AD-A123 787 SIFT: SWIC IMPLEMENTATION OF FRONT-END TOOLS(U) MITRE CORP BEDFORD MA I BRAMSON ET AL. JAN 83 MTR-8695 ESD-TR-82-420 F19628-82-C-0001 1/1

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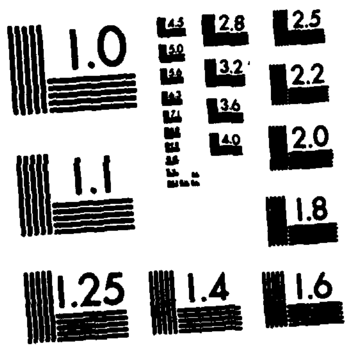

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ESD-TR-82-420 MTR-8695

SIFT: SWIC IMPLEMENTATION OF FRONT-END TOOLS

By
IRWIN BRAMSON
JOANNE RICCIARDONE

JANUARY 1983

Prepared for

DEPUTY FOR DEVELOPMENT PLANS
ELECTRONIC SYSTEMS DIVISION
AIR FORCE SYSTEMS COMMAND
UNITED STATES AIR FORCE
Hanscom Air Force Base, Massachusetts

Approved for public release;
distribution unlimited.

Project No. 4960
Prepared by
THE MITRE CORPORATION
Bedford, Massachusetts
Contract No. F19628-82-C-0001

REVIEW AND APPROVAL

This technical report has been reviewed and is approved for publication.

Edwin W. Knox, 2Lt USAF
Project Officer, C2 CONCAP

FOR THE COMMANDER

CHARLES J. LaBLONDE, Lt Col, USAF
Acting Director
Advanced Concepts and Technology
Deputy for Development Plans

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ESD-TR-82-420	2. GOVT ACCESSION NO. AD-A123 787	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) SIFT: SWIC IMPLEMENTATION OF FRONT-END TOOLS		5. TYPE OF REPORT & PERIOD COVERED
		6. PERFORMING ORG. REPORT NUMBER MTR-8695
7. AUTHOR(s) IRWIN BRAMSON, JOANNE RICCIARDONE		8. CONTRACT OR GRANT NUMBER(s) F19628-82-C-0001
9. PERFORMING ORGANIZATION NAME AND ADDRESS The MITRE Corporation Burlington Road Bedford, MA 01730		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS Project No. 4960
11. CONTROLLING OFFICE NAME AND ADDRESS Deputy for Development Plans Electronic Systems Division, AFSC Hanscom AFB, MA 01731		12. REPORT DATE JANUARY 1983
		13. NUMBER OF PAGES 74
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

ADCCP COMMUNICATIONS MODEL
SWIC
REALTIME DATA COLLECTION
REALTIME DISPLAY GENERATION
STATISTICAL GRAPHICS DISPLAYS
STATISTICAL TABULAR DISPLAYS

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

SIFT, the SWIC Implementation of Front-end Tools, is a set of four statistics generation, collection, and display routines developed under the C2 CONCAP project in support of the Survivable Warning Information Concept (SWIC). These routines were written in FORTRAN IV-Plus for use on the RSX-11M operating system and are currently operational on a PDP-11/70. This paper presents the functional capabilities embodied by SIFT along with a detailed description of the data mapping process used to drive the real-time statistical

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20. ABSTRACT (concluded)

displays. With additional enhancements, SIFT may be used as general statistics generation, collection, and display tools for communication system capabilities.

ACKNOWLEDGMENTS

This report has been prepared by The MITRE Corporation under Project 4960. The contract is sponsored by the Electronic Systems Division, Air Force Systems Command, Hanscom Air Force Base, Massachusetts.

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1.0 INTRODUCTION

1.1 SIFT OVERVIEW

The intent of this document is to describe the SWIC Implementation of Front-end Tools (SIFT) developed by the C2 CONCAP project for support to the Survivable Warning Information Concept (SWIC). The capabilities are a set of front-end statistics generation and display tools whose objectives are as follows:

a) the modularization of sensor, communications channel model, and command-end simulator processes;

b) the use of specialized data collection processes for the handling of simultaneously generated statistics; and

c) the means by which the performance of the SWIC concept could be measured.

It should be noted that while this document's intent is to describe the function of each tool in order to meet these objectives, the document is not intended as a user's manual. The reader is advised to contact the authors for specific operational information.

The software for SWIC was written in FORTRAN IV-Plus for use on the PDP 11/70 under the RSX-11M Operating System. In addition, the set of tools was designed to be user-friendly; specifically, the Tabular Formation and Display Capability and the Side-by-Side Graphical Display Capability provide user prompts and displayed error messages.

The reader and potential user should be familiar with the details of the SWIC capability and the RSX-11M Operating System.

1.2 ORGANIZATION OF DOCUMENT

The document is divided into three major sections. Section 2.0 provides SWIC background information whose intent is to briefly familiarize or refresh the reader. Section 3.0 describes statistics generation and sensor message handling tools. Section 4.0 presents two statistical display capabilities using the Forms Management System (FMS) and off-the-shelf graphics software respectively. The graphics packages used include Plot-10 and Zeta. Finally, Section 5.0 offers future enhancements to SIFT and closing comments.

2.0 SIFT's ROLE IN THE SWIC PROJECT

2.1 PURPOSE

SIFT was originally designed as a set of SWIC dependent capabilities; the tools presented may be used, however, as a reference for future communications analytical capabilities. In order to understand the purpose and use of SIFT, an overview of SWIC is offered. This section briefly describes the role of SIFT in the overall SWIC capability. It is not intended as a detailed explanation of SWIC but rather as background information for the reader.

2.2 A BRIEF FAMILIARIZATION WITH SWIC

The Survivable Warning Information Concept is an approach currently under evaluation which would modify the present TW/AA system. SWIC would provide a distribution of summary messages and streamlined event messages at low data rates for jam-resistance purposes. The summary and streamlined event messages are bit-oriented rather than ASCII character strings. Presently, the SWIC capability has been modelled for the three sensors Pave Paws East (PPE), Pave Paws West (PPW), and the Simplified Processing System (SPS).

In contrast, the Current System Capability takes scenario data and generates ASCII character string event messages and transmits them at a higher data rate. Throughout this document the capabilities provided by SIFT will compare Current System Capability statistics to SWIC capability statistics. The purpose and description of these statistics will be discussed under each tool's section. At this point, SIFT has been tested with user accepted scenario data for Current and SWIC, but may also be tested with other scenarios.

Figure 2-1 offers a general schematic of the Current System Capability and the role of the following tools: Current System Communications Channel Interface, Tabular Formation and Display, and the Statistics Data Collection Capability. Similar to Figure 2-1, Figure 2-2 presents the Statistics Data Collection Capability and the Tabular Formation and Display Tool as used for the SWIC capability.

At this point the reader should note that the term 'SWIC' refers to a) the comparative project as a whole, and b) the capability itself, as compared to the Current System Capability. From this point on, the convention in this document will be to

