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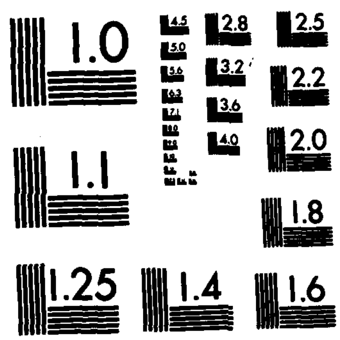

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NAVAL POSTGRADUATE SCHOOL

Monterey, California

THESIS

A COMMUNICATIONS TRAFFIC FLOW SIMULATION
MODEL OF THE MESSAGE SWITCHING SYSTEM

by

Steven P. Wolf

October 1982

Thesis Advisor: D. C. Boger

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A Communications Traffic Flow Simulation Model of the Message Switching System

by

Steven P. Wolf
Lieutenant, United States Coast Guard
B.S., United States Coast Guard Academy, 1976

Submitted in partial fulfillment of the
requirements for the degree of

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Author: ______________________

Approved by: ______________________ Thesis Advisor

______________________ Second Reader

____
Chairman, Department of Administrative Sciences

____
Dean of Information and Policy Sciences

ABSTRACT

A traffic flow model is designed using the General Purpose Simulation System (GPSS V) for the U.S. Coast Guard Communications Station San Francisco. The architecture of the proposed Message Switching System (MSS) is used to analyze the flow of message traffic in the new system. This model indicates that the MSS can adequately handle traffic loads which are currently occurring or are foreseen to occur at this COMMSTA.

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I. INTRODUCTION

In this fast moving world of data communications technology, the Coast Guard has found itself with a communications system that is falling far behind the state-of-the-art systems currently available. If Coast Guard communications is to continue to meet the needs of a quickly changing and dynamic environment, it needs to develop and implement automated systems that will support both record and data communications necessary in accomplishing its varied missions.

To achieve this goal, the Coast Guard has developed a plan to prototype automated Communication Station (COMMSTA) and Communication Center (COMMCEN) systems to meet the following objectives [1, 2]:

1. Reduce manpower intensiveness,
2. Establish a data collection capability,
3. Increase message capacity without personnel increases,
4. Incorporate the system within existing facilities,
5. Be transparent to users,
6. Interface with existing circuits, and
7. Provide data communications.

The plan calls for the development of logical models for a COMMSTA and COMMCEN utilizing procedures and methods that are available with current technology and equipment. Concurrently, selected automated communications techniques, systems, and methods that seem to have potential application in a Coast Guard communications system will be operationally tested and evaluated. Finally, the developed systems and techniques will be procured and incrementally implemented at a COMMSTA or COMMCEN. [1, 2]

The Twelfth Coast Guard District has developed an automation proposal for COMMSTA San Francisco called the Message Switching System (MSS), which is envisioned to meet the objectives for COMMSTA automation presented above. The proposed MSS is the subject of evaluation in this thesis. Chapter II will describe present COMMSTA San Francisco operations and procedures; Chapter III will outline the operational requirements of the MSS; Chapter IV will discuss the collection and analysis of the baseline statistics; Chapter V will present the development and design of the MSS computer model used for simulating the system in an operational environment; Chapter VI contains the sensitivity analyses that were performed on the model; and Chapter VII will present the conclusions of this effort.

II. DESCRIPTION OF COMMUNICATIONS STATION SAN FRANCISCO

The following description of operations at the communications station was based upon the United States Coast Guard Communications Station San Francisco Organization Manual. [3]

A. COMMUNICATIONS STATION OPERATIONS

1. Operational Mission

Communications Station (COMMSTA) San Francisco is under the operational control of the Commander, Pacific Area (COMPACAREA) and the Commander, 12th Coast Guard District (CCGDTWELVE). Operational support is routinely provided to the Commander, 11th Coast Guard District (CCGDELEVEN), the Commander, 13th Coast Guard District (CCGDTHIRTEEN), and other Coast Guard Commands. Specific operational functions are assigned as follows:

a. Provide a rapid, reliable, and secure means to exercise command, control, and coordination of Coast Guard operations within the Pacific Maritime Area.

b. Provide a rapid, reliable, and compatible means by which other forces, including international maritime and aeronautical commerce and the boating public, may intercommunicate with operational commanders whenever and wherever necessary.

c. Guard specified international distress frequencies and respond to emergency signals on other frequencies.

d. Disseminate weather and hydrographic information, storm warnings, and broadcast notice to mariners.

e. Participate in the AMVER program.

f. Receive weather observations from government and non-government ships at sea.

g. Provide voice, radioteletype, and radiotelegraph modes between operational commanders ashore and mobile units.

h. Provide communications support for National Marine Fisheries Service, National Oceanographics and Atmospheric Administration, COMSC, and other government maritime activities.

i. Maintain proper operating practices and procedures and exercise discipline on all Coast Guard circuits.

j. Insure a high standard of operational and military readiness to readily amalgamate with the Navy whenever directed by the President, and serve as an adjunct to the Naval Communication System in peacetime.

k. Represent COMPACAREA as the System Control Station (SCS) for the Pacific Area Communications System (PACAREA COMMSYS). The specific duties of the SCS are:

  1) Expedite traffic within the system.

  2) Monitor traffic to determine and initiate corrective action on procedural discrepancies.

  3) Execute frequency shifts and guard shifts in a timely manner to maintain communications, particularly during changing atmospheric conditions or periods of disturbed propagation.

  4) Resolving disputes incident to traffic handling within the system.

  5) Keep all users informed of changes to the system operating procedures.

  6) Maintain traffic load balance within the system.

  7) In cases of reduced capability at any system station, the SCS will reallocate that station's affected operational tasks to other stations within the system.

8) When the SCS determines it is unable to meet its operational commitments, such as during communications failures, CASREPS, or heavy traffic periods, the SCS can delegate partial or total control to another COMMSTA in the system.

1. Serve as Technical Control Station for remote MF operations and as such assumes ultimate responsibility for insuring the proper operation of all remote MF equipment.

2. <u>Personnel</u>

a. Concept Of Operations

In order to accomplish the mission as outlined in the previous subsection, a basic watch structure has been established within the command to provide a full time response capability. The communication station must remain in a fully functional status 24 hours per day, 365 days per year.

b. Manning Criteria

The Commandant of the United States Coast Guard has authorized sufficient billets for the command to sustain a continuous eleven-position communications watch at the receiving site and a two-man technician watch at the transmitting site (see Appendix A). Electronics and teletype maintenance support is provided on a day work basis at the receiver site, with qualified personnel on call around the clock to meet emergency repair requirements. In addition, enough support billets have been provided to maintain a Junior Officer of the Day (JOOD), a Duty Engineer, and a Duty Seaman Watch at the Bachelor Enlisted Quarters (BEQ)/Housing

Area. The watchstanding allowance is based on the four-section concept of manning. Thirteen communication watchstanding positions have been designed into the system, but only those operationally required are manned. A supplementary watch system is utilized to assist in handling peak loading conditions. During a major search and rescue (SAR) case or a natural disaster, additional positions may require activation utilizing available resources as necessary.

c. Watch Structure

The watch structure as illustrated in Figure 2.1 shows the command chain of operational and administrative control. The Commanding Officer (CO) has the ultimate responsibility to ensure a proper watch is maintained. Under the CO, the Officer of the Day (OOD) exercises control over the transmitter and receiver site watches and the Master At Arms (MAA)/Junior Officer of the Day (JOOD). The MAA/JOOD then oversee the Duty Seaman and Duty Engineer. The Executive Officer (XO) has only administrative control between the CO, OOD, and the MAA/JOOD.

3. Configuration Of Facilities

The receiving site building contains approximately 8,700 square feet of space of which 3,100 square feet are devoted to actual receiving operations. The remainder of the building houses the command's administrative spaces, electronic repair facilities, mechanical spaces, and

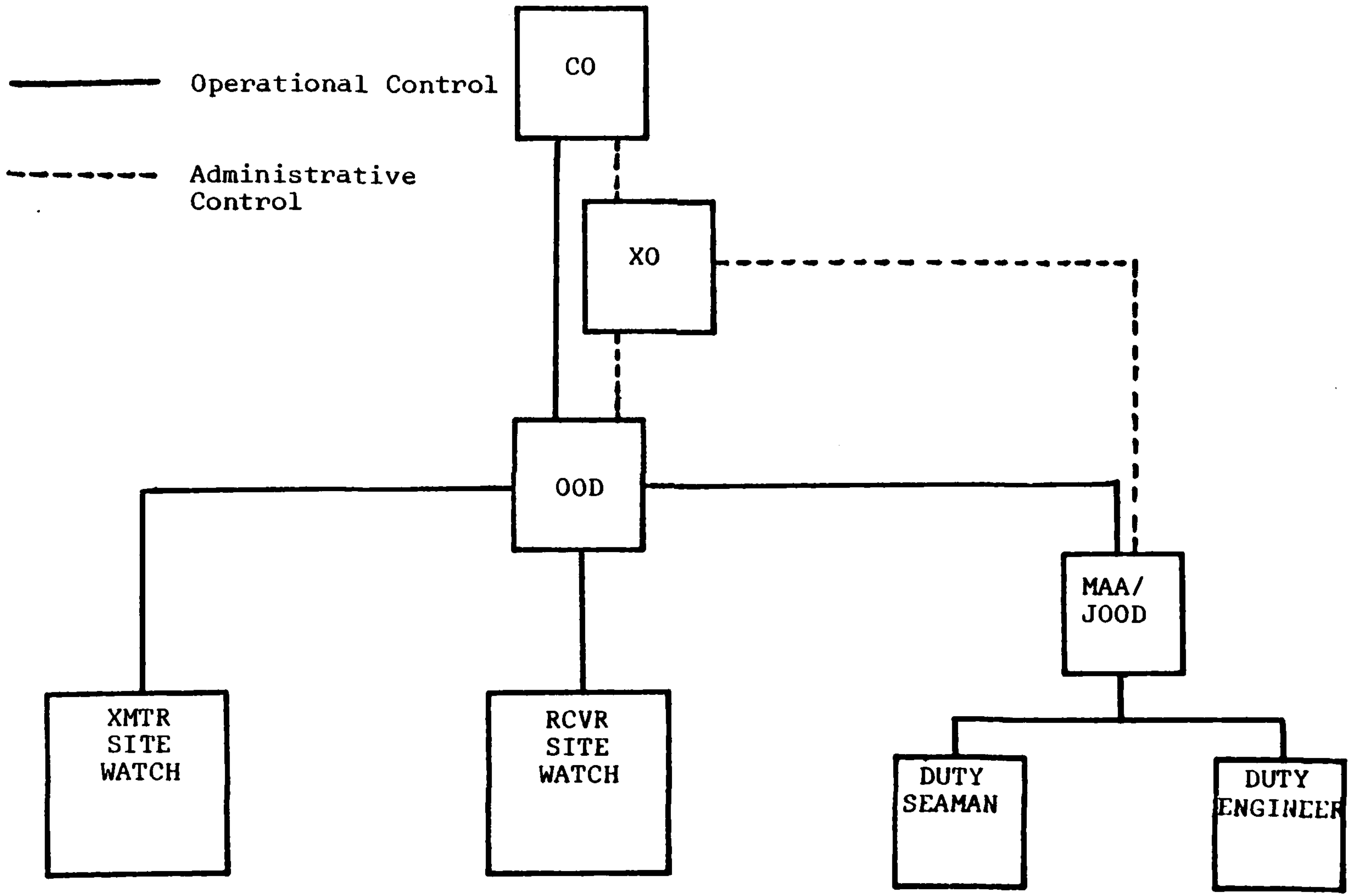


Figure 2.1 COMMSTA Watch Structure

storerooms. Within the operations area, thirteen positions have been configured as follows:

a. Communications Watch Officer,

b. Landlines,

c. MF Distress,

d. MF Working,

e. AMVER,

f. Ship/Shore RATT (2),

g. Marine Information Broadcast,

h. Voice,

i. Air/Ground,

j. Technical Control,

k. Direct Printing Radio Teletype, and

l. General Purpose Space.

Nine of these positions are manned full time with the others on a part time or "as required" basis. Each position, except Landline, centers around an operator's console which has been designed specifically by Collins Radio for the function of the particular position. Each console has the capability of addressing a special purpose computer which controls the transmitters located at the transmitting site building and associated transmitting antennas.

A total of fifty-three receivers (42 tunable Collins 651S-1A and eleven fixed frequency R-1735/URR) are located in the operations area and are manually controlled by the operators. Up to four receivers may be physically located within each console. Through console controls, receivers are automatically patched by the operator to any desired receiving antenna. Model 37 and Model 40 teletypewriters are utilized throughout the station. The receiving antenna system consists of nine antennas as follows:

a. Vertical log periodic (3),

b. Horizontal log period (3),

c. Rotatable horizontal log periodic (1), and

d. Omni-directional (2).

A 5,700 square foot building is located at the transmitting site containing a transmitter control room, transmitter room, and various mechanical, repair, and storerooms. The transmitter room is sized to accommodate 24 transmitters. Seventeen 10 KW HF Collins transmitters (URG-II system) and three 2 KW MF AN/FRT-89 transmitters are presently installed. All transmitters are automatically tuned, controlled, and patched to the desired antenna by the various operators at the receiving site by means of a special purpose computer and a high-level RF antenna matrix physically located in the transmitter control room. Audio and control functions between the receiver and transmitter site are accomplished via commercially leased landlines over two independent diverse paths. Fifteen antennas are available for transmitting:

a. Vertical log periodic (3),

b. Horizontal log periodic (3),

c. Rotatable log periodic (1), and

d. Omni-directional (8).

Medium frequency transmitters and receivers remotely controlled by COMMSTA San Francisco are installed at Astoria, Oregon, and Long Beach, California.

4. COMMSTA Traffic Flow

The actual flow of traffic within the communications station is diagrammed in Appendix B. These figures describe the possible destination of messages entering any one of the thirteen circuits just discussed. Appendix B was the basis for designing the actual model used in simulating the traffic flow at the station. The details of this design will be presented in Chapter IV.

III. MESSAGE SWITCHING SYSTEM OPERATIONAL REQUIREMENTS

The 12th Coast Guard District has proposed a Message Switching System (MSS) for COMMSTA San Francisco and operational requirements for the system have been developed as outlined in this chapter. [4]

A. GENERAL DESCRIPTION

The Message Switching System (MSS) is conceived to be a semi-automatic electronic message transfer system whose primary purpose is to provide for the receipt, temporary storage, and subsequent transmission of messages. A message is defined as a sequence of alphanumeric characters and specific control function characters that convey both information and controls which provide for the proper operation of shipboard and land station teletype terminals.

The following positions will be connected to the MSS:

1. Position 1 MF CW
2. Position 2 MF CW
3. Position 3 HF CW
4. Position 4 Unclassified Ship/Shore RATT
5. Position 5 Classified Ship/Shore RATT
6. Position 6 Broadcast
7. Position 7 Technical Control
8. Position 8 SITOR (2 machines)

9.	Position 9	Spare Booth
10.	Position 10	Air/Ground
11.	Position 11	Spare
12.	Landline	Command and Control - Classified Position
13.	Landline	NAVCOMPARS - Classified Position
14.	Landline	SARPAC
15.	Spare	
16.	Landline	WEATHER (Leased machine)
17.	Landline	District Loop

Classified and unclassified traffic will be handled by the Communication Center. A provision to recognize classified headings and the ZNY signal is required to prevent classified traffic from being sent by the MSS to an unclassified only port. Classified traffic may only be sent to the Command and Control and the NAVCOMPARS positions.

B. MESSAGE HANDLING CAPABILITIES

The MSS control station will control and monitor all the above circuits carrying inbound or outbound traffic to and from the station. Initially it must be a manned position that views all messages transmitted or received by all positions. However, an operator control introduced by the operator at any position is required to eliminate a message from routinely being screened by the MSS control station. An override of this control is also required should the MSS operator wish to monitor all messages from any selected station.

Two MSS control stations are required. One station is the primary, the other the secondary. During busy periods, the MSS should automatically queue messages for screening by either control station operator.

Messages must be queued for screening by precedence. In the date-time-group (DTG) of a message, the precedence is indicated as Flash (F), Operational Immediate (O), Priority (P), or Routine (R). The date and time should be used to feed the highest priority and earliest DTG to the MSS operator first.

All Flash messages will be processed first, by DTG. All Immediate traffic will be handled after Flash traffic by DTG. All Priority messages will be handled according to the time of receipt (TOR), first-in, first-out, after Flash and Immediate. It is a goal for all messages to be delivered within the following criteria:

1. Flash within 10 minutes,
2. Immediate within 30 minutes,
3. Priority within 2 hours, and
4. Routine within 6 hours.

A Routine message held by the station for over 5 hours is to be queued ahead of a Priority message that has a TOR of less than 2 hours. Once an attempted delivery has been made on an external circuit, it should be held in file for 10 minutes before the next attempt at delivery. Lower priority messages should be screened by the monitor or delivered during the 10 minute hold period. Delivery attempts will be made every 10 minutes until accomplished.

All incoming traffic on NAVCOMPARS, Command and Control, District Loop, Weather, and SARPAC will automatically be directed to the primary control station monitor screen. The monitor operator will then determine the delivery of the message and whether a change in message heading or format is required. By selecting appropriate keyboard functions, the message will be sent to a holding buffer pending action by one of the positions. Messages received from one of the landline positions may be retransmitted on the same or another landline by direction of the MSS control station.

Messages received by RATT (Radioteletype) from a line associated with positions 4, 5, 7, 8, 9, 10, or 11 should be routed by the MSS directly to the terminal at those positions without automatic intervention or screening by the MSS controller. Traffic received by one of the above terminals must then be edited using appropriate word processing techniques and sent to the MSS for subsequent transmission on the line designated by the respective routing, without being automatically received by the MSS control station.

C. MSS OPERATION

The MSS must have sufficient input and output buffers to translate or shift baud rates from the central processing unit (CPU) speed to on-line speed for the various circuits.

1. MSS External Circuits

The following external circuits are to be connected to the proposed system:

a. NAVCOMPARS, SARPAC, Weather, District Loop (TWPL), and Command and Control: 1200 baud, 8 level Baudot circuits.

b. RATT positions 4 and 5: 75 baud (100 WPM), 8 level Baudot circuits.

c. Position 6: 33 baud (40 WPM), 8 level Baudot circuit.

d. Position 10: 33 baud (40 WPM), ASCII with MILSTD 188C interface Model 40 Teletype.

e. Positions 1, 2, and 3: 10 baud (12 WPM), ASCII with MILSTD 188C interface Model 40 Teletype.

f. Broadcast position in conjunction with the Fredericks keyers for output only: 15 WPM, 5 level Baudot.

g. The SITOR position uses two machines, only one of which is on line at a time. In the ARQ mode, the output of the terminal may vary from zero to 60 WPM and be inconsistent from character to character. The ARQ mode uses a built-in computer for error detection and corrections so that only correct characters are outputted. This position otherwise operates like a Position 4 RATT terminal and also requires a keyboard-to-keyboard conversational mode. An optimal rate of 17 baud has been experienced for SITOR.

2. CPU Speed

The CPU in the MSS must operate at sufficient speed to appear transparent to the operator; that is, the delay time due to message handling by the MSS must be less than 2 seconds when fully loaded. It must be capable of handling all positions and the input/output functions concurrently.

The CPU shall be considered to be fully loaded when three of the circuits in C.1 are in continuous operation and the remaining circuits are all on the line operating at 80 percent duty cycle.

At least two station-log memory units are required. One will be on-line at all times with the second one always ready to process traffic should the primary unit malfunction. The MSS shall be able to recall from either log unit to ensure continuity of operations in the event of a failure in either unit. Failure of either on-line unit shall immediately be indicated at both MSS control stations.

3. CPU Operations

The CPU may operate in conjunction with input/output buffer, polling, random access, or any other technique that provides the necessary message receipt, sorting, filing, recording, forwarding to appropriate stations, editing, and retransmitting as directed by a position or the MSS control station with a handling delay of less than 2 seconds between operator command and attendant message delivery.

a. CPU Functions

Sufficient storage in the form of input/output buffers and on-line random access memory must be available to hold the messages being received and pending delivery. More storage must be available to record all transactions on a daily basis. This may be accomplished by magnetic tape or hard disk that records a copy of all incoming traffic from all circuits and all outgoing traffic on all circuits. This will become the radio log which is retained for 30 days. The storage medium must be eraseable locally and reuseable for at least 5 years.

The MSS shall automatically append the following on all messages received on incoming circuits:

1. Time of receipt (TOR),
2. Date and time using 24 hour ZULU time clock,
3. Incoming circuit designation in code, and
4. Consecutive station number for messages on that circuit.

These message statistics shall be made available to the various position terminals, but shall not be retransmitted on outgoing lines.

The MSS shall automatically append the following on all messages being transmitted:

1. Time of delivery (TOD) and
2. Date and time message completed transmission on an outgoing circuit.

The TOD shall be appended to the copy of the message stored in the station log. It must not be transmitted on the outgoing line.

Each time the MSS attempts to deliver a message either to an interior position or to an outgoing line and is unable to complete delivery, it shall append an Attempted Delivery Time (ADT) to the message in file. This data should be a part of the message permanently on file with the station log.

All messages designated for transmission on NAVCOMPARS shall undergo a format check by the MSS prior to transmission. The format check shall be for conformance with the requirements of JANAP 128(H) for Heading, End of Message, and End of Text format lines. Variable data will be inserted by the position monitor, but the MSS shall check characters, spaces, functions for consistency, and any special requirements.

The MSS shall have a means of knowing the date, Julian date, and the time expressed in Greenwich Mean Time (ZULU). This date and time will be used for TOR, TOD, and date for heading generating for consistency checks above.

The MSS shall keep track of the number of messages residing in an input/output buffer awaiting action by the operator at any position. This data should be displayed on the position screen on command. The data should include the number of Flash, Immediate, Priority, and Routine messages pending, and the number of outgoing messages from the station that still are pending delivery. Through an appropriate operator generated keyboard control, the operator shall be able to retrieve an undelivered message, cancel the delivery order, and order a different method of delivery.

A conversational mode is required whereby the CPU connects certain incoming messages directly to the RATT position and the RATT position directly to its transmitter for keyboard-to-keyboard conversation. No automatic function will be appended during keyboard-to-keyboard mode; however, all characters sent and received shall be stored in the station log. This mode is to be a special operator called-up function that essentially bypasses the CPU monitor.

D. CPU REDUNDANCY

Sufficient spare boards or a spare CPU must be provided so that in the event of failure and with the aid of software diagnostics, the CPU failure can be repaired in less than 10 minutes by the radioman on watch.

E. SUPPORT SOFTWARE

1. Recovery/Restart

Appropriate routines must be available so that in the event of a failure in the MSS, restart would be executed without the loss of any messages in the MSS. The restart program must restart all sequence counters, i.e., station number, at the same place where the failure occurred.

2. Radio Day Change

At midnight the following statistics shall be filed in memory on the station log:

a. Total message input to each position,

b. Total message output from each position,

c. Total message received on external circuits,

d. Total messages sent on external circuits, and

e. Total number of messages pending delivery.

Once this data is stored, all sequence numbers are zeroed. These statistics shall also be addressable by the MSS control stations.

The MSS requirements presented in this chapter were used in designing the parameters that were used in the simulation model described in detail in Chapter V.

IV. COMMSTA BASELINE STATISTICS

A. PURPOSE

The gathering of relevant statistics is very important in modeling a system of any type using a special-purpose language such as GPSS V (General Purpose Simulation System, Version V). GPSS V was chosen as the programming language for the traffic flow model because of its ability to sample from any given distribution function when generating input transactions, such as messages. It is a very compact language and uses relatively few statements, which makes it an easy language to learn and apply.

COMMSTA San Francisco is basically a "torn tape" message relay station; that is, messages are received via teletype or carrier wave (CW) transmission, a tape is cut and put on the teletype of the outgoing circuit, and the message is sent out. The only message statistics presently gathered are landline traffic totals sent and received on a monthly basis. Also, most messages are retained for only 30 days before they are destroyed.

B. METHOD OF DATA CAPTURE

The task of capturing the needed data for the proposed traffic flow model was a formidable one. Four pieces of information were needed concerning each message transaction for each incoming circuit for entry into the model:

1. Message interarrival rate,
2. Message precedence,
3. Message length, and
4. Message destination.

The gathering of this information entailed looking at every message that came in or came out of the COMMSTA on a given day. Through the help of watchstanders, this data was collected for the period 1-7 July 1982 using the form shown in Appendix C. These data were then analyzed and used as the message statistics for a "typical" week.

C. RESULTS OF STATISTICAL ANALYSIS

The baseline statistics were analyzed and put into a form that would be useable in the simulation program. Instead of taking an overall seven day average of message interarrival rates and message lengths, only data for the day that contained the most messages for any particular circuit was used. This was done to be "conservative" in estimating message input statistics for the model. All data for message priority and destination over the seven day period were utilized for analysis.

Table I summarizes the results of the baseline statistical analysis for the NAVCOMPARS circuit. Appendix D contains the statistical summaries of all other COMMSTA circuits used in the simulation model. Each summary is divided into four

TABLE I

NAVCOMPARS Statistics

Arrival Interval	No. of Msgs	Relative Frequency	Cumulative Frequency
0 - 9	22	.32	.32
10 - 10	26	.38	.70
20 - 29	11	.16	.86
30 - 39	5	.07	.93
40 - 49	1	.01	.95
50 - 59	3	.04	1.00

Message Length	No. of Msgs	Relative Frequency	Cumulative Frequency
0 - 10	35	.45	.45
20 - 39	27	.35	.80
40 - 59	4	.05	.85
60 - 79	3	.04	.89
80 - 99	0	.00	.89
100 - 119	0	.00	.89
120 - 139	0	.00	.89
140 - 159	8	.10	1.00

Message Precedence	No. of Msgs	Relative Frequency	Cumulative Frequency
Z	1	.02	.02
O	7	.12	.14
P	28	.48	.62
R	22	.38	1.00

Message Destination	No. of Msgs	Relative Frequency	Cumulative Frequency
MF/CW	2	.03	.03
HF/CW	2	.03	.06
CLAS S/S	16	.24	.30
UNCLAS S/S	24	.35	.65
AIR/GROUND	1	.01	.66
SITOR	2	.03	.69
INHOUSE	17	.25	.94
HF BCST	2	.03	.97
500 KHz	2	.03	1.00

categories: (1) Arrival Interval, (2) Message Length, (3) Message Precedence, and (4) Message Destination. The arrival interval was measured in minutes throughout the model. The unit of message length used for measurement was a line of text.

The meaning of the data in Table I will now be explained. Under the column labeled Arrival Interval, the first line entry indicates that 22 NAVCOMPARS messages arrived in the system within 0 to 9 minutes of the previous message received. The relative frequency of messages that occurred in this interval was 0.32. The cumulative frequency, which is vitally important to the simulation model, is simply a cumulative total of the relative frequencies. This information is used to form the probability distribution of message arrivals and is used by GPSS in generating the message inputs for the model. Similar probability distributions are formed for the length, in lines of text, of the arriving messages, their precedence, and their destination within the system. The next chapter discusses in more detail how these statistics are incorporated into the design of the simulation program.

V. GPSS V MODEL OF THE MSS

A. MODEL DESCRIPTION

1. General Purpose System Simulator

Like any model, the one presented in this chapter is not perfect, but every effort was made to design it as closely to the proposed MSS as possible. Due to the constraint of time and the limited programming skills of the author, several simplifying assumptions were made in the model design. The input and output queues connected to the CPU queue were separate entities in the model. In reality, each queue connected to the CPU will function as both an input and output queue. The contents of each output queue and the CPU are ordered by precedence and are transmitted using the First-In, First-Out (FIFO) methodology. There is no provision for the model to drop everything whenever a Flash or special precedence message arrives and to process it immediately, interrupting any message that is being transmitted at the time.

The MSS is to have both a primary and a secondary CPU. This model is designed only for primary CPU operation to find out what kind of traffic load it can handle alone. The model is designed for operating under the assumption that the CPU operator must view each incoming and outgoing message in the system.

The General Purpose System Simulator (GPSS) was chosen to approximate the envisioned characteristics of the proposed Message Switching System (MSS). The ease and flexibility of GPSS lends itself quite nicely to modeling the MSS as closely as possible. However, many assumptions were needed for simplification of some system characteristics, as will be explained in this chapter.

GPSS is a simulation programming language used to build computer models for discrete-event simulations. It offers programming convenience because the GPSS simulator itself accomplishes many tasks automatically which would otherwise be left to the model builder. This language implicitly and unobtrusively collects data describing a model's simulated behavior, then automatically prints out summaries of this data at the end of a simulation in an easy-to-read format. It also maintains a simulated clock, schedules events to occur in future simulated time, causes these events to occur in the proper, time-ordered sequence, and provides a means of assigning relative priorities to be used in resolving time ties. [5]

GPSS is structured as a block-oriented language since the use of flow charts to describe a system is well known and accepted. These blocks are defined to model the dynamic components of a system. Units of traffic in the model are called transactions. Thus, the transactions move through the model under control of the blocks and are created and destroyed as required. [6]

2. General Concept

Essentially, many characteristics of the envisioned MSS allow for the system to be modeled as a message switch with a store-and-forward capability in that the entire message is transmitted to a centrally located node or CPU, where it is stored as long as necessary, until an appropriate connection can be made with its destination. Such a message switch has the responsibility to provide rapid, reliable, and secure means to deliver messages. This was the concept used in the basic model design as illustrated in Figure 5.1

3. Specific Model Attributes

The basic model design has just been presented and will now be further broken down into its more specific attributes. (Refer to the program listing in Appendix E).

a. Message Generation

All transactions enter the model by means of the GENERATE statement. As a transaction enters the model, the processor schedules the arrival of the next transaction by randomly sampling from the interarrival-time distribution, and adding this sampled value to the simulation clock's current value. When this future time is reached, another transaction enters into the model through the GENERATE statement, and so on. [5] The interarrival rate for each

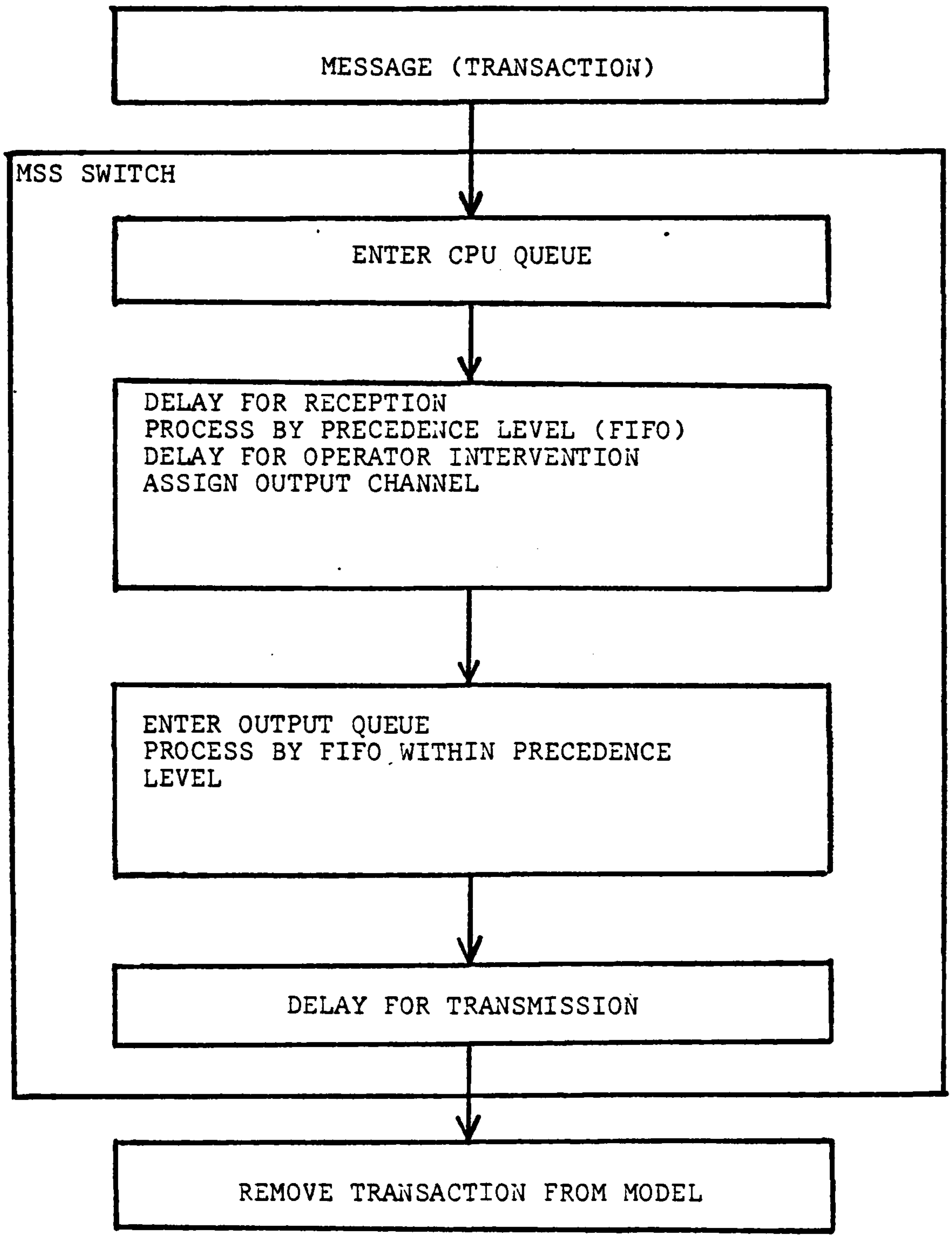


Figure 5.1 Basic Model Flow Path

type of message is listed at the beginning of the program listing using the FUNCTION statement. These values were obtained from Appendix D.

b. Message Priority (or Precedence)

A new transaction is assigned a priority level through a random sampling of a priority level distribution using the FUNCTION statement. This information is listed at the beginning of the program listing and was obtained from Appendix D. In GPSS, 128 different priority levels are possible; however, this model uses only four, each of which is assigned a numerical value: Flash = 4, Immediate = 3, Priority = 2, and Routine = 1. As each transaction enters a queue, it is serviced first-in, first-out (FIFO) by its priority level. [5]

c. Message Length

A random sampling of the probability distribution for message length is made and assigned to each transaction as it enters the system by use of the ASSIGN statement. The value obtained is the probabilistic number of lines of text of the message. FUNCTION statements are used to list the distributions in the program. These statistics came from Appendix D.

d. Message Destination

Each transaction is assigned a numerical value that indicates its destination according to Table II. The ASSIGN statement generates this value through random sampling of a given probability distribution in the FUNCTION statement. Appendix D contains these distribution statistics.

e. Circuit Speed

Each circuit has a given baud rate that is needed when calculating the delays for reception and transmission. Table III lists each circuit and its baud rate. In the VARIABLE statements, the variable P2 is the message length and is divided by the line/minute rate of the particular circuit. This calculation yields a value in minutes which is then used for the message delay time. For example, a circuit with a baud rate of 75 and a message length of 25 lines would be computed as follows: (Assume 34 characters/line and 10 bits/character)

$$\text{Delay Time} = 25 \text{ lines} * \frac{34 \text{ char/line} * 10 \text{ bits/char}}{75 \text{ bits/sec} * 60 \text{ sec/min}}$$

$$= 1.9 \text{ minutes}$$

The ASSIGN statement is again used to assign this value to each message transaction. Because the smallest incremental unit of the model is an integer minute, the above computed delay would become 2 minutes for the simulation process.

f. Additional Considerations

Each generated transaction is sent to the CPU queue (QCPU) via a TRANSFER statement. The QUEUE, SEIZE,

TABLE II

Numerical Message Destination Assignments

Numerical Assignments	Circuit
1	NAVCOMPARS
2	SARPAC
3	MF/CW
4	HF/CW
5	CLASS S/S RATT
6	UNCLASS S/S RATT
7	WEATHER
8	AIR/GROUND
9	SITOR
10	TWPL (DISTRICT LOOP)
11	INHOUSE
12	HF BROADCAST
13	COMMAND & CONTROL

TABLE III

Circuit Baud Rates

Circuit	Baud Rate
NAVCOMPARS	1200
SARPAC	1200
MF/CW	10
HF/CW	10
CLASS S/S RATT	75
UNCLASS S/S RATT	75
WEATHER	1200
AIR/GROUND	33
SITOR	17
TWPL	1200
INHOUSE	1200
HF BROADCAST	33
COMMAND & CONTROL	1200

and DEPART statements allow for only one transaction to be processed at a time while other transactions wait in a queue for processing. Also, useful statistics are gathered at this point to be printed after simulation is complete.

The TABULATE statement allows for the gathering of additional statistics that the model builder deems useful to his analysis. The ADVANCE statement is used to incorporate the delays due to reception (discussed in paragraph A.3.e) and operator intervention. Assuming a "manual" mode of operation where the operator must see every message received by the CPU and perform some processing on it, a delay of one minute was used.

Next the transaction is processed and exits the CPU queue by use of the RELEASE statement and must be sent to its destination, or output queue. The TEST statement compares the value of P1 (the message destination) with a given value, and if the two values are equal it transfers that transaction to the appropriate output queue.

Each output queue processes a transaction in the same way just described for the CPU queue, except that the message is terminated by the model after it leaves the output queue since its final destination is not relevant to the simulation.

B. MODEL OUTPUT

GPSS provides built-in statistics gathering capabilities in an easy-to-read format. The output of GPSS simulation includes statistics on the utilization of facilities, storages, and queues. [5]

Additional information pertaining to the following categories was desired:

1. The origin of messages into the CPU queue.
2. The origin of messages into each output queue.
3. The queue contents of the CPU.
4. The transit time of messages in the model.

The above statistics were gathered by the use of the TABLE and TABULATE statements. This information was found to be useful in judging the validity of the model by observing the distribution of messages that enter the CPU and how these messages are distributed to the various output queues. Of great importance is knowledge concerning how many messages are waiting in the CPU queue for processing. This model uses only a single CPU, whereas the proposed MSS is to have a primary and secondary CPU. Information on the time a transaction takes to move through the model from the time of reception to the time of transmission (called the transit time) was desired to compare message delays in the model.

In addition to tabular output, it was thought useful to augment this information with graphical representations of the statistics to facilitate comparison of the data.

C. ANALYSIS OF BASELINE MODEL RESULTS

The traffic flow simulated within the model for the baseline case of statistics, as presented in Chapter IV, will be referred to as Throughput State I. This simulation was run over a simulated 7 day period. The output collected information concerning the origin of messages into the CPU queue (Figure 5.2), the number of message entries into each output queue (Figure 5.3), the queue contents of the CPU queue (Figure 5.4), and the transit time of messages in the system (Figure 5.5).

Figure 5.2 graphically displays that most of the generated messages received by the CPU queue originated from the HF/CW circuit. From Figure 5.3 it can be observed that the NAVCOMPARS and WEATHER output queues received the most messages transmitted from the CPU queue. From Figure 5.4 it can be seen that the CPU queue had a maximum of one message transaction in its contents 99.10 percent of the time during the one day period. Figure 5.5 reveals that the average transit time for all messages was 2.674 minutes and that the maximum transit time needed by any message was 53 minutes.

