cargo that is generated in one theater for delivery to another theater. When a ship reaches a port, it first discharges any cargo deliverable to that port. Subsequent actions depend on whether the ship is in its delivery theater or its home theater, both of which are inputs for each intertheater ship. In the model, the home theater is the one that contains the home port of the ship; the delivery theater is the one for which the ship is loading cargo when in its home theater.

When a ship is in its home theater searching for cargo to load for its delivery theater, the following questions must be answered:

- Is the cargo acceptable for this ship?
- Is the depth of the destination port compatible with the ship draft?
- Does the destination port for this cargo have an acceptable unloading facility?

After all cargo meeting the above criteria is loaded, the ship sails for the closest port in the home theater for which it has retrograde cargo aboard. Retrograde cargo is cargo scheduled for delivery to a port in the home theater. This cargo was loaded in the ship's delivery theater. If there is no retrograde cargo aboard and the ship is at least 80 percent full, it sails for the closest port in its delivery theater.

If the ship's current load volume is between 20 percent and 80 percent of capacity, a check is made to determine whether the time in current operations in the home theater has exceeded 1/3 of the input cycle time between
the home theater and delivery theater of the ship. If so, the ship sails for the closest port in its delivery theater for which it has cargo.

If the ship is under 80 percent loaded and less than 1/3 of the cycle time has expired, or if the ship is under 20 percent loaded even when more than 1/3 of the cycle time has expired, the ship searches the other ports in its home theater for cargo destined for its delivery theater. If it finds acceptable cargo amounting to at least 500 measurement tons, the ship sails for that port to load that cargo. If no such port is found, a check is made to determine whether the ship has any cargo aboard. If there is no cargo aboard, the ship retires from operations and joins the ship pool. If the ship has any cargo at all, it sails to the ports in the delivery theater for which it has cargo aboard.

When a ship is at a port in its delivery theater, all cargo to be delivered to that port is discharged and acceptable cargo to be delivered to a port in the home theater is loaded. If more cargo is aboard for other port(s) in the delivery theater, the closest such port is selected as the next port of call for the ship. If there is no cargo aboard, the ship returns to its home port.

Intertheater ships may also operate as intratheater ships. This situation occurs when the next destination port of an intertheater ship is within the same theater as the current port. If it is, a check determines whether intratheater cargo exists at the current port for delivery to the next port of call. If so, and if the cargo is of an acceptable type, that cargo is also loaded at the current port.

2.2.3 Ship Pool

The model provides for a pool of ships. Ships enter the pool for one of two reasons:

1. Some ships are assigned to the pool at the start of the simulation and are available for operations at day 30. This feature may be useful in automatically allocating ships on a delayed basis.

2. The ships were previously in normal operations and entered the pool because there was no cargo to be delivered for which they were eligible carriers. Ships remain in the pool for the period of time specified in the input.
A check every seven days determines whether cargo delivery requirements during the work week warrant the removal of any ships from the pool. This check establishes an array, A(i,j), (i represents the home theater and j the delivery theater) which represents cargo awaiting delivery for which shipping is not presently available. The array is established by the following steps:

* Tabulate the current amount of cargo waiting to be moved from one theater to another or within a theater
* Determine which ships presently operating will be available to transport cargo during the following week
* Compute A(i,j) by subtracting the capacity of these available ships from the appropriate entry in the array of cargo to be delivered

If any of the entries A(i,j) are greater than 10,000 measurement tons, the pool is searched for ships that may transport the cargo. Ships are removed from the pool in the order in which they meet the following requirements:

* Ships having home theater "i" and delivery theater "j"
* Ships having home theater "i" and the capability of changing delivery theater
* Ships having the capability of changing home and delivery theaters

If a ship satisfies one of the above criteria, it is removed from the pool provided at least 500 measurement tons of acceptable cargo are available at theater "i."

When a ship is selected from the pool, it is considered available at its new home port immediately. It is assumed that the need for the ship will have been established early enough to give the ship time to reach its initial port.
2.3 PORT CHARACTERISTICS

2.3.1 Port Description

The following inputs are required to define each port:

1. Number of berths of each of six types at the port.
2. Theater in which the port is situated.
3. Maximum acceptable ship draft.

(1, 2, and 3 above restrict the ship types that may enter the port.)
4. Miscellaneous port delay (time in days) -- Represents time needed to service the ship at that port.
5. Cargo handling adjustment factor -- Used to modify the base cargo handling rate to reflect the efficiency of cargo handling operations at the port and the number of shifts worked.
6. Cargo handling costs (dollars per day) -- Represents the direct charges associated with cargo handling operations at the port.
7. Name of the port -- Used in the summary output for port identification.

Distances between ports are also input and are needed to calculate the amount of time spent traveling, the cost of travel, and in some cases, to determine the port to which the ship will travel.

2.3.2 Berth Selection and Queue Operation

When a ship reaches a port, it must determine which type of berth to enter (see Section 5.14 for berths used). Since provision is made to input preferred berth types for each ship, a check is made of the preference sequence. If there is a preferred berth type, the ship enters that type if it is available. If it is not available, a check is made to determine whether a second preference is indicated. If so, and that type is available, the ship enters that type. If that type is not available, or if there is not a second preference, the ship joins the queue, or waiting line, to await service for the preferred type.

If there are no input berth type preferences, the model determines the berth type to be used on the basis of the cargo handling rate at each berth. Computations are made to determine which berth type at the port would result in the maximum discharge rate for the type of cargo aboard. If that type
is available, the ship enters the berth. If it is not available, the model determines which of the available types has the greatest discharge rate. If that rate is at least an acceptable percentage (an input) of the previously computed maximum rate, that berth type is used by the ship. If an acceptable facility cannot be found on this basis, the ship enters the queue to await service at the berth type which has the maximum rate. If within the queue at a given port more than one ship is waiting for the same berth type, the ships are removed in the order in which they entered the queue.

2.4 CARGO CHARACTERISTICS

2.4.1 Cargo Types

DOD material is classified in terms of various supply commodities, e.g., Subsistence; Clothing; Petroleum, Oil and Lubrication (POL); Ammunition; Major End Items. A single supply commodity or a combination of commodities with similar characteristics is referred to in REACT II as a cargo type. Supply commodities can be combined when they have similar methods and rates of handling, storage requirements, and ratios of volume (measurement tons (MT)) to weight (long tons (LT)), MT/LT.

2.4.2 Cargo Generation

The buildup of cargo at a port is simulated by cargo generation. Input parameters for cargo generation are:

- Time of generation
- Frequency of generation
- Amount and type of cargo
- Origin and delivery ports

These parameters establish a schedule for cargo generation. Cargo may be generated only once or at regular intervals. The model allows for one change in the frequency of the interval during a given simulation run. Factors which control the schedule of cargo generation are:

- First day of generation
- Frequency of generation
- Day on which frequency changes
- New frequency
- Last day of generation
2.4.3 Cargo Transfer Systems

The REACT II model accommodates six different cargo transfer systems, one or more of which are associated with each ship type. A transfer system refers to the network of equipment used to load and unload a ship and includes equipment both at the port and on the ship. A given transfer system is used only at a specific type of berth. The productivity rate of a transfer system/berth combination includes the type of cargo to be handled and is input through a three-dimensional array (cargo, transfer system, and berth). For those combinations which are not valid, a zero is entered in the array.

When a ship arrives at a port, the berth providing the highest cargo handling rate is chosen. To select the berth the model may query the array or follow the user's input for the ship's first and second choices for berth types.

2.4.4 Cargo Handling Rates

The productivity rate is the amount (in measurement tons) of cargo of a particular type that may be discharged per 8-hour shift from a ship in a particular type of berth and using a particular transfer system. The rate at which a ship's cargo is loaded or discharged is a function of the base handling rate and adjustment factors (Section 5.4). The base rate may be either a single productivity rate or the sum of appropriate rates when more than one transfer system is used. (The summing of rates implies independent operation of transfer systems.) The base rate is derived from the productivity rate array and is adjusted, as required. Adjustments to productivity rates reflect that

1. Cargo may be unloaded and loaded at different rates. If the adjustment factor is other than unity, different rates will be used for the two operations.

2. Different ports can have different cargo movement rates even when all other factors are equal. For each port the base rate is adjusted by an input value.

3. Cargo may not be handled at the assigned rate when more than one ship transfer system is being utilized. An input factor accounts for independence of, or interference between, the transfer systems.
The time required to move cargo is a function of this adjusted rate and the amount of cargo to be moved.

Since a ship may carry more than one type of cargo, the time required to handle each cargo type must be computed and summed to give the total time for handling the cargo.

Since a ship may encounter miscellaneous delays at a port, a delay time is input for each port. The total time in port is the sum of this delay time and the time required for load/discharge operations.

2.5 COSTS

The model determines total system costs on a cumulative basis. These costs include the direct operating costs of the ship in port and at sea and the handling costs associated with the movement of cargo. The model requires as input: (1) the costs at sea and costs in port for a particular ship type, (2) administrative costs associated with each type of ship owner,* and (3) cargo handling costs for a given port. Each of these costs is input in dollars per day. Contributions to the total system costs for each ship (except owner type 1 ships, Berth Liner) are as follows:

* For each day in transit, operating costs at sea as a function of the ship type.
* For each day in port, operating costs as a function of ship type and cargo handling costs as a function of the individual port.
* For each day spent in the queue awaiting port service, costs on the basis of ship type.
* For each day of operation, in transit, in port, and in queue, the administrative costs as a function of the ship owner.

For owner type 1 ships, the only contribution to system costs is the cost per measurement ton per thousand miles for cargo (by type) delivered. No costs are accumulated for ships in the pool.

*Up to six different ship owner types are allowed in the program. Section 5.6 indicates those presently used.
SECTION 3
SYSTEM OUTPUT

REACT II simulates only the shipping operations being studied; no optimal solution is computed. From the output statistics, the simulated shipping operation can be analyzed.

The output of REACT II is composed of two parts: paper listing and punched cards. The paper listing consists of three sections, Model Input Listing, Ship Event History, and System Status Summary.

The Input Listing is useful in validating the input from punched cards and also describes the system to which the output applies.

The Ship Event History is a chronological record of the ships' actions and is useful in reconstructing the sequence of events during the run. The Event History includes the time a ship enters and leaves a queue, port, or ship pool, and the information associated with each event. Production of the Event History is optional; its suppression produces a shortened version of System Status Summary.

The System Status Summary is printed both periodically and at the completion of the run. It includes cumulative costs, the current number of ships in the pool, and port information. From this output, an analyst can determine whether the berthing facilities at a specific port are adequate, or whether the given number of ships is capable of meeting the cargo movement requirements.

The model also produces punched cards for input to an external program which graphs the results. A card is made for each day shown in the printed System Status Summaries. Each card contains the day the values are calculated and cumulative information describing, by class, cargo generated, cargo shipped, and cargo delivered. A sample output is given in Appendix B.
SECTION 4
THE PROGRAM

The REACT II model is composed of eleven Fortran IV subroutines. Each subroutine has a particular function, which is performed at a specific time determined either by input or by a previous operation. Figure 2 shows the organization of the REACT model.

4.1 DEFINITION OF EVENT

The requirement for a specific operation (such as the arrival of a ship at a port, or the generation of cargo at a port) schedules an event which is to occur at a later time. The event is said to occur when the operation has been performed (ship arrives, or cargo is generated). At that time decisions for subsequent events are made.

The major events in ship operations and the subroutines performing them are listed in Table 1.

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<td>CARGEN</td>
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<tr>
<td>Ship Enters Port</td>
<td>PORT</td>
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<tr>
<td>Cargo Loaded</td>
<td>LOAD</td>
</tr>
<tr>
<td>Ship Leaves Port</td>
<td>MOVE</td>
</tr>
<tr>
<td>Ship Transported To Port</td>
<td>Krgevl</td>
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<tr>
<td>Remove Ship from Pool</td>
<td></td>
</tr>
<tr>
<td>If Conditions Satisfied</td>
<td>PRINT</td>
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<tr>
<td>Print Output</td>
<td>ENDCAM</td>
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4.2 EVENT LIST

The scheduling of events in the model during the simulation requires a bookkeeping system. The system consists of an event list and operations which (1) store events on the list as they are generated, and (2) remove events from the list at the appropriate times throughout the simulation.
*IN CASE OF ABNORMAL TERMINATION, CONTROL IS TRANSFERRED TO ENDGAM. WHEN SUBROUTINES IN PARENTHESES ARE CALLED, CONTROL RETURNS TO THE CALLING SUBROUTINE.

Figure 2 - Subroutine Flow
The event list contains references to the locations in the computer used to store events generated during the simulation. Along with each event is stored the time at which it will occur and its description. The events are arranged on the list chronologically by their simulated occurrence times. Subroutine PUT stores events on the event list. An event is simulated by removing the event from the event list. Subroutine TAKE removes events from the event list. The appropriate subroutine is then entered to perform the required functions. For example, removing a cargo generation event from the list simulates the generation of a quantity of cargo specified in the input.

The initial Event List, which is formulated in Subroutine MAIN, is composed of the following events:

- Cargo generation check on day 1
- The first day the System Status report is to be printed
- The day each ship will be available at its origin port
- The first day the pool is to be checked
- The day the mission is to terminate

The events are stored in the order in which they are to occur along with ship numbers for those events involving ships.

From MAIN control is transferred to TAKE which removes the first event from the event list and transfers control to the appropriate subroutines. Once TAKE has been called, control is not returned to MAIN. Subsequently, additional events are placed on the event list to simulate ship operations. For instance, when a ship is available, a MOVE event is generated representing the movement of the ship to the port at which cargo has been generated by a CARGEN event. A PORT event simulates the ship entering the port and a LOAD event simulates loading of the ship.

4.3 SUBROUTINE DESCRIPTIONS

CARGEN generates cargo as specified by input. It is called on day 1 to generate the appropriate cargo. The "next day" cargo to be generated is determined and a new entry for the Event List is created.
ENGDAM terminates execution. Normally termination is at a day specified by input, but abnormal termination may occur earlier and an error message is then printed. ENGDAM also prints additional summary information.

KRGEVL evaluates the need to remove ships from the pool every seven days. If all criteria are met (see Section 2.2.3), a ship is removed from the pool and sent to the appropriate port (a new entry to the Event List).

LOAD loads cargo on ships, updates costs, and returns control to PORT.

MAIN reads the input data, initiates storage areas, formulates the initial event list, and writes the data inputs.

MOVE determines the time at which a ship will arrive at its destination port and sets up a PORT event for that day. If the ship is not to be sent to a port, MOVE adds it to the ship pool. MOVE also determines whether any ships are in the queue for the facility that the ship is leaving. If so, PORT events for the ships in the queue are generated.

PORT is the central control mechanism for ship cargo handling activities. This subroutine

1. Determines the berth a ship is to enter. If a berth is not available, the ship enters the queue and control is transferred to TAKE.
2. Unloads cargo.
3. Determines acceptable cargo.
4. Updates costs.
5. Tabulates cargo handling time.
6. Determines next destination port and sets up a MOVE event for the time at which the ship is to leave the port.

PRINT prints out the Status Summary Report. A PRINT event occurs at the current time plus the print interval specified in the input.

PUT enters events on the event list in chronological order.

QUEUE maintains a list of ships waiting to enter a particular berth type at a given port.

TAKE removes an event from the event list and transfers control to the appropriate subroutine.
Parameters required for execution of REACT, summarized in Table 2, are input on cards. Cards must be input in the order given in the table. The following sections describe the individual card formats.

5.1 PRODUCTIVITY RATES

These cards contain base rates used in calculating the amount of time a ship will spend in cargo handling operations at each port. The productivity rate is defined as the amount (in measurement tons) of a particular type of cargo that may be discharged per 8-hour day from a ship at a particular berth type and using a particular cargo transfer system.

\[ \text{PRODUC}(I,J,K) \]

where:

- \( I \) is the berth type number (1 to 6)
- \( J \) is the cargo transfer system number (1 to 6)
- \( K \) is the cargo type number (1 to 8)

<table>
<thead>
<tr>
<th>COLS 1-48</th>
<th>COLS 49-72</th>
<th>COLS 73-80</th>
</tr>
</thead>
<tbody>
<tr>
<td>Card 1</td>
<td>PRODUC (1,1,K) K=1,8</td>
<td>blank</td>
</tr>
<tr>
<td>Card 2</td>
<td>PRODUC (1,2,K) K=1,8</td>
<td>&quot;</td>
</tr>
<tr>
<td>Card 3</td>
<td>PRODUC (1,3,K) K=1,8</td>
<td>&quot;</td>
</tr>
<tr>
<td>Card 4</td>
<td>PRODUC (1,4,K) K=1,8</td>
<td>&quot;</td>
</tr>
<tr>
<td>Card 5</td>
<td>PRODUC (1,5,K) K=1,8</td>
<td>&quot;</td>
</tr>
<tr>
<td>Card 6</td>
<td>PRODUC (1,6,K) K=1,8</td>
<td>&quot;</td>
</tr>
<tr>
<td>Card 7</td>
<td>PRODUC (2,1,K) K=1,8</td>
<td>&quot;</td>
</tr>
<tr>
<td>Card 8</td>
<td>PRODUC (2,2,K) K=1,8</td>
<td>&quot;</td>
</tr>
<tr>
<td>Card 9</td>
<td>PRODUC (2,3,K) K=1,8</td>
<td>&quot;</td>
</tr>
<tr>
<td>Card 10</td>
<td>PRODUC (2,4,K) K=1,8</td>
<td>&quot;</td>
</tr>
<tr>
<td>Card 11</td>
<td>PRODUC (2,5,K) K=1,8</td>
<td>&quot;</td>
</tr>
<tr>
<td>Card 12</td>
<td>PRODUC (2,6,K) K=1,8</td>
<td>&quot;</td>
</tr>
<tr>
<td>Card 35</td>
<td>PRODUC (6,5,K) K=1,8</td>
<td>&quot;</td>
</tr>
<tr>
<td>Card 36</td>
<td>PRODUC (6,6,K) K=1,8</td>
<td>&quot;</td>
</tr>
</tbody>
</table>

Each productivity rate has an F6.0 format.
**TABLE 2 - INPUT CARD REQUIREMENT SUMMARY**

<table>
<thead>
<tr>
<th>Data On Card(s)</th>
<th>Card Name</th>
<th>Number of Cards</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Productivity rates</td>
<td>PROD</td>
<td>36</td>
</tr>
<tr>
<td>2. Distances</td>
<td>DIST</td>
<td>90</td>
</tr>
<tr>
<td>3. Cycle time</td>
<td>KKTME</td>
<td>1</td>
</tr>
<tr>
<td>4. Adjustments</td>
<td>ADJUST</td>
<td>1</td>
</tr>
<tr>
<td>5. Cost per ton</td>
<td>CSTTON</td>
<td>1</td>
</tr>
<tr>
<td>6. Administrative costs</td>
<td>CSTADM</td>
<td>1</td>
</tr>
<tr>
<td>7. Number of itineraries</td>
<td>NITIN</td>
<td>1</td>
</tr>
<tr>
<td>8. Itinerary</td>
<td>ITIN</td>
<td>NITIN</td>
</tr>
<tr>
<td>9. Run identification</td>
<td>IDENT</td>
<td>1</td>
</tr>
<tr>
<td>10. General information</td>
<td>GENERAL</td>
<td>1</td>
</tr>
<tr>
<td>11. Ports printed</td>
<td>REPORT</td>
<td>1</td>
</tr>
<tr>
<td>12. Number of cargo generations</td>
<td>NKOGOGN</td>
<td>1</td>
</tr>
<tr>
<td>13. Cargo generations</td>
<td>CGEN</td>
<td>NKOGOGN</td>
</tr>
<tr>
<td>14. Port information</td>
<td>PORT</td>
<td>NNPORT*</td>
</tr>
<tr>
<td>15. Ship type</td>
<td>ST</td>
<td>NTYPE*</td>
</tr>
<tr>
<td>16. Ship identification</td>
<td>SHIP</td>
<td>NSHIP*/4</td>
</tr>
<tr>
<td>17. Manipulation</td>
<td>MANIP</td>
<td>4</td>
</tr>
</tbody>
</table>

*These values also appear on the GENERAL information card, Card 10.
5.2 DISTANCES

These cards contain the distances, in nautical miles, between any two ports. These distances are used to compute sailing times for nonitinerary ships.