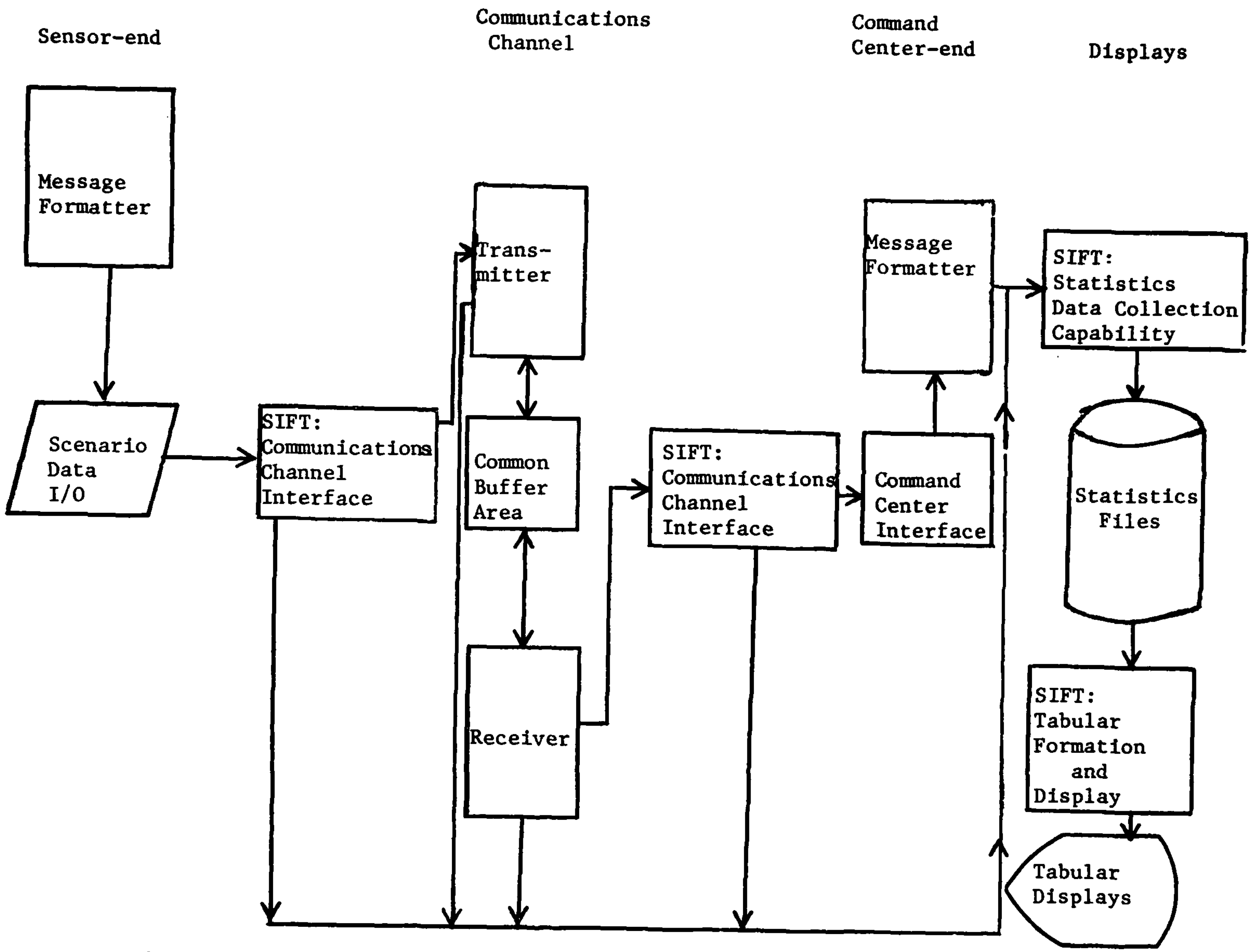


Figure 2-1. General Schematic of SIFT: Current System Capability

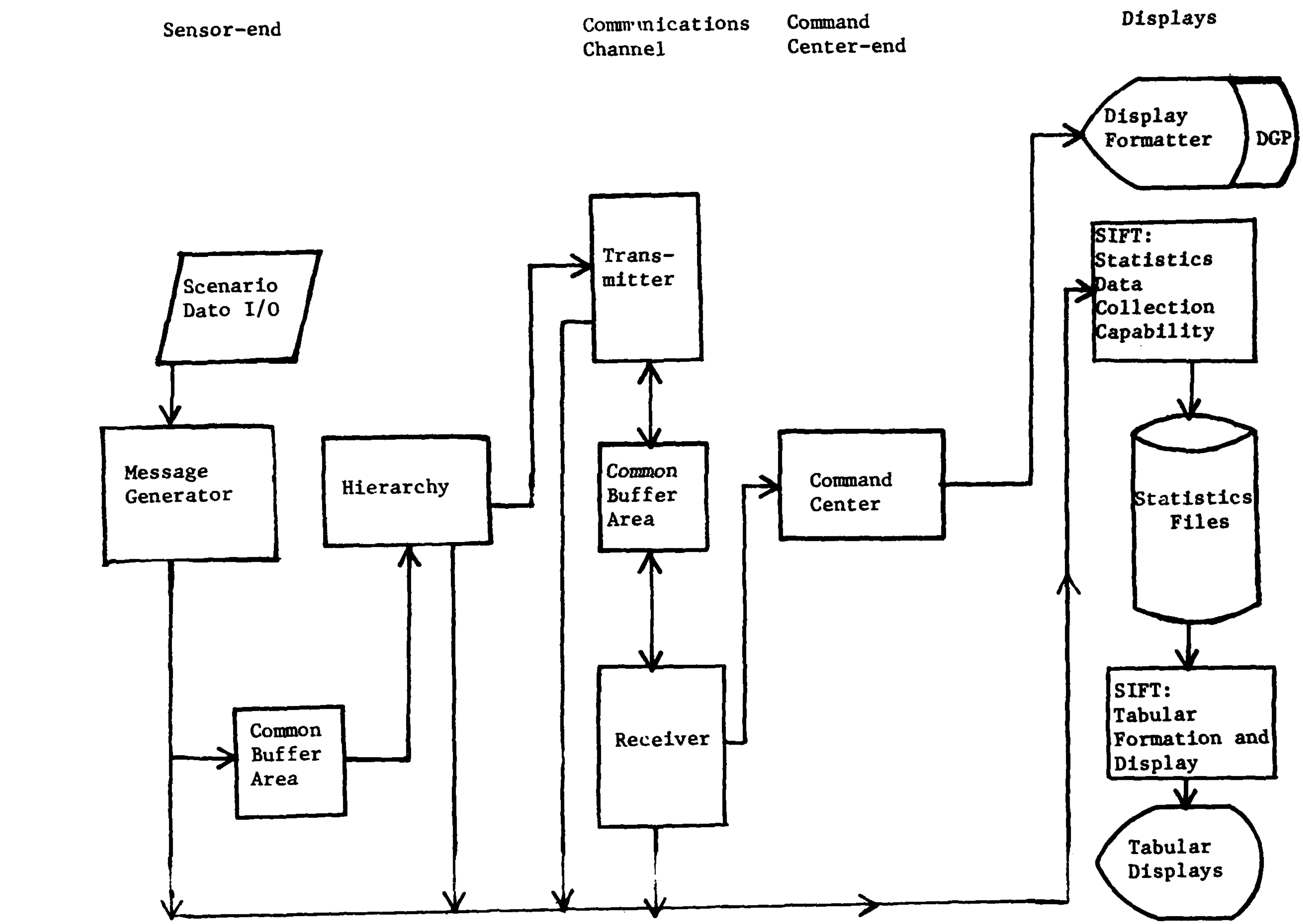


Figure 2-2. General Schematic of SIFT: SWIC Capability

shorten the Current System Capability to simply 'Current' and to use 'SWIC' in the specific latter sense, unless explicitly stated otherwise.

3.0 STATISTICS GENERATION TOOLS

3.1 OVERVIEW

The Current System Communications Channel Interface (CCINT) and the Statistics Data Collection Capability (STATGET) are a statistics generation/collection joint capability. While CCINT is designed specifically for Current, STATGET may be used for both Current and SWIC and more generally, for applications which require continuous real-time collection of on-going generated statistics. Briefly, CCINT generates and updates 51 statistics describing Current's performance for each process iteration, i.e., each sensor message. STATGET works with CCINT in that it signals CCINT by setting the appropriate statistics event flag when it is free to receive and process the next statistics arrays. The arrays are then passed through a common buffer area. The specifics of each tool are as follows.

3.2 CURRENT SYSTEM COMMAND CHANNEL INTERFACE

3.2.1 Functional Design

The purpose of CCINT is to receive messages from three sensors PPE, PPW, and SPS and to send the messages as ASCII character strings to the transmitter of three communications channel models according to message generation times. Should the channel be unavailable for message transmission due to the additional processing it must perform, CCINT stores the message in an appropriate holding buffer. When CCINT reads a set channel event flag, it then checks the queue of waiting messages. If the holding buffers contain any messages, the message with the earliest generation time, i.e., at the top of the queue, is then sent to the transmitter through the use of several interface routines, and the message in question is stored at the bottom of the appropriate queue. Should CCINT detect empty holding buffers and a free channel, the message in question is passed to a transmitter and the iteration begins again.

The channel model used supports two types of protocol: full duplex and broadcast which enable the channel's receiver to send a rejection message back to the transmitter if the message was received in error.

The common buffer area mentioned above is actually a resident common region which is memory resident. Data is passed between CCINT and the channel model by use of this resident common.

As a statistics tool, CCINT generates/updates 51 statistics which are passed through common blocks to STATGET for display on the "Internal System Operations (ISO) Summary" and the "Delay Summary" displays. (Refer to Section 4.2 for a detailed description of these tables). CCINT generates the statistics from sensor messages that are opened and read using variable named input files; conceivably any scenario's three sensors can be used as input. Inherent to the design of this module, CCINT assumes:

a) a Current sensor-end to command center-end run; and
b) an ADCCP communications type model.

3.2.2 User Interface

The user should be aware that because CCINT is a behind-the-scenes message and statistics data collector, it is dependent on the following SWIC project software modules:

- STATGET
- an ADCCP communications type model
- a command center simulator.

The following schematic (Figure 3-1) describes CCINT's position in relation to the above modules.

3.2.3 Results

The specific definitions of each statistic are provided in Appendix B. In general, the statistics which CCINT generates provide the user with message, launch, and module performance information. Since CCINT is an analytical tool for Current, its statistics also serve as a comparative tool when examining SWIC's performance.

3.3 STATISTICS DATA COLLECTION CAPABILITY

3.3.1 Introduction

STATGET is a supervisory task responsible for the efficient collection and storage of statistical data. The statistical data are produced by cooperating tasks which comprise the SWIC or Current capabilities. By use of event flags (for the passing of commands) and resident common (for the sharing of statistical data), STATGET