The output statistics over the entire 7 day period were graphed for the maximum CPU contents (Figure 5.6), the

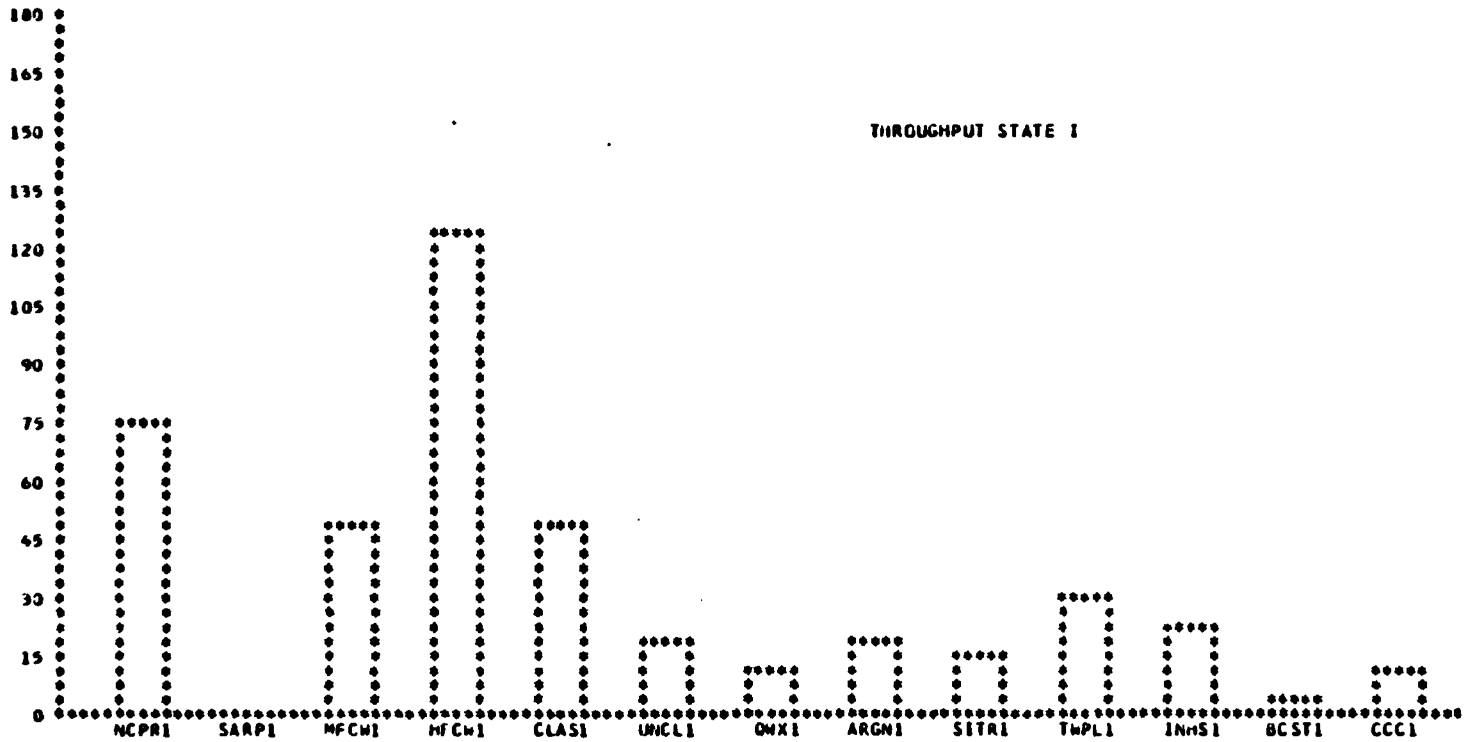
ORIGIN OF MESSAGES INTO CPU QUEUE

TABLE TAB14

ENTRIES IN TABLE	MEAN ARGUMENT	STANDARD DEVIATION	SUM OF ARGUMENTS	
448	5.171	3.277	2317.000	NON-WEIGHTED

UPPER LIMIT	OBSERVED FREQUENCY	PER CENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
1	77	17.18	17.1	82.8	.193	-1.272
2	2	.44	17.6	82.3	.386	-.967
3	50	11.16	28.7	71.2	.580	-.662
4	124	27.67	56.4	43.5	.773	-.357
5	51	11.38	67.8	32.1	.966	-.052
6	20	4.46	72.3	27.6	1.160	.252
7	14	3.12	75.4	24.5	1.353	.557
8	20	4.46	79.9	20.0	1.546	.862
9	15	3.34	83.2	16.7	1.740	1.168
10	32	7.14	90.4	9.5	1.933	1.473
11	26	5.80	96.2	3.7	2.126	1.778
12	5	1.11	97.3	2.6	2.320	2.083
13	12	2.67	100.0	.0	2.513	2.388

REMAINING FREQUENCIES ARE ALL ZERO



X AXIS: NAME OF QUEUE

Y AXIS: NUMBER OF MESSAGES ENTERING CPU QUEUE

Figure 5.2 Origin Of Messages Into The CPU Queue

MESSAGE ENTRIES INTO EACH OUTPUT QUEUE

QUEUE	MAXIMUM CONTENTS	AVERAGE CONTENTS	TOTAL ENTRIES	ZERO ENTRIES	PERCENT ZEROS	AVERAGE TIME/TRANS	$AVERAGE TIME/TRANS	TABLE NUMBER	CURRENT CONTENTS
CPU1	4	.356	448	385	85.9	.183	1.301		
NCPR1	1	.000	116	116	100.0	.000	.000		
SARP1	1	.000	84	84	100.0	.000	.000		
MFCW1	1	.002	4	4	100.0	.000	.000		
HFCW1	1	.000	2	2	100.0	.000	.000		
CLAS1	1	.000	25	25	100.0	.000	.000		
UNCL1	1	.004	48	45	93.7	.145	2.333		
QWX1	1	.000	120	120	100.0	.000	.000		
ARGN1	1	.000	1	1	100.0	.000	.000		
SITF1	1	.000	2	2	100.0	.000	.000		
TWPL1	1	.000	12	12	100.0	.000	.000		
INMS1	1	.000	25	25	100.0	.000	.000		
BCST1	1	.000	7	7	100.0	.000	.000		
CCC1	1	.000	3	3	100.0	.000	.000		

$AVERAGE TIME/TRANS = AVERAGE TIME/TRANS EXCLUDING ZERO ENTRIES

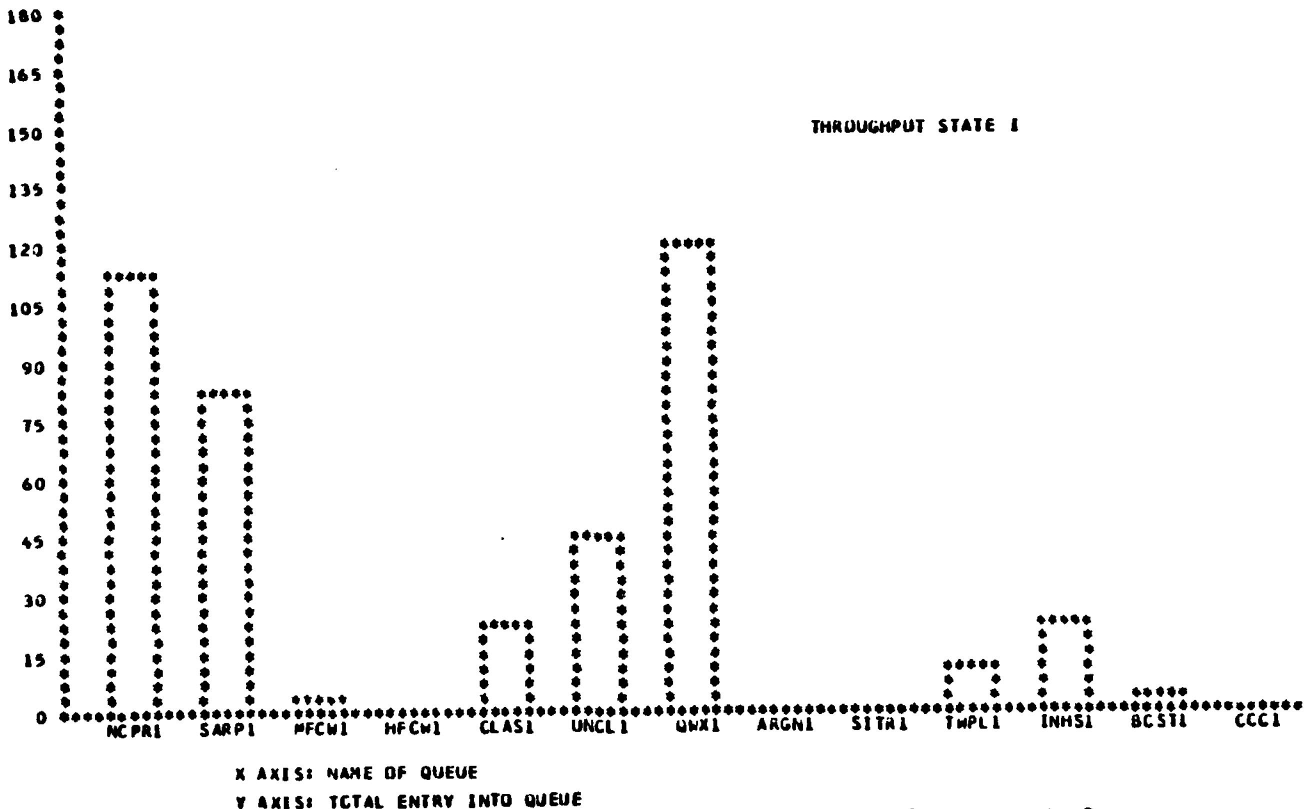


Figure 5.3 Number Of Message Entries Into Each Output Queue

QUEUE CONTENTS OF CPU AS PERCENTAGE OF TOTAL

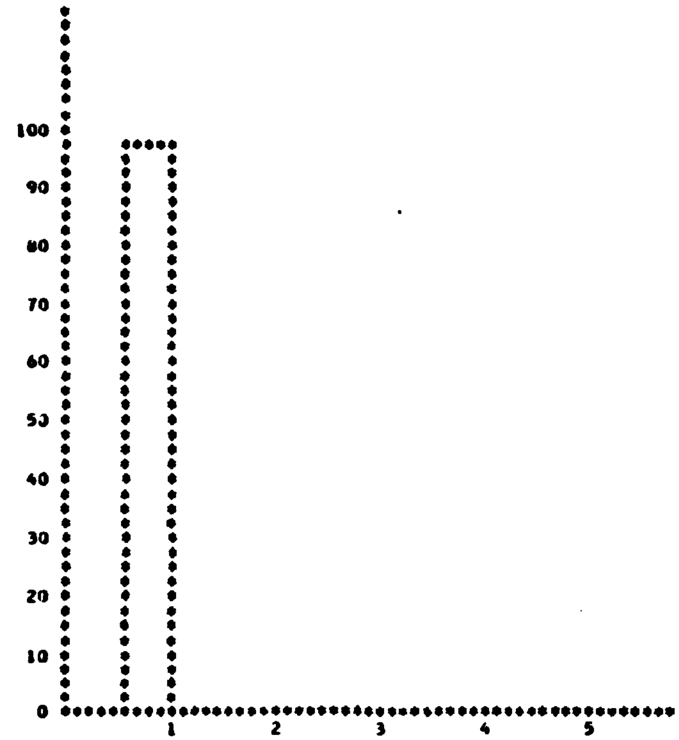
TABLE TAB15

ENTRIES IN TABLE	MEAN ARGUMENT	STANDARD DEVIATION	SUM OF ARGUMENTS	
449	.064	.310	29.000	NON-WEIGHTED

UPPER LIMIT	OBSERVED FREQUENCY	PER CENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
1	444	99.10	99.1	.8	15.448	3.011
2	2	.44	99.5	.4	30.896	6.231
3	2	.44	100.0	.0	46.344	9.451

REMAINING FREQUENCIES ARE ALL ZERO

THROUGHPUT STATE 1



X AXIS: QUEUE CONTENTS

Y AXIS: PERCENTAGE OF TOTAL

Figure 5.4 Queue Contents Of The CPU Queue

MSG TRANSIT TIME FOR THROUGHPUT STATE 1

TABLE TAB16 ENTRIES IN TABLE 449	MEAN ARGUMENT 2.674	STANDARD DEVIATION 3.917	SUM OF ARGUMENTS 1201.000	NON-WEIGHTED

UPPER LIMIT	OBSERVED FREQUENCY	PER CENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
1	169	37.63	37.6	62.3	.373	-.427
2	173	38.53	76.1	23.8	.747	-.172
3	46	10.24	86.4	13.5	1.121	.082
4	26	5.79	92.2	7.7	1.495	.336
5	7	1.55	93.7	6.2	1.869	.593
6	4	.89	94.6	5.3	2.243	.848
7	1	.22	94.8	5.1	2.616	1.103
8	0	.00	94.8	5.1	2.990	1.359
9	1	.22	95.1	4.8	3.364	1.614
10	2	.44	95.5	4.4	3.738	1.869
11	1	.22	95.7	4.2	4.112	2.124
12	4	.89	96.6	3.3	4.486	2.380
13	5	1.11	97.7	2.2	4.860	2.635
14	0	.00	97.7	2.2	5.233	2.890
15	1	.22	97.9	2.0	5.607	3.145
16	1	.22	98.2	1.7	5.981	3.401
17	2	.44	98.6	1.3	6.355	3.656
18	1	.22	98.8	1.1	6.729	3.911
19	1	.22	99.1	.8	7.103	4.166
20	1	.22	99.3	.6	7.477	4.421
21	0	.00	99.3	.6	7.850	4.677
22	1	.22	99.5	.4	8.224	4.932
23	0	.00	99.5	.4	8.598	5.187
24	0	.00	99.5	.4	8.972	5.442
25	0	.00	99.5	.4	9.346	5.698
26	0	.00	99.5	.4	9.720	5.953
27	0	.00	99.5	.4	10.094	6.208
28	1	.22	99.7	.2	10.467	6.463
29	0	.00	99.7	.2	10.841	6.719
30	0	.00	99.7	.2	11.215	6.974
31	0	.00	99.7	.2	11.589	7.229
32	0	.00	99.7	.2	11.963	7.484
33	0	.00	99.7	.2	12.337	7.740
34	0	.00	99.7	.2	12.711	7.995
35	0	.00	99.7	.2	13.084	8.250
36	0	.00	99.7	.2	13.458	8.505
37	0	.00	99.7	.2	13.832	8.760
38	0	.00	99.7	.2	14.206	9.016
39	0	.00	99.7	.2	14.580	9.271
40	0	.00	99.7	.2	14.954	9.526
41	0	.00	99.7	.2	15.328	9.781
42	0	.00	99.7	.2	15.701	10.037
43	0	.00	99.7	.2	16.075	10.292
44	0	.00	99.7	.2	16.449	10.547
45	0	.00	99.7	.2	16.823	10.802
46	0	.00	99.7	.2	17.197	11.058
47	0	.00	99.7	.2	17.571	11.313
48	0	.00	99.7	.2	17.945	11.568
49	0	.00	99.7	.2	18.318	11.823
50	0	.00	99.7	.2	18.692	12.079
51	0	.00	99.7	.2	19.066	12.334
52	0	.00	99.7	.2	19.440	12.589
53	1	.22	100.0	.0	19.814	12.844

REMAINING FREQUENCIES ARE ALL ZERO

Figure 5.5 Transit Time Of Messages In The System

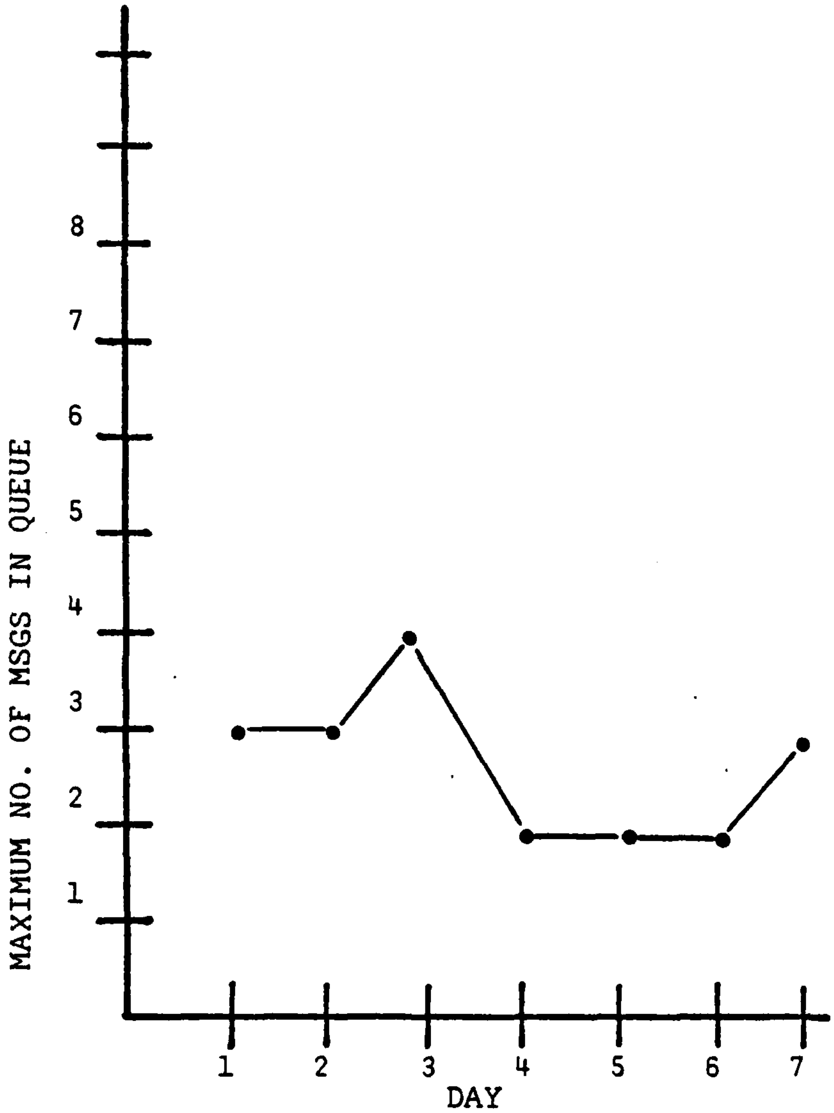


Figure 5.6 Maximum CPU Queue Contents For Throughput State

average message transit time in the system (Figure 5.7), and the maximum message transit time in the system (Figure 5.8).

It can be observed from Figure 5.6 that the maximum CPU queue contents over the 7 day period were 4 messages, and that occurred only on one day. Figure 5.7 showed that the average message transit time was under 3 minutes for the entire period. The maximum message transit time over the 7 day period is shown in Figure 5.8 to be less than 80 minutes.

Additionally, Appendix F contains information regarding the origin or messages into each output queue for the day that generated the maximum number of messages over the period of simulation. In Appendix G is found the transit times for each type of message in the system.

The results of the graphical analysis seem reasonable and are well within the operating parameters of the MSS. Knowing that the traffic load could easily double or triple under certain circumstances makes it necessary to perform a sensitivity analysis on the model. This will be the subject of the following chapter.

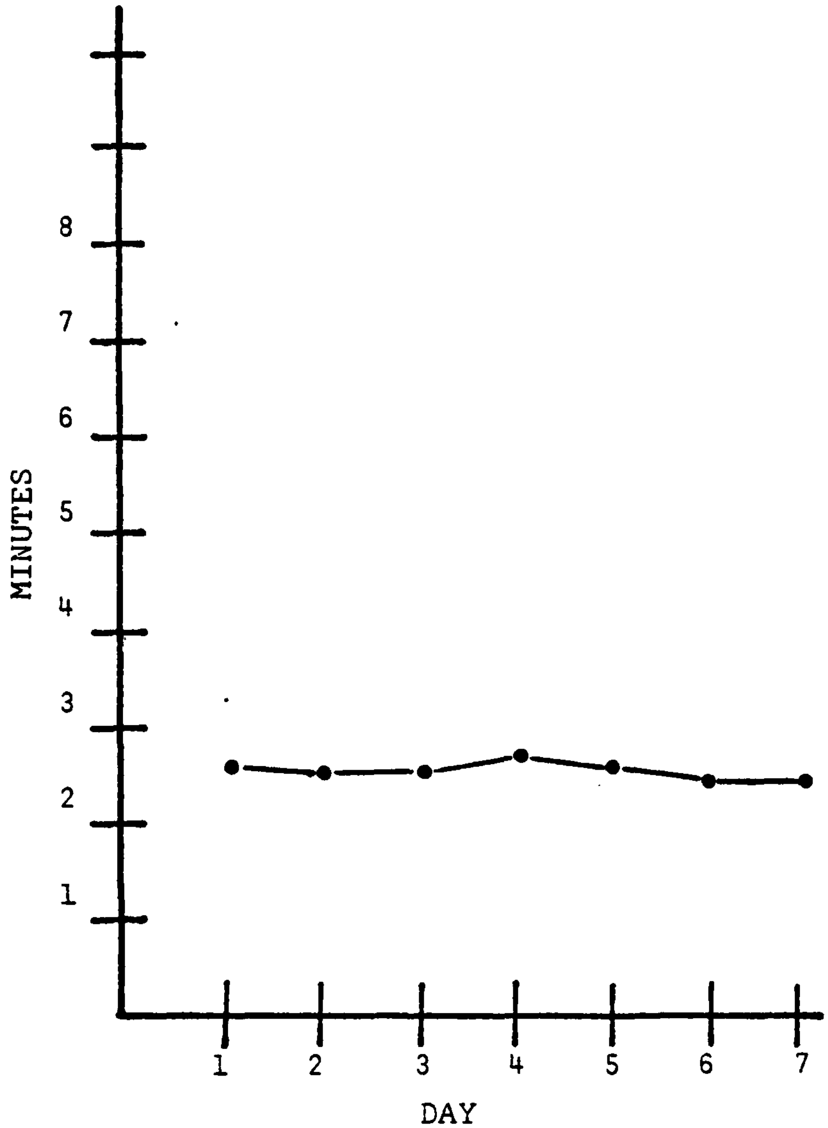


Figure 5.7 Average Message Transit Time For Throughput State I

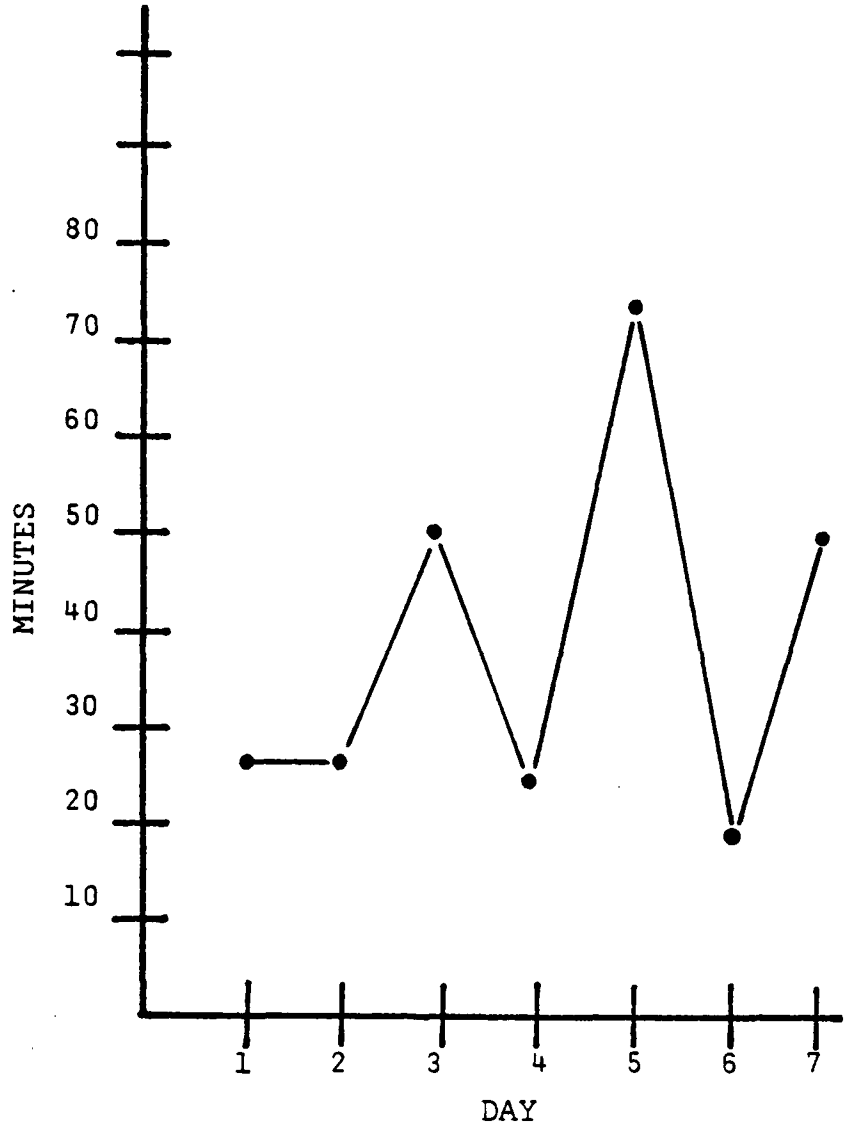


Figure 5.8 Maximum Message Transit Time For Throughput State I

VI. SENSITIVITY ANALYSIS OF MODEL

A. PURPOSE

Sensitivity analysis is a very important part of any simulation model to determine how a change in the inputs will affect the output. For the system presented here, particularly since it is a traffic flow model, the communicator is always interested in how a change in the message workload will affect the ability of the system to process and deliver the information. This chapter will describe how an analysis was performed on the model and what the results of that analysis were.

Sensitivity analysis was performed on message inter-arrival rates and message destinations. No sensitivity analysis was performed for the precedence or length parameters of the model. Because the model does not collect data concerning message precedence as an output statistic, analysis of this parameter is not available. Casual observation suggests that message length has not changed over the past several years and, additionally, is not expected to change significantly in the future under MSS. Consequently, message length was not selected as a parameter for sensitivity analysis.

B. MESSAGE INTERARRIVAL RATES

The methodology utilized to simulate an increase in the message load was to decrease the length of the time for each interval of the probability distribution in the interarrival input statistic. For example, if 10 messages were received in a 10 minute interval, decreasing that interval by one minute (or 10 percent) to 9 minutes would simulate 10 messages received in 9 minutes. This computes to an increase of 11 percent in the traffic load. Each time interval in the probability distribution was recomputed in the same way.

Simulation runs were performed for traffic load increases of 11 percent, 25 percent, 43 percent, and 67 percent with results that were not significantly different from the baseline case, or Throughput State I. The details of these results will not be presented in this paper, as they were inconclusive. However, it was discovered that traffic load increases of 100 percent, 150 percent, and 233 percent did significantly change the output results of the model. The increases will be referred to as Throughput State II, Throughput State III, and Throughput State IV, respectively. Appendices H, I, and J contain the respective input statistics for each of these states.

The results of the simulation runs for Throughput States II through IV are summarized graphically in Figures 6.1 through 6.9. For each state, graphs are presented to show the maximum CPU queue contents, the average message transit time, and the maximum message transit time.

Figure 6.1 shows that the maximum CPU queue contents for each day in State II was 4 messages. The observed average message transit time for this state in Figure 6.2 can be seen to be between 3 and 4 minutes. From Figure 6.3 the maximum message transit time for State II is 80 minutes. In Figure 6.4 it is observed that the maximum CPU queue contents are 8 messages over the 7 day period for State III. The average message transit time is still between 3 and 4 minutes as seen in Figure 6.5. Figure 6.6 shows the maximum message transit time in State III to be less than 90 minutes.

An interesting upward trend is observed for the maximum CPU queue contents in Figure 6.7 for State IV. A maximum of 63 messages is reached by the 7th day of simulation. The average message transit time graphed in Figure 6.8 also shows an upward trend over the same period to a peak of over 40 minutes. Figure 6.9 shows a similar behavior for the maximum message transit time in State IV. Here the transit time reaches its peak value on the 7th day of almost 250 minutes.

Figure 6.10 is a graphical representation of the maximum CPU contents over the 7 day simulation period for each throughput state. It was observed that between states III and IV, the contents of the CPU increased dramatically.