DIST(I,J) where:

I is the origin port number (1 to 30)

J is the destination port number (1 to 30)

<table>
<thead>
<tr>
<th>COLS 1-60</th>
<th>COLS 61-72</th>
<th>COLS 73-80</th>
</tr>
</thead>
<tbody>
<tr>
<td>Card 1</td>
<td>DIST (I,J)</td>
<td>blank</td>
</tr>
<tr>
<td>Card 2</td>
<td>&quot;</td>
<td>&quot;</td>
</tr>
<tr>
<td>Card 3</td>
<td>&quot;</td>
<td>&quot;</td>
</tr>
<tr>
<td>Card 4</td>
<td>&quot;</td>
<td>&quot;</td>
</tr>
<tr>
<td>...</td>
<td></td>
<td>...</td>
</tr>
<tr>
<td>Card 90</td>
<td>DIST (30,J)</td>
<td>&quot;</td>
</tr>
</tbody>
</table>

Each distance has an F6.0 format.

5.3 CYCLE TIME

This card contains the cycle times (in days) for intertheater ships. The values on this card are used in the model to keep the ships cycling between their home and delivery theaters at regular intervals. A ship is allowed to search for cargo in its home theater for a maximum of one-third of the input cycle time.

KTIME(I,J) where:

I is the home theater number (1 to 6)

J is the delivery theater number (1 to 6)
<table>
<thead>
<tr>
<th>COLS</th>
<th>FORMAT</th>
<th>NAME</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-12</td>
<td>612</td>
<td>KKTIME (1,J) J=1,6</td>
<td>Cycle times</td>
</tr>
<tr>
<td>13-23</td>
<td>612</td>
<td>KKTIME (2,J) J=1,6</td>
<td>Cycle times</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>61-72</td>
<td>612</td>
<td>KKTIME (6,J) J=1,6</td>
<td>Cycle times</td>
</tr>
<tr>
<td>73-80</td>
<td>A</td>
<td>&quot;KKTIME&quot;</td>
<td>Card name*</td>
</tr>
</tbody>
</table>

Each cycle time has an I2 format.

5.4 ADJUSTMENTS

Various miscellaneous factors are defined.

<table>
<thead>
<tr>
<th>COLS</th>
<th>FORMAT</th>
<th>NAME</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-6</td>
<td>F6.0</td>
<td>ADJLD</td>
<td>ad adjustment factor</td>
</tr>
<tr>
<td>7-12</td>
<td>F6.0</td>
<td>TTRAN</td>
<td>Transit time to or from ship pool</td>
</tr>
<tr>
<td>13-18</td>
<td>F6.0</td>
<td>ADJRAT</td>
<td>Queue adjustment</td>
</tr>
<tr>
<td>19-24</td>
<td>F6.0</td>
<td>ADJCGO (1)</td>
<td>Conversion factor for cargo type 1</td>
</tr>
<tr>
<td>25-30</td>
<td>F6.0</td>
<td>ADJCGO (2)</td>
<td>Conversion factor for cargo type 2</td>
</tr>
<tr>
<td>31-36</td>
<td>F6.0</td>
<td>ADJCGO (3)</td>
<td>Conversion factor for cargo type 3</td>
</tr>
<tr>
<td>37-42</td>
<td>F6.0</td>
<td>ADJCGO (4)</td>
<td>Conversion factor for cargo type 4</td>
</tr>
<tr>
<td>43-48</td>
<td>F6.0</td>
<td>ADJCGO (5)</td>
<td>Conversion factor for cargo type 5</td>
</tr>
<tr>
<td>49-54</td>
<td>F6.0</td>
<td>ADJCGO (6)</td>
<td>Conversion factor for cargo type 6</td>
</tr>
<tr>
<td>55-60</td>
<td>F6.0</td>
<td>ADJCGO (7)</td>
<td>Conversion factor for cargo type 7</td>
</tr>
<tr>
<td>61-66</td>
<td>F6.0</td>
<td>ADJCGO (8)</td>
<td>Conversion factor for cargo type 8</td>
</tr>
<tr>
<td>67-72</td>
<td>-</td>
<td></td>
<td>Blank</td>
</tr>
<tr>
<td>73-80</td>
<td>A</td>
<td>&quot;ADJUST&quot;</td>
<td>Card name</td>
</tr>
</tbody>
</table>

*The card name KKTIME is punched in columns 73-80.*
NOTES: 1. The load adjustment factor is used to convert input productivity rates (discharge rates) into loading rates. A value of "1" indicates that loading and unloading takes place at the same rate. Fractional values indicate a slower rate for loading; values greater than one indicate a faster rate for loading. 2. An input fraction is used as a criterion (by ships not having a berth preference) to determine whether to queue at an occupied berth having the highest productivity, or to enter an available berth with a lower productivity rate. The productivity rate at the available berth type must be at least this input fraction of the highest productivity rate at this port. The higher the value, the more selective ships will be in their search. This may cause the ships to queue for long periods at a port. 3. This factor (values of 0.01 to 10000) is used to convert volume (measurement tons (MT)) to weight (long tons (LT)).

5.5 COST PER TON

This card contains eight values representing the costs per measurement ton (MT) per thousand miles shipped for the eight cargo types carried by ships of owner Type 1, berth liner. Costs (dollars) may range from 0 to 99999.

<table>
<thead>
<tr>
<th>COLS</th>
<th>FORMAT</th>
<th>NAME</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-6</td>
<td>F6.0</td>
<td>CSTTON (1)</td>
<td>Cost per MT of cargo type 1</td>
</tr>
<tr>
<td>7-12</td>
<td>F6.0</td>
<td>CSTTON (2)</td>
<td>Cost per MT of cargo type 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>43-48</td>
<td>F6.0</td>
<td>CSTTON (8)</td>
<td>Cost per MT of cargo type 8</td>
</tr>
<tr>
<td>49-72</td>
<td>-</td>
<td>-</td>
<td>Blank</td>
</tr>
<tr>
<td>73-80</td>
<td>A</td>
<td>&quot;CSTTON&quot;</td>
<td>Card name</td>
</tr>
</tbody>
</table>

23
5.6 ADMINISTRATIVE COST

This card contains the daily administrative costs in dollars for the six ship owner types. Values may range from 0 to 99999.

<table>
<thead>
<tr>
<th>COLS</th>
<th>FORMAT</th>
<th>NAME</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-6</td>
<td>F6.0</td>
<td>CSTADM (1)</td>
<td>Owner Type 1 (Berth Liner)</td>
</tr>
<tr>
<td>7-12</td>
<td>F6.0</td>
<td>CSTADM (2)</td>
<td>Owner Type 2 (Military Sealift Command (MSC))</td>
</tr>
<tr>
<td>13-18</td>
<td>F6.0</td>
<td>CSTADM (3)</td>
<td>Owner Type 3 (General Agency Agreement)</td>
</tr>
<tr>
<td>19-24</td>
<td>F6.0</td>
<td>CSTADM (4)</td>
<td>Owner Type 4 (Requisition/Nationalistic)</td>
</tr>
<tr>
<td>25-30</td>
<td>F6.0</td>
<td>CSTADM (5)</td>
<td>Owner Type 5 (Self-Sustaining Container)</td>
</tr>
<tr>
<td>31-36</td>
<td>F6.0</td>
<td>CSTADM (6)</td>
<td>Owner Type 6 (Nonself-Sustaining Container)</td>
</tr>
<tr>
<td>37-72</td>
<td></td>
<td></td>
<td>Blank</td>
</tr>
<tr>
<td>73-80</td>
<td>A</td>
<td>&quot;CSTADM&quot;</td>
<td>Card name</td>
</tr>
</tbody>
</table>

5.7 NUMBER OF ITINERARIES

The value of NITIN must correspond to the number of itinerary cards (Section 5.8).

<table>
<thead>
<tr>
<th>COLS</th>
<th>FORMAT</th>
<th>NAME</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-10</td>
<td>I10</td>
<td>NITIN</td>
<td>Number of unique itineraries (values of 0 to 10)</td>
</tr>
<tr>
<td>11-72</td>
<td></td>
<td></td>
<td>Blank</td>
</tr>
<tr>
<td>73-80</td>
<td>A</td>
<td>&quot;NITIN&quot;</td>
<td>Card name</td>
</tr>
</tbody>
</table>

5.8 ITINERARY

One card is required for each itinerary specified in Section 5.7. Itinerary numbers are assigned by input order.

<table>
<thead>
<tr>
<th>COLS</th>
<th>FORMAT</th>
<th>NAME</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-10</td>
<td>I10</td>
<td></td>
<td>Number of ports on the itinerary from 1 to 10</td>
</tr>
<tr>
<td>11-12</td>
<td>I2</td>
<td></td>
<td>Number of 5th port on an itinerary</td>
</tr>
<tr>
<td>COLS</td>
<td>FORMAT</td>
<td>NAME</td>
<td>DESCRIPTION</td>
</tr>
<tr>
<td>------</td>
<td>--------</td>
<td>------</td>
<td>-------------</td>
</tr>
<tr>
<td>13-14</td>
<td>I2</td>
<td>-</td>
<td>Number of 4th port on Itinerary 1</td>
</tr>
<tr>
<td>15-16</td>
<td>I2</td>
<td>-</td>
<td>Number of 3rd port on Itinerary 1</td>
</tr>
<tr>
<td>17-18</td>
<td>I2</td>
<td>-</td>
<td>Number of 2nd port on Itinerary 1</td>
</tr>
<tr>
<td>19-20</td>
<td>I2</td>
<td>-</td>
<td>Number of 1st port on Itinerary 1</td>
</tr>
<tr>
<td>21-22</td>
<td>I2</td>
<td>-</td>
<td>Number of 10th port on Itinerary 1</td>
</tr>
<tr>
<td>23-24</td>
<td>I2</td>
<td>-</td>
<td>Number of 9th port on Itinerary 1</td>
</tr>
<tr>
<td>25-26</td>
<td>I2</td>
<td>-</td>
<td>Number of 8th port on Itinerary 1</td>
</tr>
<tr>
<td>27-28</td>
<td>I2</td>
<td>-</td>
<td>Number of 7th port on Itinerary 1</td>
</tr>
<tr>
<td>29-30</td>
<td>I2</td>
<td>-</td>
<td>Number of 6th port on Itinerary 1</td>
</tr>
<tr>
<td>31-32</td>
<td>I2</td>
<td>-</td>
<td>Sailing time from 4th to 5th port</td>
</tr>
<tr>
<td>33-34</td>
<td>I2</td>
<td>-</td>
<td>Sailing time from 3rd to 4th port</td>
</tr>
<tr>
<td>35-36</td>
<td>I2</td>
<td>-</td>
<td>Sailing time from 2nd to 3rd port</td>
</tr>
<tr>
<td>37-38</td>
<td>I2</td>
<td>-</td>
<td>Sailing time from 1st to 2nd port</td>
</tr>
<tr>
<td>39-40</td>
<td>I2</td>
<td>-</td>
<td>Sailing time from 10th to 1st port</td>
</tr>
<tr>
<td>41-42</td>
<td>I2</td>
<td>-</td>
<td>Sailing time from 9th to 10th port</td>
</tr>
<tr>
<td>43-44</td>
<td>I2</td>
<td>-</td>
<td>Sailing time from 8th to 9th port</td>
</tr>
<tr>
<td>45-46</td>
<td>I2</td>
<td>-</td>
<td>Sailing time from 7th to 8th port</td>
</tr>
<tr>
<td>COLS</td>
<td>FORMAT</td>
<td>NAME</td>
<td>DESCRIPTION</td>
</tr>
<tr>
<td>------</td>
<td>--------</td>
<td>------</td>
<td>-------------</td>
</tr>
<tr>
<td>47-48</td>
<td>I2</td>
<td>-</td>
<td>Sailing time from 6th to 8th port</td>
</tr>
<tr>
<td>49-50</td>
<td>I2</td>
<td>-</td>
<td>Sailing time from 5th to 6th port</td>
</tr>
<tr>
<td>51-72</td>
<td>-</td>
<td>-</td>
<td>Blank</td>
</tr>
<tr>
<td>73-80</td>
<td>A</td>
<td>&quot;ITIN&quot;</td>
<td>Card name</td>
</tr>
</tbody>
</table>

NOTES:  
1. A ship sequences from the first port through the last port, and then back to the first port. The same sequence is followed until all cargo is delivered. If fewer than 10 ports are used, the remaining port entries are 0 or blank.  
2. Sailing time (in days) may range from 1 to 99.

5.9 RUN IDENTIFICATION

This card contains a 72-character alphanumeric label to identify the run.

<table>
<thead>
<tr>
<th>COLS</th>
<th>FORMAT</th>
<th>NAME</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-72</td>
<td>A</td>
<td>-</td>
<td>Identifying label</td>
</tr>
<tr>
<td>73-80</td>
<td>A</td>
<td>IDENT</td>
<td>Card name</td>
</tr>
</tbody>
</table>

5.10 GENERAL INFORMATION

<table>
<thead>
<tr>
<th>COLS</th>
<th>FORMAT</th>
<th>NAME</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-9</td>
<td>I9</td>
<td>NSHIP</td>
<td>Number of ships*</td>
</tr>
<tr>
<td>10-18</td>
<td>I9</td>
<td>NSTYPE</td>
<td>Number of ship types*</td>
</tr>
<tr>
<td>19-27</td>
<td>I9</td>
<td>NNPORT</td>
<td>Number of ports*</td>
</tr>
<tr>
<td>28-36</td>
<td>I9</td>
<td>NTYPE</td>
<td>Number of berth types</td>
</tr>
<tr>
<td>37-45</td>
<td>I9</td>
<td>NTHEA</td>
<td>Number of theaters</td>
</tr>
</tbody>
</table>
| 46-54| I9     | IOUT | Output Indicator  
If IOUT=0, a shortened version of System Status Summaries will be presented.  
If IOUT=1, System Status Summaries and Event Histories will be printed.  

*Must agree with cards described in the following sections.
<table>
<thead>
<tr>
<th>COLS</th>
<th>FORMAT</th>
<th>NAME</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>55-60</td>
<td>F6.0</td>
<td>TEVAL</td>
<td>Time interval between System Status Summary printouts</td>
</tr>
<tr>
<td>61-66</td>
<td>F6.0</td>
<td>TSTOP</td>
<td>Maximum game time (limited to 320 days)</td>
</tr>
<tr>
<td>67-72</td>
<td>F6.0</td>
<td>TDEL</td>
<td>Time delay before first cycle of System Status Summary. First printout is at &quot;TDEL+TEVAL&quot; days</td>
</tr>
<tr>
<td>73-80</td>
<td>A</td>
<td>&quot;GENERAL&quot;</td>
<td>Card name</td>
</tr>
</tbody>
</table>

**5.11 PORTS PRINTED**

This card contains the numbers of ports included in the System Status Summaries.

<table>
<thead>
<tr>
<th>COLS</th>
<th>FORMAT</th>
<th>NAME</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>I2</td>
<td>IKE (1)</td>
<td>Port number</td>
</tr>
<tr>
<td>3-4</td>
<td>I2</td>
<td>IKE (2)</td>
<td>Port number</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>73-80</td>
<td>A</td>
<td>&quot;REPORT&quot;</td>
<td>Card name</td>
</tr>
</tbody>
</table>

Port numbers are entered in ascending order.

**5.12 NUMBER OF CARGO GENERATIONS**

The value of NKGOGN on this card must be the same as the number of cargo generation cards.

<table>
<thead>
<tr>
<th>COLS</th>
<th>FORMAT</th>
<th>NAME</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-10</td>
<td>I10</td>
<td>NKGOGN</td>
<td>Number of cargo generations</td>
</tr>
<tr>
<td>11-73</td>
<td>-</td>
<td>-</td>
<td>Blank</td>
</tr>
<tr>
<td>73-80</td>
<td>A</td>
<td>&quot;NKGOGN&quot;</td>
<td>Card name</td>
</tr>
</tbody>
</table>
5.13 CARGO GENERATIONS

These cards describe the types of cargo generated by quantity, frequency, generating port, and delivery port. One card is required for each cargo generation.

<table>
<thead>
<tr>
<th>COLS</th>
<th>FORMAT</th>
<th>NAME</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3</td>
<td>I3</td>
<td>KGOGN1(I)</td>
<td>Last day cargo is to be generated</td>
</tr>
<tr>
<td>4-6</td>
<td>I3</td>
<td></td>
<td>1st day cargo is to be generated</td>
</tr>
<tr>
<td>7-8</td>
<td>I2</td>
<td></td>
<td>Interval (days between generations)</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td>Blank</td>
</tr>
<tr>
<td>10</td>
<td>I1</td>
<td></td>
<td>Cargo Type</td>
</tr>
<tr>
<td>11-12</td>
<td>I2</td>
<td></td>
<td>Port generating cargo</td>
</tr>
<tr>
<td>13-14</td>
<td>I2</td>
<td></td>
<td>Delivery port</td>
</tr>
<tr>
<td>15-19</td>
<td>I5</td>
<td>KGOGN2(I)</td>
<td>Blank</td>
</tr>
<tr>
<td>20-24</td>
<td>I5</td>
<td></td>
<td>Amount of cargo generated</td>
</tr>
<tr>
<td>25-29</td>
<td>I5</td>
<td>KGOGN4(I)</td>
<td>Blank</td>
</tr>
<tr>
<td>30-32</td>
<td>I3</td>
<td></td>
<td>Day frequency changes</td>
</tr>
<tr>
<td>33-34</td>
<td>I2</td>
<td></td>
<td>New interval (must be a multiple of the old interval)</td>
</tr>
<tr>
<td>35-72</td>
<td></td>
<td></td>
<td>Blank</td>
</tr>
<tr>
<td>73-80</td>
<td>A</td>
<td>CGEN</td>
<td>Card name. CGEN1 for first cargo generation, CGEN2 for second, etc.</td>
</tr>
</tbody>
</table>

NOTE: Cargo generations are ordered in the input deck first by generating port number (Cols. 11-12) and second by delivery port number (Cols 13-14). For each originating port, the cargo type must be in ascending order. For example, if Port 3 generates cargo types 3, 6, and 4, the cargo types must be in the order 3, 4, and 6. If this ordering is not followed, erroneous output statistics will result.
### 5.14 PORT INFORMATION

These cards describe the characteristics of each port in the simulation. The number of these cards must correspond to the input value "NNPORT" on the "GENERAL" card.