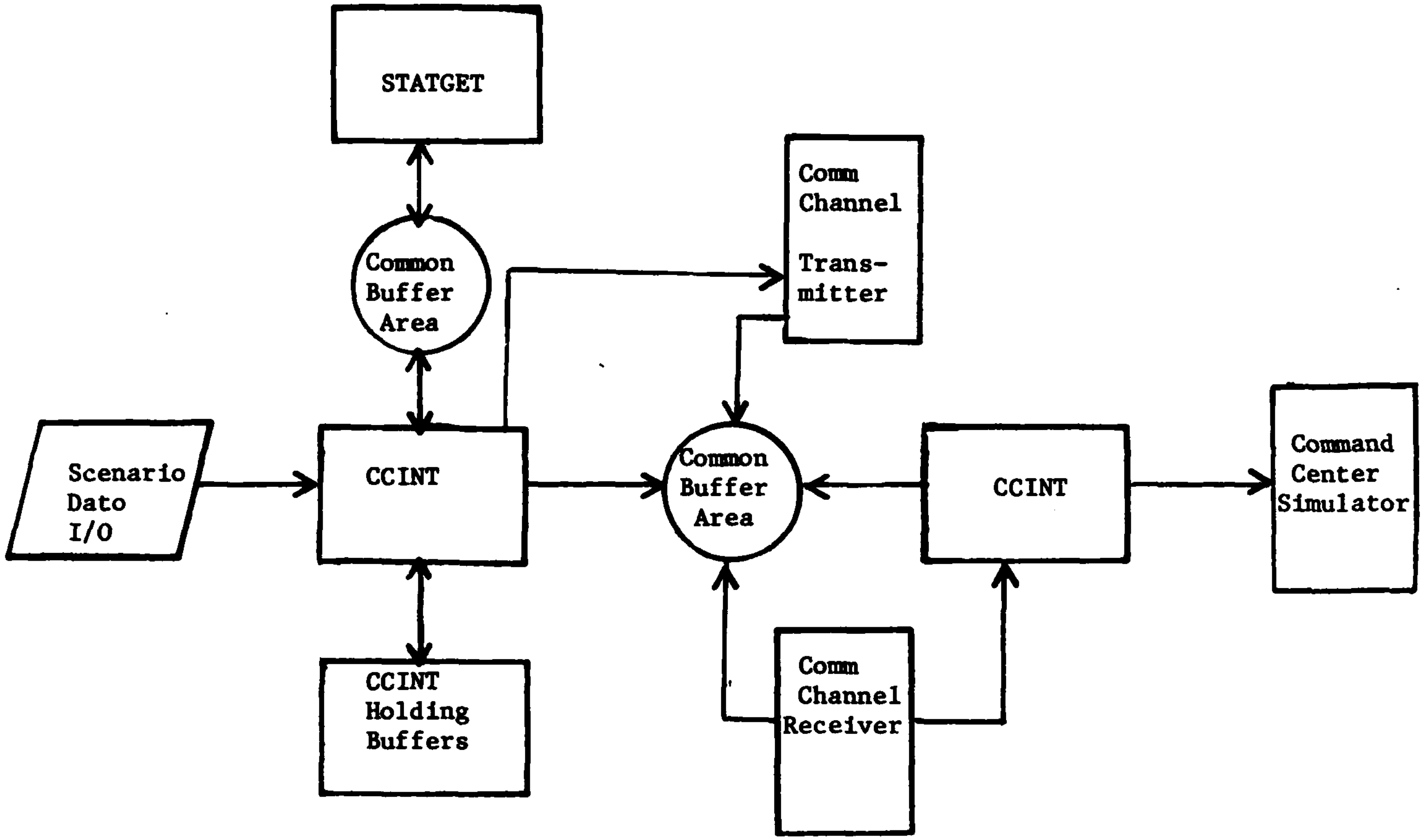


Figure 3-1. CCINT and Required SWIC Software Modules

transfers statistical data to an output file in real-time with minimum impact to the performance of other tasks. The specifics of the STATGET mechanism are presented below.

3.3.2 High Level Functional Description

STATGET obtains input data from a shared area of computer memory, i.e., resident common. Each statistics generating task (SGT) updates the data it produces in a unique part of resident common. STATGET shares all of these memory areas and can therefore access the most current statistical data at any time for potential display purposes.

Once STATGET is invoked, it reads portions of resident common to obtain specific information used for a unique header record. This header record is the first data written to the output statistics file and serves as identification for the file during its life cycle. The header record uniquely identifies an output file during its life cycle by including such data items as filename, date/time of creation, communications concept model, scenario used, ...etc. After writing the header record to the new output file, STATGET then begins its normal data collection cycle.

STATGET makes use of an interval timer whose function is to invoke the STATGET data collection cycle. A predefined, user-determined time slice dictates the length of time between cycle iterations. Once STATGET is signalled by the timer, the task obtains input data for transfer to the output file, thus beginning the cycle again. STATGET then:

(1) resets the interval timer
(2) issues a "cease updating resident common" command to all SGTs
(3) waits for all SGTs to halt their updating processes
(4) transfers all current statistical data from resident common to internal storage buffers
(5) issues a "resume updating resident common" command to all SGTs
(6) transfers data from internal storage buffers to the output file
(7) checks to see whether the simulation run is complete

If the simulation run is not complete, the above cycle is repeated at equal time intervals signalled by the timer. A high-level schematic of the statistics gathering process is provided in Figure 3-2.

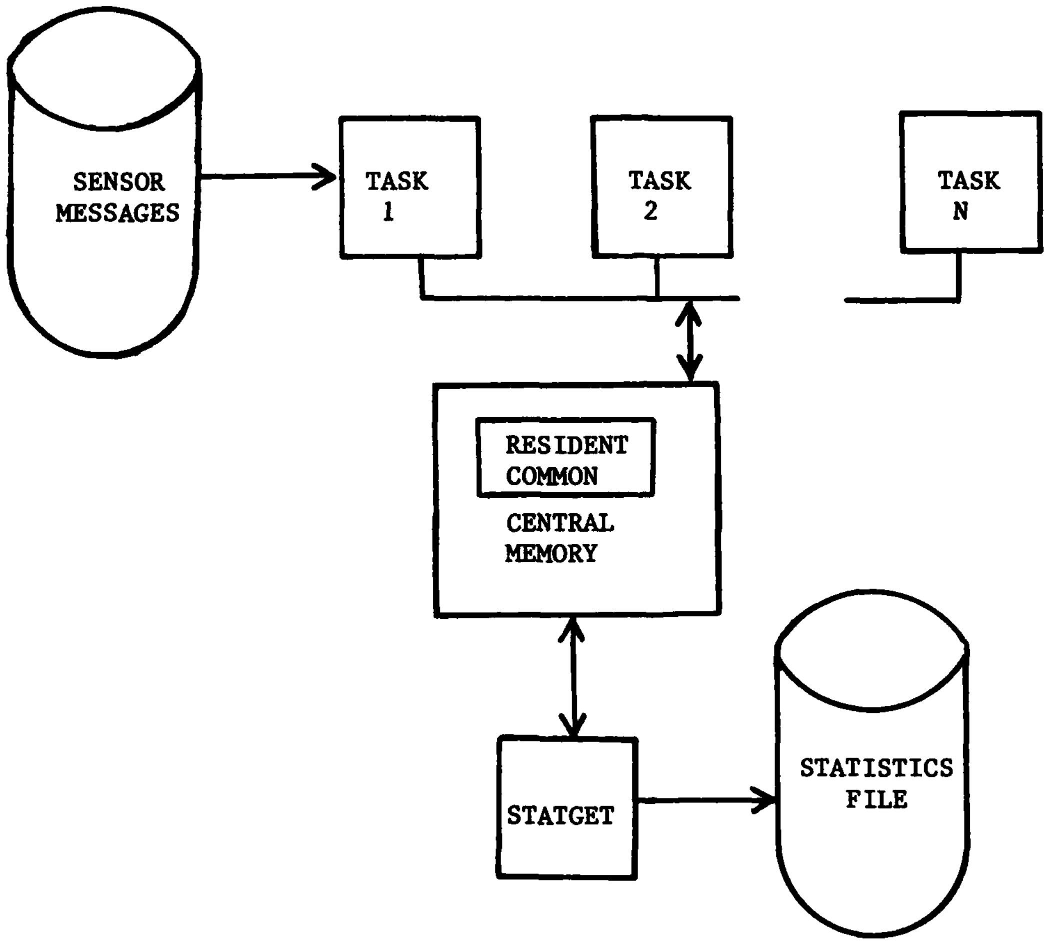


Figure 3-2. Statistics Gathering Process Schematic

3.3.3 Results

The end product of STATGET is a sequential statistics file stored on magnetic disk. This file is written unformatted (without any conversion) to the output device in order to minimize I/O transfer time. Two types of data records are written to the file: a header record and an unspecified number of data records.

Data records are of fixed length and contain two primary key fields: the integer time in seconds at which the data was created, and statistics code (statcode) used to uniquely categorize the statistical counts in the data record. The time field is used to order the data for proper display by the Tabular Formation and Display Routine (STATFORM). The statcode is also used to map the statistical counts into individual fields on the selected formatted tabular displays. Appendix C presents detailed formats for both header and data records. The statcode concept will be amplified in section 4.2.

3.3.4 Stand-Alone Utility Functions

As a convenience to users and analysts, three stand-alone utility routines were written to provide additional capabilities not provided by STATGET:

- sort a statistics output file by increasing values of time.
- create a formatted printout of any statistics output file.
- create a formatted file of user selectable statistics. The statistics may be extracted from up to six data files.

These utility routines are described as follows.

<u>Sort Utility</u>

Due to the asynchronous nature in which the SGTs are executed by the host computer, data records written to the output file are not always in ascending time order. STATGET makes no attempt to time order the data before records are written out to the file since this extra processing would add unjustified overhead to the data collection process. The time ordering of data records, however, is critical in the next phase of processing: the formation and display of the statistical information by STATFORM.

The absence of a generalized sort/merge utility prompted the writing of SORT11. SORT11 is a stand-alone, interactive sort program which accepts the name of an unsorted statistics data file as input. From this, it then creates an intermediate indexed sequential file. The indexed file is then read back in sorted order, one record at a time, by means of the time field, which is used as a minor key to allow for the possibility of multiple data records generated at the same time. As the sorted records are retrieved from the indexed file, they are written out to a new sequential data file. This new data file is identical in format to the original input file with the exception that the data records are ordered by increasing time. At the completion of the file creation process, the intermediate indexed file is deleted. The new sorted sequential file is now in proper order to be accepted by SIFT's STATFORM. The disposition of the original unsorted input file is left up to the user.