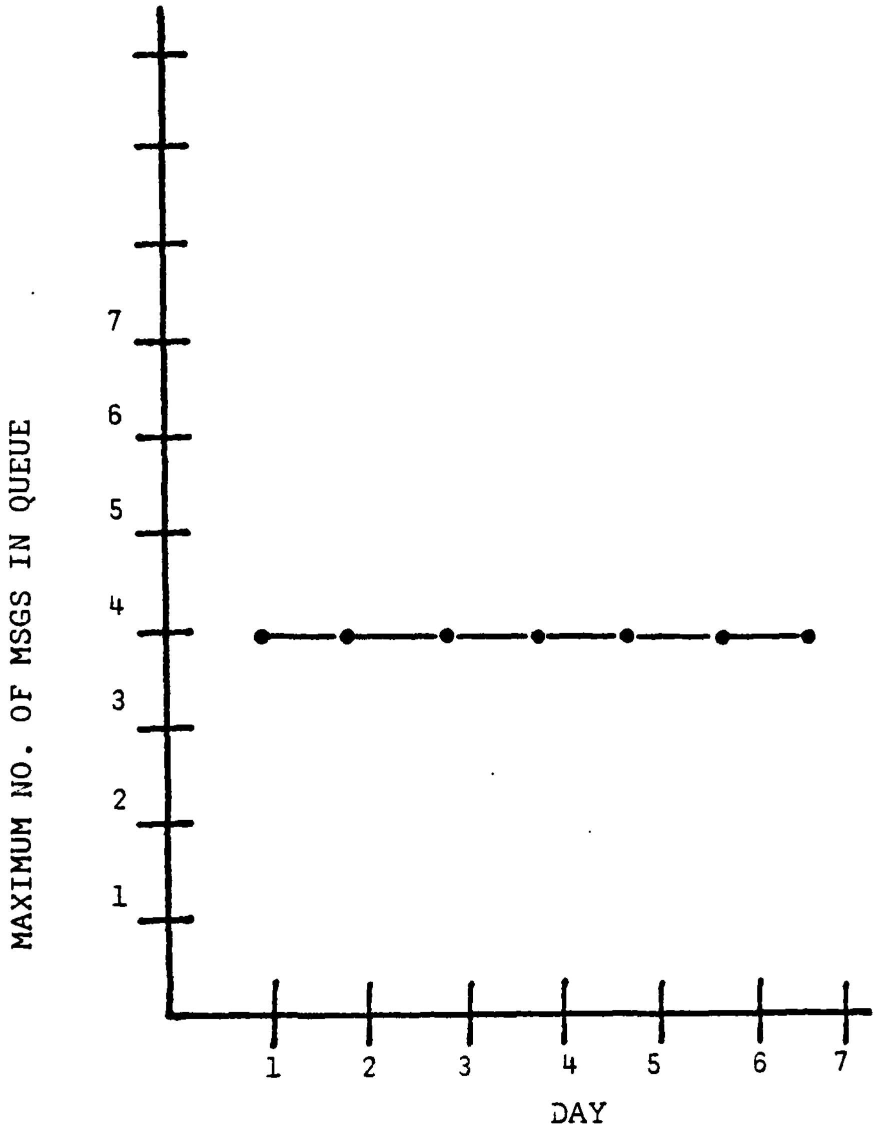


Figure 6.1 Maximum CPU Queue Contents For Throughput State II

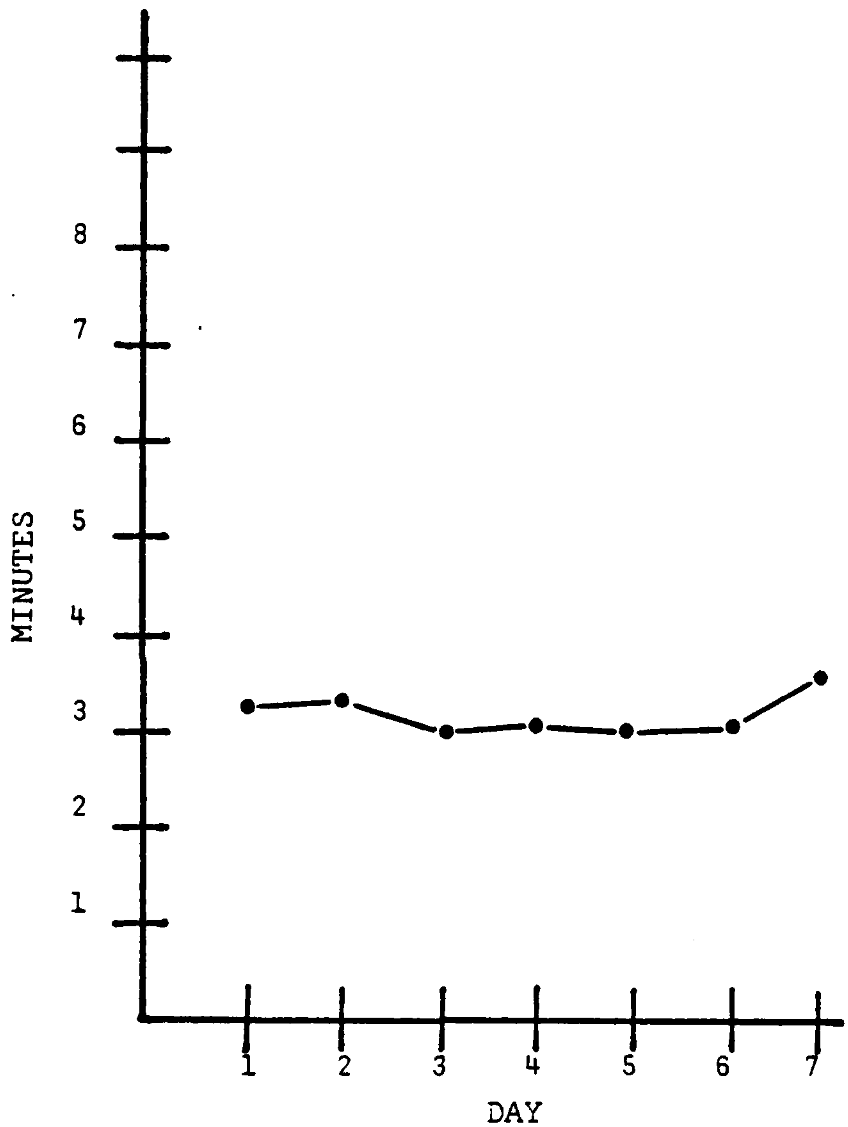


Figure 6.2 Average Message Transit Time For Throughput State II

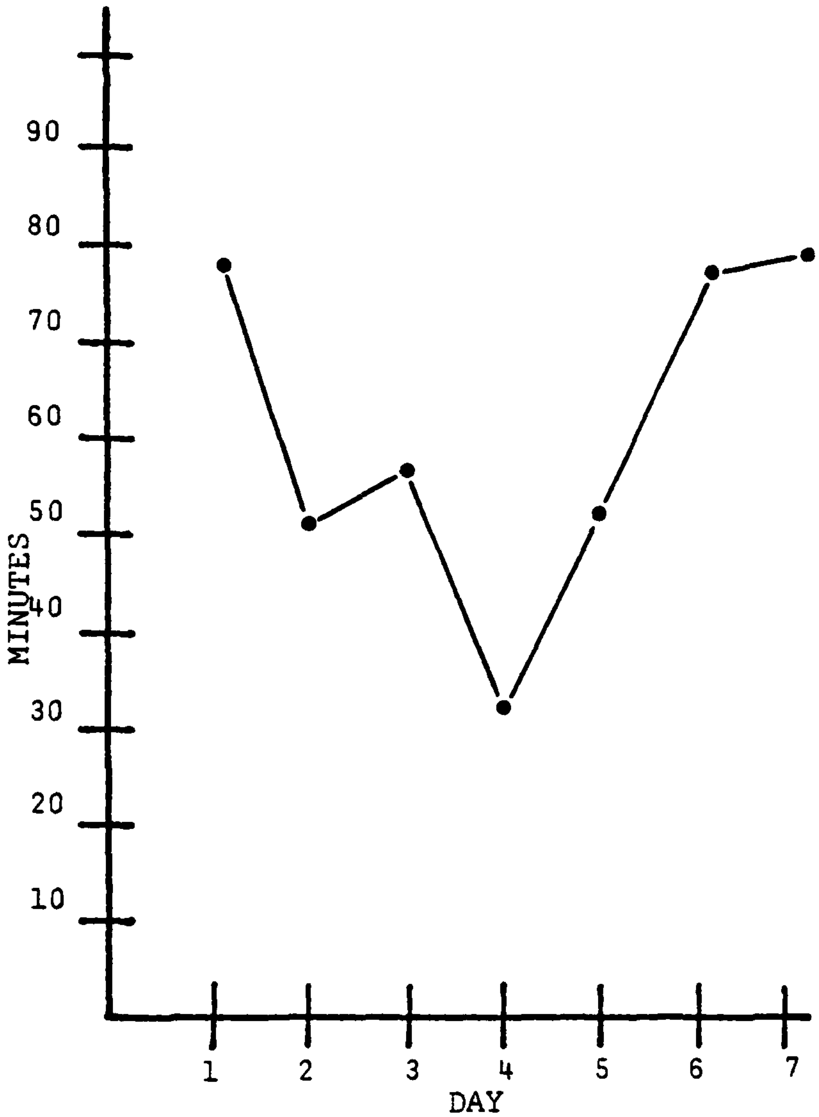


Figure 6.3 Maximum Message Transit Time For Throughput State II

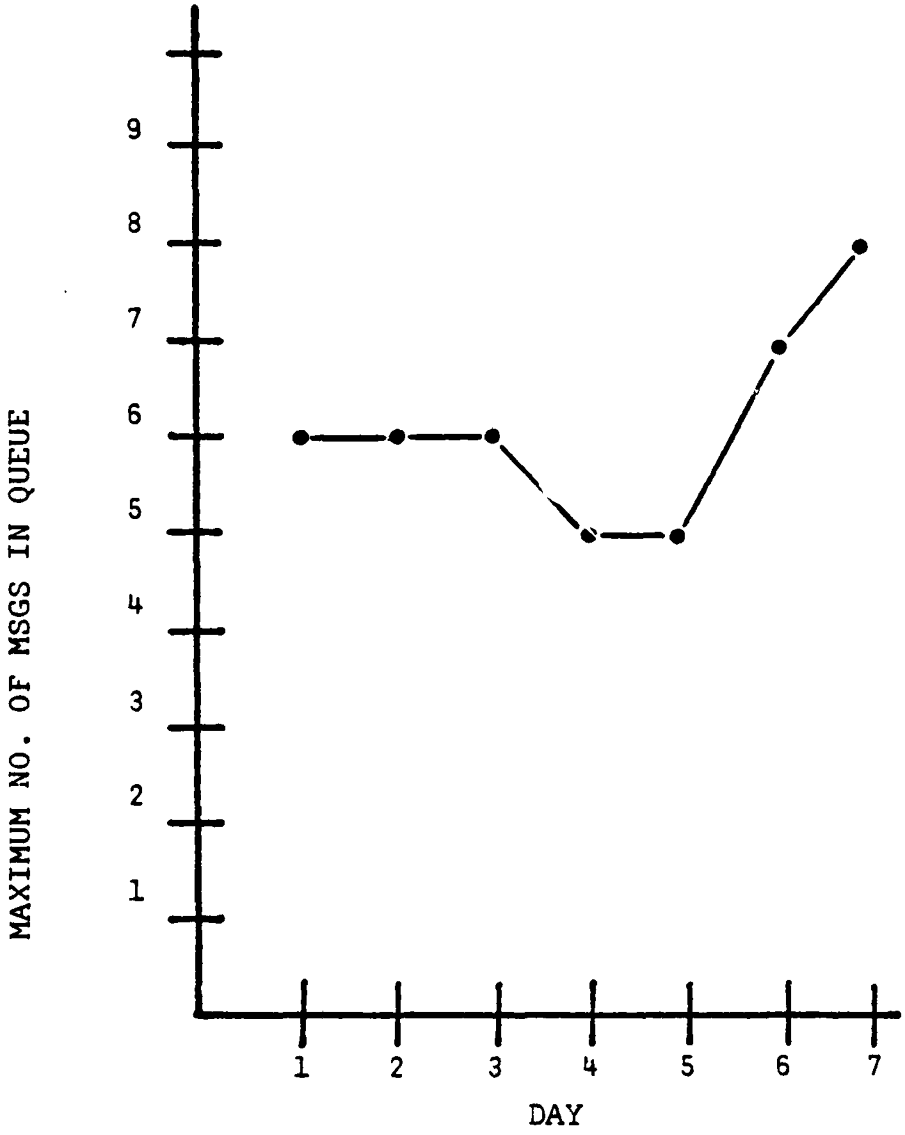


Figure 6.4 Maximum CPU Queue Contents For Throughput State III

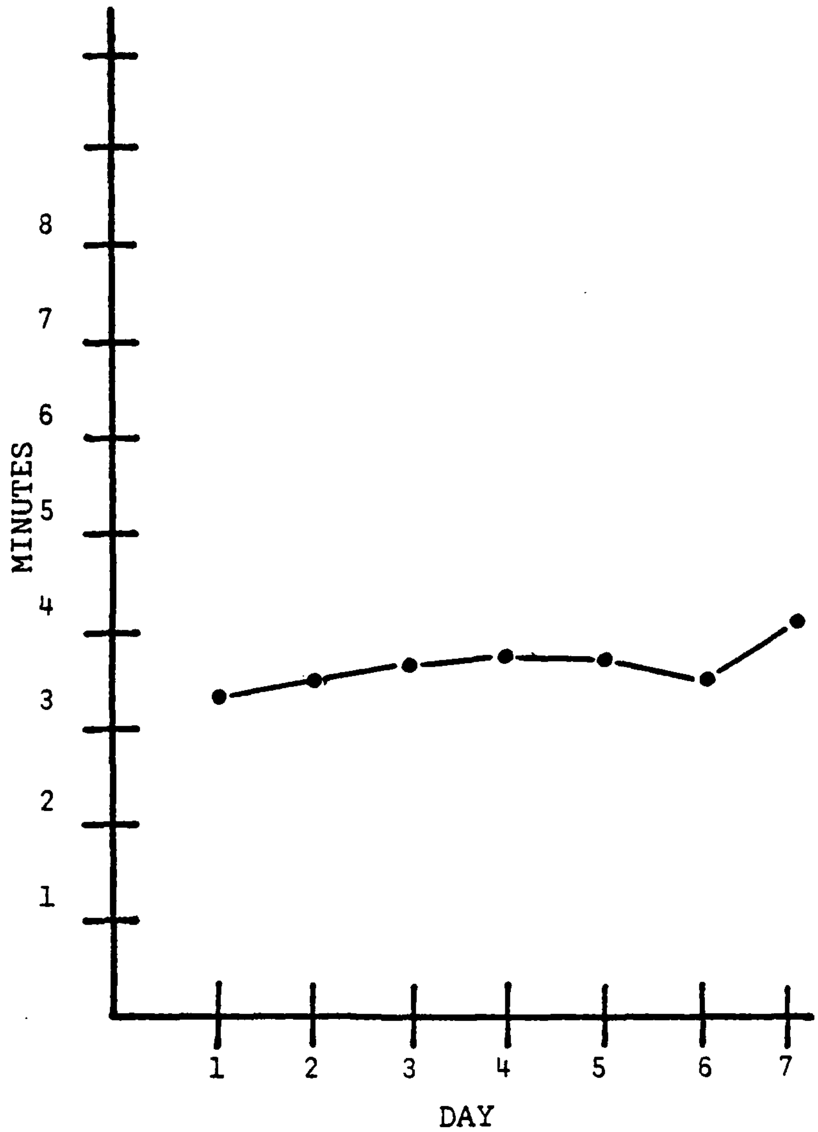


Figure 6.5 Average Message Transit Time For Throughput State III

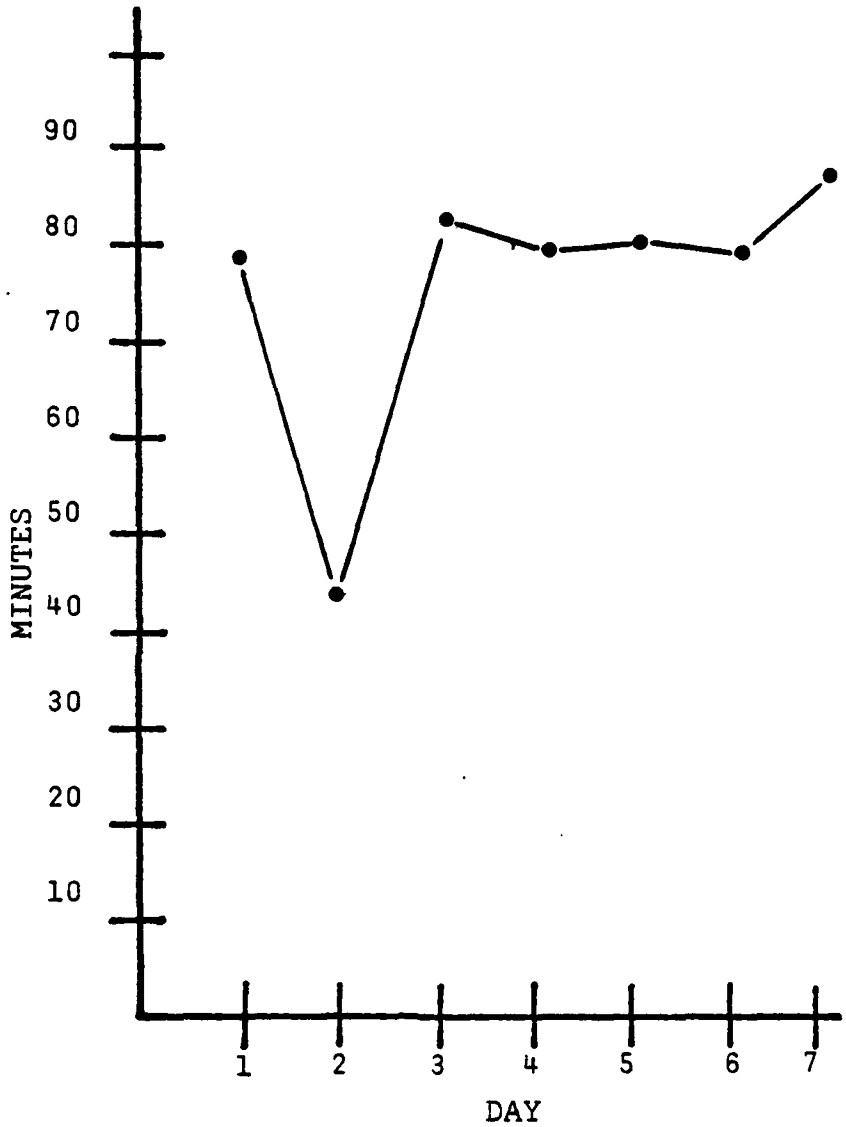


Figure 6.6 Maximum Message Transit Time For Throughput State III

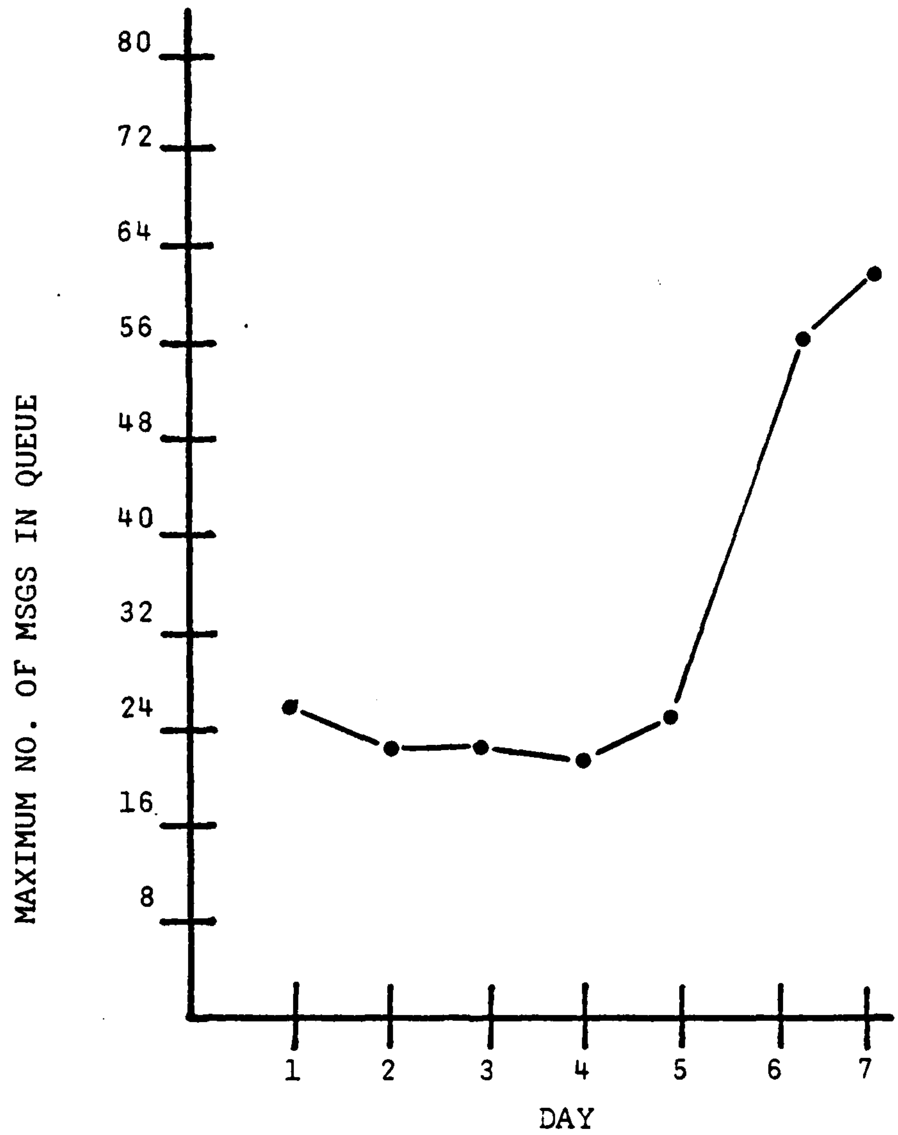


Figure 6.7 Maximum CPU Queue Contents For Throughput State IV

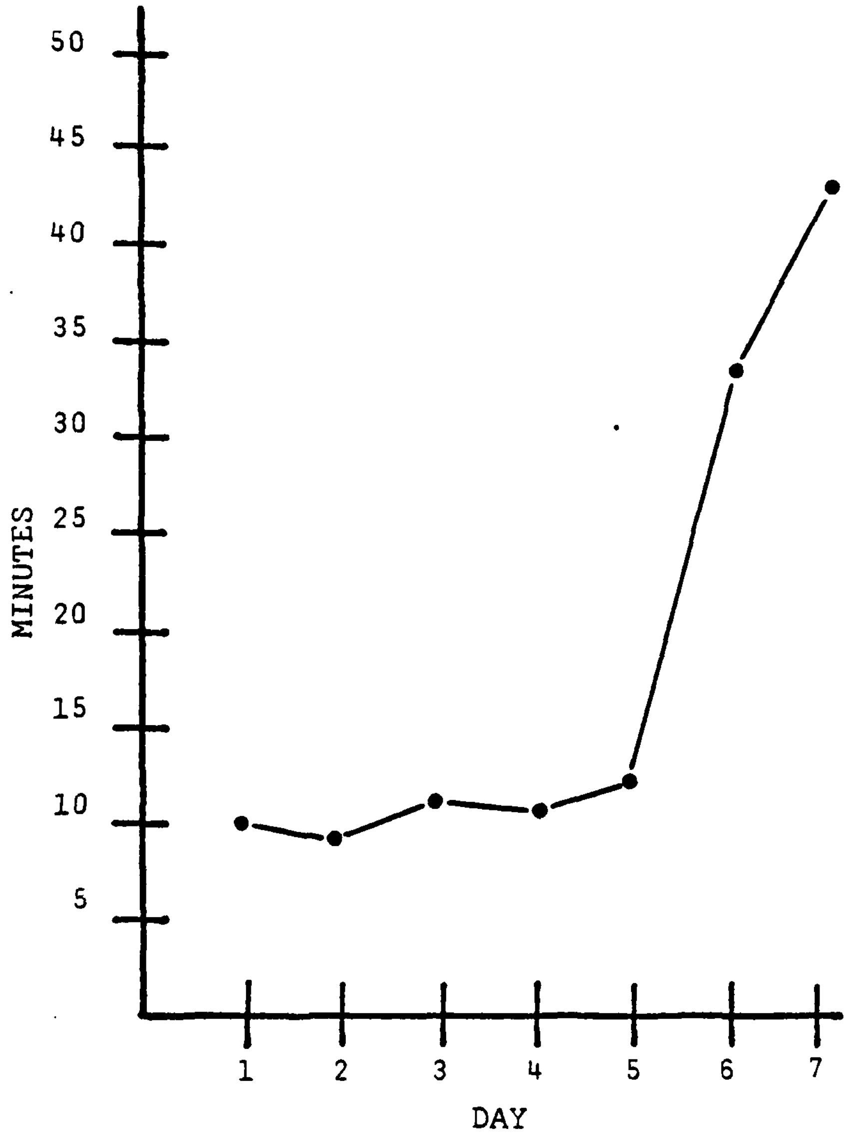


Figure 6.8 Average Message Transit Time For Throughput State IV

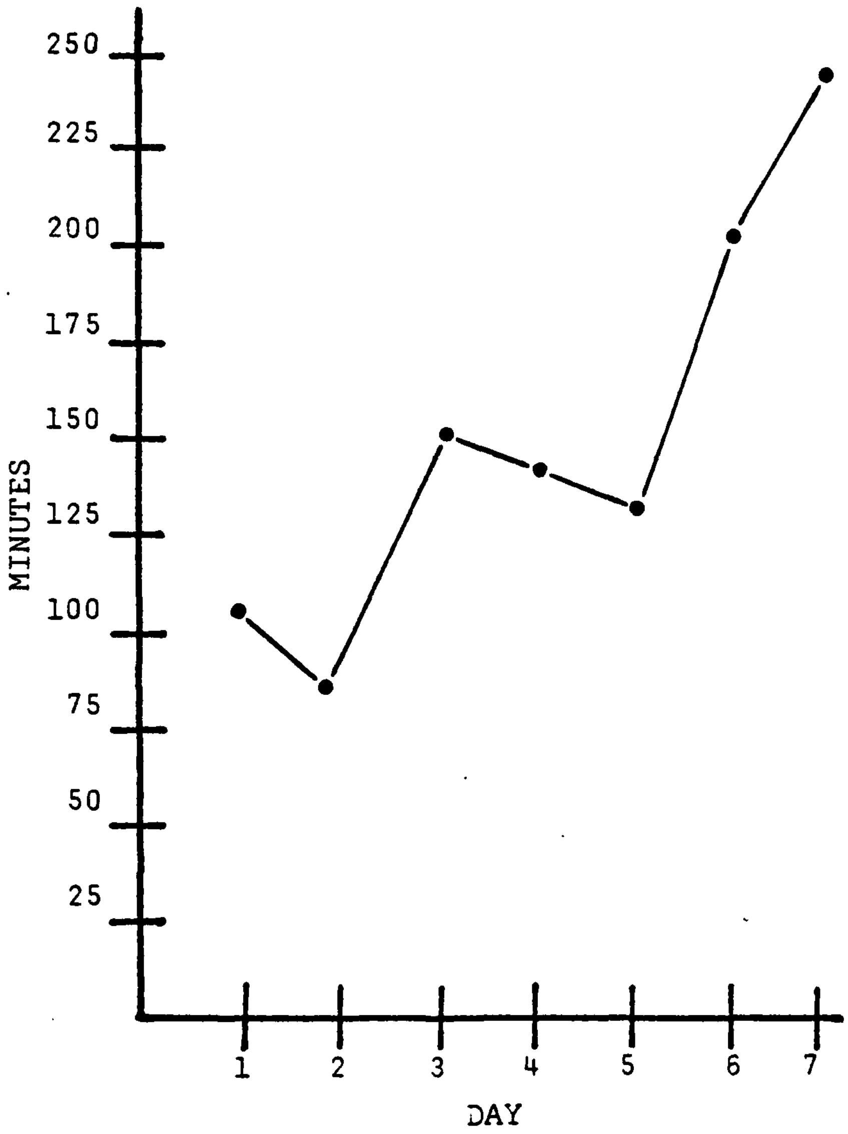


Figure 6.9 Maximum Message Transit Time For Throughput State IV

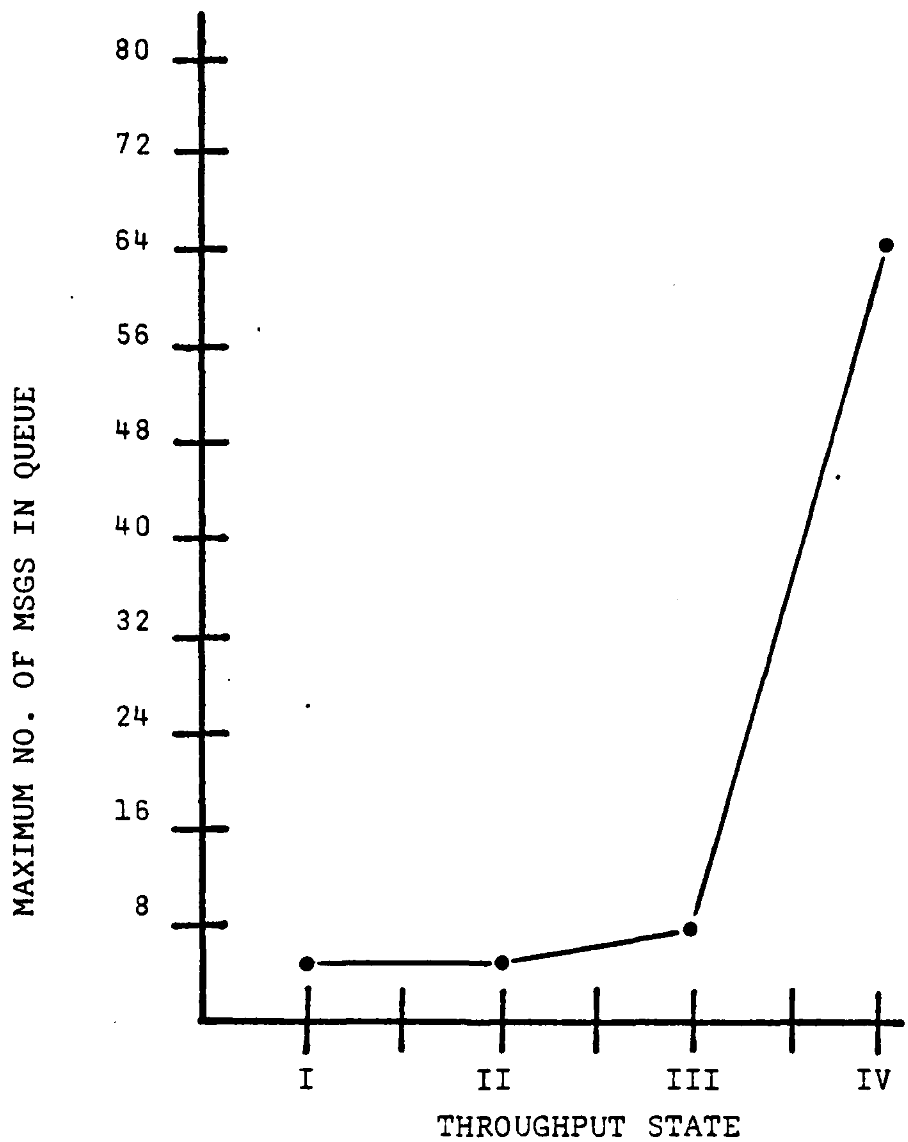


Figure 6.10 Maximum CPU Queue Contents For Each Throughput State

C. MESSAGE DESTINATION

In performing the sensitivity analysis for message destination, a slow speed circuit was chosen to see what would happed if a large shift in the destination of messages on that one circuit occurred. Imagine the following scenario: A merchant vessel in the Pacific Ocean has an emergency and requests help via the SITOR terminal. The COMMSTA, which has the guard for the ship, receives its transmission, and immediately relays the message over the NAVCOMPARS and/or SARPAC circuits, as illustrated on the Traffic Flow Diagram in Appendix B for the SITOR circuit. Of course, messages would be flowing back to the ship according to the Traffic Flow Diagrams for the NAVCOMPARS and SARPAC circuits.

To simulate this change, the probability distributions for NAVCOMPARS, SARPAC, and SITOR message destinations were modified to reflect a shift in message destinations according to the above scenario. A 200 percent change in message destinations over the SITOR circuit was used for computing this shift over the course of a week, i.e., the statistic for the baseline message destination for SITOR was .44,1/.55,2/1,7. After the shift, it became .63,1/.79,2/1,7 (see Table II for numerical assignment of message destinations).

In Figure 6.11 it was observed that the maximum CPU queue contents for the SITOR scenario did not change significantly from that observed for the baseline case in

Figure 5.6. The same observation was made with Figure 6.12, the average message transit time, and Figure 6.13, the maximum message transit time for the SITOR scenario. In all three cases, there was no significant difference from the baseline case presented in Chapter V.

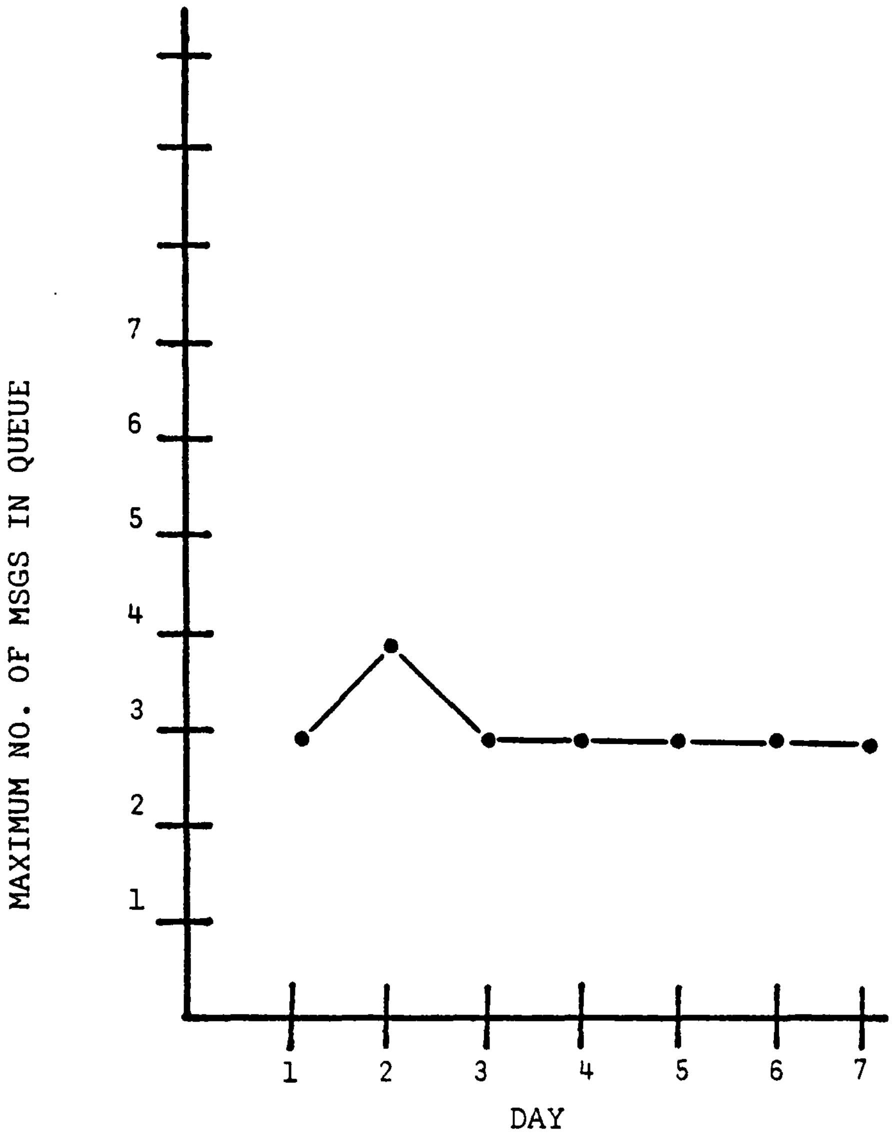


Figure 6.11 Maximum CPU Queue Contents For SITOR Scenario

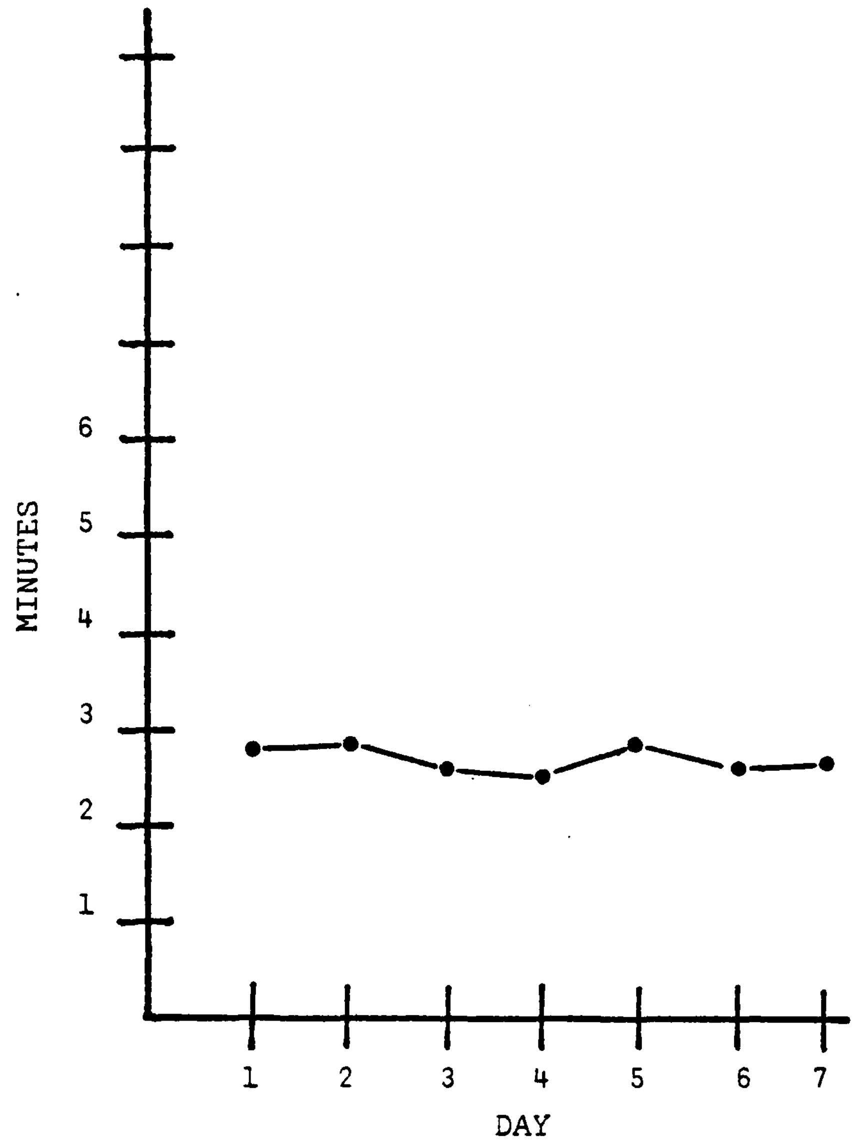


Figure 6.12 Average Message Transit Time For
SITOR Scenario

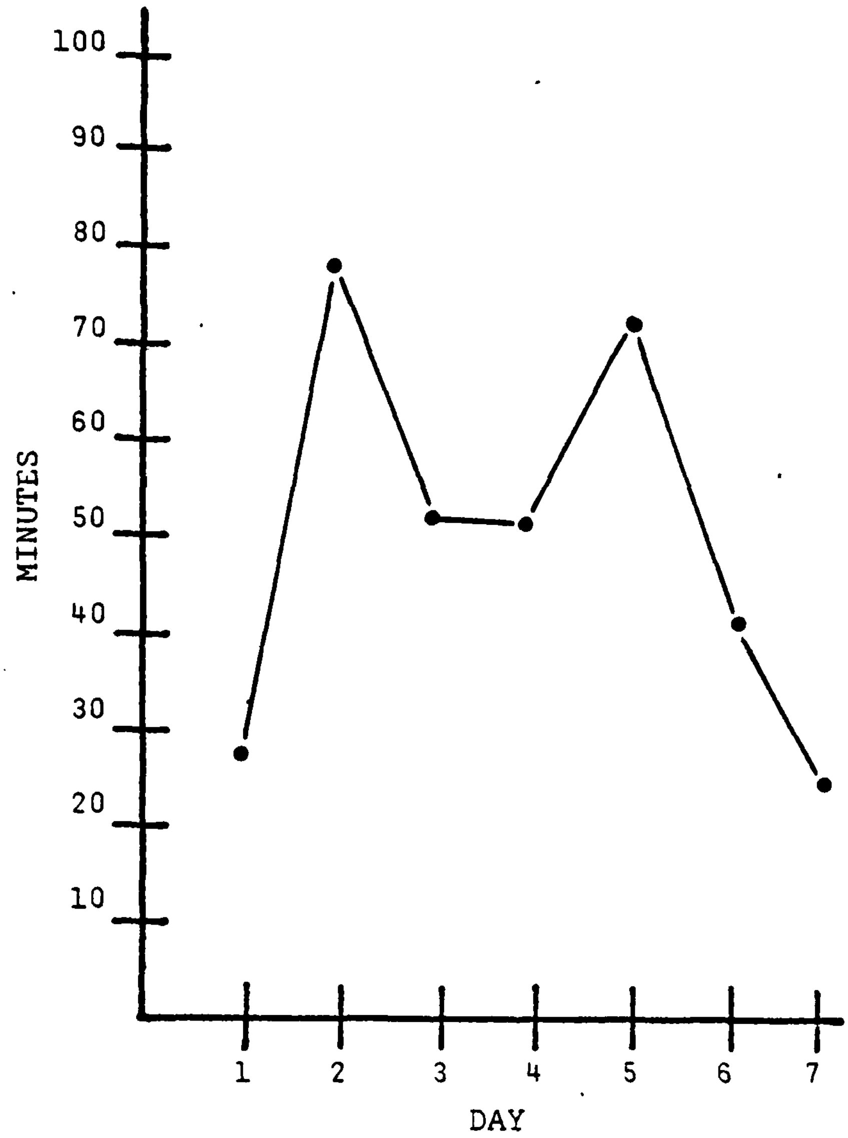


Figure 6.13 Maximum Message Transit Time For SITOR Scenario

VII. SUMMARY AND CONCLUSIONS

A. SUMMARY

The results of the model simulation for the baseline case in Chapter III showed the maximum contents of the CPU queue over a 7 day period to be 4 messages at any one given time. The average transit time for messages in the model was between 2 and 3 minutes with the maximum message transit time found to be less than 80 minutes.

The sensitivity analysis performed on the message interarrival rate revealed a dramatic increase in the maximum CPU contents when the traffic load was increased over 150 percent (Throughput State III) from the baseline case (Throughput State I). Significant increases were also noted in the average and maximum message transit times.

A shift in the message destination probability distribution was found to insignificantly change the output statistics from the baseline results.

B. CONCLUSIONS

Based upon the results of the model simulations for various increases in traffic throughput, the proposed MSS should perform well within the specified operational requirements presented in Chapter III. Single CPU operation will be efficient up to a throughput increase of 150 percent. Above that level, utilization of the secondary CPU will be necessary to maintain satisfactory processing of message traffic in the system.

It should be noted that this was the first attempt to model the proposed MSS. As such, the model was very useful for simple analyses, but should the need for a more detailed analysis arise, a better model will be necessary.

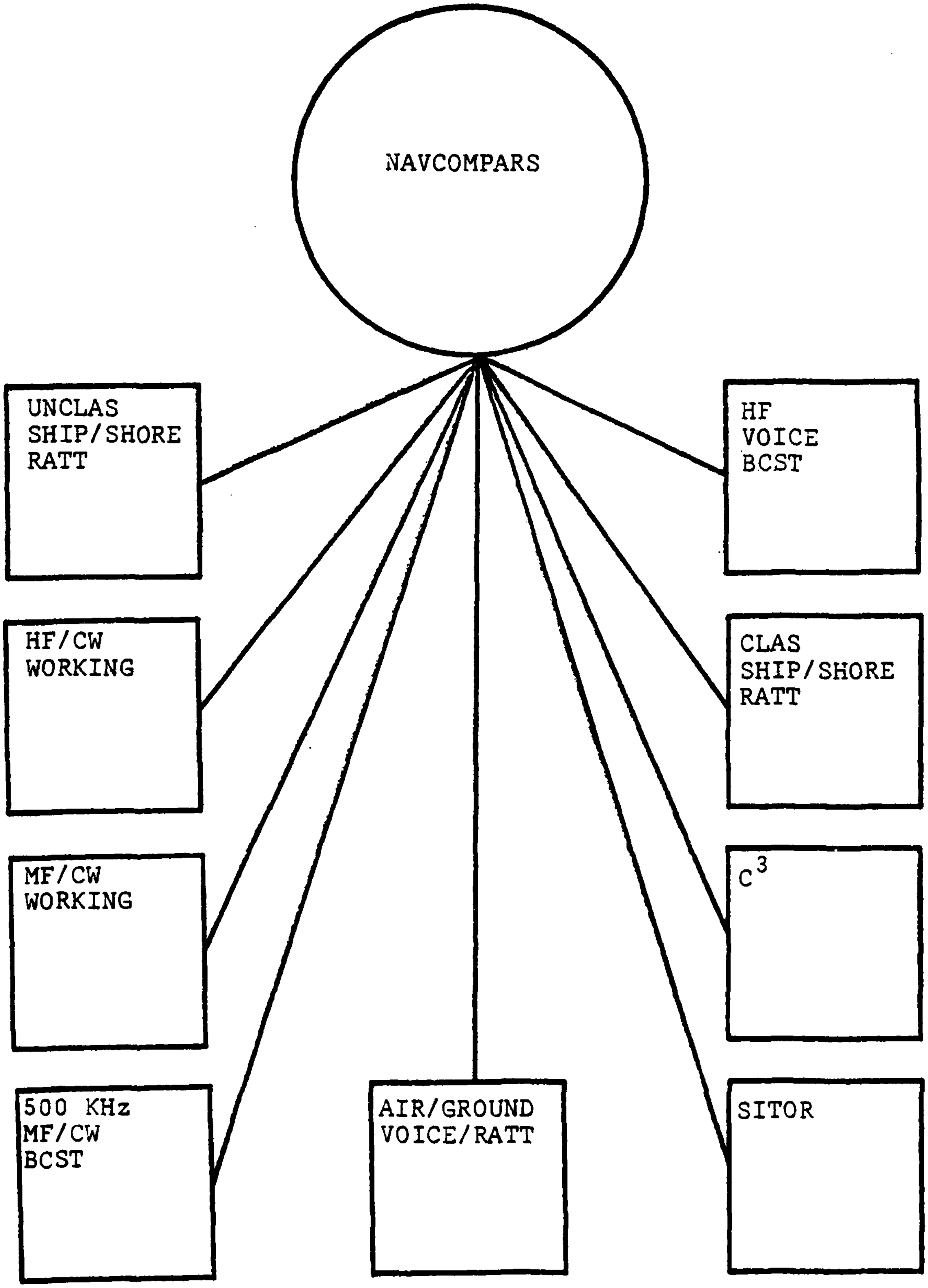
APPENDIX A

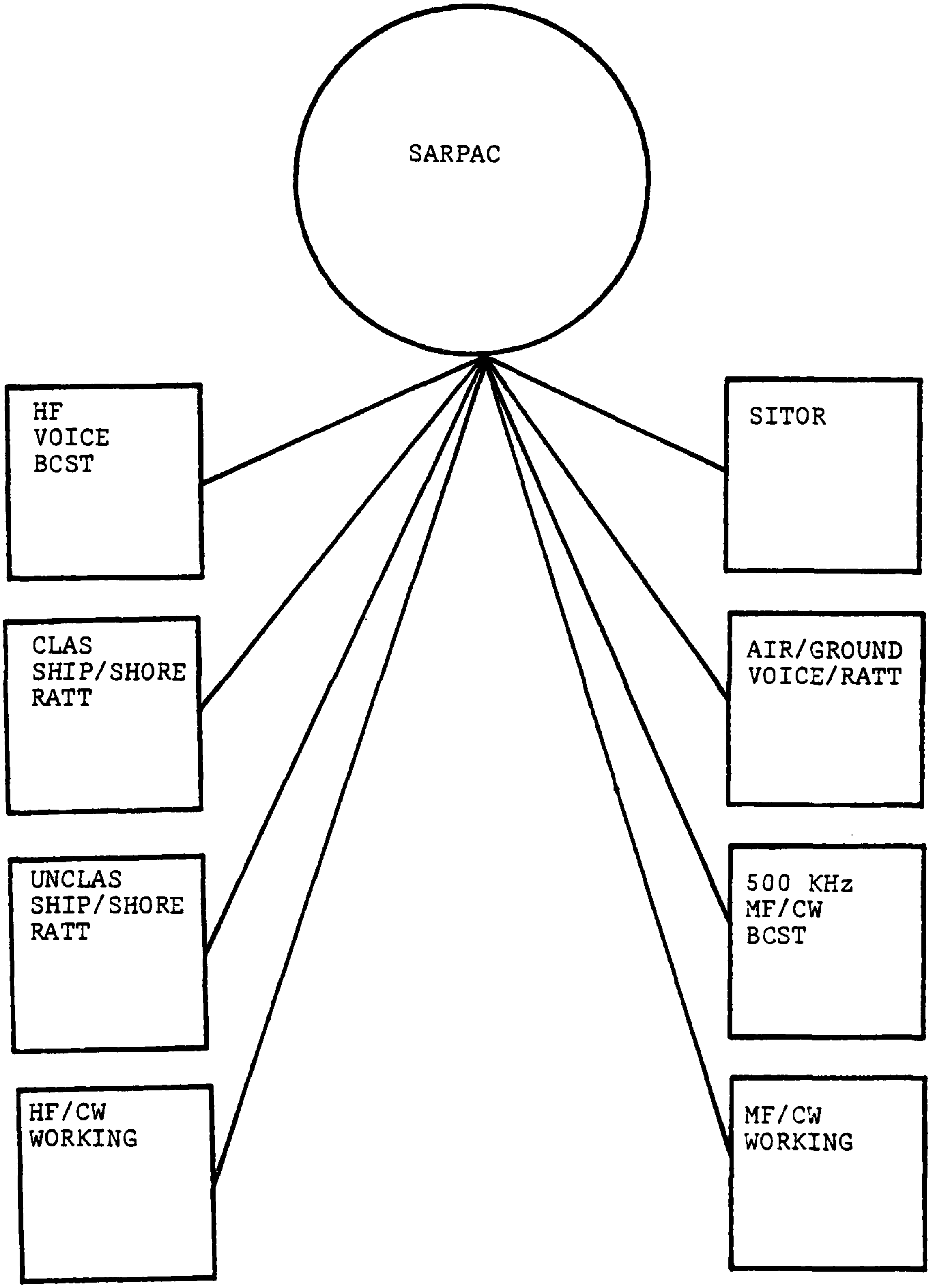
This appendix contains the Personnel Allowance List for COMMSTA San Francisco.

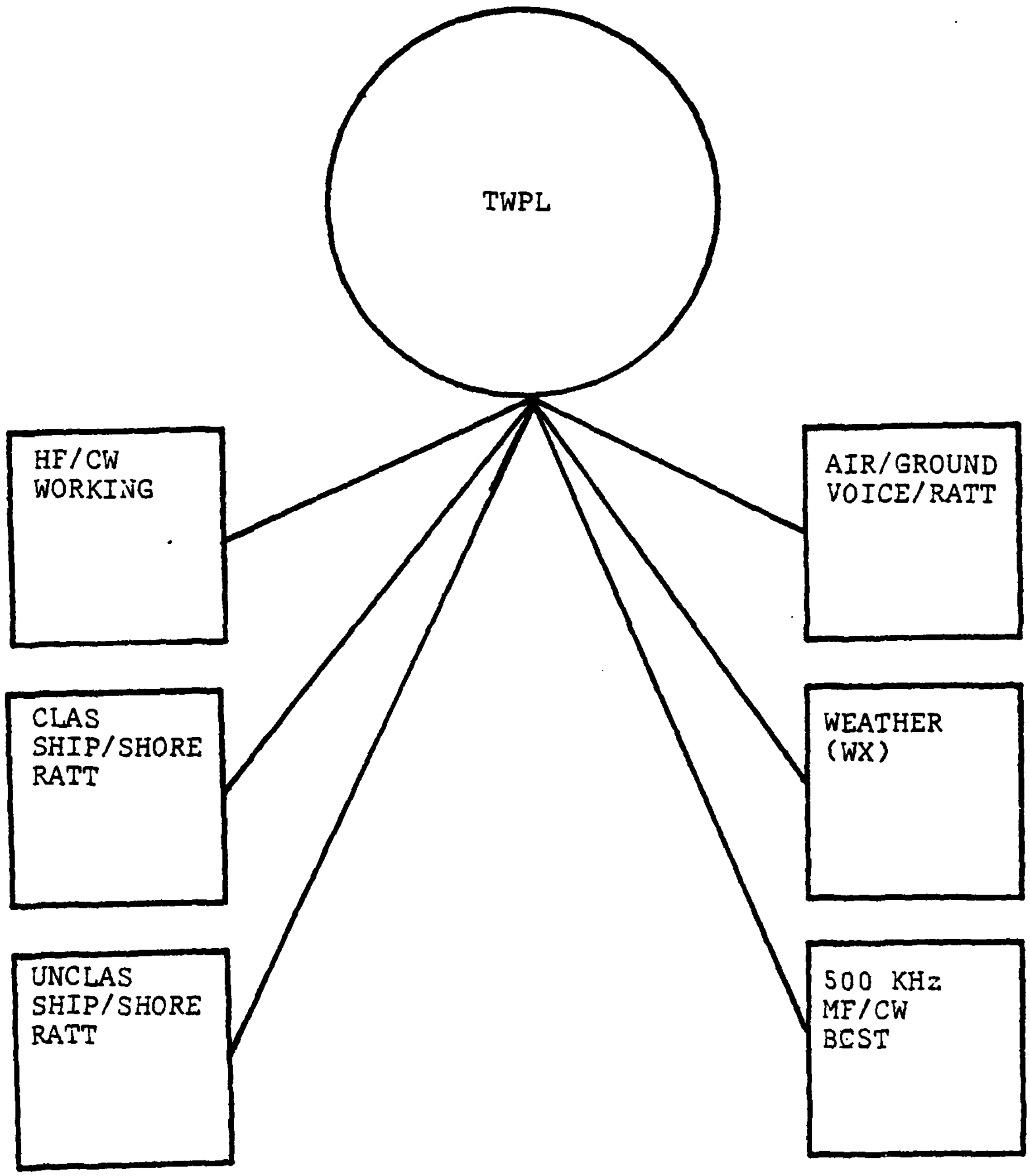
	CDR	LT	CWO	E-9	E-8	E-7	E-6	E-5	E-4	E-3	CIV	TOTALS
CO	1											1
XO		1										1
EMO			1									1
OPS			1									1
PWO			1									1
RM				1		4	10	10	25			50
ET					1	1	5		8			15
ETN								1	1			2
TT							1		1			2
SS							1	1	1			3
DC								1				1
EM									1			1
MK							1	1				2
YN							1	1				2
SK								1				1
SN										6		6
FN										2		2
WAGE BOARD											1	1
TOTALS	1	1	3	1	1	5	19	16	37	8	1	93

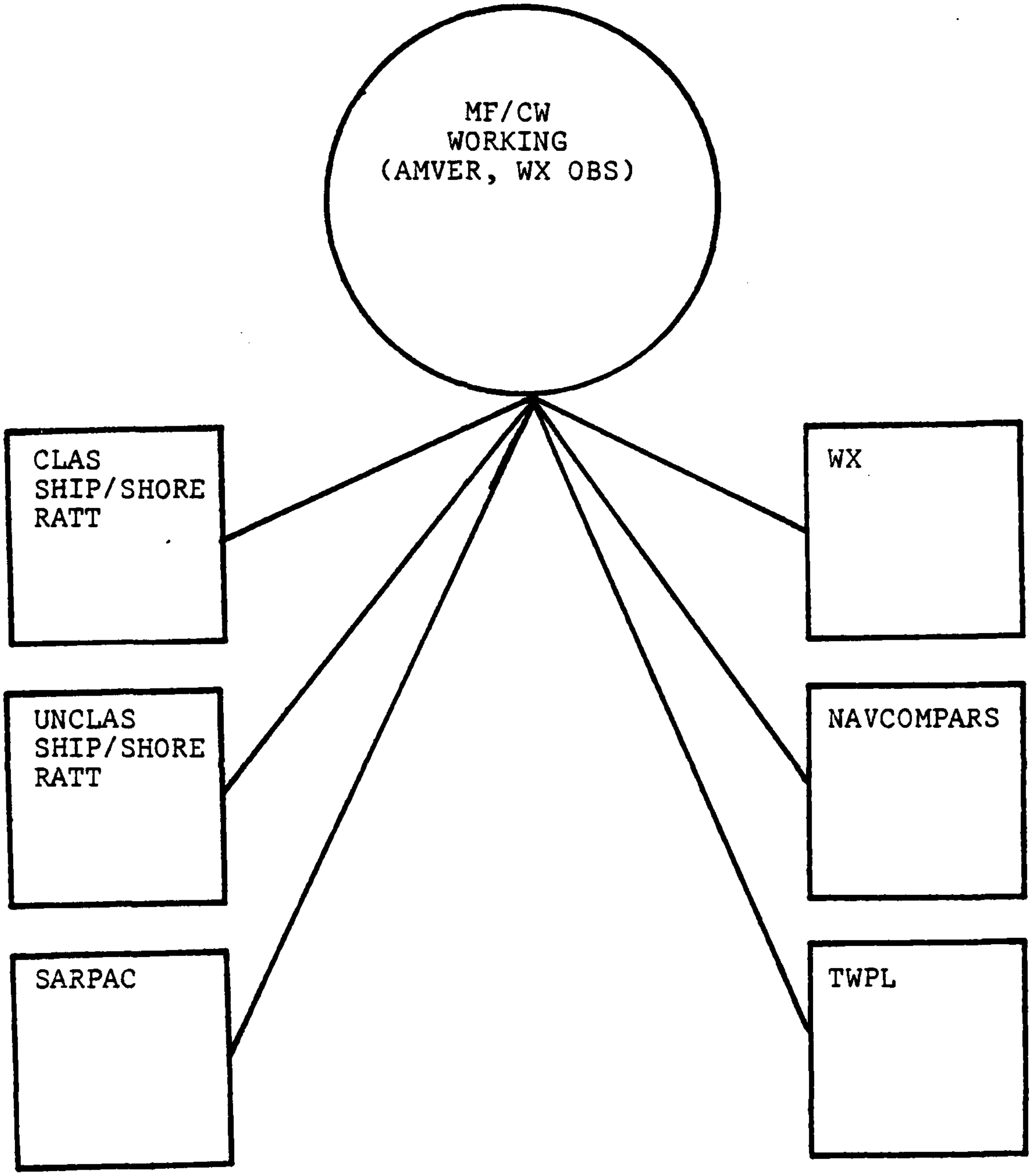
APPENDIX B

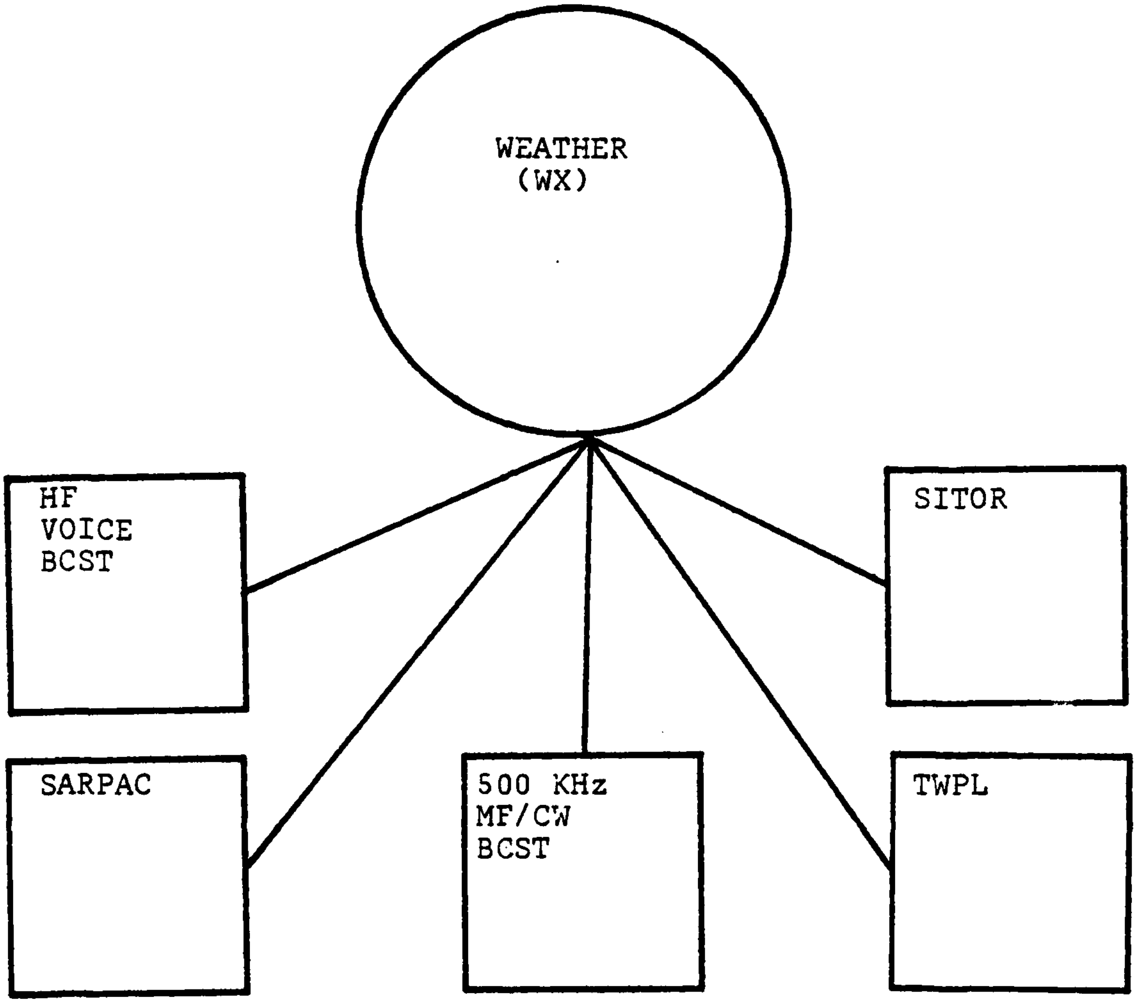
This appendix contains the traffic flow diagrams that were used in designing the simulation model for COMMSTA San Francisco.