<table>
<thead>
<tr>
<th>COLS</th>
<th>FORMAT</th>
<th>NAME</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3</td>
<td>I3</td>
<td>NFPRT1(I)</td>
<td>Number of berths type 3 (Lighterage berth)</td>
</tr>
<tr>
<td>4-6</td>
<td>I3</td>
<td>-</td>
<td>Number of berths type 2 (Self-sustaining container berth)</td>
</tr>
<tr>
<td>7-9</td>
<td>I3</td>
<td>-</td>
<td>Number of berths type 1 (Break bulk berth)</td>
</tr>
<tr>
<td>10-12</td>
<td>I3</td>
<td>NFPRT2(I)</td>
<td>Number of berths type 6 (Nonself-sustaining container berth)</td>
</tr>
<tr>
<td>13-15</td>
<td>I3</td>
<td>-</td>
<td>Number of berths type 5 (Not used)</td>
</tr>
<tr>
<td>16-18</td>
<td>I3</td>
<td>-</td>
<td>Number of berths type 4 (RoRo berth)</td>
</tr>
<tr>
<td>19</td>
<td>I3</td>
<td>ITHPRTT(I)</td>
<td>Theater of port</td>
</tr>
<tr>
<td>20-25</td>
<td>F6.0</td>
<td>TDLA(I)</td>
<td>Port delay(^1)</td>
</tr>
<tr>
<td>26-31</td>
<td>F6.0</td>
<td>ADJPRT(I)</td>
<td>Adjustment factor for productivity rates(^2)</td>
</tr>
<tr>
<td>32-37</td>
<td>F6.0</td>
<td>CSDTHDL(I)</td>
<td>Cost of cargo handling(^3)</td>
</tr>
<tr>
<td>38-40</td>
<td>F6.0</td>
<td>DFTRPT(I)</td>
<td>Maximum allowable ship draft</td>
</tr>
<tr>
<td>44-55</td>
<td>2A6</td>
<td>PRTNAM</td>
<td>Twelve-character name of port. This label will be printed on output Status Summary Report.</td>
</tr>
<tr>
<td>56-72</td>
<td>-</td>
<td>-</td>
<td>Blank</td>
</tr>
<tr>
<td>73-80</td>
<td>A</td>
<td>PORT#</td>
<td>Card name. PORT1 for first port, PORT2 for second, etc.</td>
</tr>
</tbody>
</table>

**NOTES:**

1. TDLA—Port delay time (in days) encountered by all ships using this port, with values 0 to 999.
2. **ADJPRT**—Adjustment factor (values of 0 to 99) applied to productivity rates reflecting the cargo handling capabilities of each port. A fractional value will reduce productivity rates. This modifier is used for multiple shift operations.

3. **CSTHDL**—Cargo handling cost (in dollars per day) used in computing the costs for both loading and unloading operations for all types of cargo (values of 0 to 99999).

5.15 **SHIP TYPE**

These cards describe the ship types. There must be one card for each ship type used in the model and the number of these cards must correspond to the value NSTYPE on the GENERAL card.

<table>
<thead>
<tr>
<th>COLS</th>
<th>FORMAT</th>
<th>NAME</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-8</td>
<td>F9.0</td>
<td>SPEED</td>
<td>Speed (knots) of ship type</td>
</tr>
<tr>
<td>9-16</td>
<td>F8.0</td>
<td>CAPACW</td>
<td>Cargo capacity (weight) in long tons (values of 0 to 99999)</td>
</tr>
<tr>
<td>17-24</td>
<td>F8.0</td>
<td>CAPACV</td>
<td>Cargo capacity (volume) in measurement tons (values of 0 through 99999)</td>
</tr>
<tr>
<td>5-32</td>
<td>F8.0</td>
<td>CSTSEA</td>
<td>Cost per day at sea (dollars per day) for this ship type (values of 0 to 99999)</td>
</tr>
<tr>
<td>33-40</td>
<td>F8.0</td>
<td>CSTFRT</td>
<td>Cost per day at port (dollars per day) for this ship type (values of 0 to 99999)</td>
</tr>
<tr>
<td>41-48</td>
<td>F8.0</td>
<td>DRAFT</td>
<td>Ship draft. This value (0 to 99) is used by the model to determine whether a ship of this type may enter the port, except for itinerary ships. The user must make sure that all ports on the itinerary have acceptable draft for any ship assigned to the itinerary.</td>
</tr>
<tr>
<td>COLS</td>
<td>FORMAT</td>
<td>NAME</td>
<td>DESCRIPTION</td>
</tr>
<tr>
<td>------</td>
<td>--------</td>
<td>-------</td>
<td>-------------</td>
</tr>
<tr>
<td>49-56</td>
<td>F8.0</td>
<td>ADJTRN</td>
<td>Multi-transfer system adjustment factor. This value is used to reflect the interference of cargo transfer systems operating simultaneously. The productivity rate for each transfer system is multiplied by this factor. A value of &quot;1&quot; indicates that transfer systems operate together at the same rate that they operate independently. A value from 0 through 99999 will result in a lower rate then the base productivity rate.</td>
</tr>
<tr>
<td>57</td>
<td>Blank</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>58</td>
<td>I1</td>
<td>KTRANS</td>
<td>Cargo transfer system type 6 (Nonself-sustaining container)</td>
</tr>
<tr>
<td>59</td>
<td>I1</td>
<td>-</td>
<td>Cargo transfer system type 5 (Not used)</td>
</tr>
<tr>
<td>60</td>
<td>I1</td>
<td>-</td>
<td>Cargo transfer system type 4 (RoRo)</td>
</tr>
<tr>
<td>61</td>
<td>I1</td>
<td>-</td>
<td>Cargo transfer system type 3 (Lighterage)</td>
</tr>
<tr>
<td>62</td>
<td>I1</td>
<td>-</td>
<td>Cargo transfer system type 2 (Self-sustaining container)</td>
</tr>
<tr>
<td>63</td>
<td>I1</td>
<td>-</td>
<td>Cargo transfer system type 1 (Break bulk). A &quot;1&quot; in any of the above columns indicates the use of that transfer system. A &quot;0&quot; indicates that the transfer system is not used.</td>
</tr>
<tr>
<td>64</td>
<td>I1</td>
<td>-</td>
<td>Number of different transfer systems used (values of 0 to 6)</td>
</tr>
<tr>
<td>65-72</td>
<td>B11</td>
<td>KARSHP</td>
<td>Types of cargo this ship may carry. Start in Col. 65 with the least preferred type and proceed to Col. 72 with the most preferred.</td>
</tr>
</tbody>
</table>
First berth type preference (if any) for this ship type (values 0 to 6). A value of 0 indicates that the ship has no facility preference and will enter the berths at the port giving the highest productivity rate.

Second berth type preference (if any) for this ship type. If all the berths of first preference are occupied, the ship will attempt to enter this type.

Changes in theaters a ship of this type can make when being removed from the pool.

0—ship can change both home and delivery theaters

1—ship can change only delivery theaters

2—ship can change neither theater

Card name, ST1 for first ship type card, ST2 for second, etc.

5.16 SHIP IDENTIFICATION

These cards contain initial ship information. Each card contains information for four ships.
<table>
<thead>
<tr>
<th>COLS</th>
<th>FORMAT</th>
<th>NAME</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3</td>
<td>I3</td>
<td>ISHIP(1)</td>
<td>Time of availability (in days). This is the time at which a ship initially enters the game. Any value from 0 to 319 days may be chosen. If the value entered in these columns is 320, the ship is placed in the ship pool, where it remains for at least 30 days or until cargo movement requirements warrant its removal.</td>
</tr>
<tr>
<td>4-5</td>
<td>I2</td>
<td>-</td>
<td>Initial port number. The first port of call for the ship at the beginning of the game. If the ship is on an itinerary, the initial port must be a port on the itinerary. If the ship is nonitinerary, the initial port must be a port within the home theater.</td>
</tr>
<tr>
<td>6-7</td>
<td>I2</td>
<td>-</td>
<td>Itinerary number (if any). This input (with a value of 1 to 10) is required if the ship is assigned to itinerary operations. A 0 is input if the ship is nonitinerary.</td>
</tr>
<tr>
<td>8</td>
<td>I1</td>
<td>-</td>
<td>Type of operation. Enter 1 for intertheater operations 2 for intratheater operations 0 for nonitinerary operations</td>
</tr>
<tr>
<td>9</td>
<td>I1</td>
<td>-</td>
<td>Owner. Identifies the contractual control of the ship (values of 1 to 6)</td>
</tr>
<tr>
<td>COLS</td>
<td>FORMAT</td>
<td>NAME</td>
<td>DESCRIPTION</td>
</tr>
<tr>
<td>------</td>
<td>--------</td>
<td>-------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>10-11</td>
<td>12</td>
<td>-</td>
<td>Ship type. One of the 25 possible ship types. The ship will have all the characteristics of that ship type as input on the ship type (ST) card.</td>
</tr>
<tr>
<td>12-14</td>
<td>-</td>
<td>ISHIP2</td>
<td>Blank</td>
</tr>
<tr>
<td>15</td>
<td>11</td>
<td>-</td>
<td>Delivery Theater Number. Establishes the delivery theater of an intertheater ship (a number from 1 through 6). Not applicable for ships assigned an itinerary (a zero is input). For intratheater ships, the delivery theater and home theater will be identical.</td>
</tr>
<tr>
<td>16-17</td>
<td>12</td>
<td>-</td>
<td>Home Port. Establishes the home theater of intratheater and intertheater ships; e.g., if the port input is in theater 1, then theater 1 will be the home theater of this ship. Not applicable for ships assigned to itinerary operations.</td>
</tr>
<tr>
<td>18-28</td>
<td>-</td>
<td>-</td>
<td>Same type of information shown in card columns 1-11, for a second ship.</td>
</tr>
<tr>
<td>29-34</td>
<td>-</td>
<td>-</td>
<td>Same type of information shown in card columns 12-17, for a second ship.</td>
</tr>
<tr>
<td>35-45</td>
<td>-</td>
<td>-</td>
<td>Same type of information shown in card columns 1-11, for a third ship.</td>
</tr>
<tr>
<td>46-51</td>
<td>-</td>
<td>-</td>
<td>Same type of information shown in card columns 12-17, for a third ship.</td>
</tr>
<tr>
<td>52-62</td>
<td>-</td>
<td>-</td>
<td>Same type of information shown in card columns 1-11, for a fourth ship.</td>
</tr>
<tr>
<td>63-68</td>
<td>-</td>
<td>-</td>
<td>Same type of information shown in card columns 12-17, for a fourth ship.</td>
</tr>
<tr>
<td>COLS</td>
<td>FORMAT</td>
<td>NAME</td>
<td>DESCRIPTION</td>
</tr>
<tr>
<td>------</td>
<td>--------</td>
<td>-------</td>
<td>-------------</td>
</tr>
<tr>
<td>69-72</td>
<td>-</td>
<td>-</td>
<td>Blank</td>
</tr>
<tr>
<td>73-80</td>
<td>A</td>
<td>Ship#</td>
<td>The sequence number included in the card name will be used to maintain cards in proper order. The number given to each ship by the model is dependent on the order in which cards are input, e.g., card &quot;SHIP 1&quot; will identify ship #1, ship #2, ship #3, and ship #4. Card &quot;SHIP 2&quot; will identify ship #5, ship #6, etc.</td>
</tr>
</tbody>
</table>

5.17 MANIPULATION

These four cards allow a user to vary ships used in the game by type and availability without changing ST cards or SHIP cards.

<table>
<thead>
<tr>
<th>CARD</th>
<th>COLS</th>
<th>FORMAT</th>
<th>NAME</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1-3</td>
<td>I3</td>
<td>MANIP 1</td>
<td>Number (less than or equal to NTYPE) of ship types required</td>
</tr>
<tr>
<td>2</td>
<td>1-2</td>
<td>I2</td>
<td>MANIP 2</td>
<td>Ship types used (value corresponds to value of ST)</td>
</tr>
<tr>
<td>3</td>
<td>3-4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5-6</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>1-3</td>
<td>I3</td>
<td>MANIP 3</td>
<td>Highest acceptable availability of ships*</td>
</tr>
<tr>
<td>4</td>
<td>1-3</td>
<td>I3</td>
<td>MANIP 4</td>
<td>Number subtracted from availability*</td>
</tr>
</tbody>
</table>

\*NOT*: All ships of owner type 2 (MSC shipping) will remain in the game, and no change will be made to their availability.
APPENDIX A

GENERAL DESCRIPTION OF REACT II*

*This information was excerpted from Perry, Howard W. and Catherine B. Gleason, "REACT--A Shipping Operations Simulation," Research Associates Incorporated, Silver Spring, Md. (Jan 1969).
I. INTRODUCTION

REACT, an acronym for Requirements Evaluated Against Cargo Transportation, is a computer simulation model developed for use in the study and analysis of shipping operations. The model was designed to be general enough to allow a wide spectrum of shipping operations to be analyzed.

Consider a system consisting of certain objective areas at which cargo is to be delivered. This cargo is available at certain sources. The general problem then is to transport this cargo from these sources to the required destinations using the ship inventory that is available.

REACT allows for the simulation of this shipping operation in which the sources, objective areas, and ship inventory are defined in general terms. That is, the quantity and characteristics of each of these elements are functions of the input data. It follows, therefore, that with this degree of flexibility the model can simulate a wide variety of system configurations.

The following sections describe in some detail the operation of the model with regard to the overall task of transporting cargo from one port to another.

II. SHIP OPERATION

The flexibility of the model allows the simulation of different modes of ship operation. Both itinerary and nonitinerary ships may be simulated. An itinerary is defined in the model as an ordered set of ports. Provision is made in the model for the inclusion of up to ten different itineraries, each of which may comprise up to ten ports. Thus, operations of an itinerary ship are restricted to the ports on its itinerary, while ships not assigned to an itinerary operate in response to cargo delivery requirements. Nonitinerary ships, however, must be assigned to either intra- or intertheater operations, in order to maintain some control over their activities. Intratheater ships respond only to cargo generated for delivery within the same theater, whereas intertheater ships are allowed to operate between and within two separate theaters. Ships referred to as intertheater ships may, in some cases operate as intratheater ships, depending on the cargo they carry.
III. SHIP POOL

Provision is made in the model for a pool of ships. Ships enter the pool for one of two reasons. The first is that the ships may have been input initially as being in the pool. This feature may be useful in representing, for example, the availability of the reserve fleet on some delayed basis. The second reason is that the ships may have been on normal operation previously and then entered the pool at some later time because there was no cargo to be delivered which they were eligible to carry. Ships entering the pool for this second reason must remain in the pool for a time period specified in the input before they may leave. This time represents ROS (reduced operating status) incurred when a ship is removed from cargo activity after returning to its home port and not finding any cargo to be delivered.

IV. CARGO GENERATION

Rather than directly addressing the cargo requirements existing at the various ports, the model concerns itself with the generation of cargo at certain ports for delivery to those ports which require the cargo. This approach may be considered equivalent since any requirement must ultimately be fulfilled by the generation of the specific cargo. This approach also avoids the necessity of modeling the interface between the requesting activity and that activity charged with transporting the cargo to a port area. Thus, in order to simulate cargo requirements in the model, cargo requirements at a given time must be translated into cargo generated at an earlier time to allow for the pick-up and delivery of the cargo to the required objective port. Cargo requirements are converted to generations in the following manner:

After the requirements for a particular cargo type at the given objective area have been examined, historical data can supply information concerning the ports that have fulfilled that requirement in the past and the corresponding ratios in which the commodity was supplied. The historical data can also be examined to determine the distribution of shipment amounts for these port pairs (origin-destination). With this information, the number of generations needed to provide the required cargo can be computed.
Since the sealift requirements are given on a time-phased basis, the generations must be scheduled such that the requisite amount of cargo is generated in time to meet the requirements. With this estimate as to the available time in which to generate the cargo and knowing, from the above computations, the number of generations needed, the frequency of generation can be computed. Thus, the information needed for each generation (the frequency and the distribution of cargo amounts) may be synthesized from the sealift requirements.

Hence, cargo is introduced to the model in the form of "cargo generations." A cargo generation may be defined as "generation, at a specific time, of a determined amount of a particular type of cargo at a port for delivery to some other port." Thus, cargo in the game is generated for delivery on an input time-phased schedule in amounts needed to meet the proposed requirements. The input factors which control the schedule and the amount of cargo for each generation include: (1) the frequency of generation, (2) time of initial generation, and (3) the statistical distribution required to generate cargo.

The input time of initial generation serves only to fix the time of first occurrence of a particular generation. If this input is properly chosen for all cargo generations, initialization effects in the model can be reduced to a minimum. Following the initial occurrence, cargo generation recurs on a cyclic basis where the cycle time is equal to the input frequency of generation.

When the time for a generation is reached, the statistical distribution type of the generation must be determined. The amount of cargo generated is then computed as a random variate from the distribution type, using the input parameters of the distribution. The generated cargo is then added to the system and tagged as cargo to be delivered.

An additional feature of the cargo generation package in the model is the capability to change the frequency of any cargo generation once during the play of the game. To accomplish this requires only input of the new frequency and the time at which the new frequency becomes effective. When that time is reached, the new frequency is utilized to
determine all subsequent occurrences of that particular generation. This feature can simulate the heavy delivery requirements in the initial stages of a contingency and the subsequent reduction in requirements once the necessary inventory levels are established.

V. CARGO HANDLING RATES

The rate at which cargo is loaded on or discharged from a ship is a function of several variables. In this model the base rate in measurement tons per day is input as the average rate at which cargo is discharged. It is a function of (1) the cargo type being discharged, (2) the type of transfer system(s) aboard the ship engaged in the operation, and (3) the type of facility at which the ship is berthed or anchored.