SORT11 produces a report on the operator's terminal consisting of the following information:

a) the start time for the entire process

b) an indication for each group of 100 records processed from the unsorted input file

c) the end time for the sort phase

d) an indication for each group of 100 records transferred from the intermediate indexed file to the final sorted sequential file

e) the end time for the entire process

Formatted Print Utility

During module checkout, it is necessary to examine the contents of a statistical output file. Since the file is unformatted, it is not user readable. The function of the DUMPIT utility is to convert the unformatted data file into a neatly formatted, multi-page report that would serve as a hardcopy to the user for analytical purposes.

DUMPIT prompts the user for the name of a sorted statistics file. Once the filename is entered, the file is read back unformatted. At this time a new formatted print file is created. The new output file consists of a header page followed by the necessary number of data pages to display the contents of the original unformatted data file. The header page lists the complete contents of the input file's header. All subsequent pages display the time ordered statistical data, along with the associated statcode of each data record. Figures 3-3 and 3-4 are samples of a typical header and data page, respectively.

<u>Formatted Data Extraction Utility</u>

Often, only a small subset of the large collection of generated statistics is needed for capability analysis purposes. EXTRACT is an independent task which allows a user to select a subset of up to 30 unique statistics located in a maximum of six input data files. The data is written out in time order to a formatted print file. Each output record, except the first which is a header record, contains the user-selected statistics written out in a user-specified order.

As input to the utility are the names of the sorted statistics files and interactive user input. The first record written is a special header record. Unlike the aforementioned header record, this one cites the total number of extracted statistics and their corresponding buffer locations. The buffer location for each desired statistic is obtained from the report included in Appendix B. Figure 3-5 displays a typical output file created by the EXTRACT utility.

4.0 STATISTICS DISPLAY TOOLS

4.1 OVERVIEW

Once CCINT and STATGET are run, the statistics they generate and collect respectively are ready for display purposes. The Tabular Formation and Display Tool (STATFORM) and the Side-by-Side Graphical Display Capability (BIGRAPH) provide two clear examples of how message, launch, and performance statistics may be displayed for capability analysis and Proof-of-Concept purposes.

4.2 TABULAR FORMATION AND DISPLAY

4.2.1 Introduction

STATFORM is a stand-alone, interactive task which retrieves and formats statistical data into tabular displays. The displays are used to compare performance parameters for both SWIC and Current. A friendly user interface is provided which allows the terminal operator increased control over the data being displayed. These capabilities are described in the following general functional description. The detailed processes involved in transforming statistical output files into formatted displays are too lengthy to include here; hence, they are discussed in Appendix A.

```
HEADER RECORD DUMP FOR STATISTICS FILE: PPE756.DAT

GENERATION DATE:        2/ 3/82
GENERATION TIME:       12 HRS 38 MINS 37 SECS
SCENARIO:
SYSTEM:                SMIC
SENSOR:                PPE
TRANSMISSION RATE:       75
MODE:                  BROADCAST
BIT ERROR RATE:        0.00000
NUMBER OF OUTAGES:     0
OUTAGE START TIMES:      0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
OUTAGE DURATIONS:        0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
TRANSMISSION DELAY:    0.250
TIMEOUT DELAY:         0.000
```

Figure 3-3. DUMPIT Utility: Header Page

TIME	STATCODE	STATISTICS														PAGE 1
101	1	0	0	2	2	0	2	2	2	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
101	3	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
104	1	0	0	3	3	0	3	3	3	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
104	3	0	0	2	0	2	0	0	1	0	1	2	0	0	0	0
		1	0	0	0	2	0	0	0	0	0	0	0	0	0	0
106	1	0	0	4	4	0	4	4	4	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
107	3	0	0	3	0	3	0	0	1	0	1	3	0	0	0	0
		1	0	0	0	3	0	0	0	0	0	0	0	0	0	0
107	3	0	0	3	0	3	0	0	1	0	1	3	0	0	0	0
		1	0	0	0	3	0	0	0	0	0	0	0	0	0	0
109	1	0	0	7	7	1	7	7	7	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
109	3	0	0	3	1	3	0	0	4	0	4	3	5	1	0	0
		1	1	0	0	3	0	0	0	0	0	0	0	0	0	0
110	1	0	0	9	9	1	9	9	9	0	0	0	0	0	0	0

Figure 3-4 DUMPIT Utility: Data Page

HEADER RECORD

8	2	1	3	5	31	30	32	34
TIME	<-----------STATISTICS							----------->
100	0	0	0	0	0	0	0	0
110	0	0	9	1	0	0	2	0
120	0	0	14	2	0	0	4	0
130	0	0	17	2	0	3	5	1
140	0	1	18	2	0	5	8	2
150	0	2	22	3	0	5	9	2
160	0	4	25	3	0	7	11	2
170	0	4	31	4	0	11	12	3
180	0	7	35	5	0	13	13	3
190	0	9	37	5	0	15	13	3
200	0	19	43	7	0	18	17	5
210	0	22	49	8	0	19	23	6
220	0	26	52	8	0	20	26	6
230	0	28	55	9	0	23	31	7
240	0	33	57	10	0	28	33	8
250	0	46	62	11	0	30	33	8
260	0	49	64	12	0	35	36	9
270	0	55	69	13	0	37	36	9

Figure 3-5. EXTRACT Utility: Sample Data Page

4.2.2 High Level Functional Description

STATFORM obtains its input data from four sources:

(1) statistical output files created by STATGET (see Section 3.3)
(2) tables which allow statistical counts to be mapped into their proper locations on one of the formatted displays
(3) a file containing the names of input files to process
(4) interactive user input to control the data update interval and tabular display selection

Statistics files generated by STATGET have been discussed in Section 3.3. It should be noted that STATFORM processes a maximum of six unique statistics files. This maximum is not a program limitation, but is imposed by the current number of communications capabilities (2) and the number of sensor models presently being tested (3).

The tables used by STATFORM serve to map the large volume of available statistics into the suite of tabular displays. The two tabular forms are:

- a statcode mapping table which stores all statistics associated with a particular statcode into contiguous locations within an internal storage area (large holding buffer)
- five individual screen mapping tables (one for each tabular display) which perform the routing of statistics from the large holding buffer to unique tabular display locations

The names of the input statistics files are contained in a separate file. This file is updated using one of the standard text editors in order to achieve program independence from any particular set of input files.

An interactive operator interface is provided which allows the user control over the following functions:

- the rate at which data is refreshed on a tabular display
- the selection of a particular tabular displav
- the length of time a screen can be viewed once it has been refreshed with new data (freeze frame feature)
- the explicit restart command which reactivates the refresh cycle

- o the ability to input a future time at which data is to be displayed (fast forward feature)
- o the ability to unconditionally terminate the STATFORM procedure

The above capabilities are discussed in more detail as part of the STATFORM data processing cycle.

The following 18 steps, although numerous, are offered so that the reader may better understand the details of this cycle without viewing the software itself.

Step-By-Step Procedural Description

Step 1 reads in the Global Mapping Matrix described in Appendix A. This matrix allows the statcode elements to be stored as they are read in.

Step 2 reads in the individual Screen Mapping Matrices. These matrices described in Appendix A, allow individual statcode elements to be mapped into their respective locations on the tabular displays.

Step 3 reads in the file containing the names of the statistics files to process.

Step 4 prompts the operator for the screen refresh interval. This time interval governs the rate at which any tabular display is filled with a new set of time-dependent data.

Step 5 loads a unique screen buffer (character array) for each of the five tabular displays with default starting values. These are the values that are displayed until the first refresh interval occurs.

Step 6 displays the default values on the tabular display. This is the default display brought up by STATFORM at the beginning of execution.

Step 7 enables the operator request option. This is merely the invocation of a QIO request to the System Executive. In this manner, an operator can interrupt the normal flow of events and request that a certain action be carried out. The alternate function keypad located on the right hand side of the VT-100 keyboard is used as the operator's mode of communication. Steps 17 and 18 describe the available operator options.

Step 8 initiates the interval timer (a call to the MARKTIME directive). The timer will signal STATFORM via an event flag when it is the proper time to refresh the displays.

Step 9 is responsible for reading all statistics files whose names were input in Step 3. For each input file, data is read a record at a time and mapped into the large holding buffer (global map). Each file is read until a record is encountered whose time tag exceeds the next time to display statistics. When this step terminates, the data needed to show all tabular displays is available. This data is current relative to the present display time.

Step 10 utilizes the five screen mapping matrices input via Step 2. A module exists for each tabular display which extracts the proper statistics from the large holding buffer and maps them into a display character array (local map). At refresh time, the contents of this character array is routed to its associated tabular display.

Step 11 detects if an operator request has occurred. Operator requests are input via the alternate function keypad. The QIO function enabled in Step 7 detects when one of the alternate keypad function keys has been pressed. An event flag is then set which is detected by STATFORM. STATFORM then services the request. Operator requests are processed in Step 18.

Step 12 is invoked once the interval timer signals STATFORM to refresh the data associated with the tabular displays. This step is invoked only if an operator request has not occurred first. When the display is being updated, operator requests are temporarily disabled.

Step 13 transfers the contents of a character array (filled in Step 10) to the currently selected tabular display. This is accomplished by appropriate calls to the Form Driver Component of the Forms Management System (FMS), a DEC software product.