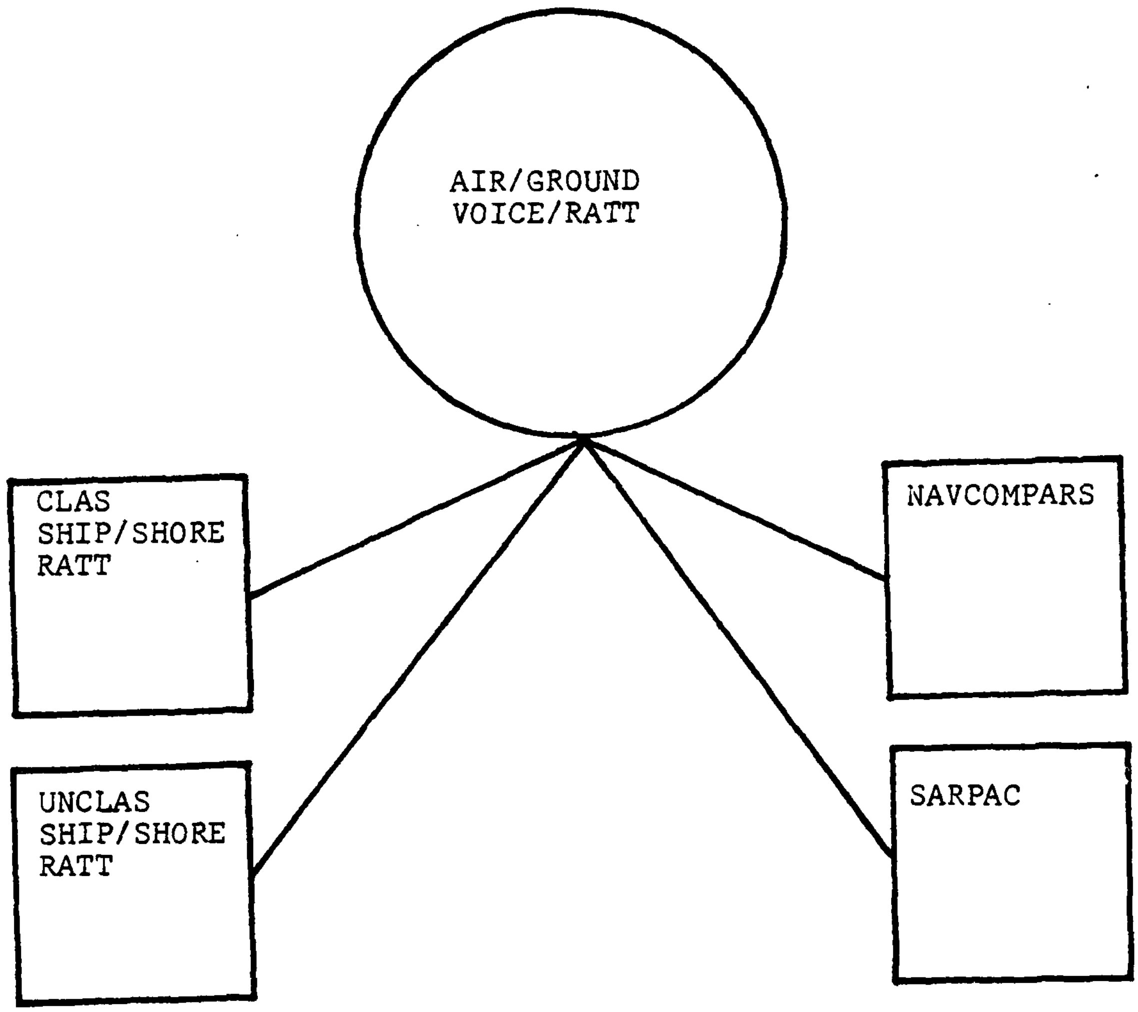

NAVCOMPARS
UNCLAS SHIP/SHORE RATT
HF VOICE BCST
HF/CW WORKING
CLAS SHIP/SHORE RATT
MF/CW WORKING
C^3
500 KHz MF/CW BCST
AIR/GROUND VOICE/RATT
SITOR

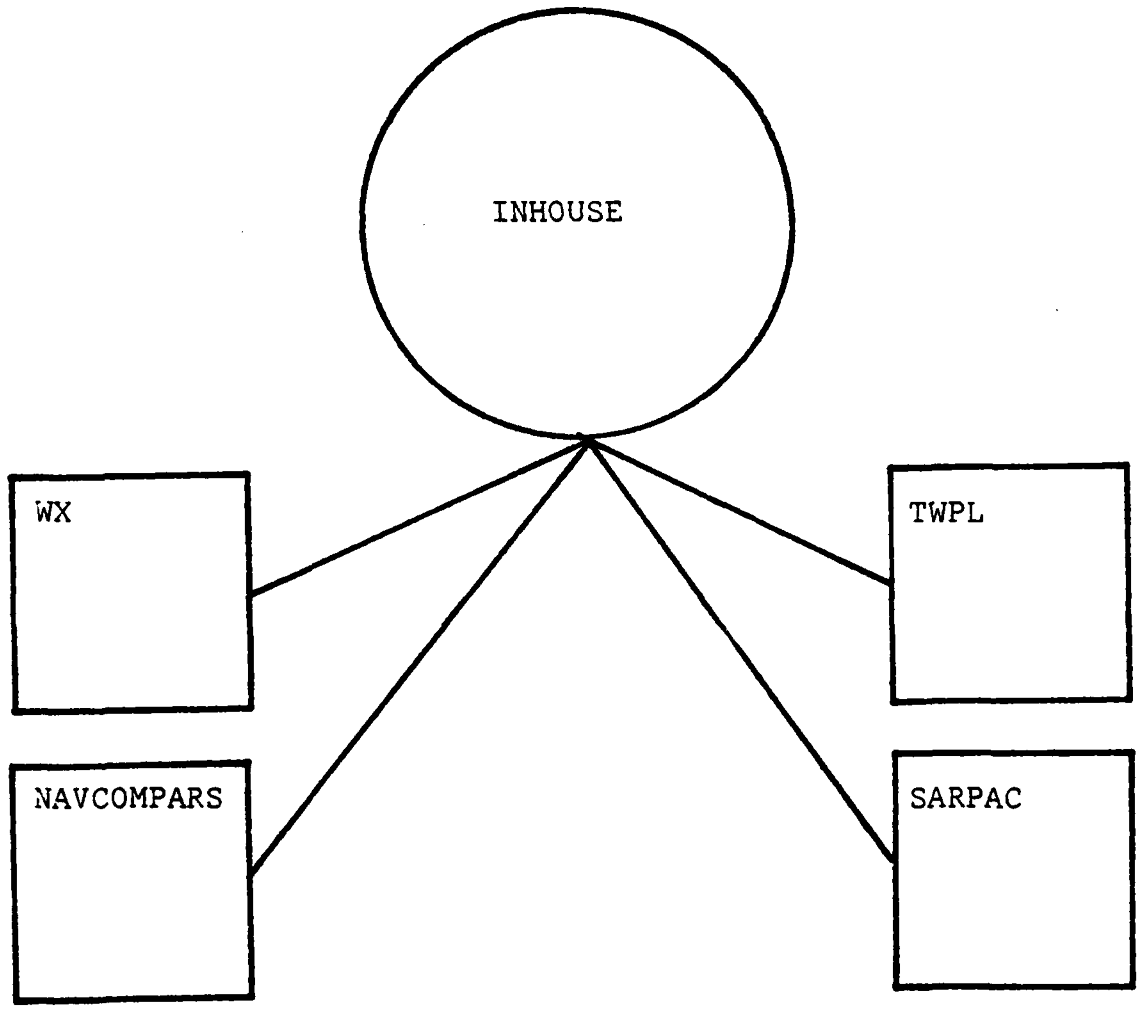

SARPAC
HF
VOICE
BCST
CLAS
SHIP/SHORE
RATT
UNCLAS
SHIP/SHORE
RATT
HF/CW
WORKING
SITOR
AIR/GROUND
VOICE/RATT
500 KHz
MF/CW
BCST
MF/CW
WORKING

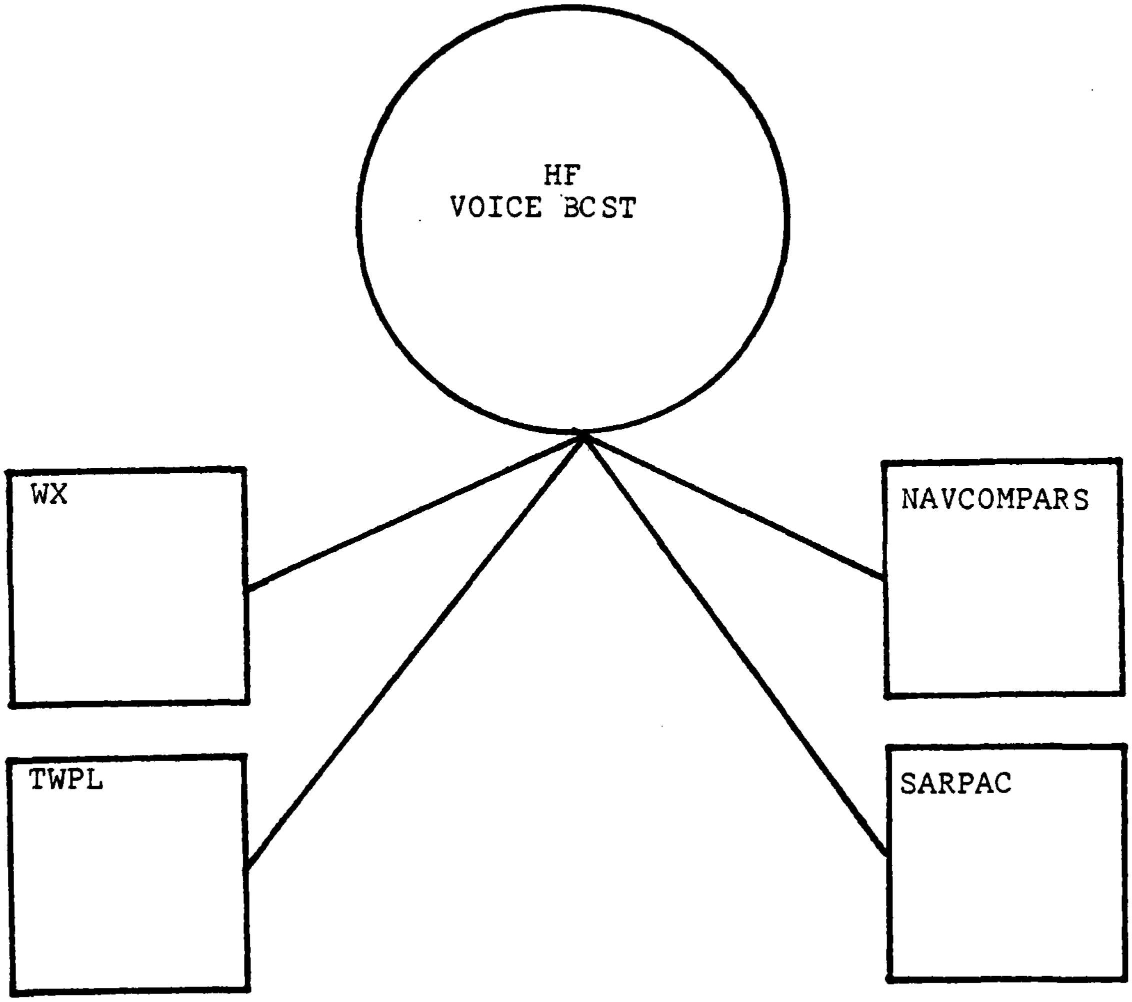

TWPL
HF/CW WORKING
CLAS SHIP/SHORE RATT
UNCLAS SHIP/SHORE RATT
AIR/GROUND VOICE/RATT
WEATHER (WX)
500 KHz MF/CW BCST

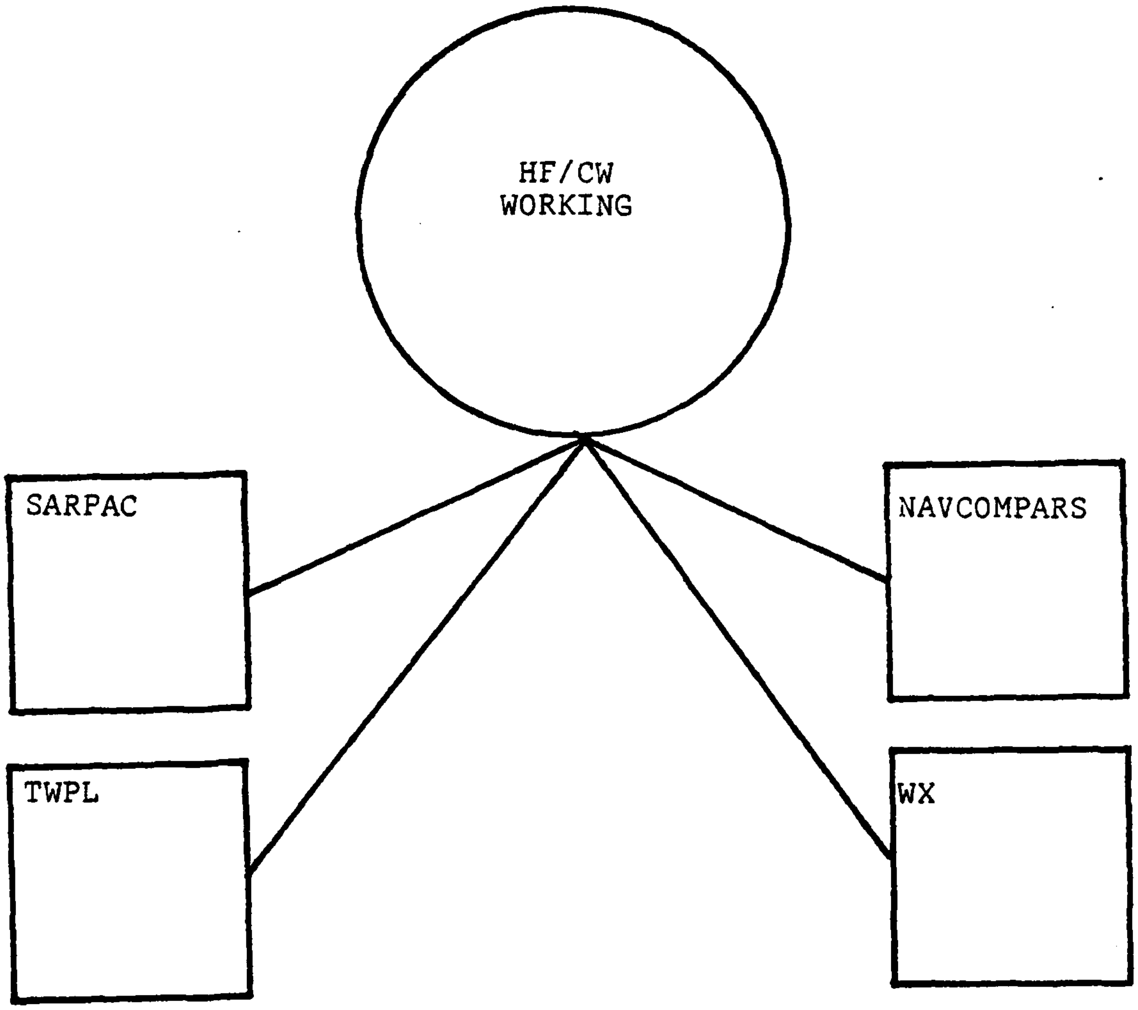

MF/CW
WORKING
(AMVER, WX OBS)
CLAS
SHIP/SHORE
RATT
UNCLAS
SHIP/SHORE
RATT
SARPAC
WX
NAVCOMPARS
TWPL

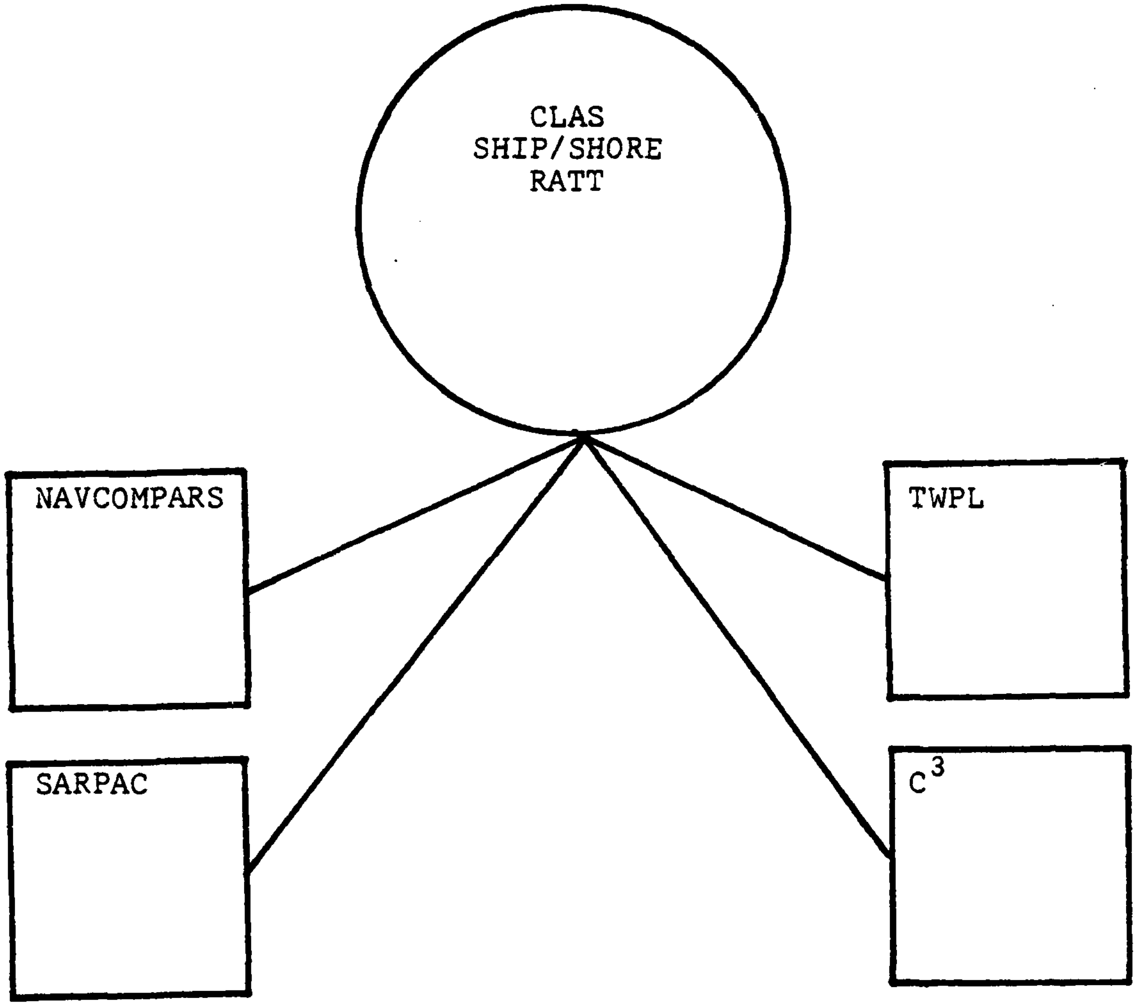

WEATHER
(WX)
HF
VOICE
BCST
SITOR
SARPAC
500 KHz
MF/CW
BCST
TWPL

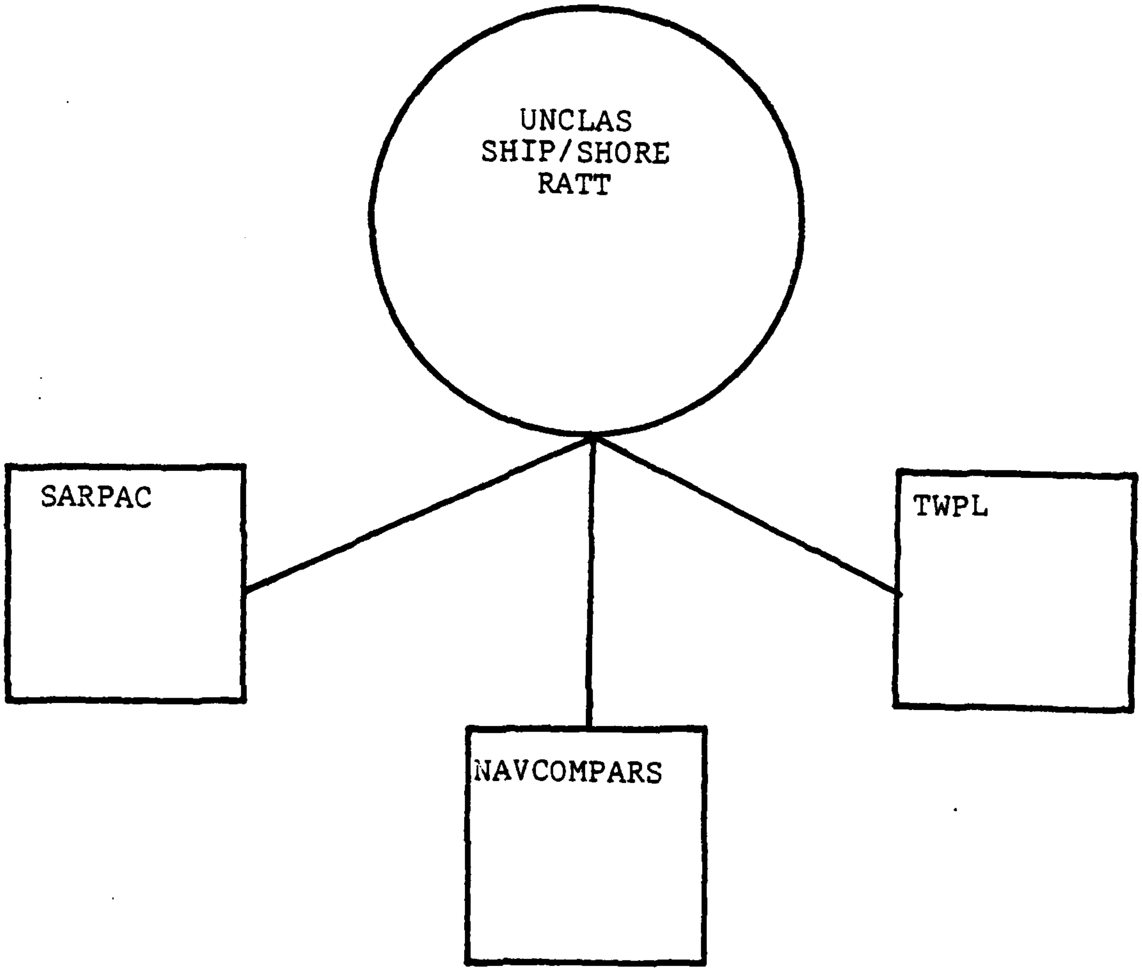

AIR/GROUND
VOICE/RATT
CLAS
SHIP/SHORE
RATT
UNCLAS
SHIP/SHORE
RATT
NAVCOMPARS
SARPAC

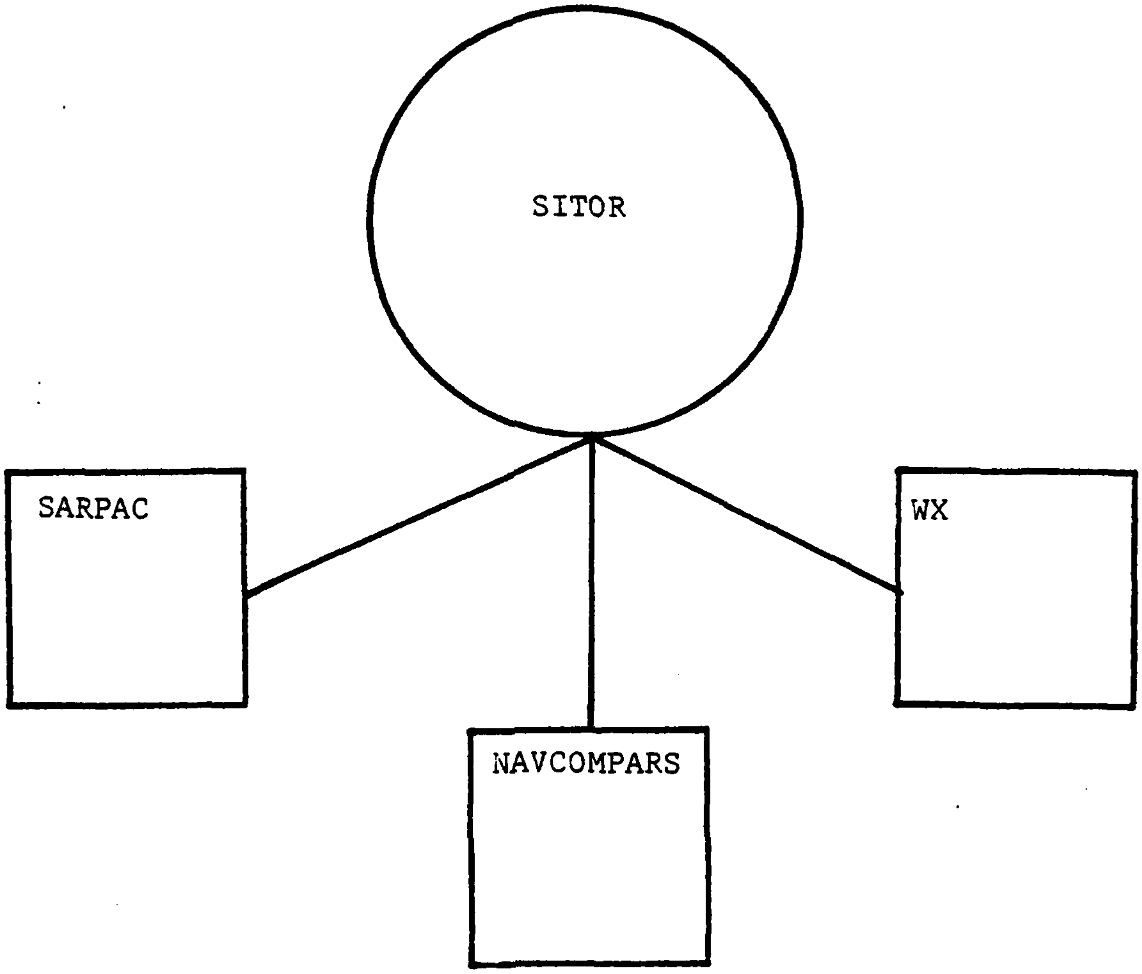

INHOUSE
WX
NAVCOMPARS
TWPL
SARPAC

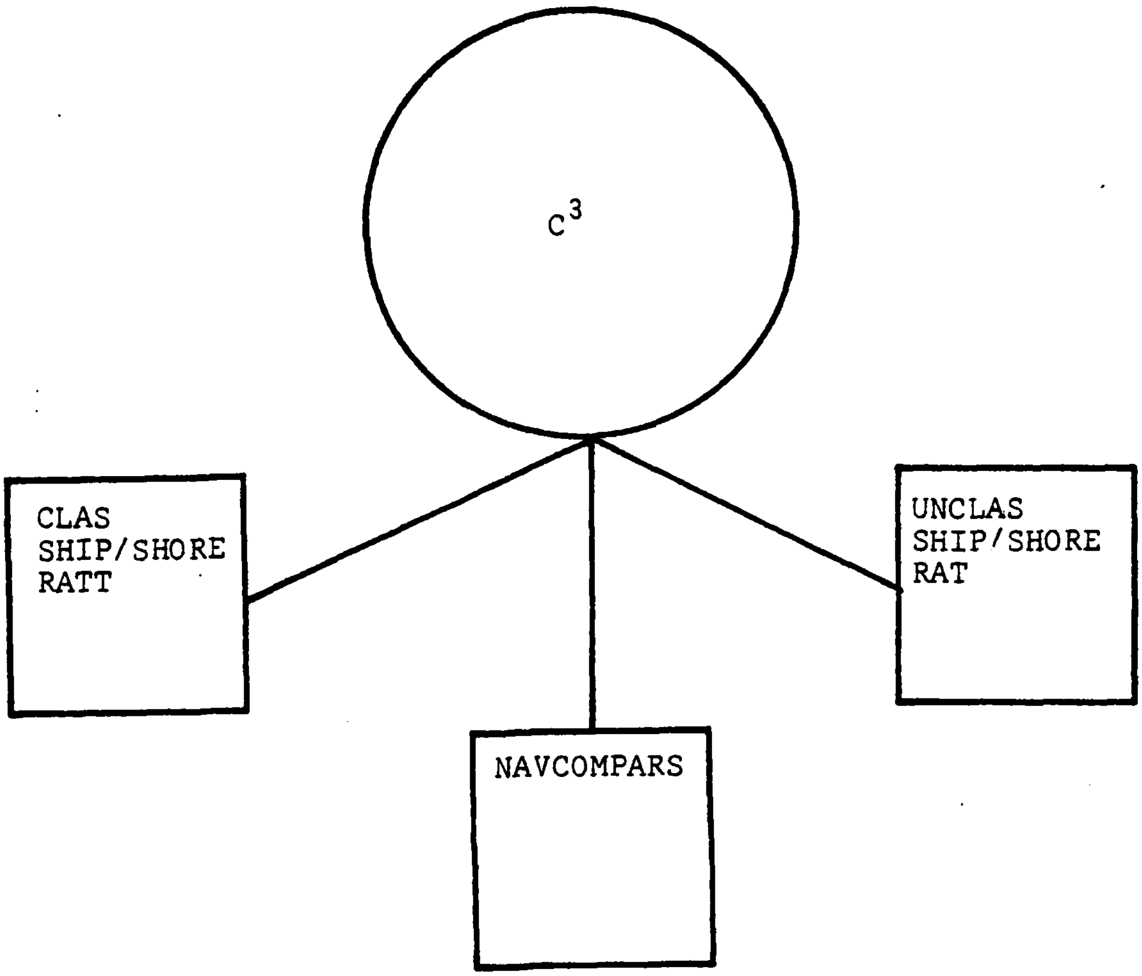

HF
VOICE BCST
WX
TWPL
NAVCOMPARS
SARPAC


HF/CW
WORKING
SARPAC
NAVCOMPARS
TWPL
WX


CLAS
SHIP/SHORE
RATT
NAVCOMPARS
TWPL
SARPAC
C^3


UNCLAS
SHIP/SHORE
RATT
SARPAC
TWPL
NAVCOMPARS


SITOR
SARPAC
WX
NAVCOMPARS


C^3
CLAS
SHIP/SHORE
RATT
NAVCOMPARS
UNCLAS
SHIP/SHORE
RAT

APPENDIX C

This appendix contains a copy of the form that was used in collecting the statistics from the COMMSTA daily traffic files that were needed as inputs to the simulation model.

Communication System:			VIA									
TOR	Precedence	Length	TOT	Unclas Ship/Shore	Clas Ship/Shore	HF/CW Working	MF/CW Working	500 KHz MF/CW BCST	HF BCST Voice	Air/Ground Voice/RATT	SITOR	C^3

APPENDIX D

This appendix contains summaries of the statistics collected from COMMSTA San Francisco for the period 1 to 7 July 1982.

SARPAC Statistics

Arrival Interval	No. of Msgs	Relative Frequency	Cumulative Frequency
0 - 99	5	.63	.63
100 - 199	0	.00	.63
200 - 299	2	.25	.88
300 - 399	0	.00	.88
400 - 499	0	.00	.88
500 - 599	0	.00	.88
600 - 699	0	.00	.88
700 - 799	1	.13	1.00

Message Length	No. of Msgs	Relative Frequency	Cumulative Frequency
0 - 9	2	.22	.22
10 - 19	3	.33	.55
20 - 29	2	.22	.77
30 - 39	1	.11	.88
40 - 49	1	.11	1.00

Message Precedence	No. of Msgs	Relative Frequency	Cumulative Frequency
Z	0	.00	.00
O	1	.25	.25
P	2	.50	.75
R	1	.25	1.00

Message Destination	No. of Msgs	Relative Frequency	Cumulative Frequency
MF/CW	1	.20	.20
CLAS S/S	1	.20	.40
UNCLAS S/S	1	.20	.60
HF BCST	1	.20	.80
500 KHZ	1	.20	1.00

MF/CW Statistics

Arrival Interval	No. of Msgs	Relative Frequency	Cumulative Frequency
0 - 24	41	.76	.76
25 - 49	6	.11	.87
50 - 74	2	.04	.91
75 - 99	2	.04	.95
100 - 124	1	.02	.97
125 - 149	0	.00	.97
150 - 174	0	.00	.97
175 - 199	0	.00	.97
200 - 224	1	.02	.98
225 - 249	0	.00	.98
250 - 274	1	.02	1.00

Message Length	No. of Msgs	Relative Frequency	Cumulative Frequency
0 - 4	52	.93	.93
5 - 9	1	.02	.95
10 - 14	1	.02	.97
15 - 19	2	.03	1.00

Message Precedence	No. of Msgs	Relative Frequency	Cumulative Frequency
P	34	.89	.89
R	4	.11	1.00

Message Destination	No. of Msgs	Relative Frequency	Cumulative Frequency
NAVCOMPARS	13	.32	.32
SARPAC	15	.37	.69
CLAS S/S	1	.02	.71
UNCLAS S/S	2	.05	.76
WEATHER	9	.22	.98
INHOUSE	1	.02	1.00

HF/CW Statictics

Arrival Interval	No. of Msgs	Relative Frequency	Cumulative Frequency
0 - 9	79	.75	.75
10 - 19	16	.15	.90
20 - 29	4	.04	.94
30 - 39	4	.04	.98
40 - 49	0	.00	.98
50 - 59	2	.02	1.00

Message Length	No. of Msgs	Relative Frequency	Cumulative Frequency
0 - 4	110	.94	.94
5 - 9	0	.00	.94
10 - 14	0	.00	.94
15 - 19	0	.00	.94
20 - 24	7	.06	1.00

Message Precedence	No. of Msgs	Relative Frequency	Cumulative Frequency
Z	1	.01	.01
O	1	.01	.02
P	85	.91	.93
R	6	.06	.99

Message Destination	No. of Msgs	Relative Frequency	Cumulative Frequency
NAVCOMPARS	15	.16	.16
SARPAC	24	.25	.41
UNCLAS S/S	1	.01	.99
WEATHER	54	.57	.99
TWPL	1	.01	1.00

CLASSIFIED SHIP/SHORE RATT Statistics

Arrival Interval	No. of Msgs	Relative Frequency	Cumulative Frequency
0 - 9	12	.43	.43
10 - 19	5	.18	.61
20 - 29	0	.00	.61
30 - 39	3	.11	.72
40 - 49	6	.21	.93
50 - 59	1	.04	.97
60 - 69	0	.00	.97
70 - 79	1	.04	1.01

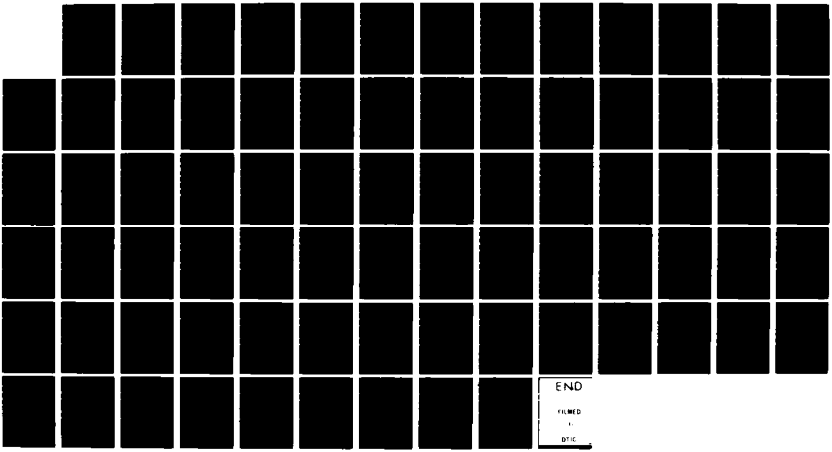
Message Length	No. of Msgs	Relative Frequency	Cumulative Frequency
0 - 9	0	.00	.00
10 - 19	5	.15	.15
20 - 29	15	.45	.60
30 - 39	9	.27	.87
40 - 49	0	.00	.87
50 - 59	1	.03	.90
60 - 69	2	.06	.96
70 - 79	1	.03	.99

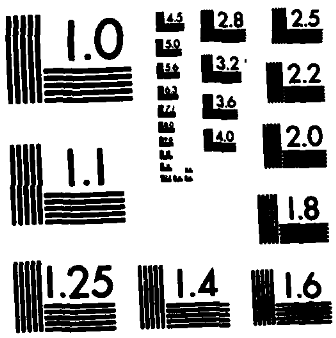
Message Precedence	No. of Msgs	Relative Frequency	Cumulative Frequency
Z	0	.00	.00
O	1	.07	.07
P	9	.60	.67
R	5	.33	1.00

Message Destination	No. of Msgs	Relative Frequency	Cumulative Frequency
NAVCOMPARS	15	.75	.75
SARPAC	1	.05	.80
CLAS S/S	1	.05	.85
UNCLAS S/S	1	.05	.90
WEATHER	1	.05	.95
TWPL	1	.05	1.00

AD-A124 593 A COMMUNICATIONS TRAFFIC FLOW SIMULATION MODEL OF THE MESSAGE SWITCHING SYSTEM(U) NAVAL POSTGRADUATE SCHOOL MONTEREY CA S P WOLF OCT 82 2/2

UNCLASSIFIED F/G 17/2 NL





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

UNCLASS SHIP/SHORE RATT Statistics

Arrival Interval	No. of Msgs	Relative Frequency	Cumulative Frequency
0 - 24	5	.24	.24
25 - 50	7	.33	.57
51 - 74	2	.10	.67
75 - 99	2	.10	.77
100 - 124	3	.14	.91
125 - 149	1	.05	.96
150 - 174	0	.00	.96
175 - 199	0	.00	.96
200 - 224	0	.00	.96
225 - 249	1	.05	1.00

Message Length	No. of Msgs	Relative Frequency	Cumulative Frequency
0 - 9	5	.24	.24
10 - 19	12	.57	.81
20 - 29	3	.14	.95
30 - 39	0	.00	.95
40 - 49	0	.00	.95
50 - 59	1	.05	1.00

Message Precedence	No. of Msgs	Relative Frequency	Cumulative Frequency
Z	0	.00	.00
O	1	.06	.06
P	9	.56	.62
R	6	.38	1.00

Message Destination	No. of Msgs	Relative Frequency	Cumulative Frequency
NAVCOMPARS	13	.76	.76
SARPAC	1	.06	.82
UNCLAS S/S	1	.06	.88
TWPL	1	.06	.94
INHOUSE	1	.06	1.00

WEATHER Statistics

Arrival Interval	No. of Msgs	Relative Frequency	Cumulative Frequency
0 - 24	10	.48	.48
25 - 49	3	.14	.62
50 - 74	2	.10	.72
75 - 99	3	.14	.86
100 - 124	0	.00	.86
125 - 149	0	.00	.86
150 - 174	0	.00	.86
175 - 199	0	.00	.86
200 - 224	0	.00	.86
225 - 249	2	.10	.96
250 - 274	0	.00	.96
275 - 299	0	.00	.96
300 - 324	1	.05	1.01

Message Length	No. of Msgs	Relative Frequency	Cumulative Frequency
0 - 24	4	.17	.17
25 - 49	7	.30	.47
50 - 74	6	.26	.73
75 - 99	1	.04	.77
100 - 124	5	.22	.99

Message Precedence	No. of Msgs	Relative Frequency	Cumulative Frequency
.sp 2 a			
Z	0	.00	.00
C	0	.00	.00
P	12	1.00	1.00
R	0	.00	1.00

Message Destination	No. of Msgs	Relative Frequency	Cumulative Frequency
NAVCOMPARS	1	.06	.06
SARPAC	7	.41	.47
TWPL	1	.06	.53
INHOUSE	1	.06	.59
HF BCST	6	.35	.94
500 KHZ	1	.06	1.00

AIR/GROUND Statistics

Arrival Interval	No. of Msgs	Relative Frequency	Cumulative Frequency
0 - 24	2	.25	.25
25 - 49	2	.25	.50
50 - 74	3	.38	.88
75 - 99	0	.00	.88
100 - 124	0	.00	.88
125 - 149	0	.00	.88
150 - 174	1	.13	1.01

Message Length	No. of Msgs	Relative Frequency	Cumulative Frequency
0 - 9	0	.00	.00
10 - 19	0	.00	.00
20 - 29	5	.56	.56
30 - 39	4	.44	1.00

Message Precedence	No. of Msgs	Relative Frequency	Cumulative Frequency
Z	0	.00	.00
O	7	.88	.88
P	1	.13	1.01
R	0	.00	1.01

Message Destination	No. of Msgs	Relative Frequency	Cumulative Frequency
NAVCOMPARS	4	.25	.25
SARPAC	7	.44	.69
CLAS S/S	1	.06	.75
UNCLAS S/S	4	.25	1.00

SITOR Statistics

Arrival Interval	No. of Msgs	Relative Frequency	Cumulative Frequency
0 - 49	8	.57	.57
50 - 99	4	.29	.86
100 - 149	0	.00	.86
150 - 199	0	.00	.86
200 - 249	0	.00	.86
250 - 299	0	.00	.86
300 - 349	1	.07	.93
350 - 399	0	.00	.93
400 - 449	0	.00	.93
450 - 499	1	.07	1.00

Message Length	No. of Msgs	Relative Frequency	Cumulative Frequency
0 - 4	12	.80	.80
5 - 9	0	.00	.80
10 - 14	1	.07	.87
15 - 19	0	.00	.87
20 - 24	2	.13	1.00

Message Precedence	No. of Msgs	Relative Frequency	Cumulative Frequency
Z	0	.00	.00
O	1	.10	.10
P	8	.80	.90
R	1	.10	1.00

Message Destination	No. of Msgs	Relative Frequency	Cumulative Frequency
NAVCOMPARS	4	.44	.44
SARPAC	1	.11	.55
WEATHER	4	.44	.99

TWPL (DISTRICT LOOP) Statistics

Arrival Interval	No. of Msgs	Relative Frequency	Cumulative Frequency
0 - 19	21	.58	.58
20 - 39	5	.14	.72
40 - 59	1	.03	.75
60 - 79	0	.00	.75
80 - 99	2	.06	.81
100 - 119	4	.11	.92
120 - 139	1	.03	.95
140 - 159	0	.00	.95
160 - 179	2	.06	1.01

Message Length	No. of Msgs	Relative Frequency	Cumulative Frequency
0 - 9	13	.34	.34
10 - 19	6	.16	.50
20 - 29	1	.03	.53
30 - 39	3	.08	.61
40 - 49	11	.29	.90
50 - 59	4	.11	1.00

Message Precedence	No. of Msgs	Relative Frequency	Cumulative Frequency
Z	0	.00	.00
O	4	.20	.20
P	10	.50	.70
R	6	.30	1.00

Message Destination	No. of Msgs	Relative Frequency	Cumulative Frequency
HF/CW	1	.04	.04
UNCLAS S/S	1	.04	.08
WEATHER	16	.67	.75
INHOUSE	4	.17	.92
HF BCST	1	.04	.96
500 KHZ	1	.04	1.00

INHOUSE Statistics

Arrival Interval	No. of Msgs	Relative Frequency	Cumulative Frequency
0 - 24	6	.40	.40
25 - 49	3	.20	.60
50 - 74	3	.20	.80
75 - 99	2	.13	.93
100 - 124	0	.00	.93
125 - 149	0	.00	.93
150 - 174	1	.07	1.00

Message Length	No. of Msgs	Relative Frequency	Cumulative Frequency
0 - 4	0	.00	.00
5 - 9	2	.09	.09
10 - 14	10	.45	.54
15 - 19	4	.18	.72
20 - 24	2	.09	.81
25 - 29	3	.14	.95
30 - 34	1	.05	1.00

Message Precedence	No. of Msgs	Relative Frequency	Cumulative Frequency
Z	0	.00	.00
O	1	.13	.13
P	3	.38	.51
R	4	.50	1.01

Message Destination	No. of Msgs	Relative Frequency	Cumulative Frequency
NAVCOMPARS	3	.30	.30
SARPAC	2	.2	.50
CLAS S/S	1	.10	.60
UNCLAS S/S	1	.10	.70
WEATHER	1	.10	.80
TWPL	2	.20	1.00

HP BROADCAST Statistics

Arrival Interval	No. of Msgs	Relative Frequency	Cumulative Frequency
0 - 49	1	.25	.25
50 - 99	1	.25	.50
100 - 149	0	.00	.50
150 - 199	0	.00	.50
200 - 249	0	.00	.50
250 - 299	0	.00	.50
300 - 349	1	.25	.75
350 - 399	0	.00	.75
400 - 449	1	.25	1.00

Message Length	No. of Msgs	Relative Frequency	Cumulative Frequency
0 - 4	0	.00	.00
5 - 9	1	.25	.25
10 - 14	3	.75	1.00

Message Precedence	No. of Msgs	Relative Frequency	Cumulative Frequency
Z	0	.00	.00
C	0	.00	.00
P	2	1.00	1.00
R	0	.00	1.00

Message Destination	No. of Msgs	Relative Frequency	Cumulative Frequency
NAVCOMPARS	1	.25	.25
SARPAC	1	.25	.50
WEATHER	1	.25	.75
TWPL	1	.25	1.00

COMMAND & CONTROL Statistics

Arrival Interval	No. of Msgs	Relative Frequency	Cumulative Frequency
0 - 100	1	.50	.50
101 - 200	1	.50	1.00

Message Length	No. of Msgs	Relative Frequency	Cumulative Frequency
0 - 24	1	.50	.50
25 - 49	0	.00	.50
50 - 74	1	.50	1.00

Message Precedence	No. of Msgs	Relative Frequency	Cumulative Frequency
Z	0	.00	.00
O	0	.00	.00
P	2	.66	.66
R	1	.34	1.00

Message Destination	No. of Msgs	Relative Frequency	Cumulative Frequency
NAVCOMPARS	1	.50	.50
SARPAC	1	.50	1.00