Provision is made in the model for a ship type to have multiple transfer systems. This gives the capability of simulating the newer multi-purpose ships. In considering cargo operations aboard the multi-transfer system ships, the model makes the assumption that each transfer system may operate simultaneously on each cargo block that is to be moved. The overall rate using the available transfer systems is then adjusted by an input factor. This factor is used to account for mutual interference of the transfer systems. This approach is not exactly equivalent to the real life situation in which each transfer system operates on different cargo blocks simultaneously. It does not preclude, however, obtaining realistic port times for the multi-purpose ships if the values of the associated inputs are judiciously chosen.
APPENDIX B

SAMPLE OUTPUT
<table>
<thead>
<tr>
<th>Productivity Rates Based on Cargo Type, Transfer System, and Facility Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1797</td>
</tr>
<tr>
<td>4651</td>
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### CONVERSION FACTORS FOR EACH CARGO TYPE (MT/UNIT)

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### COST (MT/UNIT) FOR COMMERCIALLY CARRIED CARGO BY TYPE

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### TRANSIT TIME TO OR FROM SHIP POOL

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### ACCEPTABLE PERCENTAGE OF HIGHEST AVAILABLE PRODUCTIVITY RATE

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### GENERAL INPUTS

**Data Identification:** Piraeus with MOD 2 SRP and MOD CARGEN

- **Number of ships in game:** 25
- **Number of ships in game:** 145
- **Number of theaters in game:** 1
- **Number of ports in game:** 18
- **Number of facility types in game:** 6
- **Number of itineraries in game:** 0

**Time interval between periodic system status printout (in days):** 5.

**Time for maximum length of play in days:** 30.

**First system status printout (in days):** At 5.

**Differential cost for owner type:**

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**System Status at 5.0 Days**

CUMULATIVE SYSTEM COST = 0.000 (MIL $)
CURRENT NUMBER OF SHIPS IN POOL = 2

**Port Information**

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**Number of Ships that Have Used Port 3 by Facility Type**

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**Number of Ships (Including Those in Queue) Currently at Port 3 by Facility Type**

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**Percentage of Ships that Had to Wait to Discharge at Port 3 = 0.8 Per Cent**

**Mean Waiting Time of These Ships = 0.0 Days**
### CARGO DELIVERED TO PORT 4 NORFOLK BY TYPE (NT)

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### TOTAL AMOUNT OF CARGO GENERATED AT PORT 4 BY TYPE (NT)

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### TOTAL AMOUNT OF CARGO SHIPPED FROM PORT 4 BY TYPE (NT)

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### NUMBER OF SHIPS THAT HAVE USED PORT 4 BY FACILITY TYPE

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### NUMBER OF SHIPS (INCLUDING THOSE IN QUEUE) CURRENTLY AT PORT 4 BY FACILITY TYPE

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### PERCENTAGE OF SHIPS THAT HAD TO WAIT TO DISCHARGE AT PORT 4 = 8.9 PER CENT

**MEAN WAITING TIME OF THESE SHIPS = 0.8 DAYS**
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<td>Numner of Ships That Have Used Port 5 by Facility Type</td>
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<tr>
<td>Percentage of Ships That Had to Wait to Discharge at Port 5 = 0.0 PER CENT</td>
<td>0.0 PER CENT</td>
<td>0.0 DAYS</td>
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# Cargo Delivered to Port 17 S.Cal by Type (HT)

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<tr>
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</tr>
<tr>
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<td>0</td>
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## Total Amount of Cargo Generated at Port 17 by Type (HT)

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## Total Amount of Cargo Shipped from Port 17 by Type (HT)

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## Number of Ships That Have Used Port 17 by Facility Type

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## Number of Ships (Including Those in Queue) Currently at Port 17 by Facility Type

<table>
<thead>
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<td>0</td>
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<td>0</td>
<td>0</td>
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</tbody>
</table>

## Percentage of Ships That Had to Wait to Discharge at Port 17

- Mean waiting time of these ships = 8.8 days

## Cargo Totals

- Total amount of cargo generated = 612888
- Total amount of cargo shipped = 0
- Total amount of cargo delivered = 0

Intermediate output has been removed.
AT 38.2 DAYS, THE GAME ENDED

SYSTEM STATUS AT 38.2 DAYS

CUMULATIVE SYSTEM COST = 7.0 (MIL $)
CURRENT NUMBER OF SHIPS IN POOL = 3

PORT INFORMATION

<table>
<thead>
<tr>
<th>CARGO DELIVERED TO PORT</th>
<th>1</th>
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<th>S</th>
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TOTAL AMOUNT OF CARGO GENERATED AT PORT 3 BY TYPE (INT)

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TOTAL AMOUNT OF CARGO SHIPPED FROM PORT 3 BY TYPE (INT)

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NUMBER OF SHIPS THAT HAVE USEFUL PORT 3 BY FACILITY TYPE

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NUMBER OF SHIPS (INCLUDING THOSE IN QUEUE) CURRENTLY AT PORT 3 BY FACILITY TYPE

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</table>

PERCENTAGE OF SHIPS THAT HAD TO WAIT TO DISCHARGE AT PORT 3 = 0.0 PCT
MEAN WAITING TIME OF THESE SHIPS = 0.0 DAYS
### CARGO DELIVERED TO PORT 4 NORFOLK

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### TOTAL AMOUNT OF CARGO GENERATED AT PORT 4 BY TYPE (MT)

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### TOTAL AMOUNT OF CARGO SHIPPED FROM PORT 4 BY TYPE (MT)

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### NUMBER OF SHIPS THAT HAVE USED PORT 4 BY FACILITY TYPE

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### NUMBER OF SHIPS (INCLUDING THOSE IN QUEUE) CURRENTLY AT PORT 4 BY FACILITY TYPE

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</tbody>
</table>

### PERCENTAGE OF SHIPS THAT HAD TO WAIT TO DISCHARGE AT PORT 4 = 0.0 PER CENT

MEAN WAITING TIME OF THESE SHIPS = 0.0 DAYS
<table>
<thead>
<tr>
<th>OWNER</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>RERTH LINER</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>MSTS CONTROL</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>GAA</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>REG / NAT.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>S/S CONTNR</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>N/S/S CONTNR</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TOTAL AMOUNT OF CARGO GENERATED AT PORT</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>44361</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TOTAL AMOUNT OF CARGO SHIPPED FROM PORT</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>9</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>15525</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NUMBER OF SHIPS THAT HAVE USED PORT</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NUMBER OF SHIPS (INCLUDING THOSE IN QUEUE) CURRENTLY AT PORT</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PERCENTAGE OF SHIPS THAT HAD TO WAIT TO DISCHARGE AT PORT</th>
<th>5 = 16.7 PER CENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEAN WAITING TIME OF THESE SHIPS</td>
<td>0.8 DAYS</td>
</tr>
<tr>
<td>Owner</td>
<td>1</td>
</tr>
<tr>
<td>-------------</td>
<td>----</td>
</tr>
<tr>
<td>BERTH LINER</td>
<td>27453</td>
</tr>
<tr>
<td>NTS CONTROL</td>
<td>27454</td>
</tr>
<tr>
<td>GAA</td>
<td>18880</td>
</tr>
<tr>
<td>SEC / NAT.</td>
<td>0</td>
</tr>
<tr>
<td>S/S CONTINP</td>
<td>0</td>
</tr>
<tr>
<td>N/S/S CONTIN</td>
<td>0</td>
</tr>
</tbody>
</table>

**CARGO DELIVERED TO PORT 11 PIRAEUS BY TYPE (MT)**

<table>
<thead>
<tr>
<th>TOTAL AMOUNT OF CARGO GENERATED AT PORT 11 BY TYPE (MT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
</tr>
<tr>
<td>------------------------------</td>
</tr>
<tr>
<td>0</td>
</tr>
</tbody>
</table>

**TOTAL AMOUNT OF CARGO SHIPPED FROM PORT 11 BY TYPE (MT)**

<table>
<thead>
<tr>
<th>TOTAL AMOUNT OF CARGO SHIPPED FROM PORT 11 BY TYPE (MT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
</tr>
<tr>
<td>------------------------------</td>
</tr>
<tr>
<td>0</td>
</tr>
</tbody>
</table>

**NUMBER OF SHIPS THAT HAVE USED PORT 11 BY FACILITY TYPE**

<table>
<thead>
<tr>
<th>NUMBER OF SHIPS THAT HAVE USED PORT 11 BY FACILITY TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
</tr>
<tr>
<td>26</td>
</tr>
</tbody>
</table>

**NUMBER OF SHIPS (INCLUDING THOSE IN QUEUE) CURRENTLY AT PORT 11 BY FACILITY TYPE**

<table>
<thead>
<tr>
<th>NUMBER OF SHIPS CURRENTLY AT PORT 11 BY FACILITY TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
</tr>
<tr>
<td>0</td>
</tr>
</tbody>
</table>

**PERCENTAGE OF SHIPS THAT HAD TO WAIT TO DISCHARGE AT PORT 11 = 0.0 PER CENT**

**MEAN WAITING TIME OF THESE SHIPS = 0.0 DAYS**
### Cargo Delivered to Port 17 SCAL By Type (MT)

<table>
<thead>
<tr>
<th>Owner</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Berth Liner</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>MSTS Capital</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>GAA</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Req / Nat.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>S/S Contrn.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>N/S/S Contrn.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

### Total Amount of Cargo Generated at Port 17 By Type (MT)

<table>
<thead>
<tr>
<th>Type</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>27077</td>
<td>0</td>
<td>0</td>
<td>77888</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>104964</td>
</tr>
</tbody>
</table>

### Total Amount of Cargo Shipped from Port 17 By Type (MT)

<table>
<thead>
<tr>
<th>Type</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>27076</td>
<td>0</td>
<td>0</td>
<td>77888</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>104964</td>
</tr>
</tbody>
</table>

### Number of Ships That Have Used Port 17 By Facility Type

<table>
<thead>
<tr>
<th>Type</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>17</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

### Number of Ships (Including Those In Queue) Currently at Port 17 By Facility Type

<table>
<thead>
<tr>
<th>Type</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>17</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

### Percentage of Ships That Had to Wait to Discharge at Port 17 = 0.0 PER CENT
**Mean Waiting Time of These Ships = 0.0 DAYS**

### Cargo Totals

- Total Amount of Cargo Generated = 738477
- Total Amount of Cargo Shipped = 447363
- Total Amount of Cargo Delivered = 249282
PER CENT OF SHIP VOLUME USED BY NON-ITINERARY SHIPS LEAVING HOME THEATER

<table>
<thead>
<tr>
<th>SHIP TYPE</th>
<th>USED VOLUME</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>61.5</td>
</tr>
<tr>
<td>3</td>
<td>78.3</td>
</tr>
<tr>
<td>11</td>
<td>76.3</td>
</tr>
<tr>
<td>12</td>
<td>80.0</td>
</tr>
<tr>
<td>14</td>
<td>64.8</td>
</tr>
<tr>
<td>16</td>
<td>91.7</td>
</tr>
<tr>
<td>17</td>
<td>88.8</td>
</tr>
<tr>
<td>18</td>
<td>48.6</td>
</tr>
<tr>
<td>22</td>
<td>74.8</td>
</tr>
<tr>
<td>23</td>
<td>75.4</td>
</tr>
<tr>
<td>24</td>
<td>48.8</td>
</tr>
</tbody>
</table>

PER CENT OF SHIP VOLUME USED BY NON-ITINERARY SHIPS LEAVING HOME THEATER

<table>
<thead>
<tr>
<th>ORIGIN THEATER</th>
<th>DESTINATION THEATER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2 3 4 5 6</td>
</tr>
<tr>
<td>1</td>
<td>0.8</td>
</tr>
</tbody>
</table>

PER CENT OF SHIP VOLUME USED BY NON-ITINERARY SHIPS LEAVING HOKI THEATER

= 74.8
APPENDIX C

PROGRAM LISTING
*DECK REACT1
PROGRAM REACT (INPUT, OUTPUT, TAPE5=INPUT, TAPE6=OUTPUT, PUNCH)
CALL MAIN
STOP
END
*DECK FGAM
SUBROUTINE FGAM
COMMON 1 NSTYPE,NTFORT,NFTYPF,NTHFA,NITIN,TFCAL,TSTOP,NSHIP,MONENT(12).
2 CSTAN,5.CSTON(8),PRODUCT(5,6),DIST(30,30),KTIME(5,6),TIME(
3 KEVENT(410),FFEVENT,VENT,VENT1,VENT2,VENT3,ISHIP,KNORD,NN.
COMMON 1 SPEF(25),CAPACV(25),CSTSEA(25),CSTPRT(25),DRTP(25).
2 KTRANS(25),ADJTRN(25),KARSHP(25),ISHIP(400),ISHIP(400).
3 NFTPEN(10),NPTITN(10),NPTITN(10),NPTITN(10),NPTITN(10),
4 KPREF(25),KPREF(25),KCHANG(25).
COMMON 1 NFPRF(30),NFPRT2(30),NLPR(30),TEPRT(30),ADJPRR(30),CSTMOL(30),
2 NFPRF(30),FRRN,KFPRRT(18),KFPRT(30),ADJRT,PRADD(10,2).
COMMON 1 NKARGO,KARGO(4000),ISM,CRTSYS.1Q,NO2,NO3,QUEUE,QUEUE(400).
2 KGOGNI(1000),KGOGNI(1000),GGOGN(1000),KGOGN(1000),NKOGN,ADJL0.,
3 ANJG(40).
COMMON 1 KGARG(36,6),KARGO(36),NPRFAC(36,6),KRGSHF(36,6),TOPORT(30),
2 KRGGRN(36,6),NPOOL,OUT,TVOLAI(25),TVOLUS(25),TVAVR(6,6),NVUT(6,6),
 COMMON/C/ CNAMN(6,2).
COMMON/C/ KRG(102),NPOOL(40),NTSTOP
COMMON/MM/MMTYPF(25),NCT,NAVALL,NNN.
ISM = 1
CALL PRINT
WRITE(6,101) (l,GGOGN(l),=1,NKOGN)
101 FORMAT(15X,Z2HCCAGO NOT YET SHIPPER /4X,5(FHGEN. NO. 2X,6HMAHMT. 
14X/ ( 6X,T,4X,F,0.5X,I,3.4X,F,0.5X,I,3.4X,F,0.5X,I,3.4X,F,0.5X
2 I3,4X,F,0,0. / )
WRITE(6,159)
159 FORMAT(/20X,*TIME CARGO DELIVERED CHIPS IN POOL*)
DO 160 MMM=5,NTSTOP,5
MMM=MMM+5
WRITE(6,161) MMM,KGRC(MM),NPOOL(MM)
160 CONTINUE
161 FORMAT(2X,I3,10X,10X,10X,13)
WRITE(6,162) (NMTYPF(1),I=1,NCT)
162 FORMAT(/34 SHIP TYPES IN GAME */25I3)
WRITE(6,163) MMNAVALL,NNNA
163 FORMAT(* HIGHEST AVAILABLE AVAILABILITY */I3/ NUMBER SURTA
CCTED FROM AVAILABILITY */I3/ STOP
END

66
*DECO: VGFVL
SUBROUTINE VGFVL
COMMON
1 NSLTC, WRPORT, NTYPE, NHEA, NTTIN, NTEVL, NTSTOP, NSHIP, RDENT (12),
2 CSTHIN(6), CSTOM(4), PRODUC(6,6,4), DIST(30,30), KTIME(6,6), TIME,
3 KEVENT(410), KEVENT_7, KEVENT_1, KEVENT_2, KEVENT_3, IESHIP, IWDORD, RN
COMMON...d
1 SPC(25), CAPAC(25), CAPACV(25), CSPPRT(25), DRAFT(25),
2 KTSAM(25), ADJTRN(25), KARSHIP(25), ISHIP(400), ISHIP(400),
3 NPTIN(10), NPTIN(10), NPTIN(10), NPTIN(10), NPTIN(10),
4 KPRED(25), KPRED(25), KPRED(25),
COMMON
1 NFPRT(30), WFPRT(30), ITHPR(30), TDLA(30), ADJPR(30), CSTMOL(30),
2 WFPRT(30), WTRAN, WFPRT(30), WFPRT(30), ADJPR, WTRAN (30, 2)
COMMON
1 NARGO, NARGO(400), ISAM, CSTSYS, NQ1, NQ2, NQ3, NOQUE, NQUE (400),
2 KGOGN(1000), KGOGN(1000), KGOGN(1000), KGOGN(1000), KGOGN(1000),
3 APOG(10)
COMMON
1 KARGO(30, 8, 8), WQPORT(30), WQPORT(30), WQPORT(30), WQPORT(30),
2 KGOGN(10, 8), WQPORT(30), TVDVOL(25), TVDVOL(25), TVDVOL(25), TVDVOL(25),
3 DIMENV, THRCRG(6, 6)
IF (KPOOL) 90, 90, 1
1 DO 100 J = 1, 6
DO 100 J = 1, 6
THRCRG(I, J) = 0.
100 CONTINUE