Step 14 saves the current contents of all tabular display character arrays. This is necessary because data gathered for the next refresh time is also stored in the same character arrays used for the current time. It is possible for an operator request to occur prior to the next refresh time; if the request is for a particular display, the data displayed is obtained from the character arrays saved by this step.

Step 15 computes the next time to display data. This time is made known to all tabular display generation modules (Step 13) and the input file read module (Step 9).

Step 16 transfers control back to the head of the data processing loop (Step 7). A transfer of control occurs at this step whenever the interval timer signals a normal refresh before an operator request is detected.

Steps 17 and 18 are executed whenever an operator request is encountered before a normal refresh cycle commences. The operator makes requests known to STATFORM by pressing one of a series of predefined function keys located within the alternate keypad of a VT-100 terminal. The following alternate keypad function keys will produce the following responses:

PF1: Pause with the current tabular display at the current time shown on the display. The screen will remain static for as long as the operator desires.

PF2: Proceed with the current tabular display. The normal updating cycle is resumed at the user specified update interval (entered in Step 4).

PF3: Unconditional termination of all STATFORM processing.

PF4: Fast Forward Mode. The user is prompted for a time at which data is to be displayed on the current tabular display. The time entered must be greater than the current time visible on the tabular display. If not, an error message is displayed followed by a reprompt. This feature allows the user to skip a significant amount of data by "leapfrogging" through his data files. The speed at which the new data is obtained is much faster than normal processing. After all the data for the new time has been obtained, STATFORM can proceed only forward from this time.

The next five numeric keys are used to select a particular tabular display. These keys should be pressed only after a pause is in effect (PF1). Examples of all five displays are in Figures 4-1 through 4-5.

1: Show the Internal Operations Summary (ISO) display.

2: Show the PAVE PAWS EAST (PPE) Detail display.

3: Show the PAVE PAWS WEST (PPW) Detail display.

4: Show the Simplified Processing System (SPS) Detail display.

5: Show the Delay Summary display.

Any other function key or keyboard key that is pressed results in a diagnostic at the bottom of the display in bold blinking characters. The operator may then select a correct function key. At the completion of Step 18, control resumes at Step 7.

Although the purpose of STATFORM is to display data for the SWIC project, the concepts behind the data mappings are general enough to be used as a tool for data comparison in additional applications. Appendix A discusses these concepts' processes in further detail.

4.2.3 Results

STATFORM transforms statistical output files into one of a suite of formatted tabular displays. The terminal operator has easy control over the choice of display as well as the rate at which all displays are updated. Simple tables and matrices are used to define the mapping of raw statistical data into particular displays. These data structures were designed to allow individual statcodes to be redefined without affecting the processing software.

INTERNAL SYSTEM OPERATION SUMMARY

SENSOR DATA — COMMUNICATION CHANNEL DATA

TIME INTO RAID: 2 MIN 0 SEC

MESSAGE		CURRENT SYSTEM					SWIC					
TYPE	#RPTD	#OUT TO COMM CHANNEL	# WAITNG	#RECVD CORRECT E	#RECVD CORRECT O	# RETX	#OUT TO COMM CHANNEL	# WAITNG	#RECVD CORRECT S	#RECVD CORRECT E	#RECVD CORRECT O	# RETX
PPE												
Event		0	0	0	0	0				0	0	
Summry								0	0		0	
PPW												
Event		0	0	0	0	0		0		0	0	
Summry	0						0	0	0		0	
SPS												
Event		0	0	0		0				0		
Summry								0	0			

Figure 4-1. Internal Operations Summary Display

INTERNAL SYSTEM OPERATION

SENSOR DATA

	PPE	PPW	SPS
#Miss. Lnchd			
#Objects			
#Obs in Boost			

COMMUNICATIONS CHANNEL DATA

	CURRENT SYS	SWIC
CHANNEL PROTOCOL		BROADCAST
TRANSMISSION RATE	0 bps	bps
BIT ERROR RATE	0.000	0.000
NUMBER OF OUTAGES	0	0

TIME INTO RAID: 2 MIN 0 SEC

SENSOR: PPE

MESSAGE		CURRENT SYSTEM					SWIC					
TYPE	#RPTD	#OUT TO COMM CHANNEL	#MSG WAITING	#RECVD CORRECT E	#RECVD CORRECT O	#MSG RETX	#OUT TO COMM CHANNEL	#MSG WAITING	S	#RECVD CORRECT E	#RECVD CORRECT O	#MSG RETX
AA EVENT	0	0	0			0	0	0		0	0	
TW EVENT	0	0	0			0	0	0		0	0	
QU EVENT										0	0	
W SUM								0	0		0	

Figure 4-2. Pave Paws East Detail Display

INTERNAL SYSTEM OPERATION

SENSOR DATA

	PPE	PPW	SPS
#Miss. Lnchd			
#Objects			
#Obs in Boost			

COMMUNICATIONS CHANNEL DATA

	CURRENT SYS	SWIC
CHANNEL PROTOCOL		BROADCAST
TRANSMISSION RATE	0 bps	bps
BIT ERROR RATE	0.000	0.000
NUMBER OF OUTAGES	0	0

TIME INTO RAID: 2 MIN 0 SEC

SENSOR: PPW

MESSAGE		CURRENT SYSTEM					SWIC					
TYPE	#RPTD	#OUT TO COMM CHANNEL	#MSG WAITNG	#RECVD CORRECT E	#RECVD CORRECT O	#MSG RETX	#OUT TO COMM CHANNEL	#MSG WAITNG	S	#RECVD CORRECT E	#RECVD CORRECT O	#MSG RETX
AA EVENT	0	0	0			0	0	0		0	0	
TW EVENT	0	0	0			0	0	0		0	0	
QU EVENT								0		0	0	
T SUM	0						0	0	0		0	

Figure 4-3. Pave Paws West Detail Display

INTERNAL SYSTEM OPERATION

SENSOR DATA

	PPE	PPW	SPS
#Miss. Lnchd			
#Objects			
#Obs in Boost			

COMMUNICATIONS CHANNEL DATA

	CURRENT SYS	SWIC
CHANNEL PROTOCOL		BROADCAST
TRANSMISSION RATE	0 bps	bps
BIT ERROR RATE	0.000	0.000
NUMBER OF OUTAGES	0	0

TIME INTO RAID: 2 MIN 0 SEC

SENSOR: SPS

MESSAGE TYPE	#RPTD	CURRENT SYSTEM #OUT TO COMM CHANNEL	CURRENT SYSTEM #MSG WAITNG	CURRENT SYSTEM #RECVD CORRECT E	CURRENT SYSTEM #RECVD CORRECT O	CURRENT SYSTEM #MSG RETX	SWIC #OUT TO COMM CHANNEL	SWIC #MSG WAITNG	SWIC S	SWIC #RECVD CORRECT E	SWIC #RECVD CORRECT O	SWIC #MSG RETX
MLch		0	0	0		0				0		
SLch		0	0	0		0	0			0		
NDET	0	0	0	0		0	0	0		0		
W SUM								0	0			
L/A SUM								0	0			
DTR SUM								0	0			
NUD SUM	0						0	0	0			
AOI SUM	0						0	0	0			
IML SUM	0						0	0	0			

Figure 4-4. Simplified Processing System Detail Display

DELAY SUMMARY

		PPE				PPW				SPS			
DELAY		AA	TW	QU	WS	AA	TW	QU	WS	ML	SL	MD	[illegible]
AVG	C	0	0			0	0			0	0	0	
	S	0	0			0	0		0		0	0	
PEAK	C	0	0			0	0			0	0	0	
	S	0	0			0	0		0		0	0	

▮ TIME INTO RAID 2 MIN 0 SEC

Figure 4-5. Delay Summary Display

4.3 SIDE-BY-SIDE GRAPHICAL DISPLAY CAPABILITY

4.3.1 Functional Design

BIGRAPH was designed under the SWIC project for Current/SWIC comparative purposes. BIGRAPH provides the user with two sets of screen displays as output, each for Tektronix 4025 terminals. The capability references Plot-10, Zeta, and FAST routines (for the graphics work) and rounding and hierarchy routines written by the authors. It should be noted that because of recent enhancements, however, BIGRAPH serves as a prototype to PLOTEK, a more general graphical capability providing the user three screen displays as output for one Tektronix 4025 terminal. A forthcoming PLOTEK User's Manual will cover these enhancements by explaining in detail the user requirements and interface for this newer graphics capability.

An overview BIGRAPH schematic is offered in Figure 4-6. In general, each screen display contains a top static graphic display and a bottom interactive time-step. (Refer to Figure 4-7,8). Both Screen I and Screen II's graphs provide the user variable axis labels, axis increments, legend, and screen title. The user determines the number of curves to be plotted but beyond four curves the display appears cluttered. Any of these curves may be drawn in solid, dashed, and dotted (and various combination) line types. The user may also choose special symbols to identify each of the curves by referencing the Zeta routines.

After the graph is drawn, the user enters a series of times (which must be in multiples of ten seconds). For each time entered by the user, the data comprising the curves on the above graph are displayed below under appropriately labelled column headings. If the user enters a time which is not a multiple of ten seconds, a warning tone and error message result. The user is then reprompted.

Screen I displays one graph/tabular set while Screen II provides the capability of displaying one to three graph/tabular sets determined by a subset of Tektronix function keys: F1, F2, and F3. To exit a Screen II display and hence select a new one, the user must enter an exit time of 999 from the host terminal. Once this has been done, the user may select from any of the previously defined function keys. Function key PT on the host terminal terminates the program.

Input data may specify each curve as a separate data file, i.e., a maximum of 16. As more efficient use of I/O, each screen may require one data file, i.e., a maximum of four.