APPENDIX E

This appendix contains the program listing for the simulation model that was designed to simulate the proposed MSS.

```
BLOCK                                                                              STATEMENT
NUMBER  *LOC   OPERATION  A,B,C,D,E,F,G,H,I        COMMENTS                          NUMBER
               SIMULATE
        *      THIS IS A GPSS PROGRAM WRITTEN TO SIMULATE THE TRAFFIC FLOW AT THE
        *      UNITED STATES COAST GUARD COMMUNICATIONS STATION SAN FRANCISCO LOCATED
        *      AT POINT REYES, CALIFORNIA.  THIS IS BEING DONE AS A PART OF MY THESIS
        *      TO MODEL THE PROPOSED MESSAGE SWITCHING SYSTEM (MSS) UNDER DEVELOPMENT
        *      BY THE 12TH COAST GUARD DISTRICT.  USING TRAFFIC FLOW STATISTICS
        *      RECENTLY GATHERED AT THE STATION AS INPUTS TO THE MODEL, MY THESIS WILL
        *      ANALYZE THE RESULTS AND OBSERVE GENERAL TRENDS IN THE MODEL TO ASSIST
        *      IN THE DEVELOPMENT OF DESIGN PARAMETERS FOR THE MSS.  THIS WILL, I HOPE,
        *      CULMINATE IN A SYSTEM THAT WILL MEET THE PRESENT AND FUTURE NEEDS OF
        *      COMMUNICATIONS AT COMMSTA SAN FRANCISCO.
        *
        *
        *
        *
        *      THE FOLLOWING FUNCTIONS DEFINE THE MESSAGE STATISTICS TO BE USED
        *      THROUGHOUT THIS SIMULATION.
        *
        *
        *
        *      STATISTICS FOR NAVCOMPARS MESSAGE INTERARRIVAL RATE (ANCPR), MESSAGE
        *      PRIORITY (PNCPR), MESSAGE DESTINATION (DNCPR), AND MESSAGE LENGTH
        *      (LNCPR).
        *
        ANCPR FUNCTION    RN1,C6
        .32,10/.70,20/.86,30/.93,40/.95,50/1,60
        PNCPR FUNCTION    RN1,D4
        .38,1/.86,2/.98,3/1,4
        DNCPR FUNCTION    RN1,D9
        .03,3/.06,4/.30,5/.65,6/.66,8/.69,9/.94,11/.97,12/1,14
        LNCPR FUNCTION    RN1,C5
        .45,20/.80,40/.85,60/.89,140/1,160
        *
        *
        *
        *      STATISTICS FOR SARPAC MESSAGE INTERARRIVAL (ASARP), MESSAGE PRIORITY
        *      (PSARP), MESSAGE DESTINATION (DSARP), AND MESSAGE LENGTH (LSARP).
        *
        ASARP FUNCTION    RN2,C3
        .63,200/.88,700/1,800
        PSARP FUNCTION    RN2,D3
        .25,1/.75,2/1,3
        DSARP FUNCTION    RN2,D5
        .2,3/.4,5/.6,6/.8,12/1,14
        LSARP FUNCTION    RN2,C5
        .22,10/.55,20/.77,30/.88,40/1,50
        *
        *
        *
        *      STATISTICS FOR MF/CW MESSAGE INTERARRIVALS (AMFCW), MESSAGE PRIORITY
        *      (PMFCW), MESSAGE DESTINATION (DMFCW), AND MESSAGE LENGTH (LMFCW).
        *
        AMFCW FUNCTION    RN3,C7
        .76,25/.87,50/.91,75/.95,100/.97,200/.98,250/1,275
        PMFCW FUNCTION    RN3,D2
        .11,1/1,2
```

```
 DMFCW FUNCTION    RN3,D6
.32,1/.69,2/.71,5/.76,6/.98,7/1,11
 LMFCW FUNCTION    RN3,C4
.93,5/.95,10/.97,15/1,20
*
*
*
*      STATISTICS FOR HF/CW MESSAGE INTERARRIVALS (AHFCW), MESSAGE PRIORITY
*      (PHFCW), MESSAGE DESTINATION (DHFCW), AND MESSAGE LENGTH (LHFCW).
*
 AHFCW FUNCTION    RN4,C5
.75,10/.90,20/.94,30/.98,50/1,60
 PHFCW FUNCTION    RN4,D4
.07,1/.98,2/.99,3/1,4
 DHFCW FUNCTION    RN4,D5
.16,1/.41,2/.42,6/.99,7/1,10
 LHFCW FUNCTION    RN4,C2
.94,20/1,25
*
*
*
*      STATISTICS FOR CLASSIFIED SHIP/SHORE MESSAGE INTERARRIVALS (ACLAS),
*      MESSAGE PRIORITY (PCLAS), MESSAGE DESTINATION (DCLAS), AND MESSAGE
*      LENGTH (LCLAS).
*
 ACLAS FUNCTION    RN6,C6
.43,10/.61,30/.72,40/.93,50/.97,70/1,80
 PCLAS FUNCTION    RN6,D3
.33,1/.93,2/1,3
 DCLAS FUNCTION    RN6,D6
.75,1/.80,2/.85,5/.90,6/.95,7/1,10
 LCLAS FUNCTION    RN6,C6
.15,20/.60,30/.87,50/.90,60/.96,70/1,80
*
*
*
*      STATISTICS FOR UNCLASSIFIED SHIP/SHORE MESSAGE INTERARRIVALS (AUNCL),
*      MESSAGE PRIORITY (PUNCL), MESSAGE DESTINATION (DUNCL), AND MESSAGE
*      LENGTH (LUNCL).
*
 AUNCL FUNCTION    RN5,C7
.24,25/.57,50/.67,75/.77,100/.91,125/.96,225/1,250
 PUNCL FUNCTION    RN5,D3
.38,1/.94,2/1,3
 DUNCL FUNCTION    RN5,D5
.76,1/.82,2/.88,6/.94,10/1,11
 LUNCL FUNCTION    RN5,C4
.24,10/.81,20/.95,50/1,60
*
*
*
*      STATISTICS FOR WEATHER MESSAGE INTERARRIVALS (AWX), MESSAGE DESTINATION
*      (DWX), AND MESSAGE LENGTH (LWX).
*
 AWX   FUNCTION    RN7,C6
.48,25/.62,50/.72,75/.86,225/.96,300/1,325
 DWX   FUNCTION    RN7,D6
.06,1/.47,2/.53,10/.59,11/.94,12/1,14
```

```
LWX    FUNCTION    RN7,C5
.17,25/.47,50/.73,75/.77,100/1,125
*
*
*      STATISTICS FOR AIR/GROUND MESSAGE INTERARRIVALS (AARGN), MESSAGE
*      PRIORITY (PARGN), MESSAGE DESTINATION (DARGN), AND MESSAGE LENGTH
*      (LARGN).
*
AARGN FUNCTION    RN8,C4
.25,25/.50,50/.88,150/1,175
PARGN FUNCTION    RN7,D2
.13,2/1,3
DARGN FUNCTION    RN8,D4
.25,1/.69,2/.75,5/1,6
LARGN FUNCTION    RN8,C3
0,20/.56,30/1,40
*
*
*
*      STATISTICS FOR SITOR MESSAGE INTERARRIVALS (ASITR), MESSAGE PRIORITY
*      (PSITR), MESSAGE DESTINATION (DSITR), AND MESSAGE LENGTH (LSITR).
*
ASITR FUNCTION    RN1,C4
.57,50/.86,303/.93,450/1,500
PSITR FUNCTION    RN8,D3
.1,1/.9,2/1,3
DSITR FUNCTION    RN1,D3
.44,1/.55,2/1,7
LSITR FUNCTION    RN1,C3
.80,10/.87,20/1,25
*
*
*
*      STATISTICS FOR TWPL MESSAGE INTERARRIVALS (ATWPL), MESSAGE PRIORITY
*      (PTWPL), MESSAGE DESTINATION (DTWPL), AND MESSAGE LENGTH (LTWPL).
*
ATWPL FUNCTION    RN2,C7
.58,20/.72,40/.75,80/.81,100/.92,120/.95,160/1,180
PTWPL FUNCTION    RN1,D3
.3,1/.8,2/1,3
DTWPL FUNCTION    RN2,C6
.04,4/.08,6/.75,7/.92,11/.96,12/1,14
LTWPL FUNCTION    RN2,C6
.34,10/.50,20/.53,30/.61,40/.90,50/1,60
*
*
*
*      STATISTICS FOR INHOUSE MESSAGE INTERARRIVALS (AINHS), MESSAGE PRIORITY
*      (PINHS), MESSAGE DESTINATION (DINHS), AND MESSAGE LENGTH (LINHS).
*
AINHS FUNCTION    RN3,C5
.4,25/.6,50/.8,75/.93,150/1,175
PINHS FUNCTION    RN2,D3
.5,1/.88,2/1,3
DINHS FUNCTION    RN3,D6
```

```
.3,1/.5,2/.6,5/.7,6/.8,7/1,10
 LINHS FUNCTION   RN3,C7
0,5/.09,10/.54,15/.72,20/.81,25/.95,30/1,35
*
*
*
*       STATISTICS FOR HF BROADCAST MESSAGE INTERARRIVALS (ABCST), MESSAGE
*       DESTINATION (DBCST), AND MESSAGE LENGTH (LBCST).
*
 ABCST FUNCTION   RN4,C4
.25,50/.5,300/.75,400/1,450
 DBCST FUNCTION   RN4,D4
.25,1/.50,2/.75,7/1,10
 LBCST FUNCTION   RN4,C3
0,5/.25,10/1,15
*
*
*
*       STATISTICS FOR COMMAND CONTROL COMMUNICATIONS MESSAGE INTERARRIVALS
*       (ACCC), MESSAGE PRIORITY (PCCC), MESSAGE DESTINATION (DCCC), AND
*       MESSAGE LENGTH (LCCC).
*
 ACCC  FUNCTION   RN5,C2
.5,100/1,200
 PCCC  FUNCTION   RN3,D2
.34,1/1,2
 DCCC  FUNCTION   RN5,D2
.5,1/1,2
 LCCC  FUNCTION   RN5,C2
.5,50/1,75
*
*
*
*
*       THE FOLLOWING VARIABLES COMPUTE TIME DELAY CREATED BY THE MESSAGE
*       GOING THROUGH THE SYSTEM AS P2*BITS PER CHARACTER/BAUD RATE.
*       P2 IS THE PARAMETER USED FOR MESSAGE LENGTH.
*
*
*
 VMSG1 VARIABLE   P2/212
 VMSG2 VARIABLE   P2/212
 VMSG3 VARIABLE   P2/2
 VMSG4 VARIABLE   P2/2
 VMSG5 VARIABLE   P2/13
 VMSG6 VARIABLE   P2/13
 VMSG7 VARIABLE   P2/212
 VMSG8 VARIABLE   P2/6
 VMSG9 VARIABLE   P2/3
 VMG10 VARIABLE   P2/212
 VMG11 VARIABLE   P2/212
 VMG12 VARIABLE   P2/6
 VMG13 VARIABLE   P2/212
 VMSG  VARIABLE   P4
*
*
*
```

```
*
*        THE FOLLOWING TABLES WILL OUTPUT STATISTICS ON THE ORIGINS OF THE
*        MESSAGES THAT ENTER EACH MESSAGE QUEUE.  P3 IS THE PARAMETER USED
*        TO INDICATE THE PLACE OF ORIGIN FOR EACH INDIVIDUAL MESSAGE.
*
*
*
  TAB1   TABLE       P3,1,1,14
  TAB2   TABLE       P3,1,1,14
  TAB3   TABLE       P3,1,1,14
  TAB4   TABLE       P3,1,1,14
  TAB5   TABLE       P3,1,1,14
  TAB6   TABLE       P3,1,1,14
  TAB7   TABLE       P3,1,1,14
  TAB8   TABLE       P3,1,1,14
  TAB9   TABLE       P3,1,1,14
  TAB10  TABLE       P3,1,1,14
  TAB11  TABLE       P3,1,1,14
  TAB12  TABLE       P3,1,1,14
  TAB13  TABLE       P3,1,1,14
  TAB14  TABLE       P3,1,1,14
  TAB15  TABLE       Q$CPU1,1,1,10
  TAB16  TABLE       MP5,1,1,20
  TAB17  TABLE       MP5,1,1,20
  TAB18  TABLE       MP5,1,1,20
  TAB19  TABLE       MP5,1,1,20
  TAB20  TABLE       MP5,1,1,20
  TAB21  TABLE       MP5,1,1,20
  TAB22  TABLE       MP5,1,1,20
  TAB23  TABLE       MP5,1,1,20
  TAB24  TABLE       MP5,1,1,20
  TAB25  TABLE       MP5,1,1,20
  TAB26  TABLE       MP5,1,1,20
  TAB27  TABLE       MP5,1,1,20
  TAB28  TABLE       MP5,1,1,20
*
*
*
*
*
*        NAVCOMPARS MESSAGES ARE GENERATED AND SENT TO THE PROPER MESSAGE QUEUE.
*
*
*
*
*
1  GENA  GENERATE    FN$ANCPR,,,,FN$PNCPR
2        ASSIGN      1,FN$DNCPR
3        ASSIGN      2,FN$LNCPR
4        ASSIGN      3,1
5        ASSIGN      4,V$VMSG1
6        MARK        5
7        TRANSFER    ,QCPU
*
*
*
*
```

```
           *
           *
           *
           *      SARPAC MESSAGES ARE GENERATED AND ROUTED TO THE PROPER MESSAGE QUEUE.
           *
           *
           *
           *
           *
  8        GENB   GENERATE    FN$ASARP,,,FN$PSARP
  9               ASSIGN      1,FN$DSARP
 10               ASSIGN      2,FN$LSARP
 11               ASSIGN      3,2
 12               ASSIGN      4,V$VMSG2
 13               MARK        5
 14               TRANSFER    ,QCPU
           *
           *
           *
           *
           *
           *
           *
           *      HF/CW MESSAGES ARE GENERATED AND ROUTED TO THE PROPER MESSAGE QUEUE.
           *
           *
           *
           *
           *
 15        GENC   GENERATE    FN$AMFCW,,,FN$PMFCW
 16               ASSIGN      1,FN$DMFCW
 17               ASSIGN      2,FN$LMFCW
 18               ASSIGN      3,3
 19               ASSIGN      4,V$VMSG3
 20               MARK        5
 21               TRANSFER    ,QCPU
           *
           *
           *
           *
           *
           *
           *
           *      HF/CW MESSAGES ARE GENERATED AND ROUTED TO THE PROPER MESSAGE QUEUE.
           *
           *
           *
           *
           *
 22        GEND   GENERATE    FN$AHFCW,,,FN$PHFCW
 23               ASSIGN      1,FN$DHFCW
 24               ASSIGN      2,FN$LHFCW
 25               ASSIGN      3,4
 26               ASSIGN      4,V$VMSG4
 27               MARK        5
 28               TRANSFER    ,QCPU
           *
```

```
        *
        *
        *
        *
        *
        *
        *       CLASSIFIED SHIP/SHORE RATT MESSAGES ARE GENERATED AND ROUTED TO THE
        *       PROPER MESSAGE QUEUE.
        *
        *
        *
        *
29       GENE   GENERATE    FN$ACLAS,,,,FN$PCLAS
30              ASSIGN      1,FN$DCLAS
31              ASSIGN      2,FN$LCLAS
32              ASSIGN      3,5
33              ASSIGN      4,V$VMSG5
34              MARK        5
35              TRANSFER    ,QCPU
        *
        *
        *
        *
        *
        *
        *
        *       UNCLASSIFIED SHIP/SHORE RATT MESSAGES ARE GENERATED AND ROUTED TO THE
        *       PROPER MESSAGE QUEUE.
        *
        *
        *
        *
        *
36       GENF   GENERATE    FN$AUNCL,,,,FN$PUNCL
37              ASSIGN      1,FN$DUNCL
38              ASSIGN      2,FN$LUNCL
39              ASSIGN      3,6
40              ASSIGN      4,V$VMSG6
41              MARK        5
42              TRANSFER    ,QCPU
        *
        *
        *
        *
        *
        *
        *
        *       WEATHER MESSAGES ARE GENERATED AND ROUTED TO THE PROPER MESSAGE QUEUE.
        *
        *
        *
        *
        *
43       GENG   GENERATE    FN$AWX,,,,2
44              ASSIGN      1,FN$DWX
45              ASSIGN      2,FN$LWX
46              ASSIGN      3,7
```

```
47              ASSIGN      4,VSVMSG7
48              MARK        5
49              TRANSFER    ,QCPU
         *
         *
         *
         *
         *
         *
         *
         *      AIR/GROUND MESSAGES ARE GENERATED AND ROUTED TO THE PROPER MESSAGE QUEUE
         *
         *
         *
         *
         *
50       GENH   GENERATE    FN$AARGN,,,,FN$PARGN
51              ASSIGN      1,FN$DARGN
52              ASSIGN      2,FN$LARGN
53              ASSIGN      3,8
54              ASSIGN      4,VSVMSG8
55              MARK        5
56              TRANSFER    ,QCPU
         *
         *
         *
         *
         *
         *
         *
         *      SITOR MESSAGES ARE GENERATED AND ROUTED TO THE PROPER MESSAGE QUEUE.
         *
         *
         *
         *
         *
57       GENI   GENERATE    FN$ASITR,,,,FN$PSITR
58              ASSIGN      1,FN$DSITR
59              ASSIGN      2,FN$LSITR
60              ASSIGN      3,9
61              ASSIGN      4,VSVMSG9
62              MARK        5
63              TRANSFER    ,QCPU
         *
         *
         *
         *
         *
         *
         *
         *      TWPL MESSAGES ARE GENERATED AND ROUTED TO THE PROPER MESSAGE QUEUE.
         *
         *
         *
         *
         *
```

```
64    GENJ   GENERATE   FN$ATWPL,,,FN$PTWPL
65           ASSIGN     1,FN$DTWPL
66           ASSIGN     2,FN$LTWPL
67           ASSIGN     3,10
68           ASSIGN     4,V$VMG10
69           MARK       5
70           TRANSFER   ,QCPU
     *
     *
     *
     *
     *
     *
     *       INHOUSE MESSAGES ARE GENERATED AND ROUTED TO THE PROPER QUEUE.
     *
     *
     *
     *
     *
71    GENK   GENERATE   FN$AINHS,,,FN$PINHS
72           ASSIGN     1,FN$DINHS
73           ASSIGN     2,FN$LINHS
74           ASSIGN     3,11
75           ASSIGN     4,V$VMG11
76           MARK       5
77           TRANSFER   ,QCPU
     *
     *
     *
     *
     *
     *
     *       HF BROADCAST MESSAGES ARE GENERATED AND ROUTED TO THE PROPER MESSAGE
     *       QUEUE.
     *
     *
     *
     *
     *
78    GENL   GENERATE   FN$ABCST,,,,2
79           ASSIGN     1,FN$DBCST
80           ASSIGN     2,FN$LBCST
81           ASSIGN     3,12
82           ASSIGN     4,V$VMG12
83           MARK       5
84           TRANSFER   ,QCPU
     *
     *
     *
     *
     *
     *
     *       COMMAND CONTROL COMMUNICATIONS MESSAGES ARE GENERATED AND ROUTED TO
     *       THE PROPER MESSAGE QUEUE.
```

```
          *
          *
          *
          *
          *
85        GENM   GENERATE   FN$ACCC,,,,FN$PCCC
86               ASSIGN     1,FN$DCCC
87               ASSIGN     2,FN$LCCC
88               ASSIGN     3,13
89               ASSIGN     4,V$VMG13
90               MARK       5
91               TRANSFER   ,QCPU
          *
          *
          *
          *
          *
          *
          *
          *                 DESTINATICN TABLE
          *
          *                  1 = NAVCOMPARS
          *                  2 = SARPAC (SEARCH AND RESCUE PACIFIC)
          *                  3 = MF/CW (MEDIUM FREQUENCY/CARRIER WAVE)
          *                  4 = HF/CW (HIGH FREQUENCY/CARRIER WAVE)
          *                  5 = CLASSIFIED SHIP/SHORE RATT
          *                  6 = UNCLASSIFIED SHIP/SHORE RATT
          *                  7 = WEATHER
          *                  8 = AIR/GRCUND
          *                  9 = SITOR
          *                 10 = TWPL (CISTRICT LOOP)
          *                 11 = INHOUSE
          *                 12 = HF (HIGH FREQUENCY) BROADCAST
          *                 13 = COMMAND CONTROL COMMUNICATIONS (SECURE CG NET)
          *
          *
          *
          *
          *
          *                 PRIORITY TABLE
          *
          *                  1 = ROUTINE
          *                  2 = PRIORITY
          *                  3 = IMMEDIATE
          *                  4 = FLASH
          *
          *
          *
          *
          *      CPU MESSAGE QUEUE
          *
          *
92        QCPU   QUEUE      CPU1
93               SEIZE      CPU
94               DEPART     CPU1
95               TABULATE   TAB14
96               TABULATE   TAB15
```

```
 97              ADVANCE     V$VMSG
 98              ADVANCE     1
 99              RELEASE     CPU
100              TEST NE     P1,1,QNCPR
101              TEST NE     P1,2,CSARP
102              TEST NE     P1,3,QMFCW
103              TEST NE     P1,4,QHFCW
104              TFST NE     P1,5,CCLAS
105              TEST NE     P1,6,QUNCL
106              TEST NE     P1,7,CWX
107              TEST NE     P1,8,QARGN
108              TEST NE     P1,9,QSITR
109              TEST NE     P1,10,QTWPL
110              TEST NE     P1,11,QINHS
111              TEST NE     P1,12,QBCST
112              TRANSFER    ,QCCC
          *
          *
          *
          *
          *
          *      NAVCOMPARS MESSAGE QUEUE
          *
          *
113        QNCPR QUEUE       NCPR1
114              SEIZE       NCPR
115              CEPART      NCPR1
116              TABULATE    TAB1
117              ADVANCE     V$VMSG1
118              RELEASE     NCPR
119              TABULATE    TAB16
120              TERMINATE
          *
          *
          *
          *
          *
          *      SARPAC MESSAGE QUEUE
          *
          *
121        QSARP QUEUE       SARP1
122              SEIZE       SARP
123              DEPART      SARP1
124              TABULATE    TAB2
125              ADVANCE     V$VMSG2
126              RELEASE     SARP
127              TABULATE    TAB17
128              TERMINATE
          *
          *
          *
          *
          *
          *      MF/CW MESSAGE QUEUE
          *
          *
129        QMFCW QUEUE       MFCW1
```

```
130              SEIZE      HFCW
131              DEPART     HFCW1
132              TABULATE   TAB3
133              ADVANCE    1
134              ADVANCE    V$VMSG3
135              RELEASE    HFCW
136              TABULATE   TAB18
137              TERMINATE
        *
        *
        *
        *
        *
        *       HF/CW MESSAGE QUEUE
        *
        *
138     QHFCW    QUEUE      HFCW1
139              SEIZE      HFCW
140              DEPART     HFCW1
141              TABULATE   TAB4
142              ADVANCE    1
143              ADVANCE    V$VMSG4
144              RELEASE    HFCW
145              TABULATE   TAB19
146              TERMINATE
        *
        *
        *
        *
        *
        *       CLASSIFIED SHIP/SHORE RATT QUEUE
        *
        *
147     QCLAS    QUEUE      CLAS1
148              SEIZE      CLAS
149              DEPART     CLAS1
150              TABULATE   TAB5
151              ADVANCE    1
152              ADVANCE    V$VMSG5
153              RELEASE    CLAS
154              TABULATE   TAB20
155              TERMINATE
        *
        *
        *
        *
        *
        *       UNCLASSIFIED SHIP/SHORE RATT MESSAGE QUEUE
        *
        *
156     QUNCL    QUEUE      UNCL1
157              SEIZE      UNCL
158              DEPART     UNCL1
159              TABULATE   TAB6
160              ADVANCE    1
161              ADVANCE    V$VMSG6
162              RELEASE    UNCL
```

```
163            TABULATE   TAB21
164            TERMINATE
        *
        *
        *
        *
        *
        *      WEATHER MESSAGE QUEUE
        *
        *
165     QWX    QUEUE      QWX1
166            SEIZE      QWX2
167            DEPART     QWX1
168            TABULATE   TAB7
169            ADVANCE    1
170            ADVANCE    V$VMSG7
171            RELEASE    QWX2
172            TABULATE   TAB22
173            TERMINATE
        *
        *
        *
        *
        *
        *      AIR/GROUND MESSAGE QUEUE
        *
        *
174     QARGN  QUEUE      ARGN1
175            SEIZE      ARGN
176            DEPART     ARGN1
177            TABULATE   TAB8
178            ADVANCE    1
179            ADVANCE    V$VMSG8
180            RELEASE    ARGN
181            TABULATE   TAB23
182            TERMINATE
        *
        *
        *
        *
        *
        *      SITOR MESSAGE QUEUE
        *
        *
183     QSITR  QUEUE      SITR1
184            SEIZE      SITR
185            DEPART     SITR1
186            TABULATE   TAB9
187            ADVANCE    1
188            ADVANCE    V$VMSG9
189            RELEASE    SITR
190            TABULATE   TAB24
191            TERMINATE
        *
        *
        *
        *
```

```
*
*          TWPL (DISTRICT LOOP) MESSAGE QUEUE
*
*
192    QTWPL  QUEUE        TWPL1
193           SEIZE        TWPL
194           DEPART       TWPL1
195           TABULATE     TAB10
196           ADVANCE      1
197           ADVANCE      V$VMG10
198           RELEASE      TWPL
199           TABULATE     TAB25
200           TERMINATE
*
*
*
*
*          INHOUSE MESSAGE QUEUE
*
*
201    QINHS  QUEUE        INHS1
202           SEIZE        INHS
203           DEPART       INHS1
204           TABULATE     TAB11
205           ADVANCE      1
206           ADVANCE      V$VMG11
207           RELEASE      INHS
208           TABULATE     TAB26
209           TERMINATE
*
*
*
*
*          HF BROADCAST MESSAGE QUEUE
*
*
210    QBCST  QUEUE        BCST1
211           SEIZE        BCST
212           DEPART       BCST1
213           TABULATE     TAB12
214           ADVANCE      1
215           ADVANCE      V$VMG12
216           RELEASE      BCST
217           TABULATE     TAB27
218           TERMINATE
*
*
*
*
*          COMMAND CONTROL COMMUNICATIONS MESSAGE QUEUE
*
*
219    QCCC   QUEUE        CCC1
220           SEIZE        CCC
```

```
221          DEPART     CCC1
222          TABULATE   TAB13
223          ADVANCE    1
224          ADVANCE    V$VMG13
225          RELEASE    CCC
226          TABULATE   TAB28
227          TERMINATE
      *
      *
      *
      *
      *
228          GENERATE   1440
229          TERMINATE  1
      *
      *
      *
      *
      *
             START      1,NP
             RESET
             START      1
             RESET
             START      1
             RESET
             START      1
             RESET
             START      1
             RESET
             START      1
             RESET
             START      1
             RESET
             START      1
      *
      *
             REPORT
             EJECT
       QUE   TITLE      ,MESSAGE ENTRIES INTO EACH OUTPUT QUEUE
             GRAPH      QC,NCPR1,CCC1
             ORIGIN     50,10
             X          SYM,5,3
             Y          0,15,12,4
       75    STATEMENT  10,21,THROLGHPUT STATE I
       25    STATEMENT  54,21,X AXIS: NAME OF QUEUE
       25    STATEMENT  56,30,Y AXIS: TCTAL ENTRY INTO QUEUE
             ENDGRAPH
             EJECT
      *
      *
       TAB   TITLE      1,ORIGIN OF MESSAGES INTO NAVCOMPARS QUEUE
             GRAPH      TF,TAB1
             ORIGIN     50,5
             X          ,5,4,1,1,13,NO
             Y          0,7,12,4
       75    STATEMENT  10,20,THROUGHPUT STATE I
       10    STATEMENT  51,44,NCPR1     SARP1     MFCW1     MFCW1     CLAS1
```

```
55      STATEMENT   51,44,UNCL1     QWX1    ARGN1   SITR1   TWPL1
100     STATEMENT   51,22,INHS1     BCST1   CCC1
25      STATEMENT   54,25,X AXIS: NAME OF QUEUE
25      STATEMENT   56,47,Y AXIS: NUMBER OF MESSAGES ENTERING NCPR QUEUE
        ENDGRAPH
        EJECT
*
*
TAB     TITLE       2,ORIGIN OF MESSAGES INTO SARPAC QUEUE
        GRAPH       TF,TAB2
        ORIGIN      50,5
        X           ,5,4,1,1,13,NO
        Y           0,5,12,4
75      STATEMENT   10,2C,THROLGHPUT STATE I
10      STATEMENT   51,44,NCPR1     SARP1   MFCW1   HFCW1   CLAS1
55      STATEMENT   51,44,UNCL1     QWX1    ARGN1   SITR1   TWPL1
100     STATEMENT   51,22,INHS1     BCST1   CCC1
25      STATEMENT   54,25,X AXIS: NAME OF QUEUE
25      STATEMENT   56,47,Y AXIS: NUMBER OF MESSAGES ENTERING SARP QUEUE
        ENDGRAPH
        EJECT
*
*
TAB     TITLE       3,ORIGIN OF MESSAGES INTO MF/CW QUEUE
        GRAPH       TF,TAB3
        ORIGIN      50,5
        X           ,5,4,1,1,13,NO
        Y           0,1,12,4
75      STATEMENT   10,20,THROUGHPUT STATE I
10      STATEMENT   51,44,NCPR1     SARP1   MFCW1   HFCW1   CLAS1
55      STATEMENT   51,44,UNCL1     QWX1    ARGN1   SITR1   TWPL1
100     STATEMENT   51,22,INHS1     BCST1   CCC1
25      STATEMENT   54,25,X AXIS: NAME CF QUEUE
25      STATEMENT   56,47,Y AXIS: NUMBER OF MESSAGES ENTERING MF/CW QUEUE
        ENDGRAPH
        EJECT
*
*
TAB     TITLE       4,ORIGIN OF MESSAGES INTO HF/CW QUEUE
        GRAPH       TF,TAB4
        ORIGIN      50,5
        X           ,5,4,1,1,13,NO
        Y           0,1,12,4
75      STATEMENT   10,20,THROLGHPUT STATE I
10      STATEMENT   51,44,NCPR1     SARP1   MFCW1   HFCW1   CLAS1
55      STATEMENT   51,44,UNCL1     QWX1    ARGN1   SITR1   TWPL1
100     STATEMENT   51,22,INHS1     BCST1   CCC1
25      STATEMENT   54,25,X AXIS: NAME OF QUEUE
25      STATEMENT   56,47,Y AXIS: NUMBER OF MESSAGES ENTERING HF/CW QUEUE
        ENDGRAPH
        EJECT
*
*
TAB     TITLE       5,ORIGIN OF MESSAGES INTO CLASSIFIED SHIP/SHORE QUEUE
        GRAPH       TF,TAB5
        ORIGIN      50,5
        X           ,5,4,1,1,13,NO
```

```
            Y               0,3,12,4
 75         STATEMENT       10,20,THROUGHPUT STATE I
 10         STATEMENT       51,44,NCPR1     SARP1      MFCW1      HFCW1      CLAS1
 55         STATEMENT       51,44,UNCL1      QWX1      ARGN1      SITR1      TWPL1
 100        STATEMENT       51,22,INHS1     BCST1      CCC1
 25         STATEMENT       54,25,X AXIS: NAME OF QUEUE
 25         STATEMENT       56,47,Y AXIS: NUMBER OF MESSAGES ENTERING CLAS QUEUE
            ENDGRAPH
            EJECT
*
*
 TAB        TITLE           6,ORIGIN OF MESSAGES INTO UNCLAS SHIP/SHORE QUEUE
            GRAPH           TF,TAB6
            ORIGIN          50,5
            X               ,5,4,1,1,13,NO
            Y               0,4,12,4
 75         STATEMENT       10,20,THROUGHPUT STATE I
 10         STATEMENT       51,44,NCPR1     SARP1      MFCW1      HFCW1      CLAS1
 55         STATEMENT       51,44,UNCL1      QWX1      ARGN1      SITR1      TWPL1
 100        STATEMENT       51,22,INHS1     BCST1      CCC1
 25         STATEMENT       54,25,X AXIS: NAME OF QUEUE
 25         STATEMENT       56,47,Y AXIS: NUMBER OF MESSAGES ENTERING UNCL QUEUE
            ENDGRAPH
            EJECT
*
*
 TAB        TITLE           7,ORIGIN OF MESSAGES INTO WEATHER QUEUE
            GRAPH           TF,TAB7
            ORIGIN          50,5
            X               ,5,4,1,1,13,NO
            Y               0,10,12,4
 75         STATEMENT       10,20,THROUGHPUT STATE I
 10         STATEMENT       51,44,NCPR1     SARP1      MFCW1      HFCW1      CLAS1
 55         STATEMENT       51,44,UNCL1      QWX1      ARGN1      SITR1      TWPL1
 100        STATEMENT       51,22,INHS1     BCST1      CCC1
 25         STATEMENT       54,25,X AXIS: NAME OF QUEUE
 25         STATEMENT       56,47,Y AXIS: NUMBER OF MESSAGES ENTERING WX QUEUE
            ENDGRAPH
            EJECT
*
*
 TAB        TITLE           8,ORIGIN OA MESSAGES INTO AIR/GROUND QUEUE
            GRAPH           TF,TAB8
            CRIGIN          50,5
            X               ,5,4,1,1,13,NO
            Y               0,1,12,4
 75         STATEMENT       10,20,THROUGHPUT STATE I
 10         STATEMENT       51,44,NCPR1     SARP1      MFCW1      HFCW1      CLAS1
 55         STATEMENT       51,44,UNCL1      QWX1      ARGN1      SITR1      TWPL1
 100        STATEMENT       51,22,INHS1     BCST1      CCC1
 25         STATEMENT       54,25,X AXIS: NAME OF QUEUE
 25         STATEMENT       56,47,Y AXIS: NUMBER OF MESSAGES ENTERING ARGN QUEUE
            ENDGRAPH
            EJECT
*
*
 TAB        TITLE           9,ORIGIN OF MESSAGES INTO SITOR QUEUE
```

```
          GRAPH       TF,TAB9
          ORIGIN      50,5
          X           ,5,4,1,1,13,NO
          Y           0,1,12,4
75        STATEMENT   10,20,THROUGHPUT STATE I
10        STATEMENT   51,44,NCPR1      SARP1     MFCW1     HFCW1     CLAS1
55        STATEMENT   51,44,UNCL1      QWX1      ARGN1     SITR1     TWPL1
100       STATEMENT   51,22,INHS1      BCST1     CCC1
25        STATEMENT   54,25,X AXIS: NAME OF QUEUE
25        STATEMENT   56,47,Y AXIS: NUMBER OF MESSAGES ENTERING SITOR QUEUE
          ENDGRAPH
          EJECT
*
*
TAB       TITLE       10,ORIGIN CF MESSAGES INTO TWPL (DISTRICT LOOP) QUEUE
          GRAPH       TF,TAB10
          ORIGIN      50,5
          X           ,5,4,1,1,13,NO
          Y           0,1,12,4
75        STATEMENT   10,20,THROLGHPUT STATE I
10        STATEMENT   51,44,NCPR1      SARP1     MFCW1     HFCW1     CLAS1
55        STATEMENT   51,44,UNCL1      QWX1      ARGN1     SITR1     TWPL1
100       STATEMENT   51,22,INHS1      BCST1     CCC1
25        STATEMENT   54,25,X AXIS: NAME OF QUEUE
25        STATEMENT   56,47,Y AXIS: NUMBER OF MESSAGES ENTERING TWPL QUEUE
          ENDGRAPH
          EJECT
*
*
TAB       TITLE       11,ORIGIN CF MESSAGES INTO INHOUSE QUEUE
          GRAPH       TF,TAB11
          ORIGIN      50,5
          X           ,5,4,1,1,13,NO
          Y           0,4,12,4
75        STATEMENT   10,20,THROLGHPUT STATE I
10        STATEMENT   51,44,NCPR1      SARP1     MFCW1     HFCW1     CLAS1
55        STATEMENT   51,44,UNCL1      QWX1      ARGN1     SITR1     TWPL1
100       STATEMENT   51,22,INHS1      BCST1     CCC1
25        STATEMENT   54,25,X AXIS: NAME OF QUEUE
25        STATEMENT   56,47,Y AXIS: NUMBER OF MESSAGES ENTERING INHS QUEUE
          ENDGRAPH
          EJECT
*
*
TAB       TITLE       12,ORIGIN OF MESSAGES INTO HF BROADCAST QUEUE
          GRAPH       TF,TAB12
          ORIGIN      50,5
          X           ,5,4,1,1,13,NO
          Y           0,2,12,4
75        STATEMENT   10,20,THROLGHPUT STATE I
10        STATEMENT   51,44,NCPR1      SARP1     MFCW1     HFCW1     CLAS1
55        STATEMENT   51,44,UNCL1      QWX1      ARGN1     SITR1     TWPL1
100       STATEMENT   51,22,INHS1      BCST1     CCC1
25        STATEMENT   54,25,X AXIS: NAME OF QUEUE
25        STATEMENT   56,47,Y AXIS: NUMBER OF MESSAGES ENTERING BCST QUEUE
          ENDGRAPH
          EJECT
```

```
*
*
TAB    TITLE      13,ORIGIN OF MESSAGES INTO COMMAND & CONTROL QUEUE
       GRAPH      TF,TAB13
       ORIGIN     50,5
       X          ,5,4,1,1,13,NO
       Y          0,1,12,4
75     STATEMENT  10,20,THROUGHPUT STATE I
10     STATEMENT  51,44,NCPR1      SARP1      MFCW1      HFCW1      CLAS1
55     STATEMENT  51,44,UNCL1       QWX1      ARGN1      SITR1      TWPL1
100    STATEMENT  51,22,INHS1      BCST1      CCC1
25     STATEMENT  54,25,X AXIS: NAME OF QUEUE
25     STATEMENT  56,47,Y AXIS: NUMBER OF MESSAGES ENTERING CCC QUEUE
       ENDGRAPH
       EJECT
*
*
TAB    TITLE      14,ORIGIN OF MESSAGES INTO CPU QUEUE
       GRAPH      TF,TAB14
       ORIGIN     50,5
       X          ,5,4,1,1,13,NO
       Y          0,15,12,4
75     STATEMENT  10,20,THROUGHPUT STATE I
10     STATEMENT  51,44,NCPR1      SARP1      MFCW1      HFCW1      CLAS1
55     STATEMENT  51,44,UNCL1       QWX1      ARGN1      SITR1      TWPL1
100    STATEMENT  51,22,INHS1      BCST1      CCC1
25     STATEMENT  54,25,X AXIS: NAME OF QUEUE
25     STATEMENT  56,47,Y AXIS: NUMBER OF MESSAGES ENTERING CPU QUEUE
       ENDGRAPH
       EJECT
*
*
TAB    TITLE      15,QUEUE CONTENTS OF CPU AS PERCENTAGE OF TOTAL
       GRAPH      TP,TAB15
       ORIGIN     50,5
       X          ,5,4,1,1,5
       Y          0,10,10,4
75     STATEMENT  10,20,THROUGHPUT STATE I
25     STATEMENT  54,22,X AXIS: QUEUE CONTENTS
25     STATEMENT  56,27,Y AXIS: PERCENTAGE OF TOTAL
       ENDGRAPH
       EJECT
*
*
TAB    TITLE      16,NCPR MESSAGE TRANSIT TIME IN SYSTEM
       GRAPH      TF,TAB16
       ORIGIN     40,5
       X          ,3,3,1,1,15
       Y          0,8,9,4
75     STATEMENT  10,20,THROUGHPUT STATE I
25     STATEMENT  54,31,X AXIS: TRANSIT TIME IN MINUTES
25     STATEMENT  56,40,Y AXIS: NO. OF MESSAGES PER TRANSIT TIME
       ENDGRAPH
       EJECT
*
*
TAB    TITLE      17,SARP MESSAGE TRANSIT TIME IN SYSTEM
```

```
         GRAPH      TF,TAB17
         ORIGIN     50,5
         X          ,3,3,1,1,15
         Y          0,5,12,4
75       STATEMENT  10,20,THROUGHPUT STATE I
25       STATEMENT  54,31,X AXIS: TRANSIT TIME IN MINUTES
25       STATEMENT  56,40,Y AXIS: NO. OF MESSAGES PER TRANSIT TIME
         ENDGRAPH
         EJECT
*
*
TAB      TITLE      18,HF/CW MESSAGE TRANSIT TIME IN SYSTEM
         GRAPH      TF,TAB18
         ORIGIN     50,5
         X          ,3,3,1,1,15
         Y          0,1,12,4
75       STATEMENT  10,20,THROUGHPUT STATE I
25       STATEMENT  54,31,X AXIS: TRANSIT TIME IN MINUTES
25       STATEMENT  56,40,Y AXIS: NO. OF MESSAGES PER TRANSIT TIME
         ENDGRAPH
         EJECT
*
*
TAB      TITLE      19,HF/CW MESSAGE TRANSIT TIME IN SYSTEM
         GRAPH      TF,TAB19
         ORIGIN     50,5
         X          ,3,3,1,1,15
         Y          0,1,12,4
75       STATEMENT  10,20,THROUGHPUT STATE I
25       STATEMENT  54,31,X AXIS: TRANSIT TIME IN MINUTES
25       STATEMENT  56,40,Y AXIS: NO. OF MESSAGES PER TRANSIT TIME
         ENDGRAPH
         EJECT
*
*
TAB      TITLE      20,CLAS MESSAGE TRANSIT TIME IN SYSTEM
         GRAPH      TF,TAB20
         ORIGIN     50,5
         X          ,3,3,1,1,15
         Y          0,2,12,4
75       STATEMENT  10,20,THROUGHPUT STATE I
25       STATEMENT  54,31,X AXIS: TRANSIT TIME IN MINUTES
25       STATEMENT  56,40,Y AXIS: NO. OF MESSAGES PER TRANSIT TIME
         ENDGRAPH
         EJECT
*
*
TAB      TITLE      21,UNCL MESSAGE TRANSIT TIME IN SYSTEM
         GRAPH      TF,TAB21
         ORIGIN     50,5
         X          ,3,3,1,1,15
         Y          0,4,12,4
75       STATEMENT  10,20,THROUGHPUT STATE I
25       STATEMENT  54,31,X AXIS: TRANSIT TIME IN MINUTES
25       STATEMENT  56,40,Y AXIS: NO. OF MESSAGES PER TRANSIT TIME
         ENDGRAPH
         EJECT
```

```
*
*
TAB     TITLE      22,WEATHER MESSAGE TRANSIT TIME IN SYSTEM
        GRAPH      TF,TAB22
        ORIGIN     50,5
        X          ,3,3,1,1,15
        Y          0,10,12,4
 75     STATEMENT  10,20,THROUGHPUT STATE I
 25     STATEMENT  54,31,X AXIS: TRANSIT TIME IN MINUTES
 25     STATEMENT  56,40,Y AXIS: NO. OF MESSAGES PER TRANSIT TIME
        ENDGRAPH
        EJECT
*
*
TAB     TITLE      23,ARGN MESSAGE TRANSIT TIME IN SYSTEM
        GRAPH      TF,TAB23
        ORIGIN     50,5
        X          ,3,3,1,1,15
        Y          0,1,12,4
 75     STATEMENT  10,20,THROUGHPUT STATE I
 25     STATEMENT  54,31,X AXIS: TRANSIT TIME IN MINUTES
 25     STATEMENT  56,40,Y AXIS: NO. OF MESSAGES PER TRANSIT TIME
        ENDGRAPH
        EJECT
*
*
TAB     TITLE      24,SITOR MESSAGE TRANSIT TIME IN SYSTEM
        GRAPH      TF,TAB24
        ORIGIN     40,5
        X          ,3,3,1,1,20
        Y          0,1,9,4
 75     STATEMENT  10,20,THROUGHPUT STATE I
 25     STATEMENT  44,31,X AXIS: TRANSIT TIME IN MINUTES
 25     STATEMENT  46,40,Y AXIS: NO. OF MESSAGES PER TRANSIT TIME
        ENDGRAPH
        EJECT
*
*
TAB     TITLE      25,TWPL MESSAGE TRANSIT TIME IN SYSTEM
        GRAPH      TF,TAB25
        ORIGIN     50,5
        X          ,3,3,1,1,15
        Y          0,1,12,4
 75     STATEMENT  10,20,THROUGHPUT STATE I
 25     STATEMENT  54,31,X AXIS: TRANSIT TIME IN MINUTES
 25     STATEMENT  56,40,Y AXIS: NO. OF MESSAGES PER TRANSIT TIME
        ENDGRAPH
        EJECT
*
*
TAB     TITLE      26,INHOUSE MESSAGE TRANSIT TIME IN SYSTEM
        GRAPH      TF,TAB26
        ORIGIN     40,5
        X          ,3,3,1,1,20
        Y          0,2,8,4
 75     STATEMENT  10,20,THROUGHPUT STATE I
 25     STATEMENT  44,31,X AXIS: TRANSIT TIME IN MINUTES
```

```
25     STATEMENT  46,40,Y AXIS: NO. OF MESSAGES PER TRANSIT TIME
       ENDGRAPH
       EJECT
*
*
TAB    TITLE      27,HF BCST MESSAGE TRANSIT TIME IN SYSTEM
       GRAPH      TF,TAB27
       ORIGIN     50,5
       X          ,3,3,1,1,15
       Y          0,2,12,4
75     STATEMENT  10,20,THROUGHPUT STATE I
25     STATEMENT  54,31,X AXIS: TRANSIT TIME IN MINUTES
25     STATEMENT  56,40,Y AXIS: NO. OF MESSAGES PER TRANSIT TIME
       ENDGRAPH
       EJECT
*
*
TAB    TITLE      28, CCC MESSAGE TRANSIT TIME IN SYSTEM
       GRAPH      TF,TAB28
       ORIGIN     50,5
       X          ,3,3,1,1,15
       Y          0,1,12,4
75     STATEMENT  10,20,THROUGHPUT STATE I
25     STATEMENT  54,31,X AXIS: TRANSIT TIME IN MINUTES
25     STATEMENT  56,40,Y AXIS: NO. OF MESSAGES PER TRANSIT TIME
       ENDGRAPH
       EJECT
*
*
       END
```

APPENDIX F

This appendix contains the output statistics for the origins of messages into each output queue in model for Throughput State I. This information was taken from the day that generated the most message entries for that simulated week.