I = 1
2 IF (KGOGN(I)) 4, 4, 3
3 J = MOD(KGOGN(I), 100)
4 K = MOD(KGOGN(I)/100, 10)
5 J = ITRPRT(J)
6 K = ITRPRT(K)
7 THRCRG(K, J) = THRCRG(J, K) + KGOGN(I)
4 I = I + 1
8 IF (I = NKGOGN) 2, 2, 400
400 I = 10. * (TIME + 7.)
J = KEVENT
401 IF (MOD(KEVENT(J), 8000) = 1) 410, 410, 410
410 ISAVE = MOD(KEVENT(J)/1000000, 10)
420 IF (ISAVE = 1) 420, 420, 420
420 IF (ISAVE = 2) 420, 420, 420
430 J = J - 1
440 ISAVE = KEVENT(J) / 1000000
L = MOD(IISHIP(I), ISAVE/100, 10)
K = MOD(IISHIP(I), ISAVE/100)
450 THRCRG(K, L) = THRCRG(L, K) - CAPACV(ISHIP)
GO TO 430
490 WRITE (6, 491) THRCRG(1, 3), THRCRG(3, 1), THRCRG(3, 2), THRCRG(2, 1)
WRITE(6,492) ISHIP(6),ISHIP2(6)
NCOUNT=1
800  UO  80  K=1, NSHIP
ISAVE = ISHIP(K)/100000000
IF (ISAVE) 60,60,30
30  IF (KTIME - 320)  31,51,32
31  IF (KTIME-ISHAVF)  40,32,32
32  L = MOD(ISHIP(K),100)
GO TO (331,332,333), NCOUNT
331  IGFI=ITHPRT(NUL,ISHIP2(K),100))
IDFL=MOD(ISHIP2(K)/100,10)
XMOUNT=0.
GO TO 40000
332  IF (KCHANG(L))  21,333,60,60
333  IGFI=ITHPRT(NUL,ISHIP2(K),100))
XMOUNT=3.
GO TO 330
333  IF (KCHANG(L))  33,33,90
33  IGFI=1
330  IDFL=1
4000  IF (THRCRG(IGEN, IDFL) - 1000) .70,.70,40
40  DO 60 KK=1, NHPRT
IF (ITHPRT(KK) - IGFI) 60,.42,.60
42  IF (IDFL) - DFTPRT(KK) .143,.68,.60
43  GO TO (435,435,431), NCOUNT
435  XMOUNT=0.
435  DO 50 LL=1,8
LLL=LL-1
JJJ=MOD(KARSHP(L)/10**LLL,10)
IF (JJJ) 50,50,44
44  DO 40 NK=1, MKGOUN
IF (MOD(KGOGN1(NK),180000)/100) - KK1 .40,.45,.48
45  IF (MOD(KGOGN1(NK),180000)/100000-JJJ) 40,.46,.48
46  TDPR=MOD(KGOGN1(NK),100))
IF (ITHPRT(TDPR) - IDFL) 40,.47,.48
47  XMOUNT=XMOUNT+CGCN3(NK);
48  CONTINUE
50  CONTINUE
WRITE(6,51) IGFI, DFL, KK, K, XMOUNT
51  FORMAT(1X, 45, 40)
GO TO (60, 60, 610), NCOUNT
610  IF (XMOUNT - 50000, 61, 60, 72, 72
60  CONTINUE
61  IF (XMOUNT - 5000, 62, 72, 72
62  GO TO (160, 70, 70, 1), NCOUNT
710  IDFL=IDFL+1
70  IF (IDFL = 6) 40000, 40000, 70
700  GO TO (160, 60, 71), NCOUNT
71  IGFI=IGFI+1
IDFL=1
IF (IGFI = 6) 40000, 40000, 60
72  NSAVE= MOD(ISHIP(K),10000)
ISHIP(K) = NSAVE + KK*1000000
ISHIP2(K) = KK + 100*IDFL
THRCRG(IGEN, IDFL) = THRCRG(IGEN, IDFL) - .8*CAPACV(LSAVF)
IF (IOUT) 76,76,75
75  WRITE(6,99) TIME,K, IGFI, IDFL
WRITE(6,492) SHIP(A6),ISHIP(86)
WRITE(6,491) THRCRG(1,3),THRCRG(3,1),THRCRG(3,2),THRCRG(2,3)
492 FORMAT(1X,2(I4))
491 FORMAT(1X,4(F12,0))
76 LVENT1 = K
LVENT2 = 2
LVENT3 = 0
TVENT = TIME
CALL PUT
NPOLL = NPOOL - 1
IF (NPOLL) 90,90,40
40 CONTINUE
WRITE(6,401) NCOUNT
41 FORMAT(1X,13)
NCOUNT = NCOUNT + 1
IF (NCOUNT <= 4) 80,80,90
90 LVENT1 = 6
LVENT2 = 4
LVENT3 = 0
TVENT = TIME + 7.
CALL PUT
CALL TAKE
RETURN
99 FORMAT(10X,4MAT,F5.1,16H DAYS, SHIP NO. ,I3,52H -ENCEVR FROM P
1ool TO CARRY CARGO BETWEEN THEATRES ,I2,5H AND ,I2)
END
*DECK LOAD
SURROUNFD LOAD
COMMON
1 NSTYPE,NPORT,NFTYPE,FMTA,NTIMN,TFVAL,ISTOP,NSHIP,RDENT(12),
2 CSTAND(1),CSTANDY(1),PRODUC(6,6,6),DIST(30,10),KMTIMF(6,6),TTIM,
3 KEVT4F(141),KEVT4N.KEVT4N,LEVT3,LEVT2,LEVT1,LEVT4P,TSHIT,KWORD.
COMMON
1 SPEED(125),CAPAC(25),CAPACY(25),CSTSFJ(27),CSTSFJT(25),MSTF(25),
2 KTRAN(25),ADJTRM(25),KARSHIP(151),TSHTP(14001),TSHTP2(1400),
3 NPTIMN(10),NPTIMN(10),NPTIMN(10),NPTIMN(10),NPTIMN(10),
4 KPREF(125),KPREF(125),KCHANG(125)
COMMON
1 NFPRT1(30),NFPRT1(30),TDLA(30),ADJPT(30),ADJPT(30),ADJPT(30),
2 NFPRT2(30),TFRAN,TFRAN,TFRAN,TFRAN,TFRAN,TFRAN
COMMON
1 NARGO,KARGO(1200),ISW,CSTSYS,NQ1,NQ2,NQ3,NQUEF,KAIUEF(100),
2 KGOGN(1000),KGOGN(1000),KGOGN(1000),KGOGN(1000),KGOGN(1000),
3 ANJCG0(11)
COMMON
1 KARGO(30,3,3),NPORT(30),NPRFAC(30,3),NGSHP(30,1),TOPORT(30),
2 KRG0M(10),KAPAC(NTYPE),TOPRT1(10),KAPAC(NTYPE),TOPRT2(10),KAPAC(NTYPE),
COMMON/A/ NAMN(16,2)
COMMON/B/ NTRAN(61),NFACT(10),NFACT(10),NFACT(10),NFACT(10),NFACT(10),
1 J.4SHPVOL,SHPVOL/NTFAC,SAVF4M,
FILT=0,0
$30 LSAVE = I + 100 * NPORT
IF (KPREF1(NTYPE)) 831,831,8301
8301 DO #302 JT = 1,3
10 EX = 1000 **(JT - 1)
20 NTEMP(JT) = MOD(INFPRT1(I)/TFX,1000)
302 NTEMP(JT+1) = MOD(INPRT2(I)/IFX,1000)
31 JTEMP = KPREF1(NTYPE)
32 IF (NTEMP(JTEMP)) 833,833,8304
303 JTEMP = KPREF2(NTYPE)
304 IF (NTEMP(JTEMP)) 841,841,8404
31 IF (MOD(KGOGN(JJ),10000) - LSAVE) 832,833,841
32 J = J + 1
33 IF (J-NKGOG) 831,831,94
332 K = 1
34 LSAVE = MOD(KGOGN(JJ),10000)
35 IF (LSAVE - KCAPG(K)) 400,45,400
340 K = K+1
341 IF (K=5) 40,45,43
342 RETURN
35 IF (KGOGN(JJ)) 832,832,8500
350 IF (KGOGN(JJ) - 340000) 8502,8502,8501
3501 SELAVE2 = 340000
40 TO 850
4502 SELAVE2 = KGOGN(JJ)
450 IF (SELAVE2=6000*CAPACV(NTYPE) + SHPVOL) 851,851,857
451 SELAVE = SELAVE2
40 TO 853
452 SELAVE = 6000*CAPACV(NTYPE) - SHPVOL
453 IF (SELAVE=ANJCGO(ISAIF) - CAPACW(NTYPE) - SHPWT) 855,855,854
454 SELAVE = CAPACW(NTYPE) - SHPWT
455 SELAVE = SELAVE + ADJCGO(ISAIF)
70
IISAV = SAVE
EQLT = SAVE * ADJCGO(ISAVE) + EQLT
KRGSHP(NPORT, ISAVE) = KRGSHP(NPORT, ISAVE) + IISAV
SHPMT = SHPMT + SAVE / ADJCGO(ISAVE)
SHPVOL = SHPVOL + SAVE
CG0GN3(i) = CG0GN3(i) - SAVE
IF (II - 3) = 87, 86, 87
86 CSTSYS = CSTSYS + (DIST(NPORT, I) * CSTTON(ISAVE) * SAVF) / 1800.
87 L = 1
SAVEI = 0.
88 IF (NTRAN(I)) = 1, 0, 1
89 SAVEI = SAVEI + PRODUCFAC(L, ISAVF)
882 L = L + 1
90 IF (L - 6) = 6, 88, 90
91 IF (LL - L) = 92, 91, 91
92 SAVEI = SAVEI + ADJTRM(NTPF)
93 IF (SAVEI.LF.0.) GO TO 888
SAVTIM = SAVTIM + SAVEI
886 IF (I) = 9205, 9281, 9285
9201 DO 9204 = 1, 10
9202 IF (NNFAC(M) - I) = 9203, 9208, 9202
9203 NNFAC(M) = I
GO TO 9205
9204 CONTINUE
9205 NSAVE = I + 100 * IDSHIP
H = 1
JSAVE = SAVE
IF (NKARGO) = 930, 935, 930
930 IF (MOD(NKARGO) + 1000000 - NSAVE) = 931, 932, 933
931 M = M + 1
IF (H - NKARGO) = 930, 935, 935
932 IF (MOD(NKARGO) / 1000000 - ISAVE) = 931, 932, 931
9321 IF (KARGO(M) / 1000000 + JSAVE - 34000) = 932, 9322, 931
9322 KARGO(M) = KARGO(M) + JSAVE * 1000000
GO TO 936
933 N = NKARGO
934 KARGO(N) = KARGO(N)
N = N - 1
IF (N - M) = 935, 936, 934
935 KARGO(M) = JSAVE * 1000000 + NSAVE + ISAVE * 10000
NKARGO = NKARGO + 1
936 IF (SHPMT - CAPACV(NTPF)) = 937, 94, 94
937 IF (SHPVOL - 80 * CAPACV(NTPF)) = 938, 94, 94
938 IF (JSAVE = 33999) = 832, 831, 831
94 RETURN
END
*DECK MAIN  
**SUREONUE MAIN**  
**COMMON**  
1 NSTYPE,NPORT,NFTYPE,NTHFA,NTITIN,TFWAL,TSTOP,NSHIP,RFNTR(12)  
2 CSTADMir),CSTATION(L),PRODUC(6,6),DIST(30,30),KXTIME(6,6),TIMF  
3 KEVENT(410),EVENT,EVENT,EVENT,EVENT,EVENT,EVENT,EVENT,EVENT,EVENT  
**COMMON**  
1 SPEED(25),CAPACW(25),CAPACEV(25),CSTSFA(25),CSTPFRT(25),OPNFT(25)  
2 KTRANS(25),ADJTRN(25),ABSMP(25),IMSHIP(400),ISHIP(400)  
3 NTITN(10),NTITN(10),NTITN(10),NTITN(10),NTITN(10)  
4 KPFRT(25),KPFRT(25),KPFRT(25)  
**COMMON**  
1 NFPRT(30),NFPRT(30),TPRPT(30),NJLPTN(30),ADJRTN(30),CSTHDL(30)  
2 DFPTPT(30),KFPRT(120),KFPRT(120),ADJRTN(120,120)  
**COMMON**  
1 NARGO,KARGO?1005),NARGO,KARGO(1005),NARGO,KARGO(1005),NARGO,KARGO(1005),NARGO,KARGO(1005)  
2 KSTGRTN(1005),KSTGRTN(1005),KSTGRTN(1005),KSTGRTN(1005),KSTGRTN(1005)  
3 ADJCGO(1)  
**COMMON**  
1 KARGO,1ARGO,KARGO(1005),NARGO,KARGO(1005),NARGO,KARGO(1005),NARGO,KARGO(1005),NARGO,KARGO(1005)  
2 KRGGRTN(1005),KRGGRTN(1005),KRGGRTN(1005),KRGGRTN(1005),KRGGRTN(1005)  
**COMMON/A ONRNAM(6,2)  
**COMMON/SE-L/1KCN(40)  
**COMMON/NTAP/NTYPF(25),NTAP/NTYPF(25)  
**COMMON/NNTAR/NNTAR(200),NNTAR/NNTAR(200)  
**DIMENZION NOPE(12)  
**DATA (ONRNAM(lJ),J=1,20),NMINTEN(6,20),NMINTEN(6,20)  
**COMMON/NT=0  
**READ(5,10) ((( PRONUC(I,J,K),K=1,8),J=1,8),I=1,8)  
10 FORMAT(8F6.0,32X)  
**READ(5,11) (((NTITN(I,J),J=1,30),I=1,30)  
11 FORMAT(10F6.0,20X)  
**PFAD(5,12) (((KKTIME(I,J),J=1,8),I=1,8)  
12 FORMAT(36I2)  
**READ(5,13) ADJAO,TRAN,ADJRTN,ADJCGO(I),I=1,8,(CSTTUN(I),I=1,8)  
1,(CSTTUN(I),I=1,8)  
13 FORMAT(11F6.0,1S6.0,1S6.0)  
**WRITE(5,101) ((( PRONUC(I,J,K),K=1,8),J=1,8),I=1,8)  
101 FORMAT(77MH PRODUCTIVITY BASED ON CARGO TYPE, TRANSFR SYST  
1 AND FACILITY TYPE / (AF12.0) )  
**WRITE(5,102) (((DIST(1),J=1,30),I=1,30)  
102 FORMAT(//30H DISTANCE MATRIX FOR 30 PORTS / (10F12.0) )  
**WRITE(5,103) (((KKTIME(I),J=1,8),I=1,8)  
103 FORMAT(/32H TRANSIT CYCLE TIMES (DAYS) / (16F13,3X)) )  
**WRITE(5,104) ADJCGO, CSTTN  
104 FORMAT(/4H CONVERSION FACTORS FOR EACH CARGO TYPE (INT/FT) /  
1 8F12.2/12H COST ($MT) FOR COMMERCIALLY CARRIFEO CARGO BY TYPE /  
2 8F12.2)  
**WRITE(5,105) ADJGO,TRAN,ADJRTN  
105 FORMAT(/23H LOAD ADJUSTMENT FACTOR 8.2/ 36H TRANSIT TIME TO OR F  
1ROM SHIP POOL FT,8.2/26H ACCEPTABLE PERCENTAGE OF HIGHEST AVAILABLE  
2 PRODUCTIVITY RATE FT,A.2)  
**READ(5,14) NITIN  
**FILE NITIN
CALL PUT READ (5,14) NGOGN READ (5,401) (KGOGN(I), I=1,NGOGN)
401 FORMAT (14,2I10) READ (5,41) (NFPRY(I), I=1,NFPRY) READ (5,42) (SPEED(I), CAPAC(I), CSTFA(I), CSTPT(I))
1, DRAFT(I), ADJRTM(I), KTRANS(I), KARSHIP(I), KPRFF(I), KPRF2(I),
2 KTRANSP(I), I = 1,NSTYPE READ (5,43) (ISHIP1, ISHIP2, I = 1,NSHIP)
43 FORMAT (4(11,16.12),12X)
READ (5,501) NCT READ (5,502) (NNTYPE(I), I=1,NCT) READ (5,503) NNAVAIL READ (5,504) NNAV
01 FORMAT (13) 02 FORMAT (4Q12) 03 FORMAT (13) 04 FORMAT (13) DO 403 I=1,NSHIP
OWNER=MOD(TSHIP(I)/100,10) IF (OWNER.ME.2) GO TO 33333
ISHIP(I)=ISHIP(I)*100000000000 GO TO 403
33333 OTYPE=MOD(TSHIP(I)/100) DO 4033 J=1,NCTYPE IF (J==NNTYPE(I)) GO TO 43333
4033 CONTINUE GO TO 4033
43333 NNAVAIL=ISHIP(I)/10000000000 IF (NNAVAIL.EQ.0) GO TO 4031 IF (NNAVAIL.EQ.320) GO TO 403
4033 ISHIP(I)=2000000000+MOD(TSHIP(I),1000000000)
403 CONTINUE GO TO 403
403 ISHIP(I)=ISHIP(I)*1000000000000000+MOD(TSHIP(I),
1000000000000000)
403 CONTINUE DO 55 I = 1, NGOGN
GOGN3(I) = C, TEMP = TEOL + TFVAL WRITE (6,46) (RNTFL(I), I=1,12), NSTYPE, NSHIP, NTHEA, NNPORT, NTYPE,
1 NNTN, TFVAL, TSTOP, TEMP
46 FORMAT (32H GENERA L IN P U T S //6X,25HD A TA R I N F O R M ATION IS 12A6//6X,25HD NUMBER OF SHIP TYPES IN GAME 1X,1H=17/26X,25D NUMBER OF SHIPS IN GAME 13X,1H=17/EX,25D NUMBER OF THEATRES 3IN GAME 10X,1H=17/EX,25D NUMBER OF PORTS IN GAME 13X,1H=17/EX,32D NUMBER OF FACILITY TYPES IN GAME 5X,1H=17/EX,32D THE INTERVAL BETWEEN PRITICAL SYSTEM STARTUP AND OUTPUT (IN DAYS) IS F7.0/6X,44D FOR MAXIMUM LENGTH OF 7PLAY IN DAYS IS F7.0 //6X,44D FIRST SYSTEM STATUS PRINTOUT (IN 0 DAYS) IS AT F7.0//6X,44D FOR OWNER TYPE T3,3X = 2A6,9H I5
55 CONTINUE WRITE (6,62) I, (OWNRNM1(I), N=1,2), CSTADM(I)
61 CONTINUE 62 FORMAT (6X,45HD I F FERENTIAL COST FOR OWNER TYPE T3,3X = 2A6,9H I5
1 F10.2,4H DOLLARS/DAY 
TF (NITIN) 621,621,6101
6101 WRITE(6,611)
611 FORMAT(6X,16HITINERARY INPUTS///10X,13HITINERARY NO., 8X,2AHPORTS
 1ON ITINERARY(IN ORDER) /)
   DO 615 I = 1,NITIN
   ITFMP(1) = MOD(INPITN(I),100)
   ITFMP(2) = MOD(INPITN(I) / 1000,100)
   ITFMP(3) = MOD(INPITN(I) / 10000,100)
   ITFMP(4) = MOD(INPITN(I) / 1000000,100)
   ITFMP(5) = MOD(INPITN(I) / 100000000,100)
   IF (INPITN(I) = 5) 613,613,612
   612 WRITE(6,612) I, (ITEMP(I), J = 1,K)
   614 FORMAT(15X,I2, +14X,10I6)
   615 CONTINUE
621 WRITE(6,621)
622 FORMAT(6X,13HPORT,11X, 17HITFATRF,4X,4HPORT,6X,6HJUST,4X,5HCARGO,5X,4HMAX,6X, 9X, 23HNO. FACILITIFS AVAILABLE (AY TYPE) / 25X,7HOF PORT,4X,5HDFLAY, 36X,3HDFOR,6X,6HANDLDF,4X,5HDFRAFT /36X,4HTIMF,6X,6HPRONUC, 44X,6HST/DA,4X,4HFTI,5X, 9X,24H1,4X,2H 2,4X,2H 3,4X,2H 4, 54X,2H 5,4X,2H 6,36X,6HDAYS15X,4HRATE,5X,5H1/)
   DO 65 I = 1,NPORT
   ITFMP(1) = MOD(INFRT(I1),100)
   ITFMP(2) = MOD(INFRT(I) / 1000,100)
   ITFMP(3) = MOD(INFRT(I) / 10000,100)
   ITFMP(4) = MOD(INFRT(I) / 100000,100)
   ITFMP(5) = MOD(INFRT(I) / 1000000,100)
   WRITE(6,65) I, (NPRT(I), J = 1,K)
   65 CONTINUE
661 WRITE(6,661)
662 FORMAT(6X,13HSHIP,1X,14HPORT,11X, 14HSHIFAP,3X,5HSPF,4X,5HACARGO,4X,5HACARGO,4X,4HST/7X,4HST/7X,4HST/7X,4HDFORT, 25X,4HDFORTI5X,3H0,3X,12H AV TYPE) /4X,11HACARGO TYPF3X,5HDFACILIT, 3X,11HST/7X,3X,1HST/7X,4X,4HDFORT,4X,5HST/DA,4X,4HFTI,5X, 55HTRANSX,5HTRANS,1X,12H 1 2 3 4 5 6 11X,1H-REFERFENCG,2X,4HCHNG / 67X,4HTI6X,4HTI6X,4HTI6X,4HTI6X,4HTI6X,4HTI6X,4HTI6X,4HTI6X / 75X,4HTI6X,4HTI6X,4HTI6X,4HTI6X,4HTI6X,4HTI6X,4HTI6X,4HTI6X / 87X,4HTI6X,4HTI6X,4HTI6X,4HTI6X,4HTI6X,4HTI6X,4HTI6X,4HTI6X / 97X,4HTI6X,4HTI6X,4HTI6X,4HTI6X,4HTI6X,4HTI6X,4HTI6X,4HTI6X / 57X,4HTI6X,4HTI6X,4HTI6X,4HTI6X,4HTI6X,4HTI6X,4HTI6X,4HTI6X / 67X,4HTI6X,4HTI6X,4HTI6X,4HTI6X,4HTI6X,4HTI6X,4HTI6X,4HTI6X /
   DO 71 I = 1,NSHAP
   ITFMP(1) = MOD(INKTRANS(I),10)
   ITFMP(2) = MOD(INKTRANS(I) / 10,10)
   ITFMP(3) = MOD(INKTRANS(I) / 100,10)
   ITFMP(4) = MOD(INKTRANS(I) / 1000,10)
   ITFMP(5) = MOD(INKTRANS(I) / 10000,10)
   ITFMP(6) = MOD(INKTRANS(I) / 100000,10)
   71 CONTINUE
   CONTINUE
ITEMP(7) = MOD (TRANS(2) / 1000000.0, 10)
ITEMP(8) = MOD (KCARSHIP(I) / 10)
ITEMP(9) = MOD (KCARSHIP(I) / 100, 10)
ITEMP(10) = MOD (KCARSHIP(I) / 10000, 10)
ITEMP(11) = MOD (KCARSHIP(I) / 100000, 10)
ITEMP(12) = MOD (KCARSHIP(I) / 1000000, 10)
JTFMP = KCHANGE(I)
DISTR = CHNGSHIP(JTEMP + 1)
WRITE (6, 72) (SPEED(I), CAPCH(I), GPACS(I), GCTSEAI, GCTPRT(I),
10RAT(I), ANFRN(I), TITEMP(I), N=1,12, KPREF(I), KPAFF2(I)), DISTR
72 FORMAT (5D12.3, 5X, F5.1, 5X, F8.2, 5X, F6.0, 4X, F6.0, 5X, F8.0, 4X,
1 F6.3, 5X, I1, 4X, F8.5, 1X, I1, 6X, I1, 4X, I1) * .33, A4 / }
SPFFNT(I) = SPEEI(I) * 24.
71 CONTINUE
WRITE (6, 740)
740 FORMAT (3PH1.. CAR G O N G E N E R A T E D //
110X, N0, TYPE, ORIGIN, NPSIN, AMOUNT "?, 8ST 4
20X CHANGE NEW LAST /, 
DO 745 I = 1, NKGQGN
JTFMP(1) = MOD (KGQGN(I) / 1000.0, 10)
ITEMP(2) = MOD (KGQGN(I) / 100.0, 10)
ITEMP(3) = MOD (KGQGN(I) / 10000.0, 10)
741 ITEMP(4) = MOD (KGQGN(I) / 100000.0, 1000)
ITEMP(5) = MOD (KGQGN(I) / 1000000.0, 1000)
ITEMP(6) = MOD (KGQGN(I) / 10000000.0, 100)
743 ITEMP(7) = KGQGN(I) / 100
ITEMP(8) = MOD (KGQGN4(I) / 100, 100)
ITEMP(9) = KGQGN4(I) / 1000000000
WRITE (6, 744) I, (ITEMP(J), J = 1, 9)
744 FORMAT (10X, I2, 7X, I2, 7X, I2, 4X, I2, 7X, I2, 6X, I3, 7X, I3, 7X, I3,
1 7X, I3, 6X, I3)
745 CONTINUE
WRITE (6, 75)
75 FORMAT (5SMH SHI P I N I T I A L I Z A T I O N V A L U E S
1// .6X, 4HSHI PX, 4HSHIPX, 4HSHIPX, 4HSHIPYX, 8HDELIV#4YX, 4HCHME#4X,
27HINTIAL, 5X, 1HTIME, 2X, 1OPERATIONAL/*
3X 6X, 3HNO, 5X, 4HOWNYX, 4HTYPE#4X, 9HITENERA#4X, 7HTM#4X, 5X,
4HPORT5X, 4HPORT7X, 5HSTAVIL, 1X, 1TYPE#4X//)
DO 76 I = 1, NSHIP
JSAVE = TSHIP(I) / 100000000
TF (JSAVE = 320) 761, 760, 762
760 NPOOL = NPOOL + 1
ISMPH(I) = MOD (JSHIP(I), 100000000) + 30 * 10000000
GO TO 762
761 LVENT1 = I
LVENT2 = 2
LVENT3 = 0
TVENT = JSAVE
CALL PUT
ISMPH(I) = MOD (JSHIP(I), 100000000)
762 JTFMP(1) = MOD (JSHIP(I) / 100.0, 10)
JTFMP(2) = MOD (JSHIP(I) / 1000.0, 10)
JTFMP(3) = MOD (JSHIP(I) / 10000.0, 10)
JTFMP(4) = MOD (JSHIP2(I) / 100.0, 10)
JTFMP(5) = MOD (JSHIP2(I) / 1000.0, 10)
JTFMP(6) = MOD (JSHIP(I) / 100000.0, 10)
OP = MOD(TSHIP(I) / 1000.12) + 1
WRITE(6,77) I, (ITEMP(I), N = 1,6) *JSAVE,NOP(OP)
77 FORMAT(6X,13,6X,12,6X,12,8X,12,11X,12,8X,12,7X,12,7X,13,7X,A5)
CONTINUE
WRITE (6,78)
78 FORMAT(1X1)
CALL TAKE
RETURN
END
*DECK MCF1
SUBROUTINE MCF1
C COMMON FOR GENERAL INPUTS AND VARIABLES
COMMON
1 NSTYPE,NINPUT,NTYPE,NMTIN,NTIM,TEVAL,TSUP,SHIP,ROENT(12),
2 CSTDEN(6),CSTIN(8),PRODU(6,6,6),DIST(30,30),KXTIME(6,6),TIME,
3 KEVEN,4,l,NEVENT,TVENT,LEVENT1,LEVENT2,LEVENT3,INSHIP,SHWDB,RAN
C COMMON FOR SHIP VARIABLES AND TITANFURY PORTS
COMMON
1 SFMP(25),CAPAC1(25),CAPACV(25),CSTSEA(25),CSTPR1(25),DRAFT(25),
2 KTRNS(25),ADJTRN(25),KRTSP(25),ISHIP(401),ISHIPF(401),
3 NTPITN(10),NTPITM(10),NTPITN(10),NTPITM(10),
4 KRPFF1251,KRPFF2251,KCMPAT(25)
C COMMON FOR PORT VARIABLES AND FACILITY DATA
COMMON
1 NFPRT(30),NPPT2(30),YPMPRT(30),YMPRT(30),ADJPR1(30),CSTHNL(30),
2 ODPRT(30),VRRT,PFRT1(30),PFRT2(30),ADJRT,PRTNAM(302)
C COMMON FOR CARGO AND QUEUE INFO
COMMON
1 N KARC,KARGO(400),ISO,CSTYSQ,NQ1,NQ2,NQ3,QUEUE,QUEUE(400),
2 KGOGI(1000),KGOG2(1000),KGOG3(1000),KGOG4(1000),KGOG5(1000),KGOG6(1000),ADJLR
3 ADJGOF(A)
C COMMON FOR OUTPUT VARIABLES
COMMON
1 KARGO(30,4,6),NPORT(30),NPRTAC(30,6),KRGSP(30,6),TOPORT(30),
2 KRGGEN(30,4,6),NPOOL,OUT,TVOLAV(25),TVOLUS(25),TVAV(6,6),TVUS(6,6)
COMMON*/ NNPNAME(6,2)
COMMON/NNTAM/NIBA(300,10)
I 0 -SAVF = MOD(ISHIP(ISHIP)/100)
JSAVF = MOD(ISHIP(ISHIP)/10000/100)
LSAVF = MOD(ISHIP(ISHIP)/10000000/100)
MSAVE = MOD(ISSHIP(ISSHIP)/10000000,10)
NO1 = MOD1 ISHIP(ISSHIP) / 100000,10)
IF (ISHIP(ISSHIP)/10000000) (45.5,45
5 IF (JSAVE) 50,10,50
10 SAVTM = DIST(NQ1,KSAVE)/SPEED(VSAVF)
15 CSTYS = CSTYSQ + SAVTM * (CSTSF1(3SAVE) + CSTAE(MSAVE))
20 LVENT1 = INSHIP
LVENT2 = 2
LVENT3 = 0
TVENT = TIME + SAVTM
CALL PUT
IF (OUT) )25,25,24
24 WRITE (6,AA) TIME, INSHIP, NQ1, KSAVE, TVENT
25 NQ2 = MOD(KWOPD/10000,10)
NT=NT+1
NTRNENT=((((MOD(ISSHIP(ISSHIP)/1001)100+NQ1)*100*KSAVE)*
G100000+TVENT
NQ3 = 0
call QUEUE
IF (NQ3) 75,30,75
35 KFPRT(1,NQ1) = KFPRT(1,NQ1) - 1000*(NQ2-1)
call TAKE
40 KFPRT2(NQ1) = KFPRT2(NQ1) - 1000*(NQ2-4)
call TAKE
45 NPOOL = NPOOL + 1