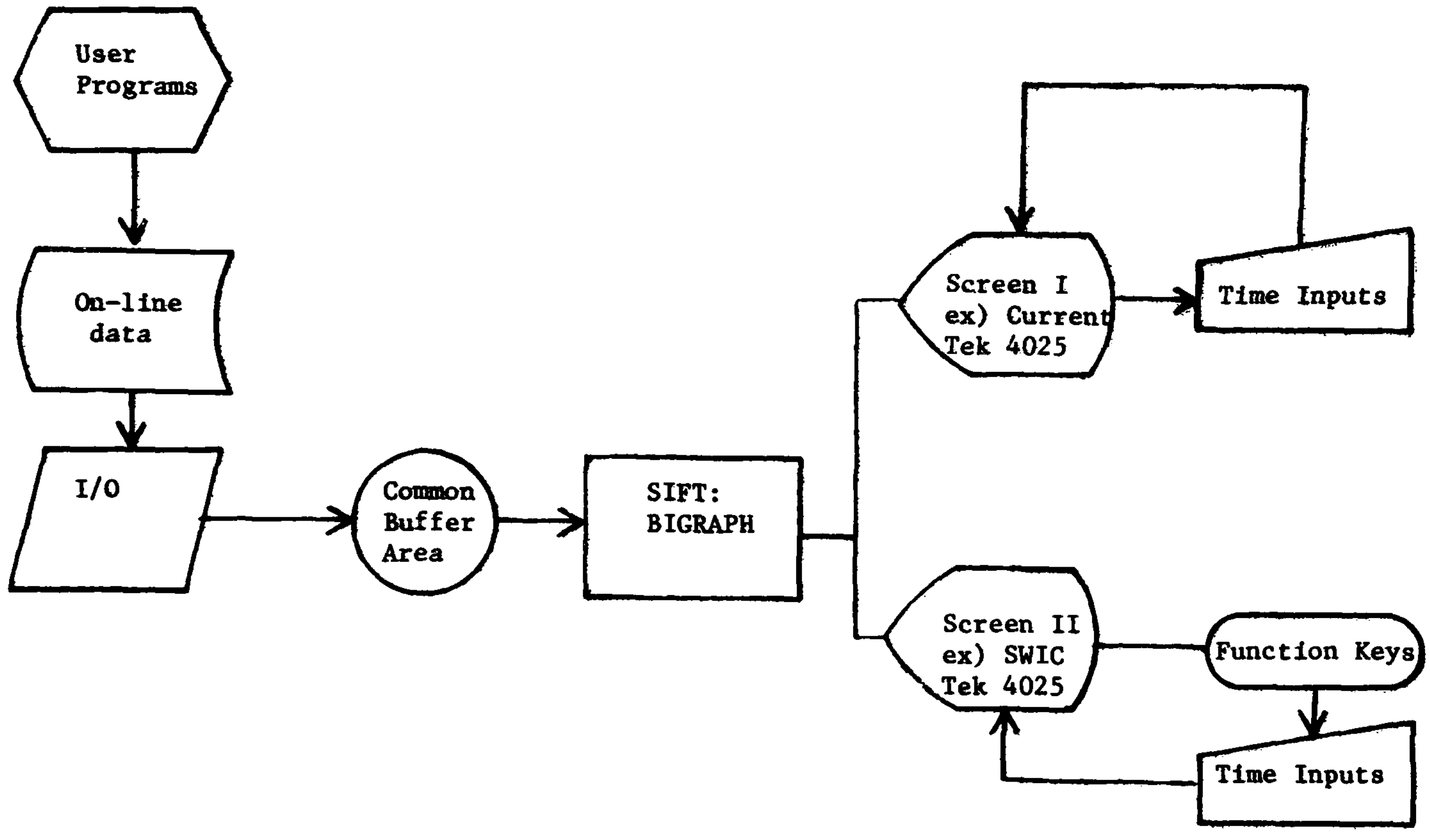


Figure 4-6. General Schematic of BIGRAPH

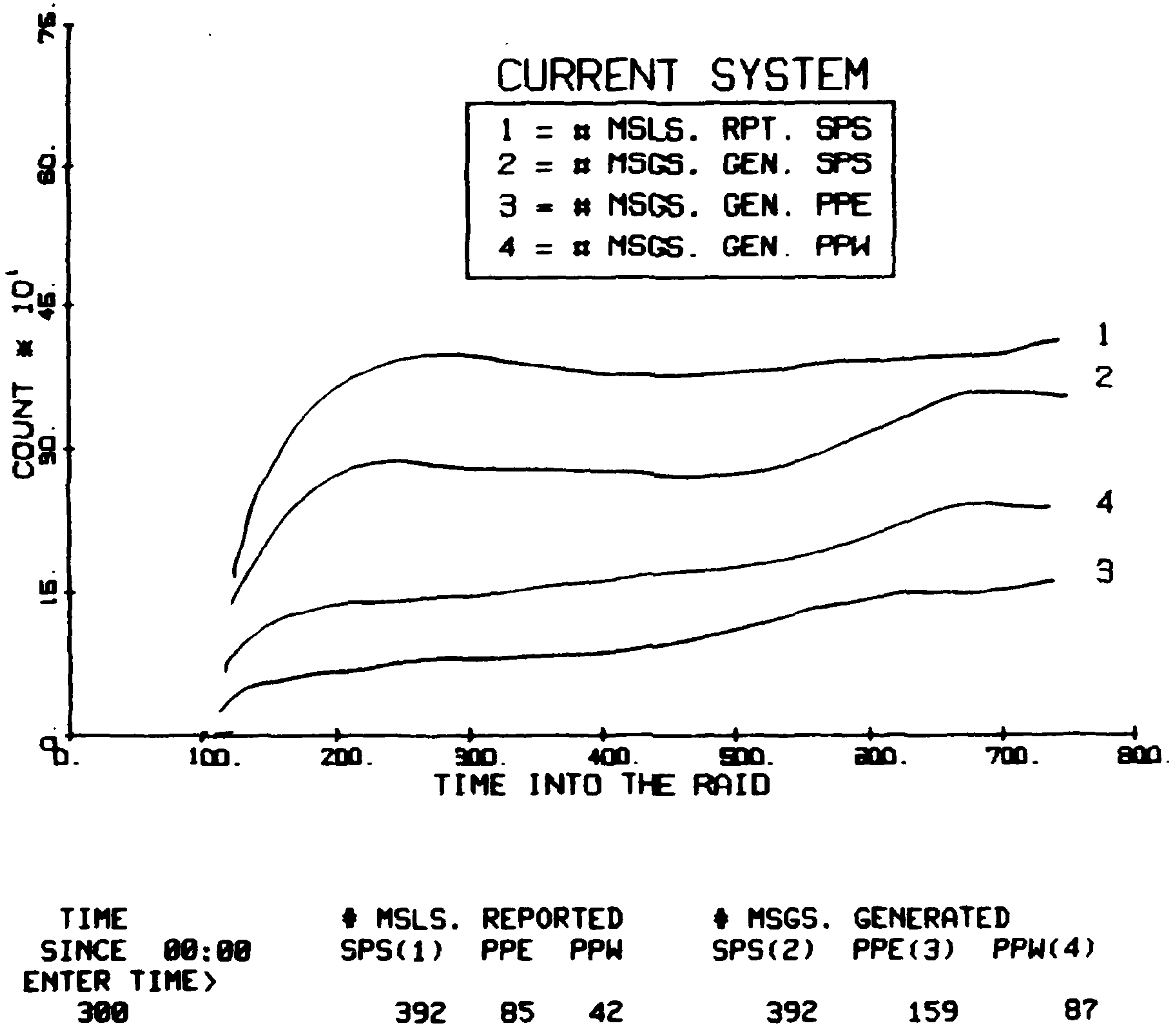
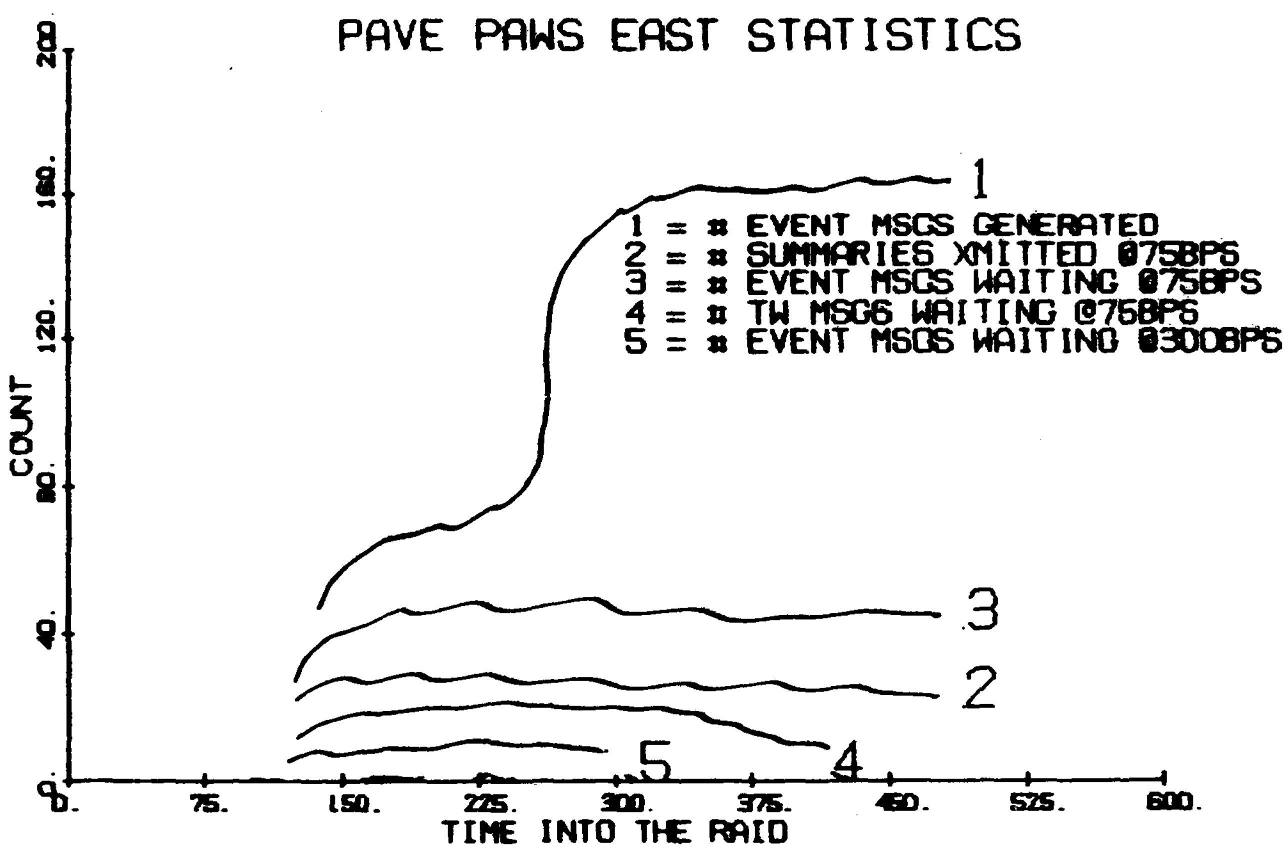
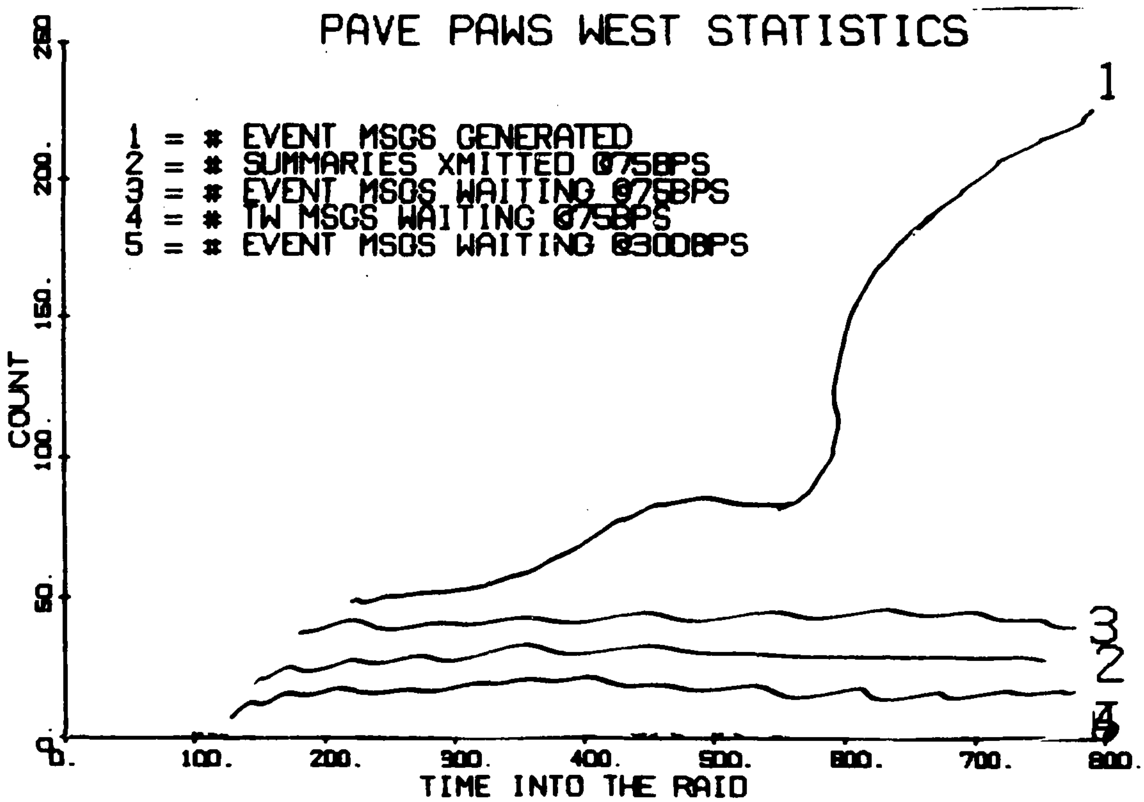