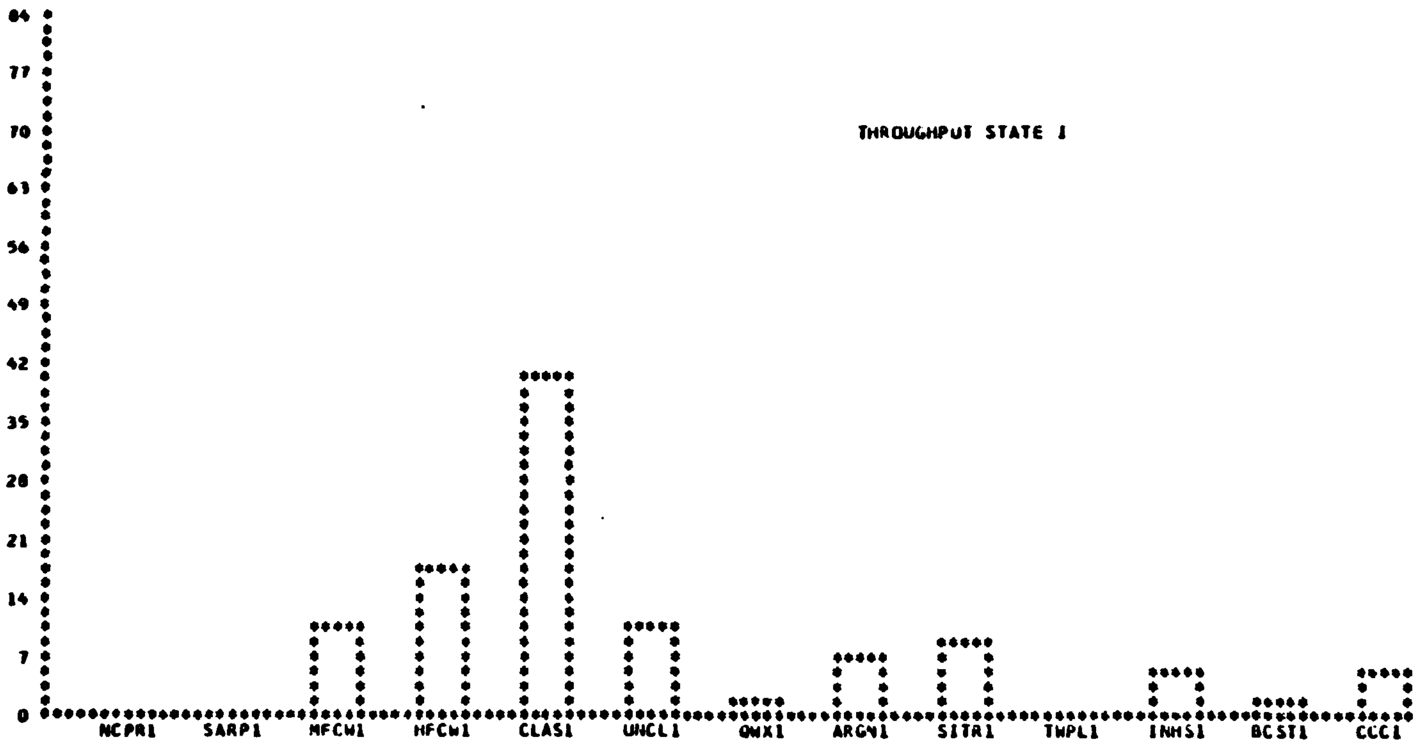
ORIGIN OF MESSAGES INTO NAVCOMPARS QUEUE

TABLE TAB1

ENTRIES IN TABLE	MEAN ARGUMENT	STANDARD DEVIATION	SUM OF ARGUMENTS	
116	6.172	2.722	716.000	NON-WEIGHTED

UPPER LIMIT	OBSERVED FREQUENCY	PER CENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
1	0	.00	.0	100.0	.162	-1.855
2	0	.00	.0	100.0	.324	-1.532
3	11	9.48	9.4	90.5	.486	-1.165
4	19	16.37	25.8	74.1	.648	-.797
5	41	35.34	61.2	38.7	.810	-.430
6	11	9.48	70.6	29.3	.972	-.063
7	2	1.72	72.4	27.5	1.134	.303
8	8	6.89	79.3	20.6	1.296	.671
9	10	8.62	87.9	12.0	1.458	1.038
10	0	.00	87.9	12.0	1.620	1.405
11	6	5.17	93.1	6.8	1.782	1.773
12	2	1.72	94.8	5.1	1.944	2.140
13	6	5.17	100.0	.0	2.106	2.507

REMAINING FREQUENCIES ARE ALL ZERO



THROUGHPUT STATE 1

X AXIS: NAME OF QUEUE

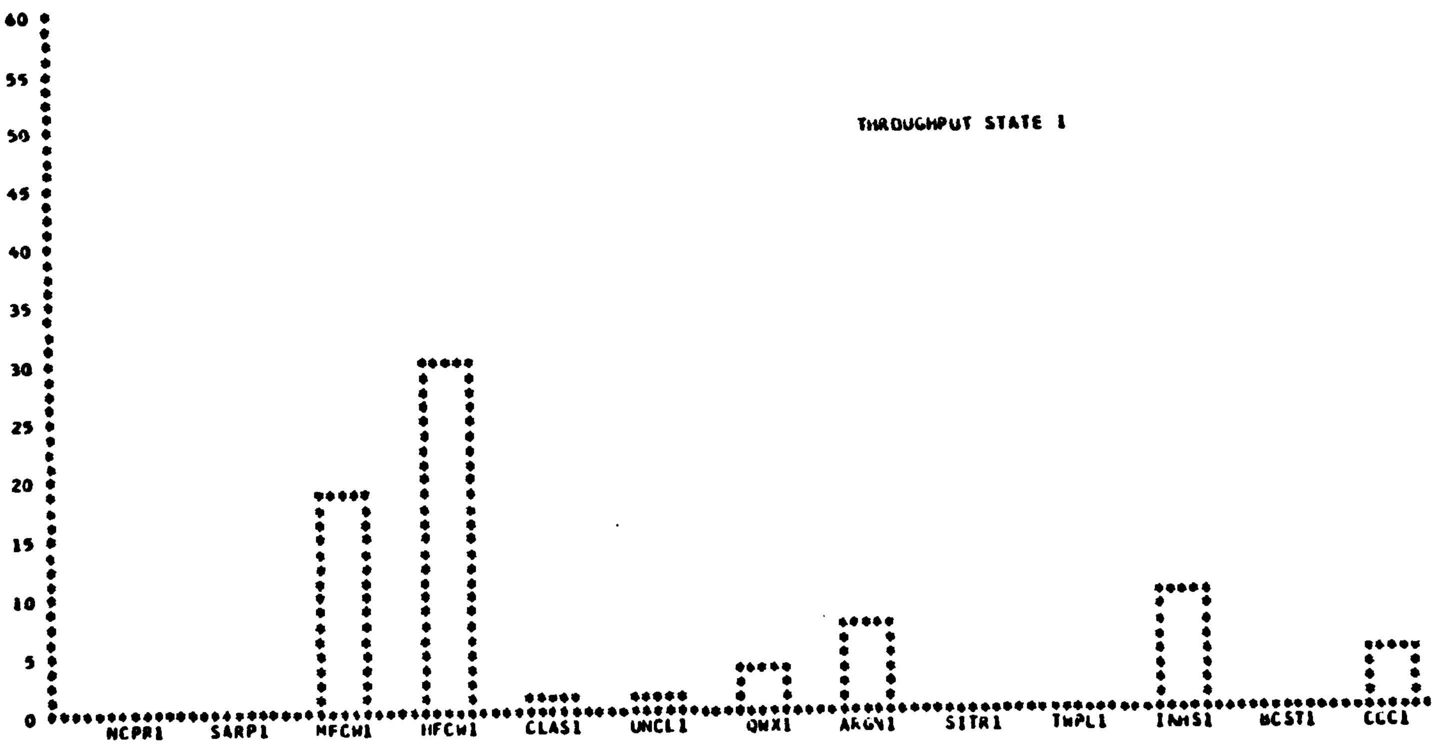
Y AXIS: NUMBER OF MESSAGES ENTERING NCPR QUEUE

ORIGIN OF MESSAGES INTO SARPAC QUEUE

TABLE TAB2
ENTRIES IN TABLE 84 | MEAN ARGUMENT 6.083 | STANDARD DEVIATION 3.367 | SUM OF ARGUMENTS 511.000 | NON-WEIGHTED

UPPER LIMIT	OBSERVED FREQUENCY	PER CENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
1	0	.00	.0	100.0	.164	-1.509
2	0	.00	.0	100.0	.328	-1.212
3	19	22.61	22.6	77.3	.493	-.915
4	30	35.71	58.3	41.6	.657	-.618
5	2	2.38	60.7	39.2	.821	-.321
6	2	2.38	63.0	36.9	.986	-.024
7	4	4.76	67.8	32.1	1.150	.272
8	8	9.52	77.3	22.6	1.315	.569
9	1	1.19	78.5	21.4	1.479	.866
10	0	.00	78.5	21.4	1.643	1.163
11	11	13.09	91.6	8.3	1.808	1.460
12	1	1.19	92.8	7.1	1.972	1.757
13	6	7.14	100.0	.0	2.136	2.054

REMAINING FREQUENCIES ARE ALL ZERO



X AXIS: NAME OF QUEUE

Y AXIS: NUMBER OF MESSAGES ENTERING SARP QUEUE

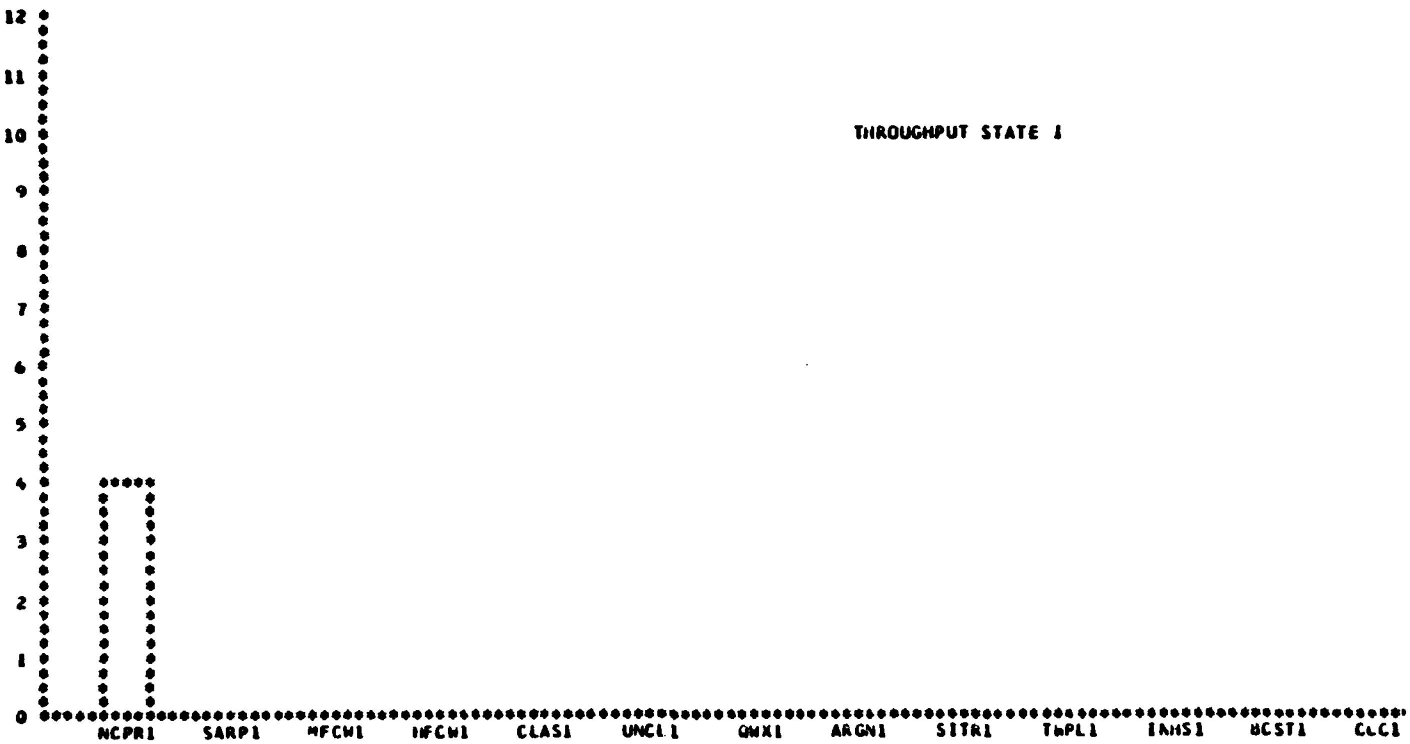
ORIGIN OF MESSAGES INTO MF/CW QUEUE

TABLE TA03

ENTRIES IN TABLE	MEAN ARGUMENT	STANDARD DEVIATION	SUM OF ARGUMENTS	
4	1.000	.000	4.000	NON-WEIGHTED

UPPER LIMIT	OBSERVED FREQUENCY	PER CENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
1	4	100.00	100.0	.0	1.000	-.000

REMAINING FREQUENCIES ARE ALL ZERO



X AXIS: NAME OF QUEUE

Y AXIS: NUMBER OF MESSAGES ENTERING MF/CW QUEUE

ORIGIN OF MESSAGES INTO HF/CW QUEUE

TABLE TAB4
ENTRIES IN TABLE 2

MEAN ARGUMENT 5.500

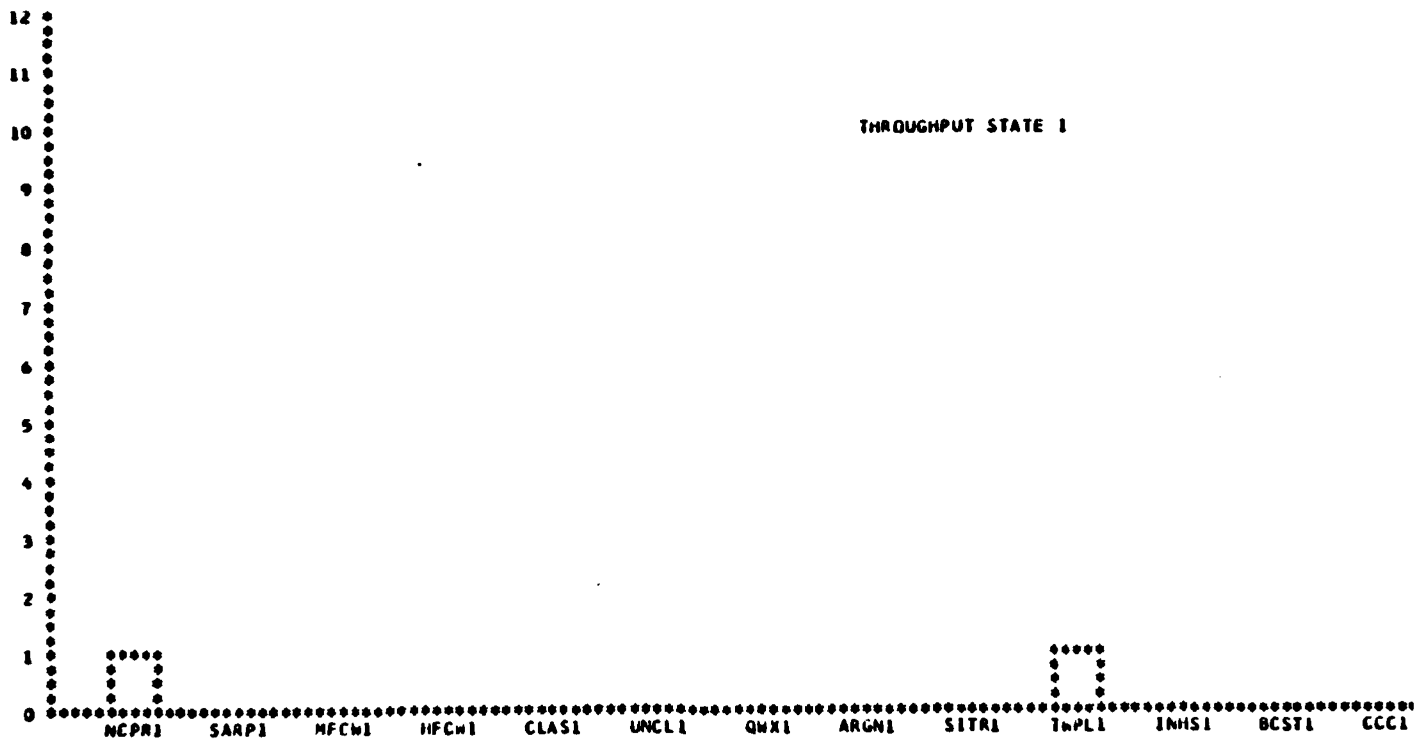
STANDARD DEVIATION 6.363

SUM OF ARGUMENTS 11.000

NON-WEIGHTED

UPPER LIMIT	OBSERVED FREQUENCY	PER CENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
1	1	50.00	50.0	50.0	.181	-.707
2	0	.00	50.0	50.0	.363	-.550
3	0	.00	50.0	50.0	.545	-.392
4	0	.00	50.0	50.0	.727	-.235
5	0	.00	50.0	50.0	.909	-.078
6	0	.00	50.0	50.0	1.090	.078
7	0	.00	50.0	50.0	1.272	.235
8	0	.00	50.0	50.0	1.454	.392
9	0	.00	50.0	50.0	1.636	.550
10	1	50.00	100.0	.0	1.818	.707

REMAINING FREQUENCIES ARE ALL ZERO



X AXIS: NAME OF QUEUE

Y AXIS: NUMBER OF MESSAGES ENTERING HF/CW QUEUE

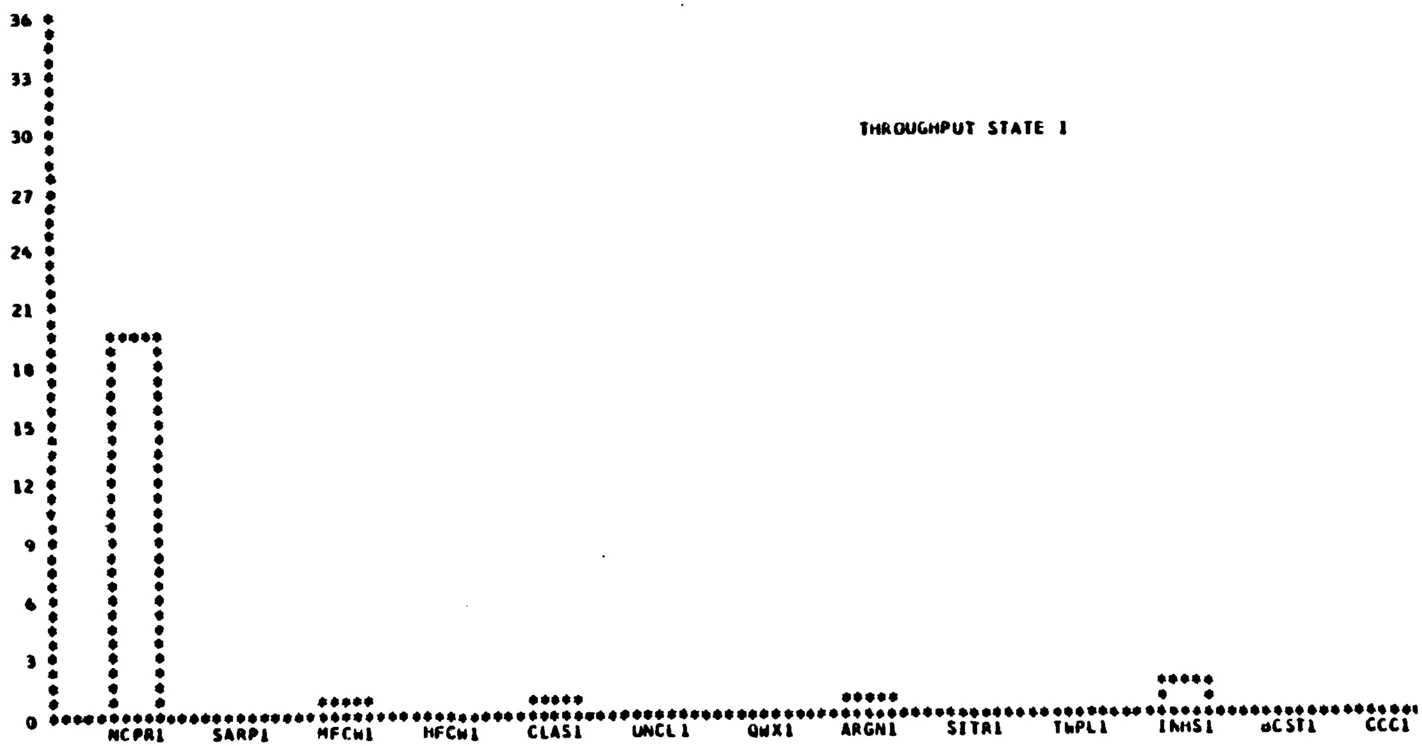
ORIGIN OF MESSAGES INTO CLASSIFIED SHIP/SHORE QUEUE

TABLE TABS

ENTRIES IN TABLE	MEAN ARGUMENT	STANDARD DEVIATION	SUM OF ARGUMENTS	
25	2.319	3.062	58.000	NON-WEIGHTED

UPPER LIMIT	OBSERVED FREQUENCY	PER CENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
1	20	79.99	79.9	20.0	.431	-.431
2	0	.00	79.9	20.0	.862	-.105
3	1	3.99	83.9	16.0	1.293	.222
4	0	.00	83.9	16.0	1.724	.548
5	1	3.99	87.9	12.0	2.155	.875
6	0	.00	87.9	12.0	2.586	1.201
7	0	.00	87.9	12.0	3.017	1.528
8	1	3.99	91.9	8.0	3.448	1.854
9	0	.00	91.9	8.0	3.879	2.181
10	0	.00	91.9	8.0	4.310	2.507
11	2	7.99	100.0	.0	4.741	2.834

REMAINING FREQUENCIES ARE ALL ZERO



X AXIS: NAME OF QUEUE

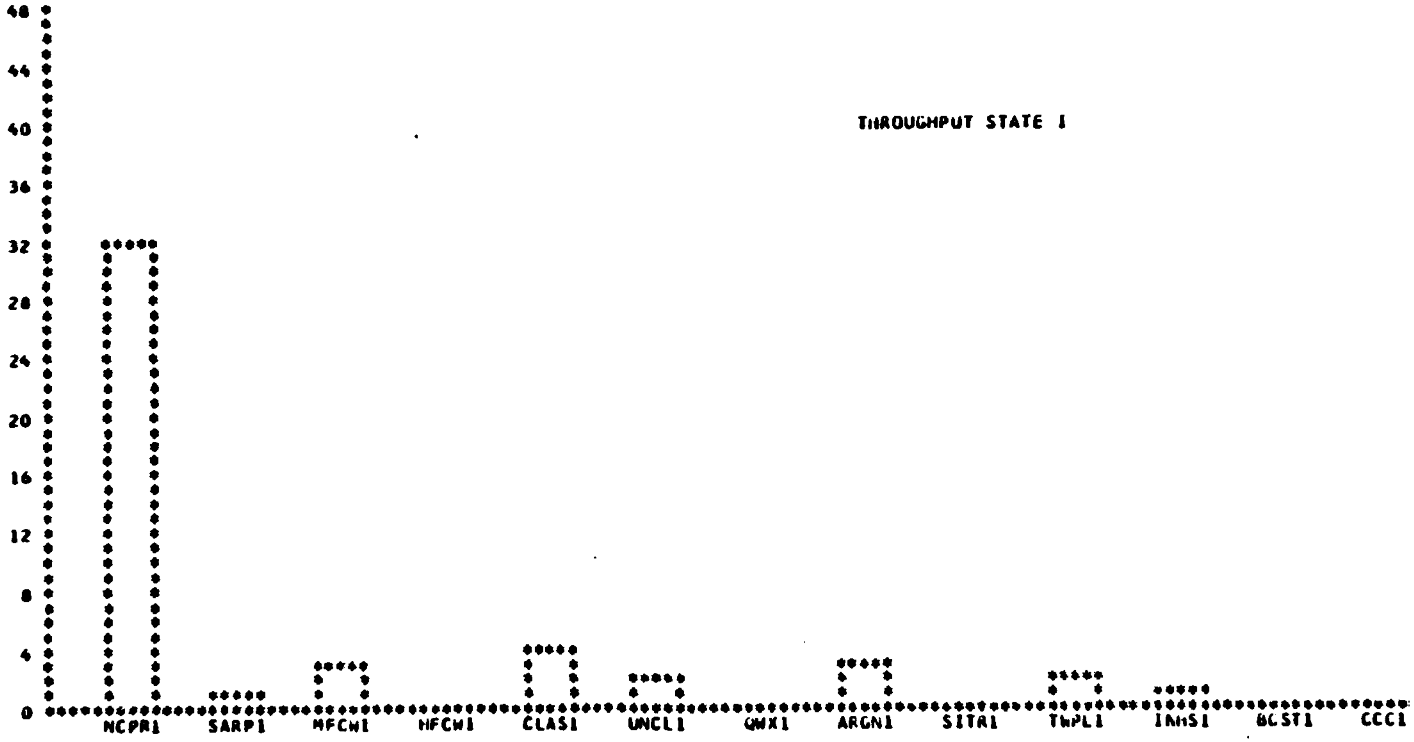
Y AXIS: NUMBER OF MESSAGES ENTERING CLAS QUEUE

ORIGIN OF MESSAGES INTO UNCLAS SHIP/SHORE QUEUE

TABLE TAB6 ENTRIES IN TABLE 48	MEAN ARGUMENT 2.708	STANDARD DEVIATION 2.902	SUM OF ARGUMENTS 130.000	NON-WEIGHTED

UPPER LIMIT	OBSERVED FREQUENCY	PER CENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
1	32	66.66	66.6	33.3	.369	-.588
2	1	2.08	68.7	31.2	.738	-.244
3	3	6.25	74.9	25.0	1.107	.100
4	0	.00	74.9	25.0	1.476	.445
5	4	8.33	83.3	16.6	1.846	.789
6	2	4.16	87.4	12.5	2.215	1.134
7	0	.00	87.4	12.5	2.584	1.478
8	3	6.25	93.7	6.2	2.953	1.823
9	0	.00	93.7	6.2	3.323	2.167
10	2	4.16	97.9	2.0	3.692	2.512
11	1	2.08	100.0	.0	4.061	2.856

REMAINING FREQUENCIES ARE ALL ZERO



X AXIS: NAME OF QUEUE

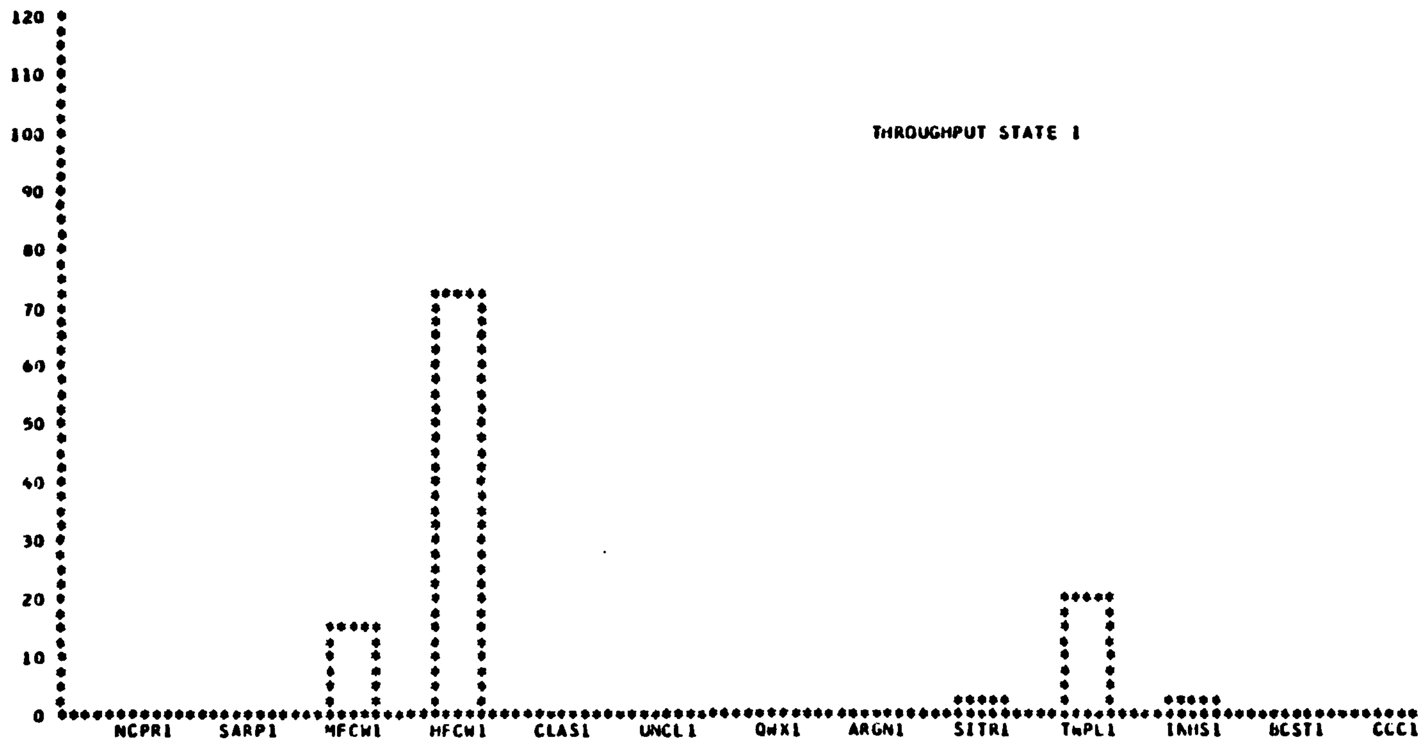
Y AXIS: NUMBER OF MESSAGES ENTERING UNCL QUEUE

ORIGIN OF MESSAGES INTO WEATHER QUEUE

TABLE TAB7
ENTRIES IN TABLE 120 | MEAN ARGUMENT 5.458 | STANDARD DEVIATION 2.808 | SUM OF ARGUMENTS 655.000 | NON-WEIGHTED

UPPER LIMIT	OBSERVED FREQUENCY	PER CENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
1	0	.00	.0	100.0	.183	-1.587
2	0	.00	.0	100.0	.366	-1.231
3	15	12.50	12.5	87.5	.549	-.875
4	74	61.66	74.1	25.8	.732	-.519
5	0	.00	74.1	25.8	.916	-.163
6	0	.00	74.1	25.8	1.099	.192
7	0	.00	74.1	25.8	1.282	.548
8	0	.00	74.1	25.8	1.465	.904
9	4	3.33	77.4	22.5	1.648	1.261
10	21	17.49	94.9	5.0	1.832	1.617
11	4	3.33	98.3	1.6	2.015	1.973
12	2	1.66	100.0	.0	2.198	2.329

REMAINING FREQUENCIES ARE ALL ZERO



X AXIS: NAME OF QUEUE

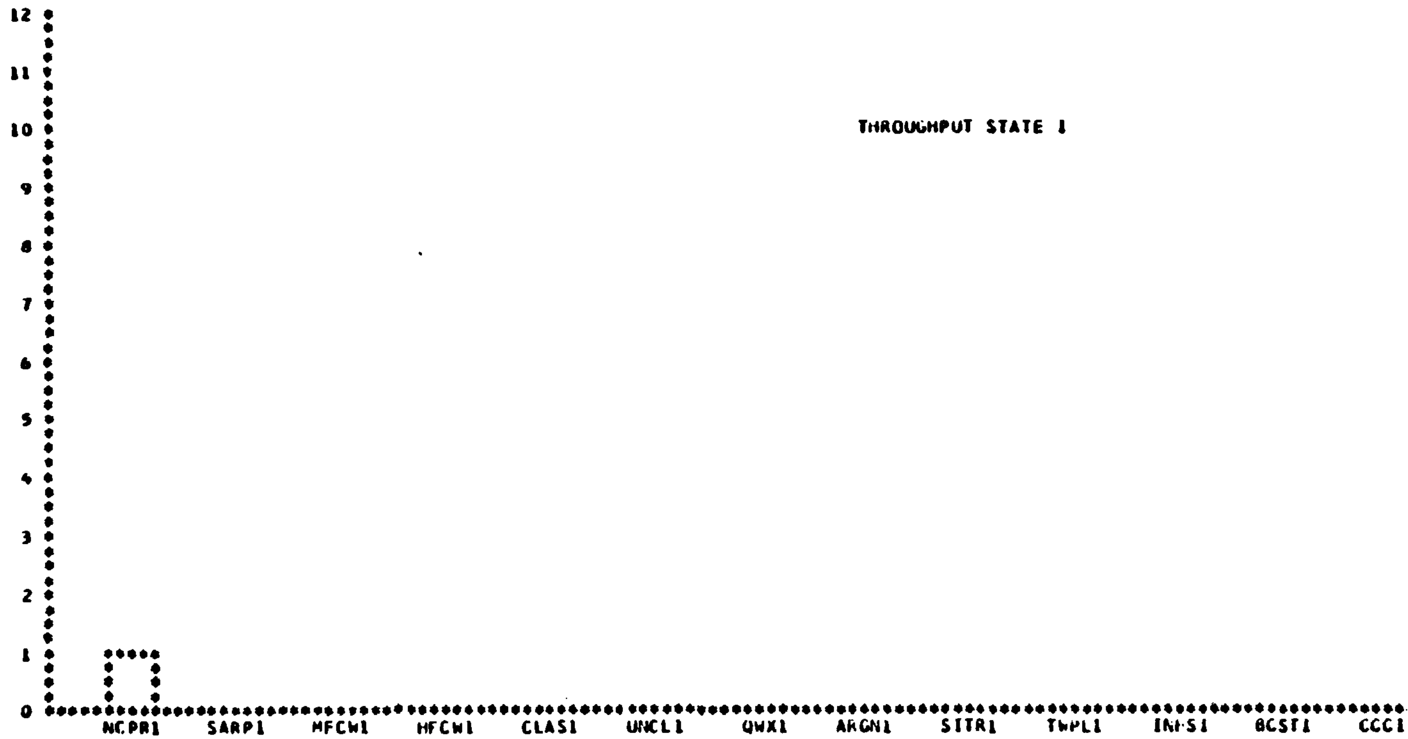
Y AXIS: NUMBER OF MESSAGES ENTERING WX QUEUE

ORIGIN ON MESSAGES INTO AIR/GROUND QUEUE

TABLE TARG ENTRIES IN TABLE	MEAN ARGUMENT	STANDARD DEVIATION	SUM OF ARGUMENTS	
1	1.000		1.000	NON-WEIGHTED

UPPER LIMIT	OBSERVED FREQUENCY	PER CENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
1	1	100.00	100.0	.0	1.000	-.000

REMAINING FREQUENCIES ARE ALL ZERO



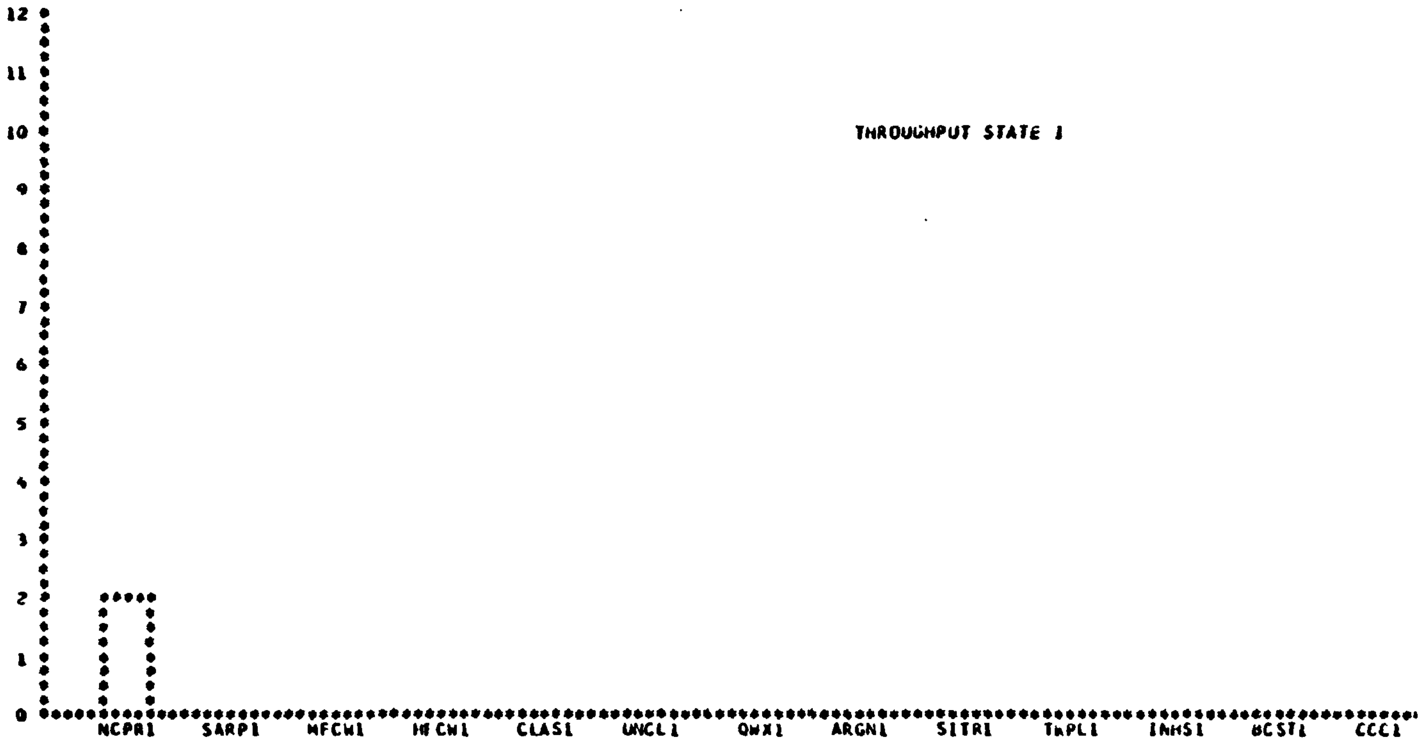
X AXIS: NAME OF QUEUE

Y AXIS: NUMBER OF MESSAGES ENTERING ARGN QUEUE

ORIGIN OF MESSAGES INTO SITOR QUEUE

TABLE TARS						
ENTRIES IN TABLE	MEAN ARGUMENT	STANDARD DEVIATION	SUM OF ARGUMENTS			
2	1.000	.000	2.000			NON-WEIGHTED
UPPER LIMIT	OBSERVED FREQUENCY	PER CENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
1	2	100.00	100.0	.0	1.000	-.000

REMAINING FREQUENCIES ARE ALL ZERO



X AXIS: NAME OF QUEUE

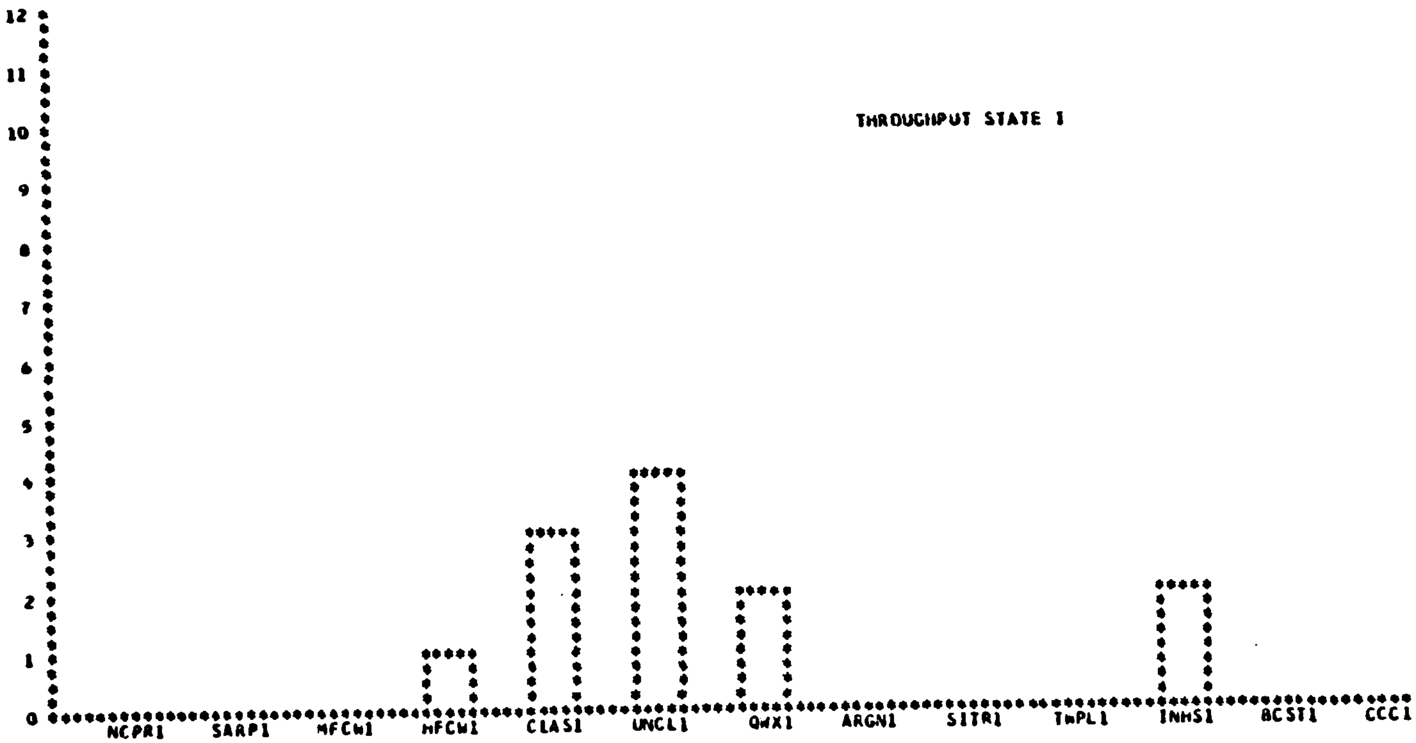
Y AXIS: NUMBER OF MESSAGES ENTERING SITOR QUEUE

ORIGIN OF MESSAGES INTO TWPL (DISTRICT LOOP) QUEUE

TABLE TAB10
ENTRIES IN TABLE 12 | MEAN ARGUMENT 6.583 | STANDARD DEVIATION 2.234 | SUM OF ARGUMENTS 79.000 | NON-WEIGHTED

UPPER LIMIT	OBSERVED FREQUENCY	PER CENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
1	0	.00	.0	100.0	.151	-2.458
2	0	.00	.0	100.0	.303	-2.051
3	0	.00	.0	100.0	.455	-1.603
4	1	8.33	8.3	91.6	.607	-1.156
5	3	25.00	33.3	66.6	.759	-.708
6	4	33.33	66.6	33.3	.911	-.261
7	2	16.66	83.3	16.6	1.063	.186
8	0	.00	83.3	16.6	1.215	.634
9	0	.00	83.3	16.6	1.367	1.081
10	0	.00	83.3	16.6	1.518	1.529
11	2	16.66	100.0	.0	1.670	1.976

REMAINING FREQUENCIES ARE ALL ZERO



X AXIS: NAME OF QUEUE

Y AXIS: NUMBER OF MESSAGES ENTERING TWPL QUEUE

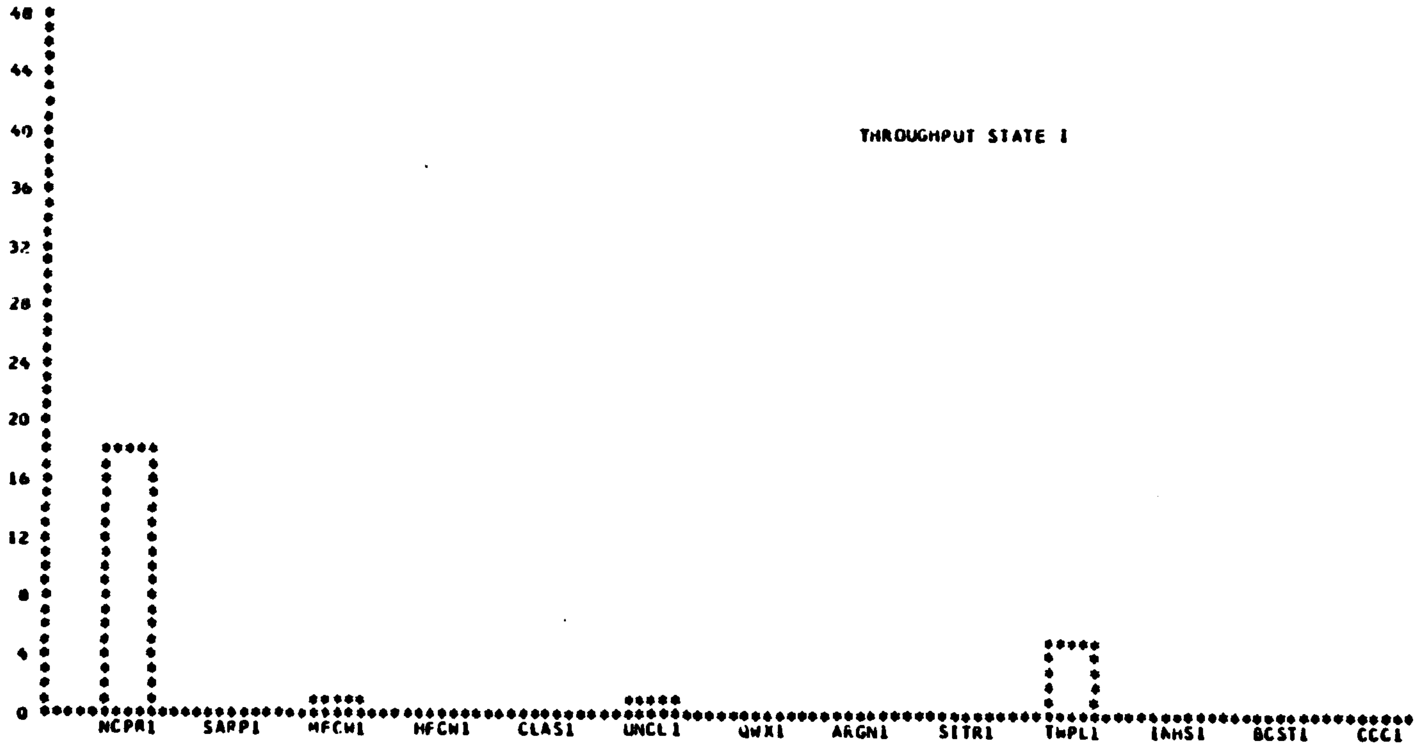
ORIGIN OF MESSAGES INTO INHOUSE QUEUE

TABLE TAB11

ENTRIES IN TABLE	MEAN ARGUMENT	STANDARD DEVIATION	SUM OF ARGUMENTS	
25	3.079	3.683	77.000	NON-WEIGHTED

UPPER LIMIT	OBSERVED FREQUENCY	PER CENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
1	18	71.99	71.9	28.0	.324	-.564
2	0	.00	71.9	28.0	.649	-.293
3	1	3.99	75.9	24.0	.974	-.021
4	0	.00	75.9	24.0	1.298	.249
5	0	.00	75.9	24.0	1.623	.521
6	1	3.99	79.9	20.0	1.948	.792
7	0	.00	79.9	20.0	2.272	1.064
8	0	.00	79.9	20.0	2.597	1.335
9	0	.00	79.9	20.0	2.922	1.607
10	5	19.99	100.0	.0	3.246	1.878