78
CSTSYS = CSTSYS + TYRAN*(CSTSEA(ISA VF) + CSTAOH(MSAVE))

IF (IOUT) 25, 25, 46

MSAVE = MOD(ISHIP2*IODSHIP,100,10)
WRITE (6,47) TIME*IODSHIP,MSAVE

FORMAT (/10X,G8.4,F5.1,16H DAYS, SHIP NO.,13,16H LEAVING PORT ,
112,52H TO JOIN THEATER POOL. CURRENT DELIVERY THEATER IS ,13)
GO TO 25

50 I = ISHIP2*IODSHIP/10000000
IF (I) 55,99,99
55 IF (I - 5) 60,60,70
60 SAVTIM = MOD(INT(100*JSAVE)1/100 **(I-1)+100)
65 IF (MSAVE - I) 15,20,15
70 SAVTIM = MOD(INT(2*JSAVE)1/100 **(I-6)+100)
GO TO 65
75 ISW = NQ2
GO TO 65
80 FORMAT(/10X,G8.4,F5.1,16H DAYS, SHIP NO.,13,16H LEAVING PORT ,
112,16H ARRIVED FOR PORT ,12,7H ETA = ,F5.1,5H DAYS )
99 WRITE (6,101)
101 FORMAT (///79H YOUR ERROR IS THAT A SHIP IS LEAVING A FACILITY TYP
e ZERO WHO IS NONEXISTENT///)
CALL ENOGAM
RETURN
FND
*UFCK PORT1
SURROUNDING PORT

COMMON
1 NTYPF, NPRT, NTYPF, NTHFA, NTIN, TFVAL, TSTOP, NSHIP, NPORT, NTYPF
2 CSTAPM(1), CSTOR(1), PRODUC(6,6), DIST(3,3), KKTMPF(6,6), TTFM
3 KEFNT1(10), NEFNT1, TFNT1, NEFNT1, TFNT2, NEFNT1, NSHIP1, NPORT1, PN

COMMON
1 SPFFD(25), CAPACW(25), CAPACV(25), CSTSF(25), CSTPR(25), DRAFT(25),
2 KTRANS(25), ANJTRN(25), KARSHP(25), ISHIP1(400), ISHIP2(400),
3 NPITN(10), NPITN(110), NPITN(10), NPITN(110), NPITN(110), NPITN(110),
4 KPREF1(25), KPRPF2(25), KCHANG(25),

COMMON
1 NFPRP1(130), NFPRP2(130), NTHPR(60,10), NPRT(30), ADJPRP(30), CSTHNL(30),
2 DFTPRP1(30), TTRAN, KFPRP1(30), KFPRP2(30), ADJRT, PRTPRMT(10,2),

COMMON
1 NKARG, KARGO(4001), TSW, CSTSYS, NQ1, NPQ2, NQ3, NQUEUF, KQUEUF(4001),
2 KQGON1(1000), KQGON2(1000), CGQGON3(1000), KQGON4(1000), NGQGON, ADJLN,
3 ADJGOTA

COMMON/A NPRT(10,2). D Charging.
COMMON/B NTRAN(6), NFAC(110), KARG(110), NTEMP(6), II, I, KPORT, NTYPF,
J=LL, SHPW1, SHPVOL, NSFAC, SAVTIM
WEIGHT=DFNSYV=VOLUME= 0.0
IF (ISPW) 1 + 1, 50
I = 1
IF (NPORT = 1) 1, 100
KARGO = MOD(KARGO(I),100000) - LSAVF, 7.5, P
I = I + 1
IF (I = 1) 4, 4, 8
A = 1
LL = MOD(KTRANS(NTYPF),10)
NSAVF = KTRANS(NTYPF) / 10
I = I + 1
IF (I = 6) 9, 9, 12
12 I = 1
13 I = 10 ** (I-1)
15 I = 10 ** (I-1)
1501 IF (KPREF1(NTYPF)) 16.16, 1502
1502 I = KPREF1(NTYPF)
1503 IF (NFAC(110) = 1) 1503, 39, 39
1504 IF (KPREF2(NTYPF)) 1504, 1505, 1504

80
1504 I = KPREF2(MTYPE)
1505 IF (KNFAC(I) - 1) 1505, 39, 39
1505 IF (KNFAC(I) - 1) 1505
1507 JSAVE = 0
GO TO 46
1508 I = KPREF2(MTYPE)
1509 IF (I < 1507) 16, 16, 1507
16 IF (KARANT) 161, 22, 161
161 I = 1
SAVE = 0.
162 IF (I < 1507) 163, 20, 163
163 J = 1
164 IF (I < 1507) 19, 19, 17
17 IF (PRODUC(J, I, KARTYP) - SAVE) 19, 19, 18
13 SAVE = PRODUC(J, I, KARTYP)
JSAVE = J
ISAVF = I
19 J = J + 1
IF (J < 6) 164, 164, 20
20 I = I + 1
IF (I < 1507) 162, 162, 30
22 I = 1
MSAVE = 0
23 IF (KNFAC(I) - MSAVE) 25, 25, 24
26 MSAVE = NNFAC(I)
LSAVF = I
25 I = 1 + 1
IF (I < 1507) 23, 23, 26
26 IF (MSAVE) 40, 40, 27
77 T = LSAVE
GO TO 39
30 IF (KNFAC(JSAVF)) 31, 31, 30
31 REST = 0.
SAVE = SAVF * ADJMAT
I = 1
32 IF (KNFAC(I) - 35, 35, 33
33 IF (PRODUC(J, I, SAVF, KARTYP) - REST) 35, 35, 34
34 REST = PRODUC(J, I, SAVF, KARTYP)
KSAVF = I
35 I = I + 1
IF (I < 1507) 32, 32, 36
36 I = KSADF
GO TO 39
38 I = JSAVF
39 IF (I < 3) 392, 392, 391
391 KPrT2(IMPORT) = KFPRT2(IMPORT) + 1000**4(I - 4)
GO TO 393
392 KFPRT2(IMPORT) = KFPRT1(IMPORT) + 1000**4(I - 1)
393 NPFAC(IMPORT, I) = NPFAC(IMPORT, I) + 1
KONWIP = NOSHIP(ISHIP) / 1000
N = 0
10
SAYTH = 0.
L = 1
W = 0
81
3931 MSAVE = IDSHIP*A100 + NPORT
IF (MOD(KARGO(L), 100000) - MSAVE) 394, 399, 395
394 L = L + 1
IF (L <= NKARGO) 399, 3931, 395
395 IF (N)
396 KSTART = L - N
KSTOP = NKARGO - N
DO 397 L = KSTART, KSTOP
K = L + N
397 KARGO(L) = KARGO(K)
KSTART = KSTOP + 1
KSTOP = NKARGO
DO 398 L = KSTART, KSTOP
398 KARGO(L) = 0
NKARGO = NKARGO - N
GO TO 70
399 KARGO = KARGO(L)
N = N + 1
GO TO 60
40 DO 400 J = 1, T
400 NTRAN(J) = 0
J = 1
I = 1
41 IF (MOD(KQUEUE(I), 100) - NPORT) 44, 47, 47
42 J = MOD(KQUEUE(I)/100000, 10)
NTRAN(J) = NTRAN(J) + 1
IF (J <= NTRAN(J) + 1)
43 IF (NTRAN(J-1)) 45, 44, 43
431 IF (NTRAN(J-1)) 44, 44, 44
44 I = I + 1
IF (I <= KQUEUE) 41, 41, 47
45 JSAVE = J - 1
46 KTIME = 10. * T
AQ1 = NPORT
AQ2 = JSAVE
AQ3 = NPORT + (100 * (IDSHIP + 1000 * (JSAVE + 10 * KTIME)))
IF (I <= AQ1) 462, 462, 460
460 WRITE (6, 461) TIME, IDSHIP, NPORT, JSAVE
462 CALL QUEUE
47 IF (NTRAN(J) = 481, 479, 481
479 IF (NTEMP(J)) 481, 481, 440
480 JSAVE = J
481 GO TO 46
481 MSAVE = 500
JSAVE = 0
I = 1
490 IF (NTRAN(I) - MSAVE) 4901, 492, 492
4901 IF (NTEMP(I)) 492, 492, 491
491 MSAVE = NTRAN(I)
JSAVE = I
492 I = I + 1
IF (I <= 5) 490, 490, 46
50 I = ISW
ISW = 0
NPORT = MOD(NQ3, 100)
IDSHIP = MOD(NQ3/100, 100)
IF (IOUT) 502,502,502
500 WRITE (6,501) TIME, IDSHP, NPORT
502 LSAVE = N03 / 1000000
SAVE = FLOAT(LSAVE) / 10.
SAVE = TIME - SAVF
TOPORT(NPORT) = TOPORT(NPORT) + SAVE
NTYPE = MOD(IDSHIP(IDSHIP) + 100
KOWFR = MOD(IDSHIP(IDSHIP)/100,10)
CSTSYS = CSTSYS + SAVE *(CSTPRKNTYPE) + CSTADD(KOWFR)
K = 1
LL = MOD(KTRANS(NTYPE) + 10
NSAVE = KTRANS(NTYPE) / 10
51 NTRAN(K) = MOD(NSAVE/10**(K-1) + 10
K=K+1
IF (K= 6) 51,51,393
60 KARTYP = MOD(KARGWO/1000000,10
KARP = KARPM/1000000
VOLUME= FLOAT(KARPM)/ADJPRT(KARTYP) + VOLUME
WEIGHT = FLOAT(KARPM) + WEIGHT
DENSITY = WEIGHT/VOLUME
KARGOL(NPORT,KARTYP,KOWFR) = KARGOL(NPORT,KARTYP,KOWFR) + KARM
I = 1
SAVE = 0
61 IF (NTRAN(I)) 62,63,62
62 SAVE = SAVE + PRODLN(NFAC.I,KARTYP)
63 I = I + 1
64 IF (I< 6) 61,61,64
65 IF (I = 10) 66,66,65
66 IF (SAVE0>0.) GO TO 67
GO TO 394
67 SAVINT = SAVINT + FLOAT(KARPM)/(SAVE*ADJPRT(NPORT))
GO TO 394
70 ITINN = MOD(IDSHIP(IDSHIP)/1000000,100)
CKRGSUM = SUMS CARGO ABOARD IN WEIGHT AND VOLUME FOR SHIP NUMAFR(IDSHIP)
NO 700 I = 1,10
700 NNFAC(I) = 0
I = 0
L = 1
SNPWT = 0
SNPVOL = 0
71 IF (MOD(KARGO(L)/1000000)-IDSHP) 75,72,76
72 ISAVE = MOD(KARGO(L)/1000000,10)
SAVE = KARGO(L)/1000000
SNPVOL = SNPWT + SAVE
SNPWT = SNPWT * ADJPRT(ISAVE)
IF (I<10) 73,75,75
73 ISAVE = MOD(KARGO(L),100)
IF (I) 731,74,731
731 IF (ISAVE< NNFAC(I)) 74,75,74
74 I = I + 1
NNFAC(I) = ISAVE
75 L = L + 1
IF (L=MKARGO) 71,74,76
76 DO 761 I = 1,5
761 KARGO(I) = MOD ( KARSHP (NTYPE) / 10**(I-1), 10
IF (ITINN) 170,77,170
77 IF (KMODE = 1) 770,771,770
770 MSAVF = ITHPR((NPORT)
GO TO A0
771 MSAVF = MON(TISHIP?TISHIP/100,10)
IF (ITHPRT(NPORT) - MSAVF) 90,772,A0
772 MSAVF = MON(TISHIP?100)
MSAVF = ITHPR(TNSAVE)
A0 I = 1
J = 1
II = 0
A1 IF (I = NPORT) 42,44,42
A2 IF (ITHPRT(I) - MSAVF) 42,43,42
A3 IF (DFTPT(I) - DRAFT(NTYPE)) 42,43,30
A30 CALL LOAD
IF (J = NNGOGN) A31,631,942
A31 IF (SHPWT - CAPACV(NTYPE)) 832,942,942
A32 IF (SHPVOL - 80*CAPACV(NTYPE)) 42,942,942
A46 I = I + 1
IF (I = NPORT) A1,81,942
94 I = 1
NSAVF = 999999
JSAVF = 0
95 J = NNAC(I)
IF (J = 951,954,951
95 I = ITHPR((J) - ITHPR((NPORT)) 954,952,954
952 TIST = DIST(NPORT,J)
IF (TIST = NSAVE) 953,954,954
953 MSAVF = TIST
JSAVF = 
954 I = I + 1
IF (I = 10) 956,95,97
97 IF (JSAVF) 110,90,110
98 IF (KMODE = 1) 150,120,150
100 MSAVF = MON(TISHIP?TISHIP, 1000000)
TISHIP?TISHIP = TISHIP = TISHIP* 1000000
IF (KMODE = 1) 117,112,117
112 IF (JN) 117,111,117
113 IF (SHPWT - CAPACW(NTYPE)) 114,117,117
114 IF (SHPVOL - 80*CAPACW(NTYPE)) 115,117,117
115 IF (DFTPT(JSAVF)-DRAFT(NTYPE)) 117,116,116
116 II = 1
J = 1
I = JSAVF
CALL LOAD
117 CSTSYS = CSTSYS + (TOLR(NPORT) + SAVTIM)* (CSTPT(NTYPE) + CSTAN(KOWNER))
CSTSYS = CSTSYS + CSTW+ CSTL(NPORT)
1171 MSAVF = MON(TISHIP?TISHIP, 1000000)
LSAVE = TISHIP?TISHIP, / 10000000
TISHIP?TISHIP = NPORT*1000000 + MSAVF + LSAVE * 1000000
TVFNT = TIME + SAVTIM + TOLR(NPORT)
LVENT1 = TISHIP
LVENT2 = 1
LVENT3 = NFAC
IF (TOUT) 119,119,118
11A TOUT = TVENT - TIME
SCN = 100, *SHPVOL / CAPACW(NTYPE)
WRITE (6,119) TIME,TVFNT, NPORT, NFAC, TOUT, SHPVL, SCN
84
IF (TVOL0 = 119, 119, 100000)