Figure 4-7. BIGRAPH Display Sample: Screen I



TIME	EVENT MSGS GENERATED	SUMMARIES XMTTED-75	EVENT MSGS WTNG-75	TW MSGS WTNG-75	EVENT MSGS WTNG-300
300	157	19	108	42	3

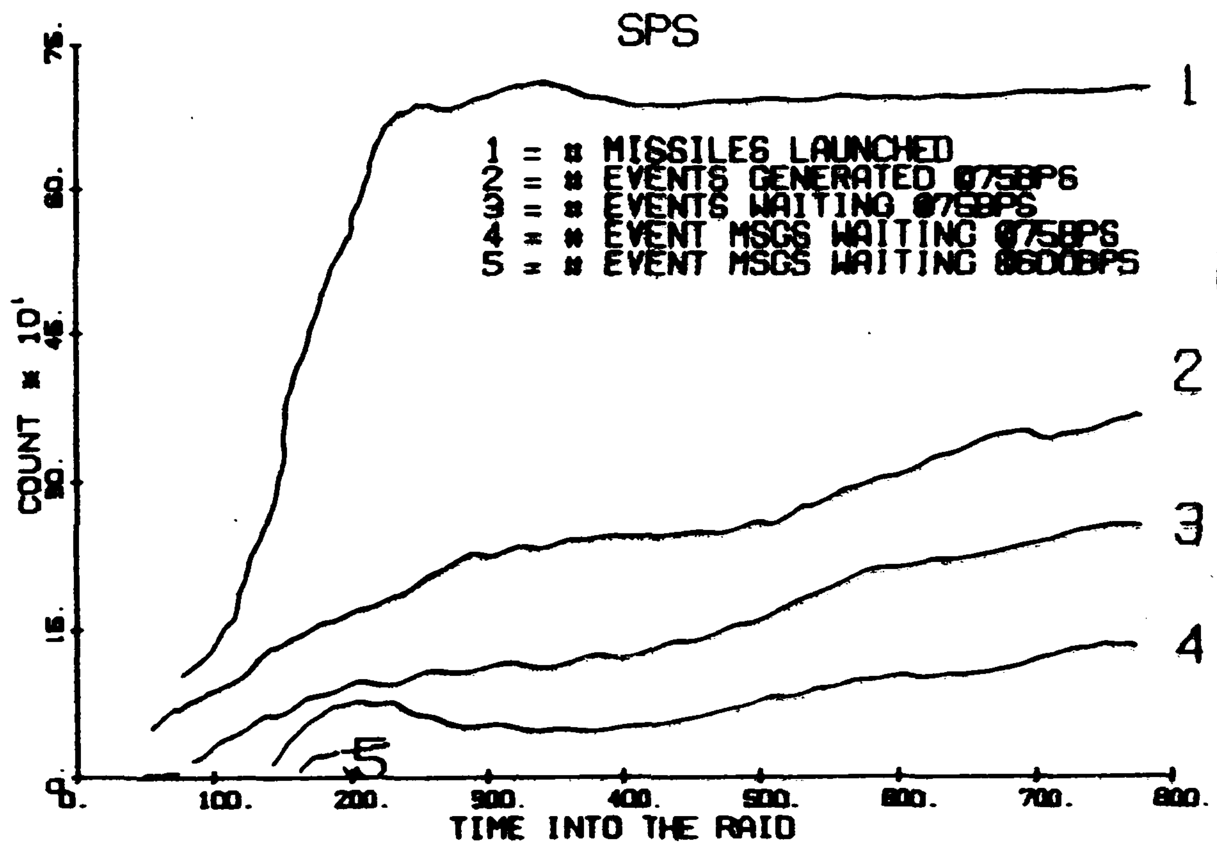
Figure 4-8. BIGRAPH Display Sample: Screen II's Three Displays



TIME	EVENT MSGS GENERATED	SUMMARIES XMTTED-75	EVENT MSGS WTNG-75	TW MSGS WTNG-75	EVENT MSGS WTNG-300
300	84	29	13	2	0

Figure 4-8. BIGRAPH Display Sample: Screen II's Three Displays

(Continued)



TIME	EVENT MSGS GENERATED	SUMMARIES XMTTED-75	EVENT MSGS WTNG-75	TW MSGS WTNG-75	EVENT MSGS WTNG-300
300	690	391	333	43	0

Figure 4-8. BIGRAPH Display Sample: Screen II's Three Displays

(Concluded)

Presently, the BIGRAPH legend will accommodate 5, one-line curve descriptions and appears in the top-left or top-right quarter of the graph. The screen title may be off-centered and decreased in character height if desired. Depending on the number of curves plotted, the user may wish to enlarge/shrink the size of his graphs accordingly.