REMAINING FREQUENCIES ARE ALL ZERO



X AXIS: NAME OF QUEUE

Y AXIS: NUMBER OF MESSAGES ENTERING INHS QUEUE

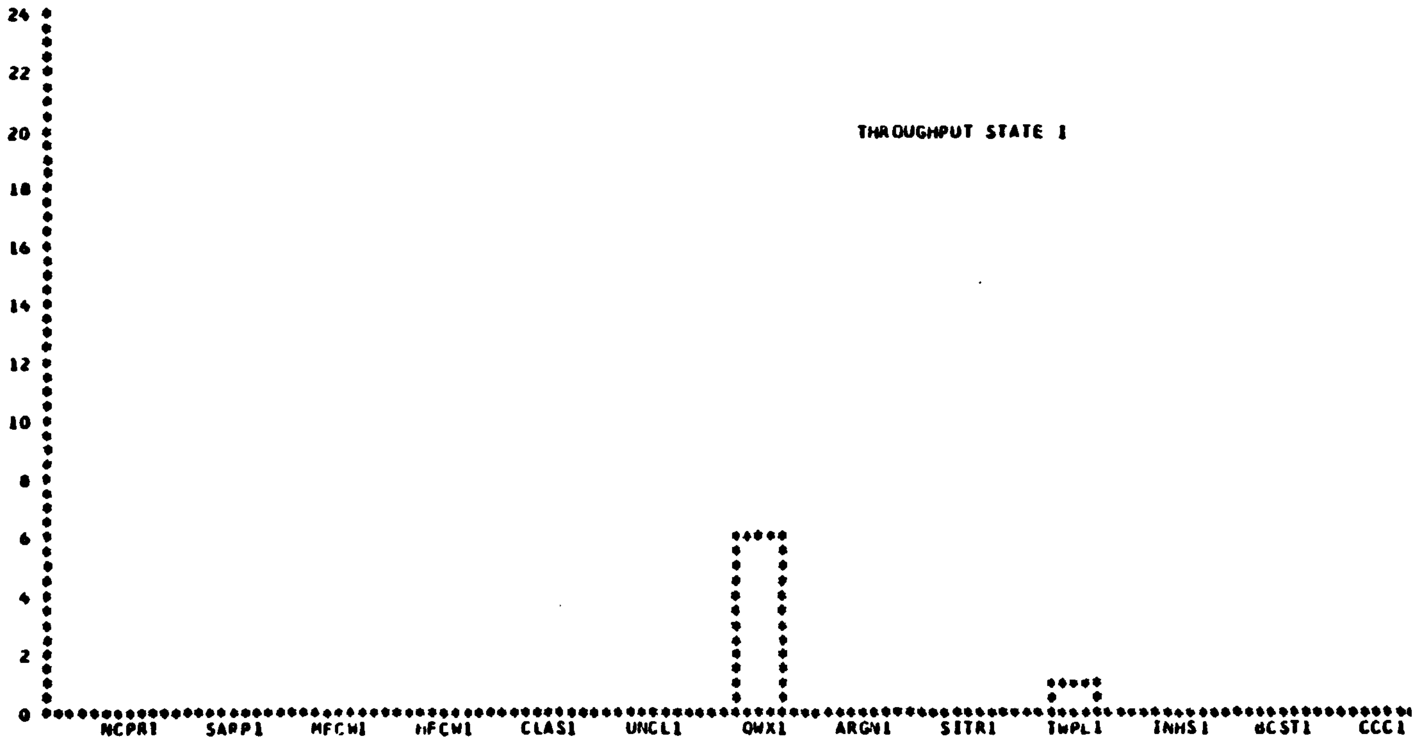
ORIGIN OF MESSAGES INTO HF BROADCAST QUEUE

TABLE TAB12

ENTRIES IN TABLE	MEAN ARGUMENT	STANDARD DEVIATION	SUM OF ARGUMENTS	
7	7.428	1.132	52.000	NON-WEIGHTED

UPPER LIMIT	OBSERVED FREQUENCY	PER CENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
1	0	.00	.0	100.0	.134	-5.674
2	0	.00	.0	100.0	.269	-4.792
3	0	.00	.0	100.0	.403	-3.909
4	0	.00	.0	100.0	.538	-3.026
5	0	.00	.0	100.0	.673	-2.143
6	0	.00	.0	100.0	.807	-1.261
7	6	85.71	85.7	14.2	.942	-.378
8	0	.00	85.7	14.2	1.076	.504
9	0	.00	85.7	14.2	1.211	1.387
10	1	14.28	100.0	.0	1.346	2.269

REMAINING FREQUENCIES ARE ALL ZERO



X AXIS: NAME OF QUEUE

Y AXIS: NUMBER OF MESSAGES ENTERING BCST QUEUE

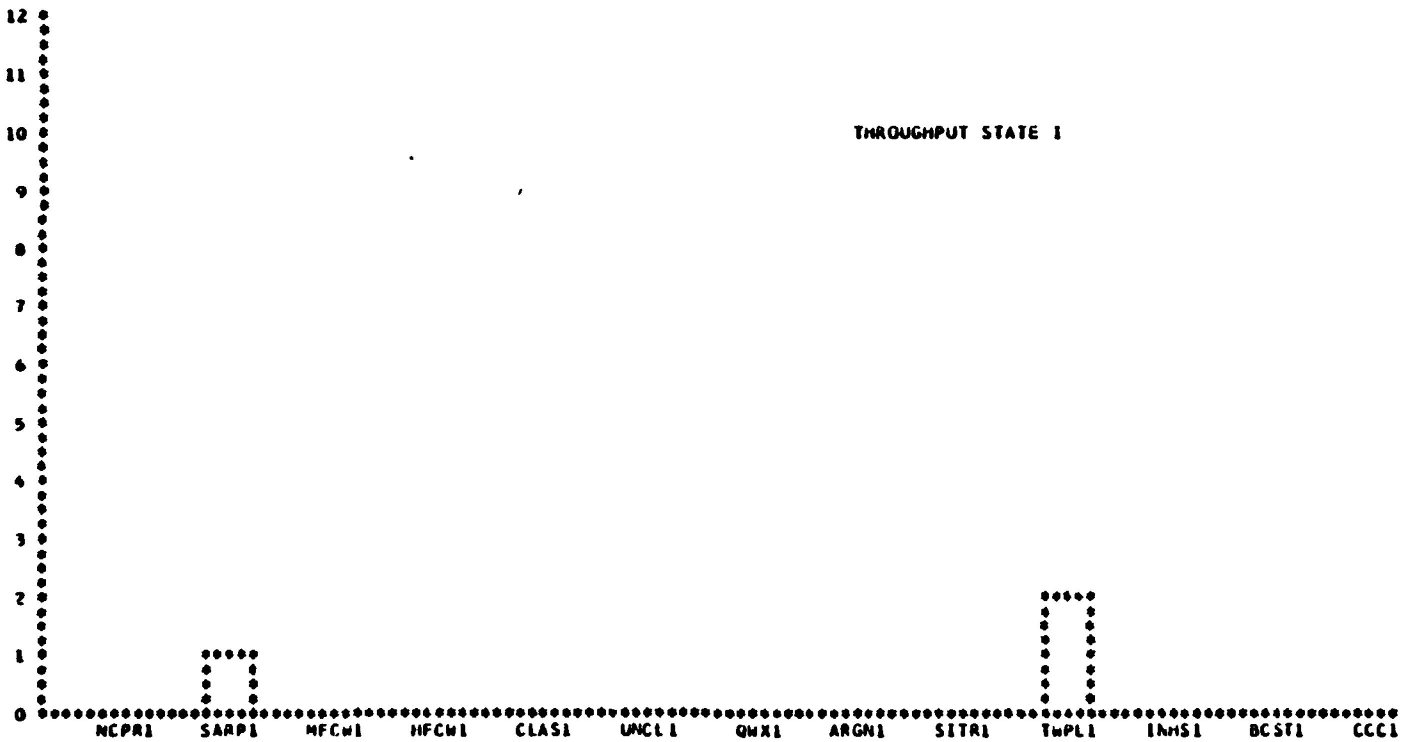
ORIGIN OF MESSAGES INTO COMMAND & CONTROL QUEUE

TABLE TAB13

ENTRIES IN TABLE	MEAN ARGUMENT	STANDARD DEVIATION	SUM OF ARGUMENTS	
3	7.333	4.617	22.000	NON-WEIGHTED

UPPER LIMIT	OBSERVED FREQUENCY	PER CENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
1	0	.00	.0	100.0	.136	-1.371
2	1	33.33	33.3	66.6	.272	-1.155
3	0	.00	33.3	66.6	.409	-.938
4	0	.00	33.3	66.6	.545	-.721
5	0	.00	33.3	66.6	.681	-.505
6	0	.00	33.3	66.6	.818	-.288
7	0	.00	33.3	66.6	.954	-.072
8	0	.00	33.3	66.6	1.090	.144
9	0	.00	33.3	66.6	1.227	.360
10	2	66.66	100.0	.0	1.363	.577

REMAINING FREQUENCIES ARE ALL ZERO



X AXIS: NAME OF QUEUE

Y AXIS: NUMBER OF MESSAGES ENTERING CCC QUEUE

APPENDIX G

This appendix contains the transit times for each type of message in the system for the day that generated the most message entries over the simulated week.

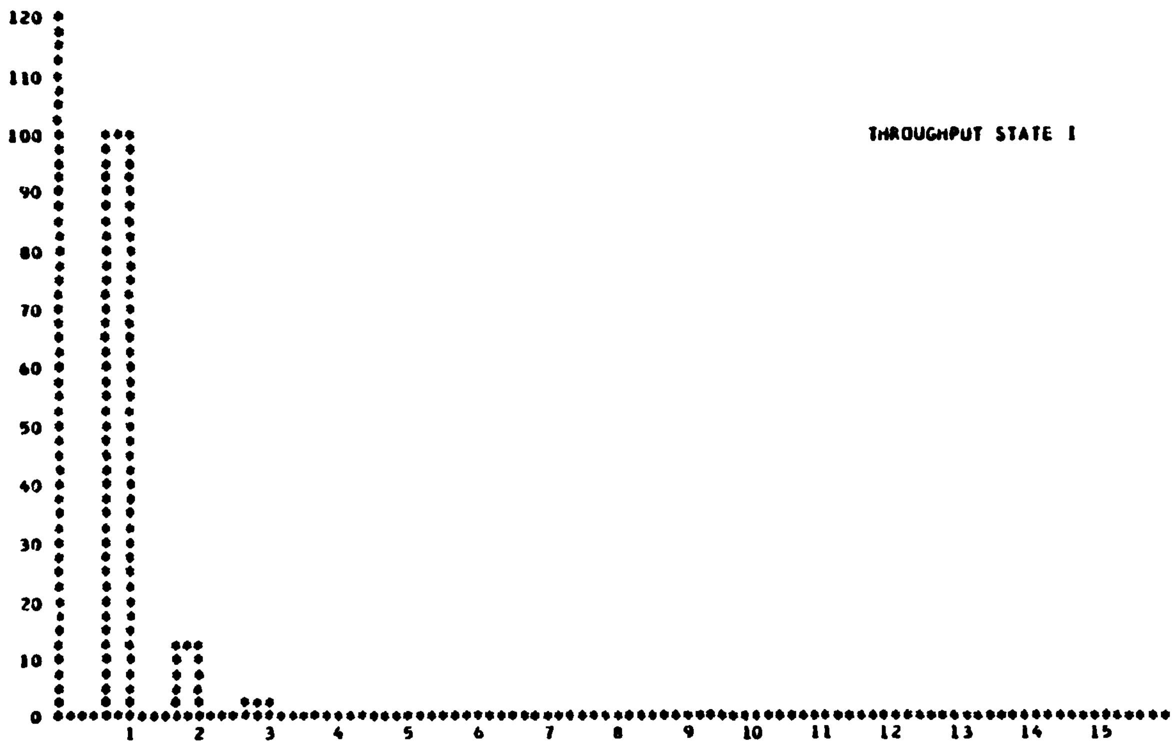
NCPR MESSAGE TRANSIT TIME IN SYSTEM

TABLE TAB16

ENTRIES IN TABLE	MEAN ARGUMENT	STANDARD DEVIATION	SUM OF ARGUMENTS	
116	1.163	.436	135.000	NON-WEIGHTED

UPPER LIMIT	OBSERVED FREQUENCY	PER CENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMMATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
1	100	86.20	86.2	13.7	.859	-.375
2	13	11.20	97.4	2.5	1.718	1.917
3	3	2.58	100.0	.0	2.577	4.211

REMAINING FREQUENCIES ARE ALL ZERO



X AXIS: TRANSIT TIME IN MINUTES

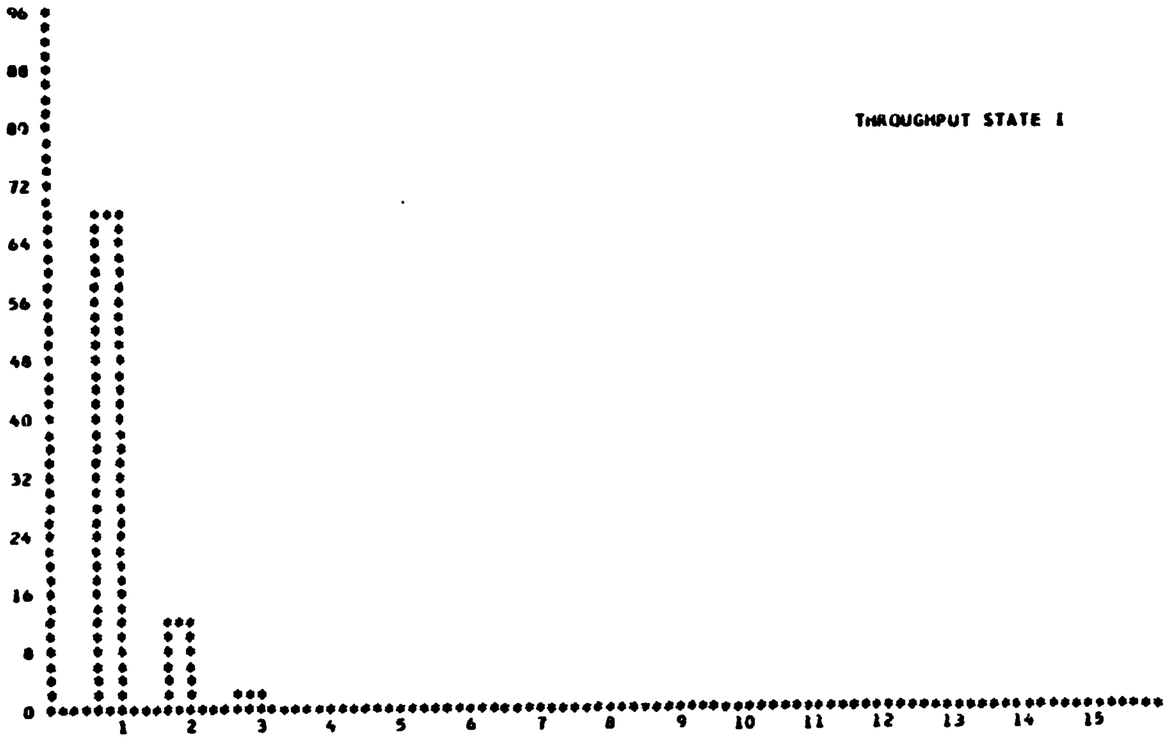
Y AXIS: NO. OF MESSAGES PER TRANSIT TIME

SARP MESSAGE TRANSIT TIME IN SYSTEM

TABLE TABL7
ENTRIES IN TABLE 84 | MEAN ARGUMENT 1.226 | STANDARD DEVIATION .545 | SUM OF ARGUMENTS 103.000 | NON-WEIGHTED

UPPER LIMIT	OBSERVED FREQUENCY	PER CENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
1	63	82.14	82.1	17.8	.815	-.414
2	12	14.28	96.4	3.5	1.631	1.418
3	2	2.38	98.8	1.1	2.446	3.252
4	1	1.19	100.0	.0	3.262	5.085

REMAINING FREQUENCIES ARE ALL ZERO



THROUGHPUT STATE I

X AXIS: TRANSIT TIME IN MINUTES

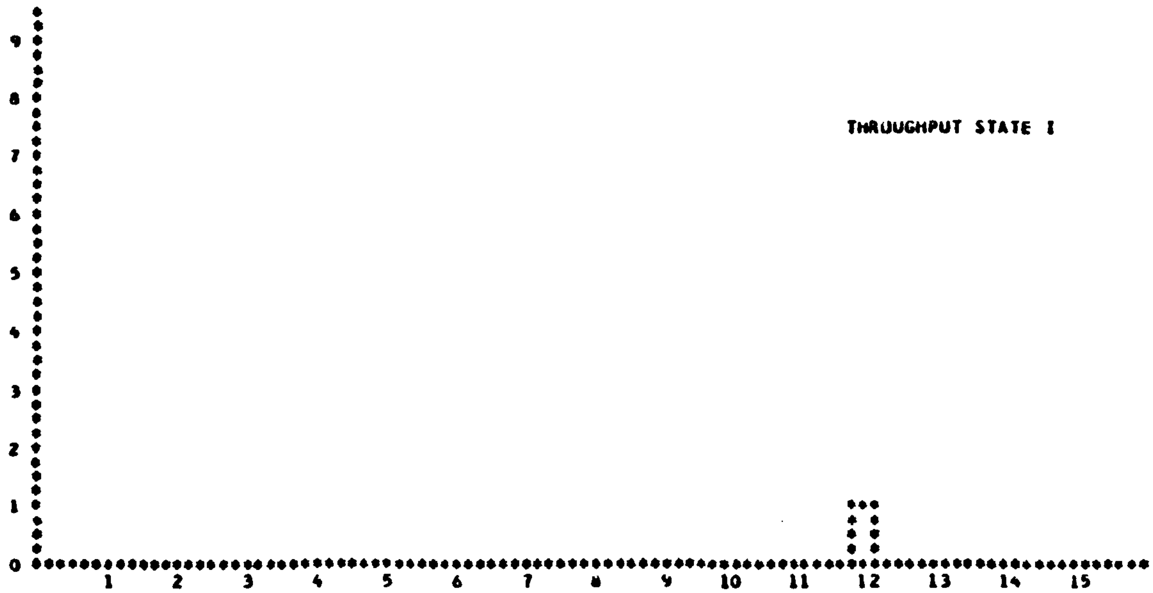
Y AXIS: NO. OF MESSAGES PER TRANSIT TIME

MF/CW MESSAGE TRANSIT TIME IN SYSTEM

TABLE TABLE
ENTRIES IN TABLE 4 | MEAN ARGUMENT 16.500 | STANDARD DEVIATION 3.316 | SUM OF ARGUMENTS 66.000 | NON-WEIGHTED

UPPER LIMIT	OBSERVED FREQUENCY	PER CENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
1	0	.00	.0	100.0	.060	-4.673
2	0	.00	.0	100.0	.121	-4.372
3	0	.00	.0	100.0	.181	-4.070
4	0	.00	.0	100.0	.242	-3.769
5	0	.00	.0	100.0	.303	-3.467
6	0	.00	.0	100.0	.363	-3.166
7	0	.00	.0	100.0	.424	-2.864
8	0	.00	.0	100.0	.484	-2.563
9	0	.00	.0	100.0	.545	-2.261
10	0	.00	.0	100.0	.606	-1.955
11	0	.00	.0	100.0	.666	-1.658
12	1	25.00	25.0	75.0	.727	-1.356
13	0	.00	25.0	75.0	.787	-1.055
14	0	.00	25.0	75.0	.848	-.753
15	0	.00	25.0	75.0	.909	-.452
16	0	.00	25.0	75.0	.969	-.150
17	2	50.00	75.0	25.0	1.030	.150
18	0	.00	75.0	25.0	1.090	.452
19	0	.00	75.0	25.0	1.151	.753
20	1	25.00	100.0	.0	1.212	1.055

REMAINING FREQUENCIES ARE ALL ZERO



X AXIS: TRANSIT TIME IN MINUTES

Y AXIS: NO. OF MESSAGES PER TRANSIT TIME

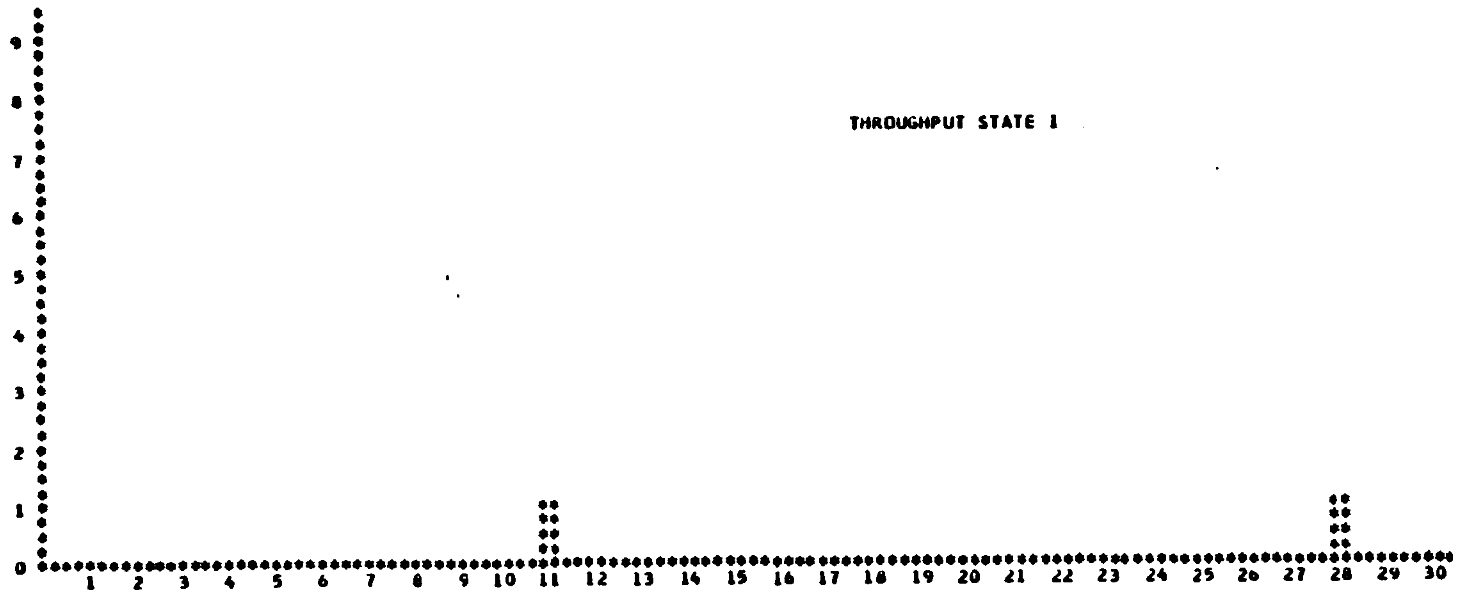
HF/CW MESSAGE TRANSIT TIME IN SYSTEM

TABLE TAB19
ENTRIES IN TABLE 2 | MEAN ARGUMENT 19.500 | STANDARD DEVIATION 12.019 | SUM OF ARGUMENTS 39.000 | NON-WEIGHTED

UPPER LIMIT	OBSERVED FREQUENCY	PER CENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
1	0	.00	.0	100.0	.051	-1.539
2	0	.00	.0	100.0	.102	-1.455
3	0	.00	.0	100.0	.153	-1.372
4	0	.00	.0	100.0	.205	-1.289
5	0	.00	.0	100.0	.256	-1.206
6	0	.00	.0	100.0	.307	-1.123
7	0	.00	.0	100.0	.358	-1.039
8	0	.00	.0	100.0	.410	-.956
9	0	.00	.0	100.0	.461	-.873
10	0	.00	.0	100.0	.512	-.790
11	1	50.00	50.0	50.0	.564	-.707
12	0	.00	50.0	50.0	.615	-.623
13	0	.00	50.0	50.0	.666	-.540
14	0	.00	50.0	50.0	.717	-.457
15	0	.00	50.0	50.0	.769	-.374
16	0	.00	50.0	50.0	.820	-.291
17	0	.00	50.0	50.0	.871	-.207
18	0	.00	50.0	50.0	.923	-.124
19	0	.00	50.0	50.0	.974	-.041
20	0	.00	50.0	50.0	1.025	.041
21	0	.00	50.0	50.0	1.076	.124
22	0	.00	50.0	50.0	1.128	.207
23	0	.00	50.0	50.0	1.179	.291
24	0	.00	50.0	50.0	1.230	.374
25	0	.00	50.0	50.0	1.282	.457
26	0	.00	50.0	50.0	1.333	.540
27	0	.00	50.0	50.0	1.384	.623
28	1	50.00	100.0	.0	1.435	.707

REMAINING FREQUENCIES ARE ALL ZERO

THROUGHPUT STATE 1



X AXIS: TRANSIT TIME IN MINUTES
Y AXIS: NO. OF MESSAGES PER TRANSIT TIME

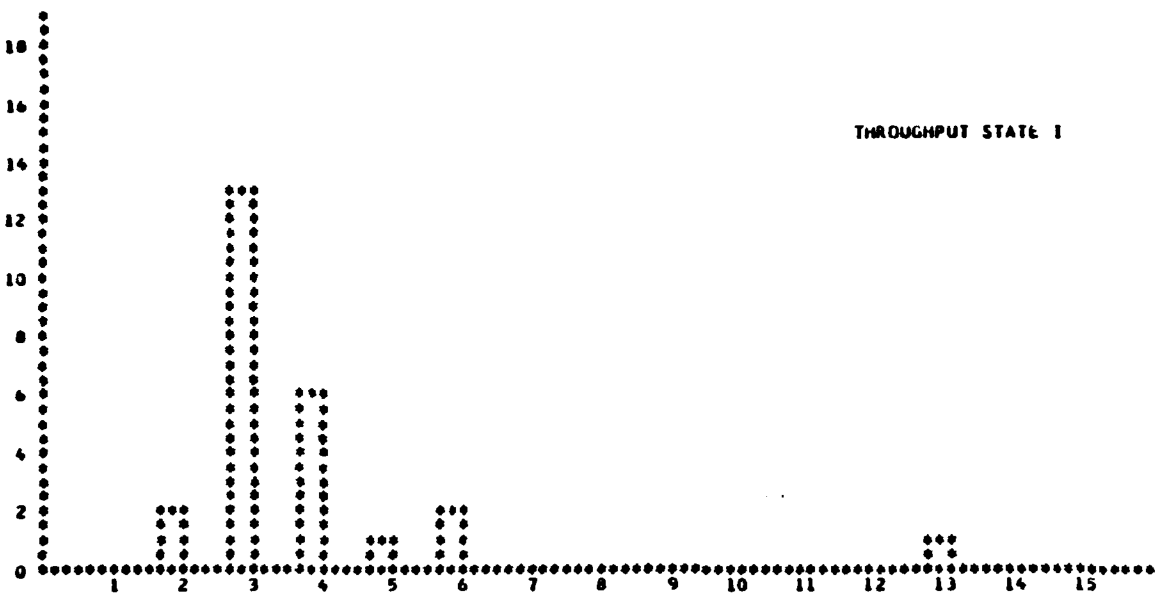
CLAS MESSAGE TRANSIT TIME IN SYSTEM

TABLE TAB20

ENTRIES IN TABLE	MEAN ARGUMENT	STANDARD DEVIATION	SUM OF ARGUMENTS	
25	3.879	2.144	97.000	NON-WEIGHTED

UPPER LIMIT	OBSERVED FREQUENCY	PER CENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
1	0	.00	.0	100.0	.257	-1.342
2	2	7.99	7.9	92.0	.515	-.876
3	13	51.99	59.9	40.0	.773	-.410
4	6	23.99	83.9	16.0	1.030	.055
5	1	3.99	87.9	12.0	1.288	.522
6	2	7.99	95.9	4.0	1.546	.988
7	0	.00	95.9	4.0	1.804	1.454
8	0	.00	95.9	4.0	2.061	1.921
9	0	.00	95.9	4.0	2.319	2.387
10	0	.00	95.9	4.0	2.577	2.853
11	0	.00	95.9	4.0	2.835	3.320
12	0	.00	95.9	4.0	3.092	3.786
13	1	3.99	100.0	.0	3.350	4.252

REMAINING FREQUENCIES ARE ALL ZERO



X AXIS: TRANSIT TIME IN MINUTES

Y AXIS: NO. OF MESSAGES PER TRANSIT TIME

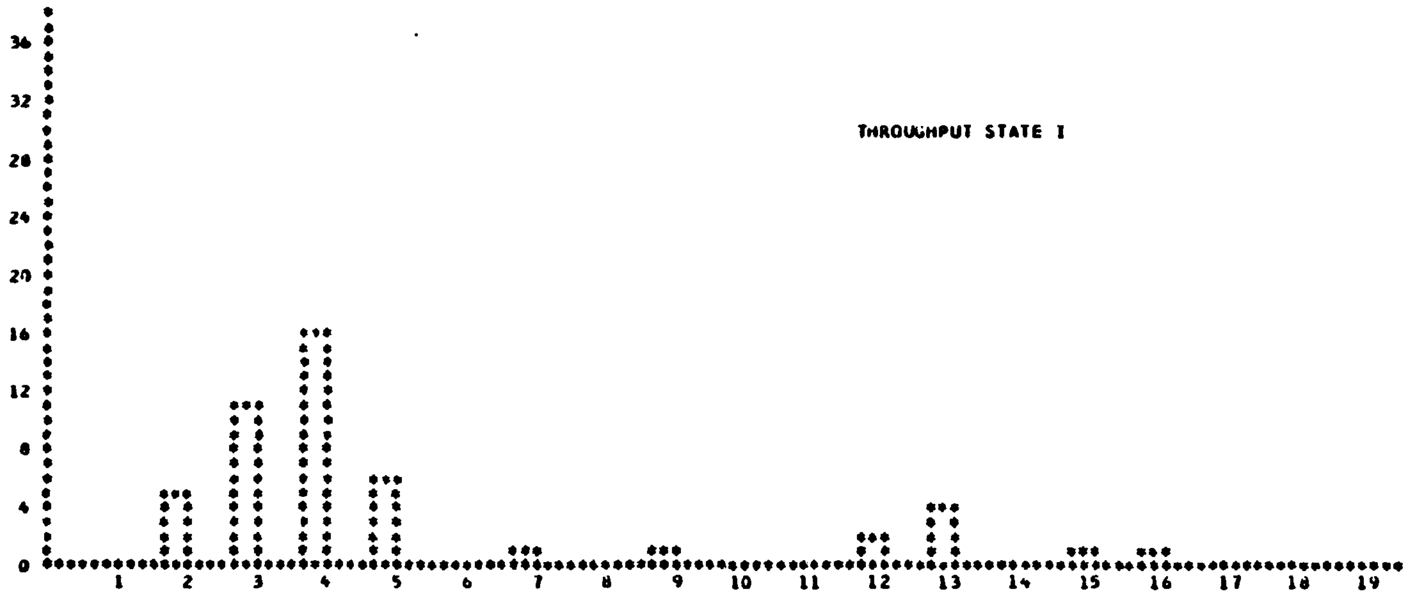
UNCL MESSAGE TRANSIT TIME IN SYSTEM

TABLE TAB21

ENTRIES IN TABLE	MEAN ARGUMENT	STANDARD DEVIATION	SUM OF ARGUMENTS	
48	5.416	3.835	260.000	NON-WEIGHTED

UPPER LIMIT	OBSERVED FREQUENCY	PER CENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
1	0	.00	.0	100.0	.184	-1.151
2	5	10.41	10.4	89.5	.369	-.890
3	11	22.91	33.3	66.6	.553	-.630
4	16	33.33	66.6	33.3	.738	-.369
5	6	12.50	79.1	20.8	.923	-.108
6	0	.00	79.1	20.8	1.107	.152
7	1	2.08	81.2	18.7	1.292	.412
8	0	.00	81.2	18.7	1.476	.673
9	1	2.08	83.3	16.6	1.661	.934
10	0	.00	83.3	16.6	1.846	1.194
11	0	.00	83.3	16.6	2.030	1.455
12	2	4.16	87.4	12.5	2.215	1.716
13	4	8.33	95.8	4.1	2.399	1.976
14	0	.00	95.8	4.1	2.584	2.237
15	1	2.08	97.9	2.0	2.769	2.498
16	1	2.08	100.0	.0	2.953	2.758

REMAINING FREQUENCIES ARE ALL ZERO



X AXIS: TRANSIT TIME IN MINUTES

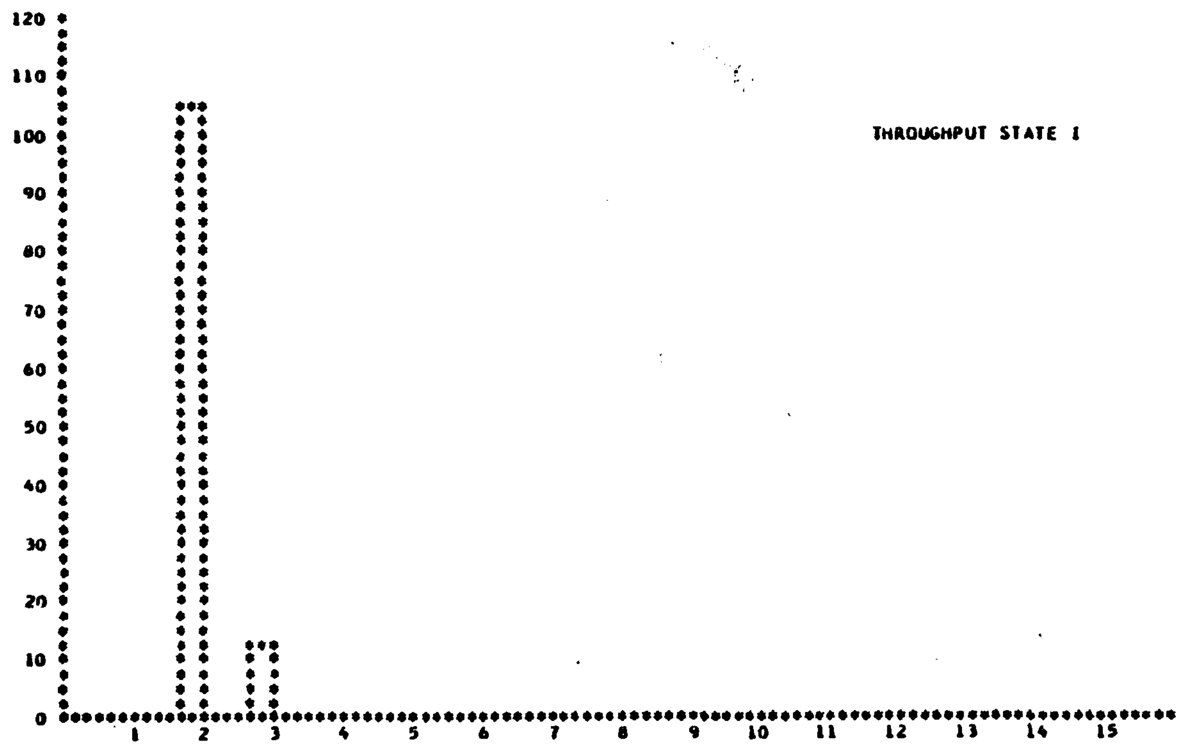
Y AXIS: NO. OF MESSAGES PER TRANSIT TIME

WEATHER MESSAGE TRANSIT TIME IN SYSTEM

TABLE TAB22 ENTRIES IN TABLE	MEAN ARGUMENT	STANDARD DEVIATION	SUM OF ARGUMENTS	
120	2.141	.395	257.000	NON-WEIGHTED

UPPER LIMIT	OBSERVED FREQUENCY	PER CENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
1	0	.00	.0	100.0	.466	-2.890
2	105	87.50	87.5	12.5	.933	-.358
3	13	10.83	98.3	1.6	1.400	2.172
4	2	1.66	100.0	.0	1.867	4.704

REMAINING FREQUENCIES ARE ALL ZERO



THROUGHPUT STATE I

X AXIS: TRANSIT TIME IN MINUTES

Y AXIS: NO. OF MESSAGES PER TRANSIT TIME

ARGN MESSAGE TRANSIT TIME IN SYSTEM

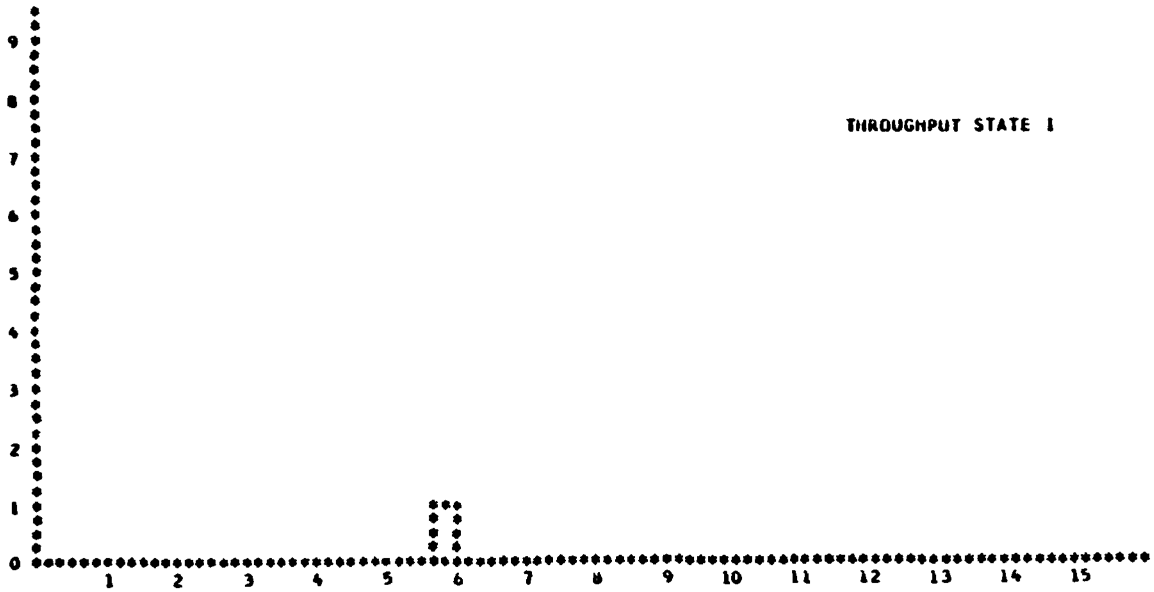
TABLE TAB23

ENTRIES IN TABLE	MEAN ARGUMENT	STANDARD DEVIATION	SUM OF ARGUMENTS	
1	6.000		6.000	NON-WEIGHTED

UPPER LIMIT	OBSERVED FREQUENCY	PER CENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
1	0	.00	.0	100.0	.166	-.000
2	0	.00	.0	100.0	.333	-.000
3	0	.00	.0	100.0	.500	-.000
4	0	.00	.0	100.0	.666	-.000
5	0	.00	.0	100.0	.833	-.000
6	1	100.00	100.0	.0	1.000	-.000

REMAINING FREQUENCIES ARE ALL ZERO

THROUGHPUT STATE 1



X AXIS: TRANSIT TIME IN MINUTES

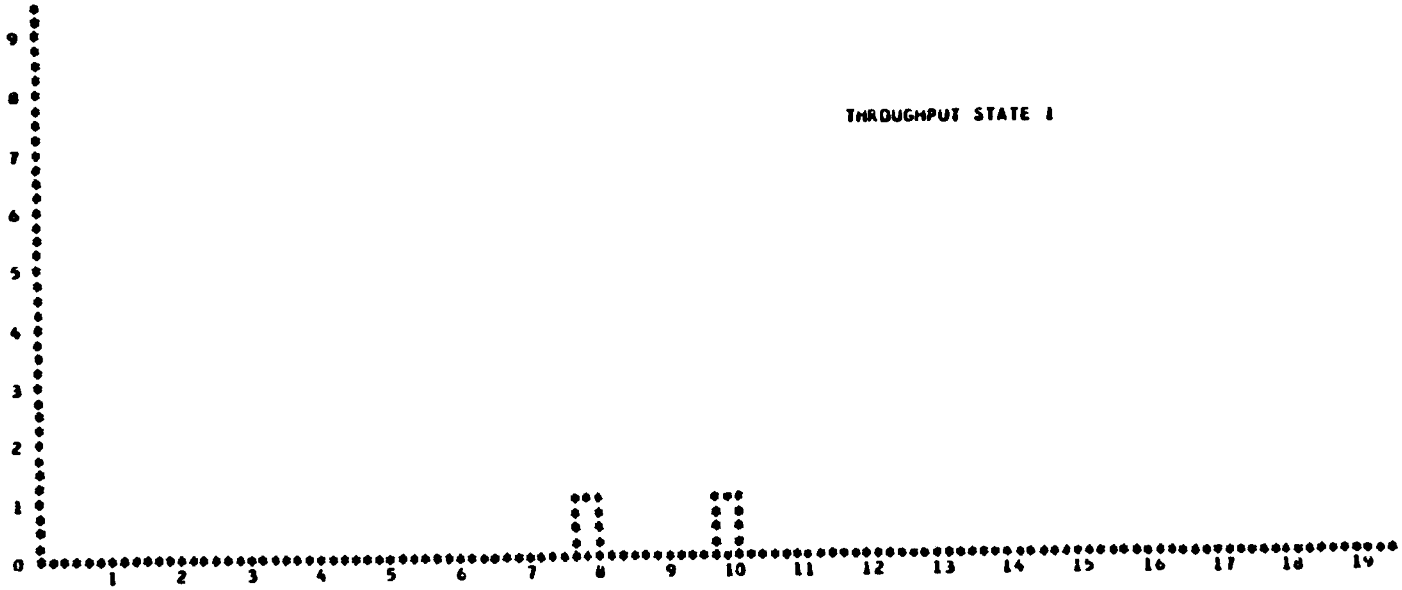
Y AXIS: NO. OF MESSAGES PER TRANSIT TIME

SITOR MESSAGE TRANSIT TIME IN SYSTEM

TABLE TAB24 ENTRIES IN TABLE 2 | MEAN ARGUMENT 9.000 | STANDARD DEVIATION 1.414 | SUM OF ARGUMENTS 18.000 | NON-WEIGHTED

UPPER LIMIT	OBSERVED FREQUENCY	PER CENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
1	0	.00	.0	100.0	.111	-5.657
2	0	.00	.0	100.0	.222	-4.950
3	0	.00	.0	100.0	.333	-4.243
4	0	.00	.0	100.0	.444	-3.535
5	0	.00	.0	100.0	.555	-2.828
6	0	.00	.0	100.0	.666	-2.121
7	0	.00	.0	100.0	.777	-1.414
8	1	50.00	50.0	50.0	.888	-.707
9	0	.00	50.0	50.0	1.000	-.000
10	1	50.00	100.0	.0	1.111	.707

REMAINING FREQUENCIES ARE ALL ZERO



X AXIS: TRANSIT TIME IN MINUTES

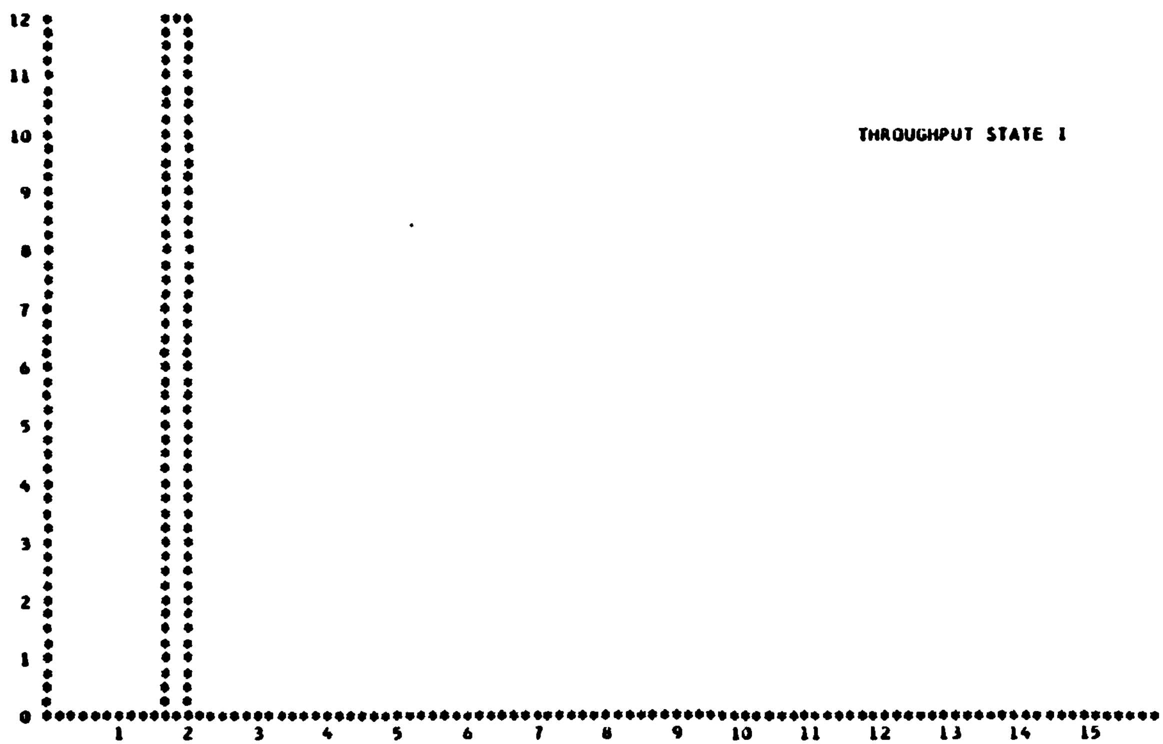
Y AXIS: NO. OF MESSAGES PER TRANSIT TIME