8000 IF (KTRANS(NTYPE) = 0, 11) NCGO = 1

IF (KTRANS(NTYPE) = 0.000001) NCGO = 3

IF (KTRANS(NTYPE) = 0.001) NCGO = 5

IF (KTRANS(NTYPE) = 0.0001) NCGO = 4

119 CALL PUT

CALL TAKE

RETURN

120 MSAVE = MOD((ISHP2(IDSHIP)/100, 10)

IF (ITHPRT(NPORT) = MSAVE) 130, 121, 130

121 LSAVE = MOD((ISHP2(IDSHIP) - 100)

IF (ISHWP = 1251, 1251, 1221

122 I = 1

MSAVE = 9999999

KSAVE = 0

123 J = MAFAC(I)

IF (J) 1230, 124, 1230

1230 IF (J = LSAVE) 1232, 1231, 1232

1231 KSAVE = J

GO TO 127

1232 IDIST = DIST(J,NPORT)

IF (IDIST = MSAVE) 1233, 124, 124

1233 MSAVE = IDIST

KSAVE = J

124 T = I + 1

IF (I - 10) 123, 124, 125

125 IF (KSAVE() = 127, 1251, 127

1251 KSAVE = LSAVE

127 SAVE = DIST(KSAVE,NPORT) / SPEED(NTYPE)

SAVE = TIME + SAVTIME + TOLTIME(NPORT)

MSAVE = SAVE

ISHIP2(IDSHIP) = MOD((ISHIP2(IDSHIP)/1000) + 1000 + MSAVE

128 MSAVE = MOD((ISHIP(IDSHIP)/100000)

ISHIP2(IDSHIP) = MSAVE + KSAVE + 100000

GO TO 117

130 IF (ISHPVAL - .2 * CAPACV(NYPF)) 1301, 140, 140

1301 IF (ISHPWT = .80 * CAPACW(NYPF)) 131, 140, 140

131 MSAVE = MOD((ISHP2(IDSHIP)/100, 10)

NSAVE = ITHPRT(NPORT)

ISAVE = KRTIME(MSAVE, MSAVE)

JSAVE = MOD((ISHP2(IDSHIP)/1000) + 1000

LSAVE = TIME

JSAVE = LSAVE - JSAVE

IF (JSAVE = ISAVE) 1321, 1322, 1321

1321 IF (ISHPVOI = .2 * CAPACV(NYPF)) 1322, 1322, 140

1322 I = 1

J = 1

SAVE = 0.

M = 0

SAVFJ = 0.

133 IF (ITHPRT(I) = MSAVE) 1354, 1330, 1354

1330 IF (I - NPORT) 1331, 1354, 1331

1331 IF (DFPRT(I) = DRAFT(NYPF)) 1354, 1332, 1332

1332 IF (KPREP1(NYPE)) 1333, 1333, 1332

13320 NO 13321 JF = 1, 3

TEX = 1000 ** (JT - 1)

NTFMP(JT) = MOD(NFPR1(JT)/TEX, 1000)
13321 NTEMP(JI+3) = MOD(NPRT2(I)/EX,1000)
JTEMP = KPRFF1(NYPF)
IF (NTEMP(JTEMP)) 13322,13323,1333
13322 IF (KPRFF2(NYPF)) 13324,1334,13323
13323 JTEMP = KPRFF2(NYPF)
IF (NTEMP(JTEMP)) 13324,1334,1333
1333 K = 1
1334 IF (THTPRT(K)-MSAVE) 135,1341,135
1341 TF (DOFRPT(K)-DPAFT(NYPF)) 135,1342,1342
1342 IF (KPPRP1(NYPF)) 1363,1343,1342
13420 JD = 13421, JD = 1.3
13421 TEK = 1000 **(JI - 1)
NTEMP(JI) = MOD(NPRT1(K)/EX,1000)
13422 NTEMP(JI+3) = MOD(NPRT2(K)/EX,1000)
JTEMP = KPRFF1(NYPF)
IF (NTEMP(JTEMP)) 13422,13423,1343
13423 IF (KPRFF2(NYPF)) 135,1343,13423
1343 TSAVE = K + 100* I
GO TO 1372
134 K = K + 1
135 IF (K - NNP) 134,134,1351
1351 IF (SAVET - SAVFJ) 1353,1353,1352
1352 SAVFJ = SAVET
1353 SAVET = 0.
1354 I = I + 1
1355 IF (I - NNP) 1353,1353,1351
1356 TF (SAVET = 500.0) 136,110,110
1357 TF (SHFW), 160,160,140
1358 IF (MOD(KGOGN(J)+10000) - TS4) 1 1372,135
137 J = J + 1
1372 IF (J - NKGOGN) 137,137,1351
1372 I = 1
1373 SAVJ = MOD(KGOGN(J)/10000*10)
1374 L = L + 1
1375 TF (L<5) 1.373,1373,1371
1375 SAVET = SAVFJ + CGOGN(J)
1376 GO TO 1371
140 I = 1
141 TSJ = 999999
KSAVF = 0
141 IF (NNFAC(I)) 142,143,142
142 J = NNFAC(I)
143 JDIST = DTNTP(NPRT,J)
144 IF (JDIST - TS4) 1421,143,143
145 KSAVF = JDIST
KSAVF = J
147 I = I + 1
148 TF (JSTJ) 141,141,148
149 TF (KSAVF) 1441,145,1441
1491 TVOLDINTYPF) = TVOLDINTYPF) + CAPACV(NYPF)
TVOLDINTYPF = TVTOLUSINTYPF) + SHPVOL
IP = ITPRT(NPRT)
JD = ITPRT(KSAVF)
TVAV(IP,JO) = TVAV(IP,JO) + CAPACV(INTYPE)
TVUS(IP,JO) = TVUS(IP,JO) + SHPVL
GO TO 12A
145 WRITE (*,146) INSHTP, NPORT, MSAVF
CALL FNDGAM
150 NSAVE = ITHPRT(NPORT)
I = 1
K = 1
SAVEI = 0.
SAVEJ = 0.
151 IF (ITHPRT(I) = NSAVE) 1543,1512,1543
1512 IF (IPFPRT(I) = OPAFT(INTYPEF)) 1543,15121,15121
1512 IF (IPFPRT(I) = OPAFT(INTYPEF)) 1513,1513,1514
1513 DO 1524 JI = 1,3
1514 IEX = 1000 **(JI - 1)
1514 NTEMP(JI) = MOD(NFPRT1(I)/IEX,1000)
1514 JTEMP = KPREF1(INTYPEF)
1515 IF (NTEMP(JTEMP)) 1515,1515,1513
1515 IF (KPREF2(INTYPEF)) 1543,1543,1516
1516 JTFMP = KPREF2(INTYPEF)
1516 IF (NTEMP(JTEMP)) 1543,1543,1513
1513 J = 1
1512 IF (ITHPRT(J) = NSAVE) 153,1521,155
1512 IF (IPFPRT(J) = OPAFT(INTYPEF)) 153,1522,1522
1512 IF (IPFPRT(J) = OPAFT(INTYPEF)) 155,155,15221
1522 DO 15222 J = 1,3
15222 IEX = 1000 **(JI - 1)
15222 NTEMP(JI) = MOD(NFPRT1(J)/IEX,1000)
15222 JTEMP = KPREF1(INTYPEF)
1523 IF (NTEMP(JTEMP)) 1523,1523,155
1523 IF (KPREF2(INTYPEF)) 153,153,1524
1524 JTFMP = KPREF2(INTYPEF)
1524 IF (NTEMP(JTEMP)) 153,153,155
1513 J = J + 1
154 IF (J = NPORT) 157,152,154
154 IF (SAVEI = SAVFJ) 1542,1542,1541
1541 SAVEJ = SAVFI
1541 KSAVE = 1
1542 SAVFI = 0
1543 L = L + 1
1544 IF (L = NPORT) 151,151,1544
1544 IF (SAVFJ) 160,160,126
1545 MSAVE = J + 100 * T
1546 GO TO 159
156 IF (MOD(KGOGN1(K),10000) = MSAVE) 158,1561,153
1561 L = 1
1562 LSAVE = MOD(KGOGN1(K)/10000,10)
1562 IF (LSAVE = KCAPG(L)) 1563,157,1563
1563 L = L + 1
1563 IF (L = 5) 1562,1562,153
157 SAVEI = SAVFI + SAVG3(K)
158 K = K + 1
159 IF (K = MGOGN) 156,156,154
160 JSAVE = JMF + TFTRAN + SAMVIN + TDLA(NPORT)
160 IF (JSAVE = 320) 1602,1602,1601
1601 JSAVF = .120
GO TO 1604
1602 IF (TTTRAN - 1.) 1603, 1604, 1604
1603 JSAVF = JSAVF + 1
1604 NSAVF = MOD(ISHIP(IOSHIP)*1000000000) 
ISHIP(IOSHIP) = JSAVF * 100000000 + NSAVE
GO TO 117
176 T = 1
NO 1700 JJ = 1.10
1760 NNFAC(JJ) = 0
KK = NPITIN(TIINN)
177 NNFAC(I) = MOD(NPITIN(TIINN)/100**(I-1),100)
I = I + 1
IF (I-5) 171, 171, 172
1771 IF (KK - 5) 173, 173, 1721
1721 T = 1
1722 NNFAC(I+5) = MOD(NPITIN2(TIINN)/100**(I-1),100)
I = I + 1
IF (I - KK + 5) 1722, 1722, 173
173 JJ = 1
174 IF (NNFAC(JJ) = NPORT) 1741, 1744, 1741
1741 JJ = JJ + 1
TF (JJ - KK) 174, 174, 1742
1742 WRTIF (6, 1743)
CALL FNOGAM
1744 KSAVF = JJ
IF (KOWNFP = 1) 175, 180, 175
175 JJ = 1
1751 JJ = JJ + 1
TF (JJ - KSAVF) 177, 1762, 177
176 IF (SHPWG - CAPACWNTYPFI) 1761, 1762, 1762
1761 IF (SHPVGL-.80*CAPACVNTYPFI) 1751, 1762, 1762
1762 IF (KSAVF = KK) 1764, 1763, 1764
1763 I = 1
GO TO 1765
1764 T = KSAVF + 1
1765 KSAVF = NNFAC(JJ)
ISHIP2(IOSHIP) = MOD(ISHIP2(IOSHIP)*100000000) + I * 100000000
GO TO 124
177 IF (JJ - KK) 1772, 1772, 1771
1771 JJ = 1
IF (JJ - KSAVF) 1772, 1762, 1772
1772 J = 1
I = NNFAC(JJ)
CALL LOAN
GO TO 176
180 IF (KSAVF = KK) 1801, 1802, 1801
1801 I = KSAVF + 1
GO TO 1803
1802 I = 1
1803 NEXT = NNFAC(JJ)
ISHIP2(IOSHIP) = MOD(ISHIP2(IOSHIP)*100000000) + I * 100000000
ISAVF = 10. * (TIME + 10.)
NNFAC(JJ) = 0
J = NEVENT
181 IF (MOD(KEVNT(JJ)*10000) - ISAVE) 1811, 1811, 190
1811 NSAVE = MOD(KEVNT(JJ)/1000000, 100)
IF (NSAVE - 1) 182,1822,182
182 IF (NSAVE - 2) 1821,1822,1821
1821 J = J - 1

1822 JSAVE = KEVFNT (J1/1000000)
IF (MOD(ISHIP1JSAVE)/1000000 - NPRT) 1021,1822,1821
1823 NSAVE = MOD(ISHIP1JSAVE)/1000000
MSAVE = MOD(ISHIP1JSAVE),100
IF (NSAVE - ITHPR1(NPRT)) 1826,1821,1826
1826 IF (MOD(ISHIP1JSAVE)/100,10) - 1) 1829,1821,1829
1829 IF (MOD(ISHIP1JSAVE) / 10000,100) 1830,1830,1871
1830 I = 1
1831 JSAVE = NNFC1(I)
IF (JSAVE) 1832,1845,1832
1832 IF (ITHPR1(JSAVE) - NSAVE) 1833,1845
1833 IF (DFPR1(JSAVE) - DRAFT(MSAVE)) 1834,1834
1834 IF (KPREFl(MSAVE)) 1844,1844,1835
1835 IF (1836 K = 1,3
1836 NTEMP(K) = MOD(NFPR1(JSAVE)/10K,1000)
1837 NTEMP(K+3) = MOD(NFPR2(JSAVE)/10K,100)
1838 JTEMP = KPF2(MSAVE)
IF (NTEMP(JTEMP)) 1843,1843,1844
1839 IF (KPREFl(MSAVE)) 1844,1844,1835
1834 NNFC1(I) = 0
1845 I = I + 1
1846 IF (I - KK) 1831,1831,1821
190 JJ = KSAVF
1901 JJ = JJ + 1
191 IF (J1 - KSAVE) 195,193,196
192 IF (ISHPW1 - CAPACW1NTYPE)) 192,193,193
193 IF (ISHPV1 - CAPACV1NTYPE)) 1901,193,193
193 NSAVE = MOD(ISHN1JSHIP1IDSHIP),1000000
193 ISHIP(IDSHIP) = MSAVE + NEXT * 1000000
GO TO 1171
194 IF (JJ = KK) 1962,1962,1961
1961 JJ = 1
1962 IF (NNFC1(JJ)) 197,1901,197
197 J = 1
I = NNFC1(JJ)
CALL LOAD
GO TO 191
461 FORMAT(/10X,4HAT,F5.1,16H DAYS, SHIP NO. ,I3,I8H ARRIVED AT PORT
1 ,I2,3H TO JOIN QUEUE FOR FACILITY TYPE ,I2)
501 FORMAT(/10X,4HAT,F5.1,16H DAYS, SHIP NO. ,I3,I5H ENTERING PORT
1 ,I2,3H FROM QUEUE)
1181 FORMAT(/10X,4HAT,F5.1,16H DAYS, SHIP NO. ,I3,I8H ARRIVED AT PORT
1 ,I2,2H SERVICED AT FAC. TYPE ,I2, 5H FOR : F5.2,5H DAYS,12H,FINA
2L VOL = F6.0, AN MT, PCT= F4.0
1184 FORMAT(/10H SHIP NO. ,I4, 18H LEAVING PORT NO. ,I3, 6H WITH N
10 CARGO FOR ASSIGNED DELIVERY THEATFR. I3 !
1743 FORMAT(/10H YOUR ERROR IS THAT CURRENT PORT IS NOT ON SHIP'S ITI
1NERARY IN THE PRESENT EVENT ///)

89
*DFCK PRINT

SUBROUTINE PRINT

COMMON
  1 NSTYPE, NPORT, NTYPE, NTHET, NITIN, TFVAL, TSTOP, NSHIP, RDFNT(12),
  2 CSTADP(6), CSTONP(6), PRODUC(6,6,6), DTST(36,30), KRTIME(6,6), TIMF,
  3 KEVENT(41), NFEVENT, TVENT1, LVENT1, LVENT2, TVENT3, TOSTP, KVAR, RN

COMMON
  1 SPEED(25), CAPACV(25), CAPACV(25), CSTSFA(25), CSTTPR(25), DRAFT(25),
  2 KTRANS(3), ATJNRT(25), KAZHP(25), TSHFT(400), ISHPR(400),
  3 NPITIN1(10), NPITIN2(10), NITIN10, NITIN210,
  4 KPREF(251), KPREF(251), KCHNG(25)

COMMON
  1 NFPRT1(30), NFPRT2(30), TVPRT1(30), TVA(30), ADJRT(30), GSCRT(30),
  2 OFPRT1(30), TRAN, KFPRT1(30), KFPRT2(30), ADJRT, ADJRT(30,2)

COMMON
  1 NKARG0, KARGO(400), ISW, QTSYS, NO1, NO2, NO3, KIQUEUF, WIQUEUF(900),
  2 K.Arg1(100), K.GORN(1000), G.GORN(1000), K.GORN(1000), NK.GORN, ANJG0,
  3 ADJG0(44)

COMMON
  1 KARG0(30,1), NPOP0RT(30), NPORE(30,1), KRGHER(30,1), T0PORT(30),
  2 KRGHER(30,1), NPOOL01, OUTF, TVOLAV(25), TVOLUS(75), TVA(6,6), TVUS(6,6)

COMMON/A/ ORNAM(6,2)

COMMON/S/ KF(30)

DIMENSION NTAB1(100), NTAB2(100), NTAR1(100), NTAR2(100)

COMMON/NTAB/NTAB(200)!

DIMENSION NFAC(6,6), NTOTYP(6,6), TFPRT1(6,6), TFPRT2(6,6)

COMMON/C/ KRGDN(40), NPOOL(40), NSTOP

LVFNT1=0
LVFNT2=5
LVFNT3=0
LVFNT=TFVAL+TFVAL

CALL PUT

IF (IOUT) 2,2,3
3 WRITE(6,101)

2 KRGSCR=0

KRGGCR=0

KRGDCR=0

NO 4 I=1,A

4 NTOTYP(I) = 0

MF = 1

SAVF = CSTSYS/1000000.