TMPL MESSAGE TRANSIT TIME IN SYSTEM

TABLE TAB25 ENTRIES IN TABLE	MEAN ARGUMENT	STANDARD DEVIATION	SUM OF ARGUMENTS	
12	2.000	.000	24.000	NON-WEIGHTED

UPPER LIMIT	OBSERVED FREQUENCY	PER CENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
1	0	.00	.0	100.0	.500	-.000
2	12	100.00	100.0	.0	1.000	-.000

REMAINING FREQUENCIES ARE ALL ZERO



X AXIS: TRANSIT TIME IN MINUTES

Y AXIS: NO. OF MESSAGES PER TRANSIT TIME

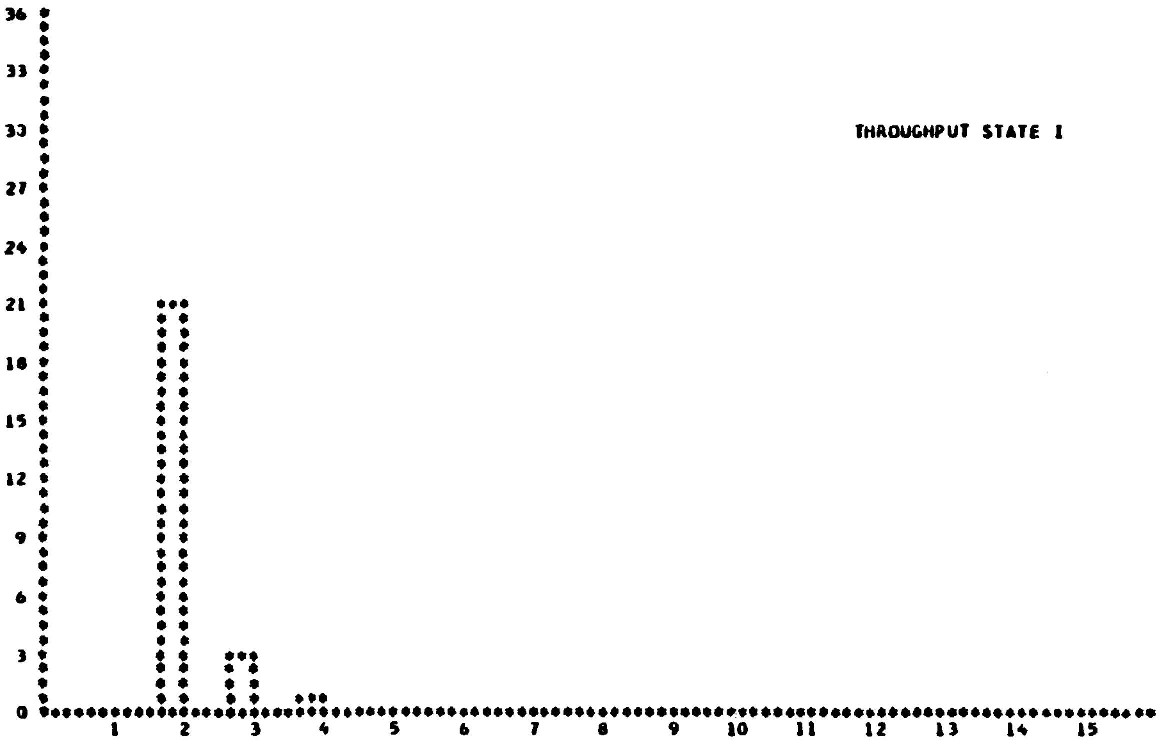
INHOUSE MESSAGE TRANSIT TIME IN SYSTEM

TABLE TAB26

ENTRIES IN TABLE	MEAN ARGUMENT	STANDARD DEVIATION	SUM OF ARGUMENTS	
25	2.199	.500	55.000	NON-WEIGHTED

UPPER LIMIT	OBSERVED FREQUENCY	PER CENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
1	0	.00	.0	100.0	.454	-2.399
2	21	83.99	83.9	16.0	.909	-.399
3	3	11.99	95.9	4.0	1.363	1.600
4	1	3.99	100.0	.0	1.818	3.600

REMAINING FREQUENCIES ARE ALL ZERO



X AXIS: TRANSIT TIME IN MINUTES

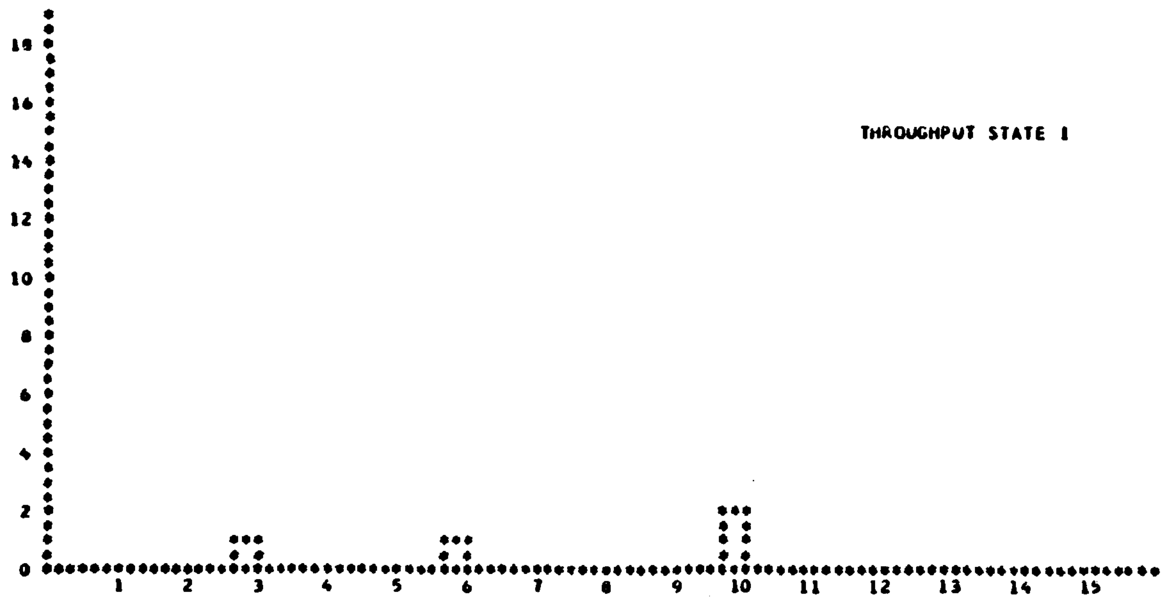
Y AXIS: NO. OF MESSAGES PER TRANSIT TIME

HF BCST MESSAGE TRANSIT TIME IN SYSTEM

TABLE TAB27
ENTRIES IN TABLE 7 | MEAN ARGUMENT 12.571 | STANDARD DEVIATION 7.160 | SUM OF ARGUMENTS 88.000 | NON-WEIGHTED

UPPER LIMIT	OBSERVED FREQUENCY	PER CENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
1	0	.00	.0	100.0	.079	-1.616
2	0	.00	.0	100.0	.159	-1.476
3	1	14.28	14.2	85.7	.238	-1.336
4	0	.00	14.2	85.7	.318	-1.197
5	0	.00	14.2	85.7	.397	-1.057
6	1	14.28	28.5	71.4	.477	-.917
7	0	.00	28.5	71.4	.556	-.778
8	0	.00	28.5	71.4	.636	-.638
9	0	.00	28.5	71.4	.715	-.498
10	2	28.57	57.1	42.8	.795	-.359
11	0	.00	57.1	42.8	.875	-.219
12	0	.00	57.1	42.8	.954	-.079
13	0	.00	57.1	42.8	1.034	.059
14	0	.00	57.1	42.8	1.113	.199
15	0	.00	57.1	42.8	1.193	.339
16	0	.00	57.1	42.8	1.272	.478
17	0	.00	57.1	42.8	1.352	.618
18	1	14.28	71.4	28.5	1.431	.758
19	1	14.28	85.7	14.2	1.511	.897
20	0	.00	85.7	14.2	1.590	1.037
21	0	.00	85.7	14.2	1.670	1.177
22	1	14.28	100.0	.0	1.750	1.316

REMAINING FREQUENCIES ARE ALL ZERO



X AXIS: TRANSIT TIME IN MINUTES
Y AXIS: NO. OF MESSAGES PER TRANSIT TIME

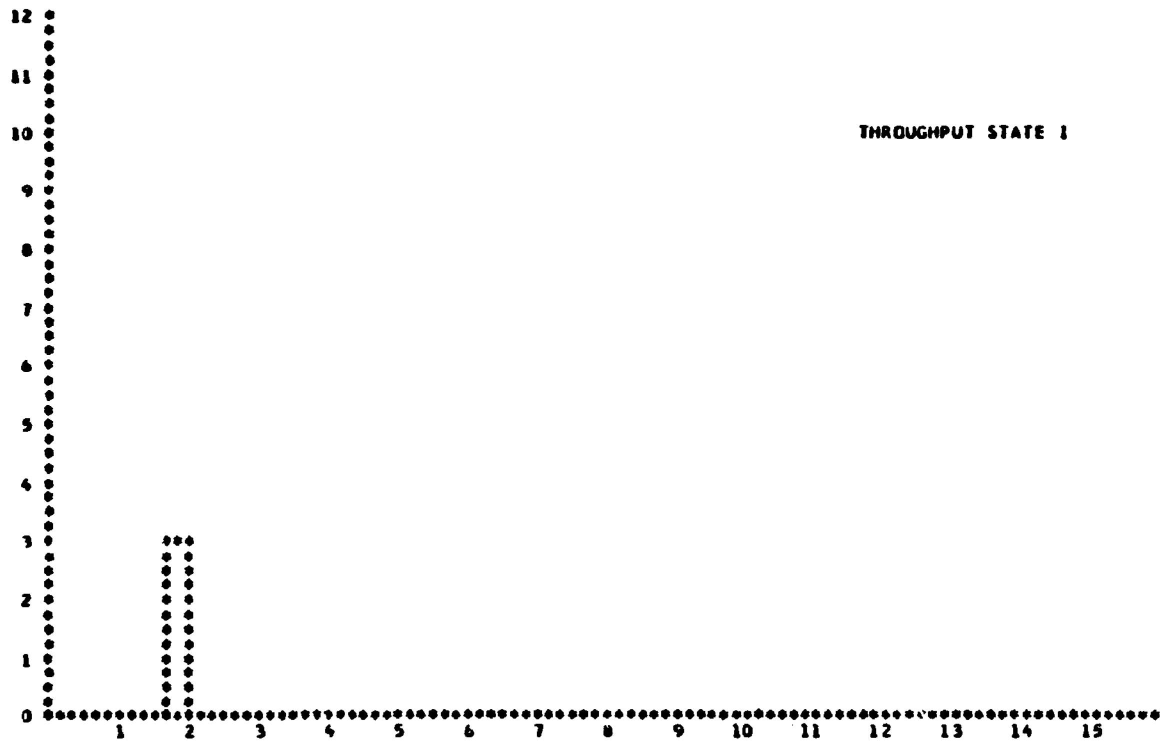
CCC MESSAGE TRANSIT TIME IN SYSTEM

TABLE TAB20

ENTRIES IN TABLE	MEAN ARGUMENT	STANDARD DEVIATION	SUM OF ARGUMENTS	
3	2.000	.000	6.000	NON-WEIGHTED

UPPER LIMIT	OBSERVED FREQUENCY	PER CENT OF TOTAL	CUMULATIVE PERCENTAGE	CUMULATIVE REMAINDER	MULTIPLE OF MEAN	DEVIATION FROM MEAN
1	0	.00	.0	100.0	.500	-.000
2	3	100.00	100.0	.0	1.000	-.000

REMAINING FREQUENCIES ARE ALL ZERO



X AXIS: TRANSIT TIME IN MINUTES

Y AXIS: NO. OF MESSAGES PER TRANSIT TIME

APPENDIX H

This appendix contains the input statistics used for Throughput State II.

```
BLOCK
NUMBER  *LOC    OPERATION  A,B,C,D,E,F,G,H,I          COMMENTS                                   STATEMENT
                                                                                                 NUMBER
                SIMULATE
        *       THIS IS A GPSS PROGRAM WRITTEN TO SIMULATE THE TRAFFIC FLOW AT THE
        *       UNITED STATES CCAST GUARD COMMUNICATIONS STATION SAN FRANCISCO LOCATED
        *       AT POINT REYES, CALIFCRNIA.  THIS IS BEING DONE AS A PART OF MY THESIS
        *       TO MODEL THE PROPOSED MESSAGE SWITCHING SYSTEM (MSS) UNDER DEVELOPMENT
        *       BY THE 12TH COAST GUARD DISTRICT.  USING TRAFFIC FLOW STATISTICS
        *       RECENTLY GATHERED AT THE STATION AS INPUTS TO THE MODEL, MY THESIS WILL
        *       ANALYZE THE RESULTS AND OBSERVE GENERAL TRENDS IN THE MODEL TO ASSIST
        *       IN THE DEVELOPMENT OF DESIGN PARAMETERS FOR THE MSS.  THIS WILL, I HOPE,
        *       CULMINATE IN A SYSTEM THAT WILL MEET THE PRESENT AND FUTURE NEEDS OF
        *       COMMUNICATIONS AT COMMSTA SAN FRANCISCO.
        *
        *
        *
        *
        *        THE FOLLOWING FUNCTIONS DEFINE THE MESSAGE STATISTICS TO BE USED
        *        THROUGHOUT THIS SIMULATION.
        *
        *
        *
        *        STATISTICS FOR NAVCOMPARS MESSAGE INTERARRIVAL RATE (ANCPR), MESSAGE
        *        PRIORITY (PNCPR), MESSAGE DESTINATION (DNCPR), AND MESSAGE LENGTH
        *        (LNCPR).
        *
         ANCPR FUNCTION    RN1,C6
        .32,5/.70,10/.86,15/.93,20/.95,25/1,30
         PNCPR FUNCTION    RN1,D4
        .38,1/.86,2/.98,3/1,4
         DNCPR FUNCTION    RN1,D9
        .03,3/.06,4/.30,5/.65,6/.66,8/.69,9/.94,11/.97,12/1,14
         LNCPR FUNCTION    RN1,C5
        .45,20/.80,40/.85,60/.89,140/1,160
        *
        *
        *
        *        STATISTICS FOR SARPAC MESSAGE INTERARRIVAL (ASARP), MESSAGE PRIORITY
        *        (PSARP), MESSAGE DESTINATION (DSARP), AND MESSAGE LENGTH (LSARP).
        *
         ASARP FUNCTION    RN2,C3
        .63,99/.88,349/1,399
         PSARP FUNCTION    RN2,D3
        .25,1/.75,2/1,3
         DSARP FUNCTION    RN2,D5
        .2,3/.4,5/.6,6/.8,12/1,14
         LSARP FUNCTION    RN2,C5
        .22,10/.55,20/.77,30/.88,40/1,50
        *
        *
        *
        *        STATISTICS FOR MF/CW MESSAGE INTERARRIVALS (AMFCW), MESSAGE PRIORITY
        *        (PMFCW), MESSAGE DESTINATION (DMFCW), AND MESSAGE LENGTH (LMFCW).
        *
         AMFCW FUNCTION    RN3,C7
        .76,12/.87,24/.91,37/.95,49/.97,99/.98,124/1,137
         PMFCW FUNCTION    RN3,D2
        .11,1/1,2
```

```
DMFCW FUNCTION   RN3,D6
.32,1/.69,2/.71,5/.76,6/.98,7/1,11
 LMFCW FUNCTION   RN3,C4
.93,5/.95,10/.97,15/1,20
*
*
*
*      STATISTICS FOR HF/CW MESSAGE INTERARRIVALS (AHFCW), MESSAGE PRIORITY
*      (PHFCW), MESSAGE DESTINATION (DHFCW), AND MESSAGE LENGTH (LHFCW).
*
 AHFCW FUNCTION   RN4,C5
.75,5/.90,10/.94,15/.98,25/1,30
 PHFCW FUNCTION   RN4,D4
.07,1/.98,2/.99,3/1,4
 DHFCW FUNCTION   RN4,D5
.16,1/.41,2/.42,6/.99,7/1,10
 LHFCW FUNCTION   RN4,C2
.94,20/1,25
*
*
*
*      STATISTICS FOR CLASSIFIED SHIP/SHORE MESSAGE INTERARRIVALS (ACLAS),
*      MESSAGE PRIORITY (PCLAS), MESSAGE DESTINATION (DCLAS), AND MESSAGE
*      LENGTH (LCLAS).
*
 ACLAS FUNCTION   RN6,C6
.43,5/.61,15/.72,20/.93,25/.97,35/1,40
 PCLAS FUNCTION   RN6,D3
.33,1/.93,2/1,3
 DCLAS FUNCTION   RN6,D6
.75,1/.80,2/.85,5/.90,6/.95,7/1,10
 LCLAS FUNCTION   RN6,C6
.15,20/.60,30/.87,50/.90,60/.96,70/1,80
*
*
*
*      STATISTICS FOR UNCLASSIFIED SHIP/SHORE MESSAGE INTERARRIVALS (AUNCL),
*      MESSAGE PRIORITY (PUNCL), MESSAGE DESTINATION (DUNCL), AND MESSAGE
*      LENGTH (LUNCL).
*
 AUNCL FUNCTION   RN5,C7
.24,12/.57,24/.67,37/.77,49/.91,62/.96,112/1,124
 PUNCL FUNCTION   RN5,D3
.38,1/.94,2/1,3
 DUNCL FUNCTION   RN5,D5
.76,1/.82,2/.88,6/.94,10/1,11
 LUNCL FUNCTION   RN5,C4
.24,10/.81,20/.95,50/1,60
*
*
*
*      STATISTICS FOR WEATHER MESSAGE INTERARRIVALS (AWX), MESSAGE DESTINATION
*      (DWX), AND MESSAGE LENGTH (LWX).
*
 AWX   FUNCTION   RN7,C6
.48,12/.62,24/.72,49/.86,112/.96,149/1,162
 DWX   FUNCTION   RN7,D6
.06,1/.47,2/.53,10/.59,11/.94,12/1,14
```

```
 LWX    FUNCTION    RN7,C5
.17,25/.47,50/.73,75/.77,100/1,125
*
*
*
*       STATISTICS FOR AIR/GROUND MESSAGE INTERARRIVALS (AARGN), MESSAGE
*       PRIORITY (PARGN), MESSAGE DESTINATION (DARGN), AND MESSAGE LENGTH
*       (LARGN).
*
 AARGN FUNCTION    RN8,C4
.25,12/.50,24/.88,74/1,87
 PARGN FUNCTION    RN7,D2
.13,2/1,3
 DARGN FUNCTION    RN8,D4
.25,1/.69,2/.75,5/1,6
 LARGN FUNCTION    RN9,C3
0,20/.56,30/1,40
*
*
*
*       STATISTICS FOR SITOR MESSAGE INTERARRIVALS (ASITR), MESSAGE PRIORITY
*       (PSITR), MESSAGE DESTINATION (DSITR), AND MESSAGE LENGTH (LSITR).
*
 ASITR FUNCTION    RN1,C4
.57,24/.86,149/.93,224/1,249
 PSITR FUNCTION    RN8,D3
.1,1/.9,2/1,3
 DSITR FUNCTION    RN1,D3
.44,1/.55,2/1,7
 LSITR FUNCTION    RN1,C3
.80,10/.87,20/1,25
*
*
*
*       STATISTICS FOR IWPL MESSAGE INTERARRIVALS (ATWPL), MESSAGE PRIORITY
*       (PTWPL), MESSAGE DESTINATION (DTWPL), AND MESSAGE LENGTH (LTWPL).
*
 ATWPL FUNCTION    RN2,C7
.58,9/.72,19/.75,39/.81,49/.92,59/.95,79/1,89
 PTWPL FUNCTION    RN1,D3
.3,1/.8,2/1,3
 DTWPL FUNCTION    RN2,D6
.04,4/.08,6/.75,7/.92,11/.96,12/1,14
 LTWPL FUNCTION    RN2,C6
.34,10/.50,20/.53,30/.61,40/.90,50/1,60
*
*
*
*       STATISTICS FOR INHOUSE MESSAGE INTERARRIVALS (AINHS), MESSAGE PRIORITY
*       (PINHS), MESSAGE DESTINATION (DINHS), AND MESSAGE LENGTH (LINHS).
*
 AINHS FUNCTION    RN3,C5
.40,12/.60,24/.80,37/.93,74/1,87
 PINHS FUNCTION    RN2,D3
.5,1/.88,2/1,3
 DINHS FUNCTION    RN3,D6
```

```
.3,1/.5,2/.6,5/.7,6/.8,7/1,10
 LINHS FUNCTION    RN3,C7
0,5/.09,10/.54,15/.72,20/.81,25/.95,30/1,35
*
*
*
*       STATISTICS FOR HF BROADCAST MESSAGE INTERARRIVALS (ABCST), MESSAGE
*       DESTINATION (DBCST), AND MESSAGE LENGTH (LBCST).
*
 ABCST FUNCTION    RN4,C4
.25,24/.50,149/.75,199/1,224
 DBCST FUNCTION    RN4,D4
.25,1/.50,2/.75,7/1,10
 LBCST FUNCTION    RN4,C3
0,5/.25,10/1,15
*
*
*
*       STATISTICS FOR COMMAND CONTROL COMMUNICATIONS MESSAGE INTERARRIVALS
*       (ACCC), MESSAGE PRIORITY (PCCC), MESSAGE DESTINATION (DCCC), AND
*       MESSAGE LENGTH (LCCC).
*
 ACCC  FUNCTION    RN5,C2
.50,50/1,100
 PCCC  FUNCTION    RN3,D2
.34,1/1,2
 DCCC  FUNCTION    RN5,D2
.5,1/1,2
 LCCC  FUNCTION    RN5,C2
.5,50/1,75
*
*
*
*
*       THE FOLLOWING VARIABLES COMPUTE TIME DELAY CREATED BY THE MESSAGE
*       GOING THROUGH THE SYSTEM AS P2*BITS PER CHARACTER/BAUD RATE.  BAUD
*       RATE USED HERE IS 9600. P2 IS THE PARAMETER USED FOR MESSAGE LENGTH.
*
*
*
 VMSG1 VARIABLE    P2/212
 VMSG2 VARIABLE    P2/212
 VMSG3 VARIABLE    P2/2
 VMSG4 VARIABLE    P2/2
 VMSG5 VARIABLE    P2/13
 VMSG6 VARIABLE    P2/13
 VMSG7 VARIABLE    P2/212
 VMSG8 VARIABLE    P2/6
 VMSG9 VARIABLE    P2/3
 VMG10 VARIABLE    P2/212
 VMG11 VARIABLE    P2/212
 VMG12 VARIABLE    P2/6
 VMG13 VARIABLE    P2/212
 VMSG  VARIABLE    P4
*
*
*
```

APPENDIX I

This appendix contains the input statistics used for Throughput State III.

```
BLOCK
NUMBER  *LOC   OPERATION  A,B,C,D,E,F,G,H,I          COMMENTS                                   STATEMENT
                                                                                                  NUMBER
               SIMULATE
        *      THIS IS A GPSS PROGRAM WRITTEN TO SIMULATE THE TRAFFIC FLOW AT THE
        *      UNITED STATES COAST GUARD COMMUNICATIONS STATION SAN FRANCISCO LOCATED
        *      AT POINT REYES, CALIFORNIA.  THIS IS BEING DONE AS A PART OF MY THESIS
        *      TO MODEL THE PROPOSED MESSAGE SWITCHING SYSTEM (MSS) UNDER DEVELOPMENT
        *      BY THE 12TH COAST GUARD DISTRICT.  USING TRAFFIC FLOW STATISTICS
        *      RECENTLY GATHERED AT THE STATION AS INPUTS TO THE MODEL, MY THESIS WILL
        *      ANALYZE THE RESULTS AND OBSERVE GENERAL TRENDS IN THE MODEL TO ASSIST
        *      IN THE DEVELOPMENT OF DESIGN PARAMETERS FOR THE MSS.  THIS WILL, I HOPE,
        *      CULMINATE IN A SYSTEM THAT WILL MEET THE PRESENT AND FUTURE NEEDS OF
        *      COMMUNICATIONS AT COMMSTA SAN FRANCISCO.
        *
        *
        *
        *
        *      THE FOLLOWING FUNCTIONS DEFINE THE MESSAGE STATISTICS TO BE USED
        *      THROUGHOUT THIS SIMULATION.
        *
        *
        *
        *      STATISTICS FOR NAVCOMPARS MESSAGE INTERARRIVAL RATE (ANCPR), MESSAGE
        *      PRIORITY (PNCPR), MESSAGE DESTINATION (DNCPR), AND MESSAGE LENGTH
        *      (LNCPR).
        *
         ANCPR FUNCTION   RN1,C6
        .32,4/.70,8/.86,12/.93,16/.95,20/1,24
         PNCPR FUNCTION   RN1,D4
        .38,1/.86,2/.98,3/1,4
         DNCPR FUNCTION   RN1,D9
        .03,3/.C6,4/.30,5/.65,6/.66,8/.69,9/.94,11/.97,12/1,14
         LNCPR FUNCTION   RN1,C5
        .45,20/.80,40/.85,60/.89,140/1,160
        *
        *
        *
        *      STATISTICS FOR SARPAC MESSAGE INTERARRIVAL (ASARP), MESSAGE PRIORITY
        *      (PSARP), MESSAGE DESTINATION (DSARP), AND MESSAGE LENGTH (LSARP).
        *
         ASARP FUNCTION   RN2,C3
        .63,80/.88,280/1,320
         PSARP FUNCTION   RN2,D3
        .25,1/.75,2/1,3
         DSARP FUNCTION   RN2,D5
        .2,3/.4,5/.6,6/.8,12/1,14
         LSARP FUNCTION   RN2,C5
        .22,10/.55,20/.77,30/.88,40/1,50
        *
        *
        *
        *      STATISTICS FOR MF/CW MESSAGE INTERARRIVALS (AMFCW), MESSAGE PRIORITY
        *      (PMFCW), MESSAGE DESTINATION (DMFCW), AND MESSAGE LENGTH (LMFCW).
        *
         AMFCW FUNCTION   RN3,C7
        .76,10/.87,20/.91,30/.95,40/.97,80/.98,100/1,110
         PMFCW FUNCTION   RN3,D2
        .11,1/1,2
```

```
DHFCW FUNCTION    RN3,D6
.32,1/.69,2/.71,5/.76,6/.98,7/1,11
LHFCW FUNCTION    RN3,C4
.93,5/.95,10/.97,15/1,20
*
*
*       STATISTICS FOR HF/CW MESSAGE INTERARRIVALS (AHFCW), MESSAGE PRIORITY
*       (PHFCW), MESSAGE DESTINATION (DHFCW), AND MESSAGE LENGTH (LHFCW).
*
AHFCW FUNCTION    RN4,C5
.75,4/.90,8/.94,12/.98,20/1,24
PHFCW FUNCTION    RN4,D4
.07,1/.98,2/.99,3/1,4
DHFCW FUNCTION    RN4,D5
.16,1/.41,2/.42,6/.99,7/1,10
LHFCW FUNCTION    RN4,C2
.94,20/1,25
*
*
*       STATISTICS FOR CLASSIFIED SHIP/SHORE MESSAGE INTERARRIVALS (ACLAS),
*       MESSAGE PRIORITY (PCLAS), MESSAGE DESTINATION (DCLAS), AND MESSAGE
*       LENGTH (LCLAS).
*
ACLAS FUNCTION    RN6,C6
.43,4/.61,12/.72,16/.93,20/.97,28/1,32
PCLAS FUNCTION    RN6,D3
.33,1/.93,2/1,3
DCLAS FUNCTION    RN6,D6
.75,1/.80,2/.85,5/.90,6/.95,7/1,10
LCLAS FUNCTION    RN6,C6
.15,20/.60,30/.87,50/.90,60/.96,70/1,80
*
*
*       STATISTICS FOR UNCLASSIFIED SHIP/SHORE MESSAGE INTERARRIVALS (AUNCL),
*       MESSAGE PRIORITY (PUNCL), MESSAGE DESTINATION (DUNCL), AND MESSAGE
*       LENGTH (LUNCL).
*
AUNCL FUNCTION    RN5,C7
.24,10/.57,20/.67,30/.77,40/.91,50/.96,90/1,100
PUNCL FUNCTION    RN5,D3
.39,1/.94,2/1,3
DUNCL FUNCTION    RN5,D5
.76,1/.82,2/.88,6/.94,10/1,11
LUNCL FUNCTION    RN5,C4
.24,10/.81,20/.95,50/1,60
*
*
*       STATISTICS FOR WEATHER MESSAGE INTERARRIVALS (AWX), MESSAGE DESTINATION
*       (DWX), AND MESSAGE LENGTH (LWX).
*
AWX   FUNCTION    RN7,C6
.48,10/.62,20/.72,40/.86,80/.96,110/1,120
DWX   FUNCTION    RN7,D6
.06,1/.47,2/.53,10/.59,11/.94,12/1,14
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```
LWX    FUNCTION    RN7,C5
.17,25/.47,50/.73,75/.77,100/1,125
*
*
*       STATISTICS FOR AIR/GRCUND MESSAGE INTERARRIVALS (AARGN), MESSAGE
*       PRIORITY (PARGN), MESSAGE DESTINATION (DARGN), AND MESSAGE LENGTH
*       (LARGN).
*
AARGN FUNCTION    RN8,C4
.25,10/.50,20/.88,60/1,70
PARGN FUNCTION    RN7,D2
.13,2/1,3
DARGN FUNCTION    RN8,D4
.25,1/.69,2/.75,5/1,6
LARGN FUNCTION    RN8,C3
0,20/.56,30/1,40
*
*
*
*       STATISTICS FOR SITOR MESSAGE INTERARRIVALS (ASITR), MESSAGE PRIORITY
*       (PSITR), MESSAGE DESTINATION (DSITR), AND MESSAGE LENGTH (LSITR).
*
ASITR FUNCTION    RN1,C4
.57,20/.86,120/.93,180/1,200
PSITR FUNCTION    RN8,D3
.1,1/.9,2/1,3
DSITR FUNCTION    RN1,D3
.44,1/.55,2/1,7
LSITR FUNCTION    RN1,C3
.80,10/.87,20/1,25
*
*
*
*       STATISTICS FOR TWPL MESSAGE INTERARRIVALS (ATWPL), MESSAGE PRIORITY
*       (PTWPL), MESSAGE DESTINATION (DTWPL), AND MESSAGE LENGTH (LTWPL).
*
ATWPL FUNCTION    RN2,C7
.58,8/.72,16/.75,32/.81,40/.92,48/.95,64/1,72
PTWPL FUNCTION    RN1,D3
.3,1/.8,2/1,3
DTWPL FUNCTION    RN2,D6
.04,4/.08,6/.75,7/.92,11/.96,12/1,14
LTWPL FUNCTION    RN2,C6
.34,10/.50,20/.53,30/.61,40/.90,50/1,60
*
*
*
*       STATISTICS FOR INHOUSE MESSAGE INTERARRIVALS (AINHS), MESSAGE PRIORITY
*       (PINHS), MESSAGE DESTINATION (DINHS), AND MESSAGE LENGTH (LINHS).
*
AINHS FUNCTION    RN3,C5
.4,10/.6,20/.8,30/.93,60/1,70
PINHS FUNCTION    RN2,D3
.5,1/.88,2/1,3
DINHS FUNCTION    RN3,D6
```

```
.3,1/.5,2/.6,5/.7,6/.8,7/1,10
 LINHS FUNCTION    RN3,C7
0,5/.09,10/.54,15/.72,20/.81,25/.95,30/1,35
*
*
*
*       STATISTICS FOR HF BROADCAST MESSAGE INTERARRIVALS (ABCST), MESSAGE
*       DESTINATION (DBCST), AND MESSAGE LENGTH (LBCST).
*
 ABCST FUNCTION    RN4,C4
.25,20/.5,100/.75,140/1,160
 DBCST FUNCTION    RN4,D4
.25,1/.50,2/.75,7/1,10
 LBCST FUNCTION    RN4,C3
0,5/.25,10/1,15
*
*
*
*       STATISTICS FOR COMMAND CONTROL COMMUNICATIONS MESSAGE INTERARRIVALS
*       (ACCC), MESSAGE PRIORITY (PCCC), MESSAGE DESTINATION (DCCC), AND
*       MESSAGE LENGTH (LCCC).
*
 ACCC  FUNCTION    RN5,C2
.5,40/1,80
 PCCC  FUNCTION    RN3,D2
.34,1/1,2
 DCCC  FUNCTION    RN5,D2
.5,1/1,2
 LCCC  FUNCTION    RN5,C2
.5,50/1,75
*
*
*
*
*       THE FOLLOWING VARIABLES COMPUTE TIME DELAY CREATED BY THE MESSAGE
*       GOING THROUGH THE SYSTEM AS P2*BITS PER CHARACTER/BAUD RATE.  BAUD
*       RATE USED HERE IS 9600. P2 IS THE PARAMETER USED FOR MESSAGE LENGTH.
*
*
*
 VMSG1 VARIABLE    P2/212
 VMSG2 VARIABLE    P2/212
 VMSG3 VARIABLE    P2/2
 VMSG4 VARIABLE    P2/2
 VMSG5 VARIABLE    P2/13
 VMSG6 VARIABLE    P2/13
 VMSG7 VARIABLE    P2/212
 VMSG8 VARIABLE    P2/6
 VMSG9 VARIABLE    P2/3
 VMG10 VARIABLE    P2/212
 VMG11 VARIABLE    P2/212
 VMG12 VARIABLE    P2/6
 VMG13 VARIABLE    P2/212
 VMSG  VARIABLE    P4
*
*
*
```

APPENDIX J

This appendix contains the input statistics used for Throughput State IV.

```
BLOCK                                                                                        STATEMENT
NUMBER  *LOC   OPERATION  A,B,C,D,E,F,G,H,I          COMMENTS                                NUMBER
               SIMULATE
        *      THIS IS A GPSS PROGRAM WRITTEN TO SIMULATE THE TRAFFIC FLOW AT THE
        *      UNITED STATES COAST GUARD COMMUNICATIONS STATION SAN FRANCISCO LOCATED
        *      AT POINT REYES, CALIFORNIA.  THIS IS BEING DONE AS A PART OF MY THESIS
        *      TO MODEL THE PROPOSED MESSAGE SWITCHING SYSTEM (MSS) UNDER DEVELOPMENT
        *      BY THE 12TH COAST GUARD DISTRICT.  USING TRAFFIC FLOW STATISTICS
        *      RECENTLY GATHERED AT THE STATION AS INPUTS TO THE MODEL, MY THESIS WILL
        *      ANALYZE THE RESULTS AND OBSERVE GENERAL TRENDS IN THE MODEL TO ASSIST
        *      IN THE DEVELOPMENT OF DESIGN PARAMETERS FOR THE MSS.  THIS WILL, I HOPE,
        *      CULMINATE IN A SYSTEM THAT WILL MEET THE PRESENT AND FUTURE NEEDS OF
        *      COMMUNICATIONS AT COMMSTA SAN FRANCISCO.
        *
        *
        *
        *
        *      THE FOLLOWING FUNCTIONS DEFINE THE MESSAGE STATISTICS TO BE USED
        *      THROUGHOUT THIS SIMULATION.
        *
        *
        *
        *      STATISTICS FOR NAVCOMPARS MESSAGE INTERARRIVAL RATE (ANCPR), MESSAGE
        *      PRIORITY (PNCPR), MESSAGE DESTINATION (DNCPR), AND MESSAGE LENGTH
        *      (LNCPR).
        *
        ANCPR FUNCTION   RN1,C6
        .32,3/.70,6/.86,9/.93,12/.95,15/1,18
        PNCPR FUNCTION   RN1,D4
        .38,1/.86,2/.98,3/1,4
        DNCPR FUNCTION   RN1,D9
        .03,3/.06,4/.30,5/.65,6/.66,8/.69,9/.94,11/.97,12/1,14
        LNCPR FUNCTION   RN1,C5
        .45,20/.80,40/.85,60/.89,140/1,160
        *
        *
        *
        *      STATISTICS FOR SARPAC MESSAGE INTERARRIVAL (ASARP), MESSAGE PRIORITY
        *      (PSARP), MESSAGE DESTINATION (DSARP), AND MESSAGE LENGTH (LSARP).
        *
        ASARP FUNCTION   RN2,C3
        .63,60/.88,210/1,240
        PSARP FUNCTION   RN2,D3
        .25,1/.75,2/1,3
        DSARP FUNCTION   RN2,D5
        .2,3/.4,5/.6,6/.8,12/1,14
        LSARP FUNCTION   RN2,C5
        .22,10/.55,20/.77,30/.88,40/1,50
        *
        *
        *      STATISTICS FOR MF/CW MESSAGE INTERARRIVALS (AMFCW), MESSAGE PRIORITY
        *      (PMFCW), MESSAGE DESTINATION (DMFCW), AND MESSAGE LENGTH (LMFCW).
        *
        AMFCW FUNCTION   RN3,C7
        .76,8/.87,16/.91,24/.95,32/.97,64/.98,80/1,88
        PMFCW FUNCTION   RN3,D2
        .11,1/1,2
```

```
DHFCW FUNCTION    RN3,D6
.32,1/.69,2/.71,5/.76,6/.98,7/1,11
LHFCW FUNCTION    RN3,C4
.93,5/.95,10/.97,15/1,20
*
*
*      STATISTICS FOR HF/CW MESSAGE INTERARRIVALS (AHFCW), MESSAGE PRIORITY
*      (PHFCW), MESSAGE DESTINATION (DHFCW), AND MESSAGE LENGTH (LHFCW).
*
AHFCW FUNCTION    RN4,C5
.75,3/.90,6/.94,9/.99,15/1,18
PHFCW FUNCTION    RN4,D4
.07,1/.98,2/.99,3/1,4
DHFCW FUNCTION    RN4,D5
.16,1/.41,2/.42,6/.99,7/1,10
LHFCW FUNCTION    RN4,C2
.94,20/1,25
*
*
*      STATISTICS FOR CLASSIFIED SHIP/SHORE MESSAGE INTERARRIVALS (ACLAS),
*      MESSAGE PRIORITY (PCLAS), MESSAGE DESTINATION (DCLAS), AND MESSAGE
*      LENGTH (LCLAS).
*
ACLAS FUNCTION    RN6,C6
.43,3/.61,11/.72,15/.93,19/.97,27/1,31
PCLAS FUNCTION    RN6,D3
.33,1/.93,2/1,3
DCLAS FUNCTION    RN6,D6
.75,1/.80,2/.85,5/.90,6/.95,7/1,10
LCLAS FUNCTION    RN6,C6
.15,20/.60,30/.87,50/.90,60/.96,70/1,80
*
*
*      STATISTICS FOR UNCLASSIFIED SHIP/SHORE MESSAGE INTERARRIVALS (AUNCL),
*      MESSAGE PRIORITY (PUNCL), MESSAGE DESTINATION (DUNCL), AND MESSAGE
*      LENGTH (LUNCL).
*
AUNCL FUNCTION    RN5,C7
.24,8/.57,16/.67,24/.77,32/.91,40/.96,72/1,80
PUNCL FUNCTION    RN5,D3
.38,1/.94,2/1,3
DUNCL FUNCTION    RN5,D5
.76,1/.82,2/.88,6/.94,10/1,11
LUNCL FUNCTION    RN5,C4
.24,10/.81,20/.95,50/1,60
*
*
*      STATISTICS FOR WEATHER MESSAGE INTERARRIVALS (AWX), MESSAGE DESTINATION
*      (DWX), AND MESSAGE LENGTH (LWX).
*
AWX   FUNCTION    RN7,C6
.48,8/.62,16/.72,24/.86,48/.96,72/1,80
DWX   FUNCTION    RN7,D6
.06,1/.47,2/.53,10/.59,11/.94,12/1,14
```

```
LWX    FUNCTION    RN7,C5
.17,25/.47,50/.73,75/.77,100/1,125
*
*
*       STATISTICS FOR AIR/GROUND MESSAGE INTERARRIVALS (AARGN), MESSAGE
*       PRIORITY (PARGN), MESSAGE DESTINATION (DARGN), AND MESSAGE LENGTH
*       (LARGN).
*
AARGN FUNCTION    RN8,C4
.25,8/.50,16/.88,48/1,56
PARGN FUNCTION    RN7,D2
.13,2/1,3
DARGN FUNCTION    RN8,D4
.25,1/.69,2/.75,5/1,6
LARGN FUNCTION    RN8,C3
0,20/.56,30/1,40
*
*
*       STATISTICS FOR SITOR MESSAGE INTERARRIVALS (ASITR), MESSAGE PRIORITY
*       (PSITR), MESSAGE DESTINATION (DSITR), AND MESSAGE LENGTH (LSITR).
*
ASITR FUNCTION    RN1,C4
.57,15/.86,90/.93,135/1,150
PSITR FUNCTION    RN8,D3
.1,1/.9,2/1,3
DSITR FUNCTION    RN1,D3
.44,1/.55,2/1,7
LSITR FUNCTION    RN1,C3
.80,10/.87,20/1,25
*
*
*       STATISTICS FOR TWPL MESSAGE INTERARRIVALS (ATWPL), MESSAGE PRIORITY
*       (PTWPL), MESSAGE DESTINATION (DTWPL), AND MESSAGE LENGTH (LTWPL).
*
ATWPL FUNCTION    RN2,C7
.58,6/.72,12/.75,24/.81,30/.92,36/.95,48/1,54
PTWPL FUNCTION    RN1,D3
.3,1/.8,2/1,3
DTWPL FUNCTION    RN2,D6
.04,4/.08,6/.75,7/.92,11/.96,12/1,14
LTWPL FUNCTION    RN2,C6
.34,10/.50,20/.53,30/.61,40/.90,50/1,60
*
*
*       STATISTICS FOR INHOUSE MESSAGE INTERARRIVALS (AINHS), MESSAGE PRIORITY
*       (PINHS), MESSAGE DESTINATION (DINHS), AND MESSAGE LENGTH (LINHS).
*
AINHS FUNCTION    RN3,C5
.4,8/.6,16/.8,24/.93,48/1,56
PINHS FUNCTION    RN2,D3
.5,1/.88,2/1,3
DINHS FUNCTION    RN3,D6
```

```
.3,1/.5,2/.6,5/.7,6/.8,7/1,10
 LINHS FUNCTION   RN3,C7
0,.57.09,10/.54,15/.72,20/.81,25/.95,30/1,35
*
*
*
*       STATISTICS FOR HF BROADCAST MESSAGE INTERARRIVALS (ABCST), MESSAGE
*       DESTINATION (DBCST), AND MESSAGE LENGTH (LBCST).
*
 ABCST FUNCTION   RN4,C4
.25,15/.5,9)/.75,120/1,135
 DBCST FUNCTION   RN4,D4
.25,1/.50,2/.75,7/1,10
 LBCST FUNCTION   RN4,C3
0,.5/.25,10/1,15
*
*
*       STATISTICS FOR COMMAND CONTROL COMMUNICATIONS MESSAGE INTERARRIVALS
*       (ACCC), MESSAGE PRIORITY (PCCC), MESSAGE DESTINATION (DCCC), AND
*       MESSAGE LENGTH (LCCC).
*
 ACCC   FUNCTION   RN5,C2
.5,30/1,60
 PCCC   FUNCTION   RN3,D2
.34,1/1,2
 DCCC   FUNCTION   RN5,D2
.5,1/1,2
 LCCC   FUNCTION   RN5,C2
.5,50/1,75
*
*
*
*
*       THE FOLLOWING VARIABLES COMPUTE TIME DELAY CREATED BY THE MESSAGE
*       GOING THROUGH THE SYSTEM AS P2*BITS PER CHARACTER/BAUD RATE.  BAUD
*       RATE USED HERE IS 9600. P2 IS THE PARAMETER USED FOR MESSAGE LENGTH.
*
*
 VMSG1 VARIABLE   P2/212
 VMSG2 VARIABLE   P2/212
 VMSG3 VARIABLE   P2/2
 VMSG4 VARIABLE   P2/2
 VMSG5 VARIABLE   P2/13
 VMSG6 VARIABLE   P2/13
 VMSG7 VARIABLE   P2/212
 VMSG8 VARIABLE   P2/6
 VMSG9 VARIABLE   P2/3
 VMG10 VARIABLE   P2/212
 VMG11 VARIABLE   P2/212
 VMG12 VARIABLE   P2/6
 VMG13 VARIABLE   P2/212
 VMSG  VARIABLE   P4
*
*
*
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