IF (ISW) 5,10,5

5 WRITE (6,102) TIMF

10 WRITE (6,103) TIMF, SAVF, NPOOL

I=1

IF (IOUT) 11,11,12

11 WRITE (6,13) T, (PRRTAM(I,K),K=1,2)

GO TO 14

12 WRITE (6,104) T, (PRRTAM(I,K),K=1,2)

14 DO 16 K = 1,6

NFAC(K) = 0

NO 16 J = 1,6

16 NFAC(K) = KARGDN(T,J,K) + NFAC(K)

K = 1

IF (IOUT) 21,21,20

21 WRITE(6,17)
GO TO 25

20 WRITE (6,105) (ONRPAH(K, J), J=1,2), (KARGDL(I, J, K), J=1,4), NFAC(K)
K = K + 1
IF (K = F ) 20, 20, 25

25 NO 26 K = 1,4
NFAC(K) = 0
NO 26 J = 1,6
26 NFAC(K) = NFAC(K) + KARGDL(I, K, J)
TOTAL = 0
NO 27 K = 1,4
NTOTAL(K) = NTOTAL(K) + NFAC(K)
27 NTOTAL = NTOTAL + NFAC(K)
IF (IOUT) 271, 271, 272

271 WRITE (6, 274) (NFAC(K), K=1,4), NTOTAL
GO TO 273

272 WRITE (6, 112) (NFAC(K), K=1,4), NTOTAL

273 CRGDCR = KRGDCR + NTOTAL
ITEMP = 0
NO 28 J = 1,4
28 ITEM = CRGDCR + NTOTAL
ITEMP = ITEM + KRGDFNI(I, J)
CRGGCB = CRGGCB + ITEMP
IF (IOUT) 281, 281, 282

281 WRITE (6, 284) (KRGDFNI(I, J), J=1,4), ITEMP
GO TO 283

282 WRITE (6, 113) I
WRITE (6, 107) (KRGDFNI(I, J), J=1,8), ITEMP

283 ITEM = 0
NO 29 J = 1,4
29 ITEM = ITEM + KRGDFNI(I, J)
CRGGCB = CRGGCB + ITEMP
IF (IOUT) 291, 291, 292

291 WRITE (6, 294) (KRGDFNI(I, J), J=1,4), ITEMP
GO TO 293

292 WRITE (6, 106) I
WRITE (6, 107) (KRGDFNI(I, J), J=1,8), ITEMP
WRITE (6, 104) T
WRITE (6, 109) (NPRFAI(I, J), J=1,NFTYPF)

293 J=1
30 NFAC(J) = MOD(KFPR1(I)/1000**(J-1)*1000)
J = J + 1
IF (J = 3) 36, 36, 35
35 NFAC(J) = MOD(KFPR2(I)/1000**(J-4)*1000)
J = J + 1
IF (J = NFTYPF) 35, 35, 40
40 IF (IQUEU) 50, 70, 50
50 K = 1
55 IF (MOD(KQUEU(K), 100) - T ) 65, 60, 70
60 L = MOD(KQUEU(K))/100000**10
NFAC(L) = NFAC(L) + 1
65 K = K + 1
IF (K = IQUEU) 55, 55, 70
70 IF (IOUT) 71, 71, 72
72 WRITE (6, 110) T
WRITE (6, 109) (NFAC(J), J=1,NFTYPF)

71 JSAVE = 0
J = 1
75 JSAVF = JSAVE + NPRFAI(I, J)

91
J = J + 1
IF (J = NTYPE)
   R0 SAVE = JSAVF
   SAVE2 = NPORT(I)
   IF(SAVE.LF.0.) GO TO R6
   SAVE = (SAVE2 / SAVE) * 100.
   R6 IF(SAVE2.LF.0.) GO TO R7
   SAVE2 = TPORT(I) / SAVE2
   R7 IF(IOUT) 870-870, R71
   R71 WRITE (6, 111) I, SAVE, SAVE2
   R70 MF =MF + 1
   IF (KE(MF).EQ.0.) GOTO 99
   IF (MF.GT.30) GOTO 99
   IF(IOUT.LE.0.) GO TO R6
   WRITE (6, 101)
   R6 I=I+1
   IF (I.EQ.EK(MF)) GOTO 15
   GOTO R6
99 IF(IOUT) 991, 991, 992
991 WRITE (6, 116) (NTOTYPE(I), I=1,6)
992 WRITE (6, 115) KRGGCR, KRGSCH, KRGDC8
   MIME = TIN
   NMITE = MITE / 5
   NPOOL(M1HMF) = NPOOL
   KRON(MMNITE) = KRONCR
   NSTOP = TSTOP
   IF(IOUT.LE.0.) GO TO 1000
   WRITE (6, 181)
   WRITE (6, 117)
1000 DO 100 I = 1, NTYPE
   SAVE = 0.
   IF(TVOLAV(I).LF.0.) GO TO 100
   SAVE = 100. * TVOLUS(I) / TAVAV(I)
   IF(IOUT.LE.0.) GO TO 100
   WRITE (6, 118) I, SAVE
100 CONTINUE
   DO 150 I = 1, NTHCA
      DO 150 J = 1, NTHCA
         TEMP(I,J) = 0.
      END
      IF(TVAV(I,J).LF.0.) GO TO 150
      TEMP(I,J) = 100. * TVUS(I,J) / TVAV(I,J)
150 CONTINUE
   IF(IOUT.LE.0.) GO TO 152
   WRITE (6, 119)
   DO 151 I = 1, NTHFA
   WRITE (6, 120) I, TEMP(I,J), J=1, NTHEA
152 SAVE = 0.
   SAVE2 = 0.
   WRITE (6, 117)
   DO 155 I = 1, NTYPE
      SAVE = SAVEF + TVOLUS(I)
   END
   SAVE2 = SAVE + TVOLAV(I)
   IF(SAVE2.LE.0.) GO TO 156
   SAVE = 100. * SAVE/SAVE2
156 WRITE (6, 114) SAVE
   WRITE (6, 101)
   DO 1561 I=1, N
101 FORMAT(I11)
102 FORMAT(/4X,3HTAY,5,F5.1,3/M DAYS, THE GAME ENDED)
103 FORMAT(/4X,3HSYSTEM STATUS AT ,F5.1,9H DAY
15//26X,24HCUMULATIVE SYSTEM COST =,F4.3,9H (MIL $),18X,33HCURRENT
2 NUMBER OF SHIPS IN POOL =,14//2/9X,31MPORT I FORMAT I
3 0 N
104 FORMAT(/49X,25HCARGO DELIVERED TO PORT ,I2,2X,?A5,
1 15H BY TYPE (MT)/
265X,10HCARGO TYPE/2A?,6HOURER, 15X,2H 1,7X,2H 2,7X,7H 3,7X,2H 4,7X
3,2H 5,7X,2H 6,7X,2F 7,7X,2H 8,6X,5HTOTAL)
105 FORMAT(25X,2A6.6X,0I9,11)
106 FORMAT(/41X,4HTOTAL AMOUNT OF CARGO SHIPPED FROM PORT ,I2,15H
1 BY TYPE (MT)/39X,2H 1,7X,2H 2,7X,2H 3,7X,2H 4,7X,2H 5,7X,2H 6,7X
2,2H 7,7X,2H 8,6X,5HTOTAL 1)
107 FORMAT(34X,8I9,11)
108 FORMAT(/41X,37NUMBER OF SHIPS THAT HAVE USED PORT ,I2,15H BY F
1ACILITY TYPE/55X,2H 1,5X,2H 2,5X,2H 3,5X,2H 4,5X,2H 5,5X,2H 6)
109 FORMAT(51X,61)
110 FORMAT(/29X,61NUMBER OF SHIPS INCLUDING THOSE IN Queue) CURRENT
1LY AT PORT ,I2,15H BY FACILITY TYPE/55X,2H 1,5X,2H 2,5X,2H 3,5X,
22H 4,5X,2H 5,5X,2H 6)
111 FORMAT(/30X,58 PERCENTAGE OF SHIPS THAT HAD TO WAIT TO DISCHARGE
1 AT PORT ,I2,15H = ,F5.1,9H PERCENT 46X,36HMMEAN WAITING TIME 0
2F THESE SHIPS = ,F5.1,7H DAYS)
112 FORMAT(32X,5HTOTAL,5X,8I9,11)
113 FORMAT(/41X,4HTOTAL AMOUNT OF CARGO GENERATED AT PORT ,I2,15H
1 BY TYPE (MT)/39X,2H 1,7X,2H 2,7X,2H 3,7X,2H 4,7X,2H 5,7X,2H 6,7X
2,2H 7,7X,2H 8,6X,5HTOTAL 1)
114 FORMAT(40X,2H= ?F6.1)
115 FORMAT(/7,25X,12HCARGO TOTALS =,5X,33HTOTAL AMOUNT OF CARGO GENE
1RATED = ,I2,4X,33HTOTAL AMOUNT OF CARGO SHIPPED = ,I2,4X,33HTO
2AL AMOUNT OF CARGO DELIVERED = ,I2,1/)
116 FORMAT(/31X,40HCUMULATIVE DELIVERED CARGO BY TYPE (MT) /3A,2H 1,
17X,2H 2,7X,2H 3,7X,2H 4,7X,2H 5,7X,2H 6,7X,2H 7,7X,2H 8,6X,5X,419)
117 FORMAT(/41X,4HTOTAL AMOUNT OF SHIP VOLUME USED BY NON-ITTNFRAY SH
1IPS LEAVING HOME THEATER /
118 FORMAT(30X,10SHIP TYPE 16,15H USED VOLUME F6.1)
119 FORMAT(/25X,7HPPR CFNT OF SHIP VOLUME USED BY NON-ITTNFRAY SH
1IPS LEAVING HOME THEATER //4X,19HDESTINATION THEATER/ 25X,
26HHORIGIN,6X,1H,9X,1H,2X,9H,1X,9X,1H,9X,1H,2X,25X,7HTHEATER)
120 FORMAT(2X,I1,2X,6F6.1,4X)
1560 FORMAT(25X,49HSHIP TYPE,5X,11HORIGIN PORT,5X,16HDESTINATION PORT,5X
G,3HETA//29X,I2,1X,12X,I2,16X,F5,11)
13 FORMAT(50X,*PORT ,I2,3X,2A6)
17 FORMAT(25X,*CAPG0 TYPE,11X,*1,8X,*2,8X,*3,AX,*4,AX,*5,AX,*6
C,*7,AX,*8,AX)*
274 FORMAT(25X,*TOTAL DELIVERED ,8I9,11)
284 FORMAT(25X,*TOTAL GENERATED ,8I9,11)

*DECK PUT
SUMROUTINE PUT
COMMON
1 NSNTYPE,NHPORT,NTYPE,NME,NTIN,TVAL,TSTOP,NSHIP,WNVENT(2),
2 CSTADM(6),CSTION(8),PRODUCT,IX,IODIST(30),KKTIMF(6),TIME,
3 KEVENT(4),NEVENT,TVENT,LVENT1,LVENT2,LVENT3,TSTOP,NSHIP,KNORM,KN
COMMON
1 SPEED(25),CAPAC1(25),CAPAC2(25),CSTSA1(25),CSTRT1(25),NSDF(25),
2 KTRANS(25),ADJTRN(25),KARSHP(25),ISHFIN(400),ISHFIN(400),
3 NTINIT1(8),NTINIT2(8),NTINITN(10),NTINITN(10),
4 KPREF1(25),KPREF2(25),KCHANG(25)
COMMON
1 NFPR1(30),NFPR2(30),ITMPRT(30),TOLA (30),ADJPR1(30),CSHDL1(30),
2 DFTPR2(30),TTRAN,KFPR1(30),KHER2(30),ADJPR2,PRTNAM(30,2)
COMMON
1 NKARGC,KARGC(4000),ISW,CSTSYS,NO1,NO2,NO3,NOUEF,NOUEF(400),
2 KGOGN1(1000),KGOGN1(1000),UGOGN3(1000),KGOGN4(1000),KGOGN4,ADJLD,
3 ADJGO2(8)
COMMON
1 KARG1(30,A),NPORT(30),NPRFAC(30,8),KRGSHP(30,8),TPORT(30),
2 KPGFFN(30,8),NPOOL,INUT,TVOLAV(25),TVOLAV(25),TVAVL(6,6),TVUST(6,6)
COMMON/A/ONRNAME(6,7)
TMFTT = 10. * TVFNT
KTP = TMFTT
KTEMP = ((LVENT1*100 + LVENT2) * 10 + LVENT3) * 10000 + KTP
K = NEVENT + 1
NEVENT = K
IF (NEVENT - 1) 3.3.1
1 KTEST = MOD(KEVENT(K-1),10000)
IF (KTEST - KTP) 2,2,3
2 KEVENT(K) = KEVENT(K-1)
K = K-1
IF (K-1) 3.3.1
1 KEVENT(K) = KTFMP
RETURN
END
*DECK QUEUF
SUBROUTINE QUEUF
COMMON
1 NSTYPE,NMPORT,NTYPE,NTHEA,NITIN,TFVAL,TSTOP,NSHIP,ROFNT(12),
2 CSTADL(5), CSTTNN(1), PRDNC(6,6,6), NIST(36,36), KFNTM(6,6), TFNT,
3 KEVENT(4,10), NEVENT, TFNTL, EVENT1, EVENT2, EVENT3, INSHIP, KWORD, RA
COMMON
1 SPEED(25), CAPAC(25), CAPAV(25), DSTSEA(25), CSTPRT(25), DFRAFT(25),
2 KTRANS(25), ADJTRN(25), KARSHPL(25), TSHIP(25), TSHIP2(25),
3 NPITN(10), NPITNL(10), NPITMN(10), NPITM2(10), NPITM2(10),
4 KPREFF(25), KPFEPF2(25), KCHANG(25)
COMMON
1 NFPRT1(10), NFPRT2(10), THPRT(30), TNDL(30), ADJPR(30), CSTMOL(30),
2 DFPT(30), TTRAN, KFPRT1(30), KFPRT2(30), ADJRFPT, PRNAM(30, 2)
COMMON
1 NKARGO,KARGO(4000), TSN, CSTSYS, NOQ1, NOQ2, NOQ3, NOQUEUF, KQUEUF(400)
2 KGOGN1(1000), KGOGN2(1000), CGOGN3(1000), KGOGN4(1000), NKGOGN, ADJLO,
3 ADJGO(1)
COMMON
1 KARGD(38, 6, 6), NPOORT(30), NPREAC(30, 6), KRGSHP(30, 6), TTOPORT(30),
2 KRGFNM38, NPOOL, TOUT, TVOLAV(251), TVOLUS(251), TVAV(6, 6, 1), TVUS(6, 6)
COMMON/A/ NRMNAM(6, 2)
L = NQUEUF
IF (NOQ3) 201, 28
1 M = 1
5 LSAVE = MOD(KQUEUF(M), 100)
IF (LSAVE = NOQ1) 3, 4, 99
4 MSAVE = MOD(KQUEUF(M), 1000000, 10)
IF (MSAVE = NOQ2) 3, 4, 3
3 M = M+1
IF (M-L) 5, 5, 99
6 NOQ3 = KQUEUF(M)
7 KQUEUF(M) = KQUEUF(M+1)
M = M+1
8 NQUEUF = NOQUEUF = 1
GO TO 99
10 IF (L) 21, 22, 21
21 LSAVE = MOD(KQUEUF(L), 100)
IF (NOQ1-LSAVE) 22, 23, 24
22 KQUEUF(L+1) = KQUEUF(L)
L = L-1
GO TO 20
23 MSAVE = MOD(KQUEUF(L), 1000000, 10)
IF (NOQ2-MSAVE) 22, 24, 24
24 KQUEUF(L+1) = NOQ3
NQUEUF = NQUEUF + 1
NPORT(NOQ1) = NPORT(NOQ1) + 1
99 RETURN
END
SUBROUTINE RNG

COMMON
1 NSTYPF, NMPORT, NFTYPEF, NTHEA, NITIN, TFVAL, FSTOP, NSHIP, RDFNT(12)
2 CSTADM(6), CSTON(81), PRODUC(6,6,1), DIST(30,301), KKTHIF(6,6), TIMF,
3 KFVENT(410), NEVFMT, EVENT, EVENT1, EVENT2, EVENT3, INSHIP, KNORM, RN

COMMON
1 SPEFD(25), CAPCY(75), CAPACY(75), CSTSFA(25), CSTPRT(25), DRAFT(25)
2 KTRANS(75), ADJTRN(25), KARHP(25), TSMIF(460), ISHRF(1480)
3 KPBITI(10), NPI(25), KPI(25), NTTN(110), NTTN2(110)
4 KPREF(25), KPPEF(25), KCHANG(25)

COMMON
1 NFPR1(30), NFPR2(30), ITHPR1(30), TOLA(30), ADJPR1(30), CSTHML(3,1),
2 OFPPR(30), ITTRAN, KFPR1(30), KFPR2(30), ADJRT, PITNAM(30,2)

COMMON
1 NKARG, KARGO(4800), ISHCSTSYS, NO1, NO2, NO3, NO4, EUPF, KQUEUE(4800)
2 KGO(1000), KGO2(1000), KGO3(1000), KGO4(1000), KGO5(1000), KGO6(1000), KGO7(1000)
3 ADJCFO(1)

COMMON
1 KARGD(30,8,6), NQPORT(30), NPRFAG(30,6), KRGSHP(30,8), TOPORT(30)
2 KRGGFN(30,8), NPOOL, IOUT, TVOLAV(25), TVOLUS(25), TVAV(6,6), TWUS(6,6)

COMMON/A/ ORNAM(6,7)
SAVE = RN * 37.
ISAVE = SAVE
SAVE1 = ISAVE
RN = SAVE - SAVF1
RETURN
END
*DECK TAKE1
SUBROUTINE TAKE1
COMMON
1 NSTYPE, NPORT, NTYPE, NTYPEA, NTYPEB, NTYPEC, NTYPED, NSTIM, TSTOP, NSHIP, IDENY(12),
2 CSTAM(14), CSTAM(16), PRODUC(6, 8), DIST(30, 36), KTIMEF(6, 6), TIMEF,
3 KEVENT(410), KEVENT, TEVENT, LVENT1, LVENT2, LVENT3, INSHIP, KWORD, RN
COMMON
1 SPEED(25), CAPACW(25), CAPACV(25), CSTSEA(25), CSIPRT(25), ISHAFT(25),
2 IRANS(25), IDJTRN(25), KARSH(25), ISHIP(400), ISHIP24(400),
3 NPTITN(10), NPTITN(10), NPTITN(10), NTITN(110), NTITN(110),
4 KPREF(125), KPFST(25), KCHANG(25)
COMMON
1 NPTPT(130), NPTPT(30), IPTPT(130), TOPTA(130), ADJPT(130), CSTHOL(130),
2 OIPPTT(30), TTRAN, KPRT:1(130), KPRT2(30), ADJRT, PRTNAM(30, 2)
COMMON
1 NKARG, KARGO(400), ISW, CSTSYS, NCOL, MQ2, MQ3, QQUEUF, QQUEUF(400),
2 KGOGN1(1000), KGOGN2(1000), CGOGN3(1000), KGOGN4(1000), KGOGN, ADJLD,
3 ANDGO4, (I)
COMMON
1 KARGO(10, 4), NPORT(30), NPFAC(30, 4), KPSHP(400), TPSHRT(30),
2 KREV0(10, 4), NPPOOL, IOUT, TVNSAV(25), TVNSUS(25), TVNSAV(25), TVNSUS(25),
COMMON/ A, OMNAM {6, 7}
7 KWOR = KEVENT (KEVENT)
  KEVENT (KEVENT) = 0
  NWT = KEVENT - 1
  TWE = NWT(KWORD, 10000)
  TIME = TP / 10.
  TDSIP = KWORD / 1000000
  T = NODS(KWORD / 100000, 100)
  IF (T(30), 2) GOSUB 12
  WRITE (14, 120) TIME, TDSIP, T
100 FORMAT (4X, F6.4, 7X, 1X, 12)
  GO TO 7
12 GO TO (1, 2, 3, 4, 5, 6), 1
1 CALL MOVF
2 CALL PORT
3 CALL CARGF
4 CALL KARFGN
5 CALL PRINT
6 CALL FMGM
RFYRN
FDN
REFERENCE

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1. DYNAMIC REPORTS, A PERMANENT SERIES, CONTAIN INFORMATION OF PERMANENT TECHNICAL VALUE. THEY CARRY A CONSECUTIVE NUMERICAL IDENTIFICATION REGARDLESS OF THEIR CLASSIFICATION OR THE ORIGINATING DEPARTMENT.

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3. TECHNICAL MEMORANDA, AN INFORMAL SERIES, CONTAIN TECHNICAL DOCUMENTATION OF LIMITED USE AND INTEREST. THEY ARE PRIMARILY WORKING PAPERS INTENDED FOR INFORMAL USE. THEY CARRY AN IDENTIFYING NUMBER WHICH INDICATES THEIR TITLE AND THE NUMERICAL CODE OF THE ORIGINATING DEPARTMENT. ANY DISTRIBUTION OUTSIDE DIVISION MUST BE APPROVED BY THE HEAD OF THE ORIGINATING DEPARTMENT ON A CASE-BY-CASE BASIS.