4.3.2 User Interface

The user must reference the mainlines CRPLOT and FEBDEMO to display the present Current/SWIC example. Should the user require greater flexibility, the previously mentioned PLOTEK is offered. Briefly, PLOTEK allows for run-time sizing, legend design, and axis lengths interaction.

4.3.3 Results

The primary results of BIGRAPH are:

a) its use as a Current/SWIC comparative tool for performance analysis; and
b) its use as a prototype to PLOTEK.

As an aside, with an average number of users on the CONCAP PDP-11/70, BIGRAPH uses approximately seven seconds for plotting time. Interactive response time for each input is approximately two seconds while total run-time is completely dependent on the number of user inputs.

5.0 FUTURE ENHANCEMENTS AND CLOSING COMMENTS

The capabilities provided by SIFT can be improved in the two areas as follows.

Statform

A desirable enhancement to STATFORM is a "reverse frame" capability. This would allow an operator to view any tabular display at any time prior to the current time. Normal operator functions may then be exercised.

Bigraph

In the near future, the BIGRAPH package may include:

a) a more detailed time-step procedure in which additional sensor message information is expanded upon; and
b) axis pointers to that time interval presently being examined.

In closing, SIFT capabilities were developed as Current/SWIC modules but with additional enhancements, they may be used as general statistics generation, collection, and display tools for communications simulation capabilities. SIFT may also be viewed as a guide for future communications simulation analysis where two capabilities must be compared. And finally, it is important to note that SIFT was designed and is presently seen as an analyst's set of tools, whose purpose is to aid in the assessment of SWIC's performance.

APPENDIX A

THE DATA MAPPING PROCESS

A.1 OVERVIEW

This appendix discusses the data mapping processes involved in transferring information obtained from the statistical input files (generated by STATGET) to one of five tabular displays. The mapping process is both global (file to large holding buffer) and local (large holding buffer to character array). Intermediate tables (mapping matrices) are needed along the way and are generated by special purpose modules which are also discussed. Table A-1 depicts the entire data mapping process.

For the SWIC project, a tabular display is envisioned as an ordered set, D, of elements (T, L). The first coordinate (T) denotes the data type of a displayable element: numeric or character. The second coordinate (L) denotes the length, in characters, of the data item as it will appear on the tabular display. The order in which the elements of the set D appear directly corresponds to the order in which the display generation routines fill in the data items on the tabular display of interest. This order is well-defined and is known to the designer of the tabular display. The data type and length attribute of each displayable item are also known. In the discussion which follows, N will denote the number of ordered pairs in the set D (the number of elements displayed). The ordering is made precise by using subscripts in the definition of D:

$$D = \{ (T_j, L_j) \mid j=1,2,3,\ldots,N\} \qquad (1)$$

With this definition of a tabular display, we now proceed to describe global mapping procedures. Let S denote the set of all statistics of interest. The set S is generated by all statistics generating tasks (SGTs) comprising both SWIC and Current. Each SGT can compute many statistical quantities. For this reason, statistical quantities generated by the same SGT were grouped into ordered sets called statcodes.

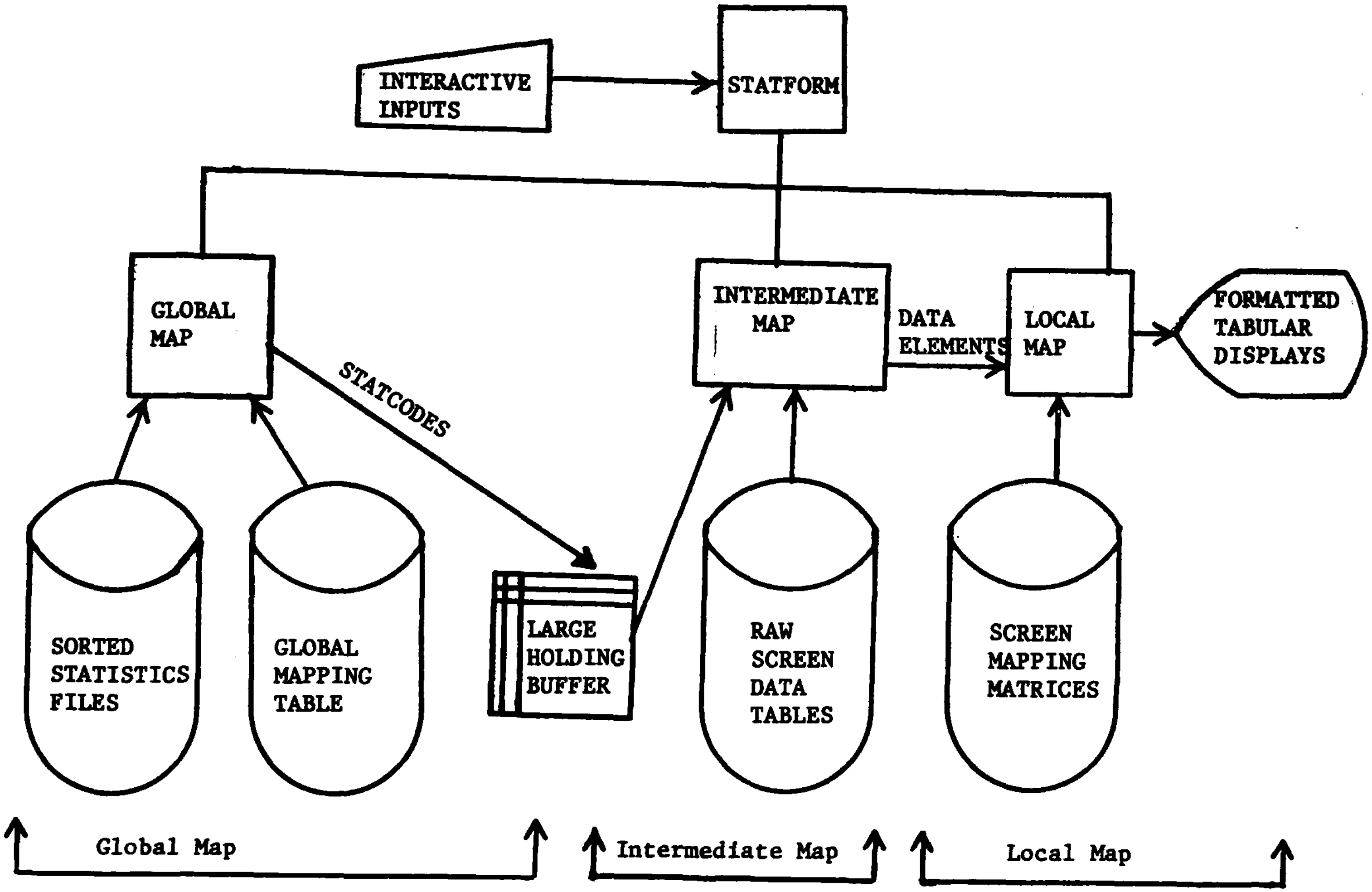


Table A-1. The Data Mapping Process

Each SGT is responsible for at least one statcode. The statcodes induce a partition on S. The totality of all statcodes generate S and the statcodes are mutually exclusive. If S_i denotes the i'th statcode, N_i denotes the number of elements in S_i, N_s denotes the number of statcodes, and e_{ij} denotes the j'th element of the i'th statcode; then the following relationships hold:

$$S_i = \{ e_{ij} \mid j = 1,2,\ldots,N_i \} \qquad (2)$$

$$S_i \subset S \qquad (3)$$

$$S = S_1 \cup S_2 \cup \ldots \cup S_{N_S} \qquad (4)$$

$$S_i \cap S_j = 0 \text{ for all } i \neq j \qquad (5)$$

Equation (2) formally defines a statcode as a set of ordered elements. Equation (3) states that a statcode is a proper subset of the set of all statistics of interest. Equation (4) states that the union of all the statcodes generates the set of all statistics. Equation (5) then expresses that the statcodes are mutually exclusive as sets.

The statcode is a convenient entity to use since it is composed of a well-defined set of statistics (see Appendix B). Statcodes also correspond to data records written to statistical output files generated by STATGET (section 3.3). The first mapping discusses the global mapping of statcodes into an internal area of storage called the "large holding buffer".

A.2 THE GLOBAL MAPPING

As data is read from the statistical input files, the statistics in each record (statcode) are stored into contiguous locations in a large holding buffer. This buffer is large enough to hold 303 statistics of interest (represented by 36 unique statcodes). Any data record representing the same statcode will always map into the same set of storage locations within the large holding buffer. This is accomplished via a table (Global Mapping Table) consisting of 36 rows (one for each statcode), i.e., the j'th row of the table corresponds to the j'th statcode (j=1,2,...,36). Each table row consists of the following elements:

a) the number of elements in the statcode
b) the starting location within the large holding buffer at which to begin storing the statcode elements

Statcodes are read in sorted order from statistics files until all data records have been retrieved whose time-tags do not exceed the current refresh time. Each unique statcode will occupy unique storage locations within the large holding buffer. This has the effect of overlaying the locations reserved for a particular statcode with elements for only that particular statcode. Furthermore, the data contained within the large holding buffer will always be up-to-date (subject to the refresh time). A representation of this global mapping process is shown in Table A-1. Table A-2 presents time global mapping table format and its relation to the large holding buffer.

```
<-----------------------LARGE HOLDING BUFFER----------------------->

--------------------------------------------------------------------
| statcode 1 | statcode 2 | . . . | statcode 20 | . . . | statcode 36 |
--------------------------------------------------------------------
 1          89                    115          121          299       303
```

GLOBAL MAPPING MATRIX

STATCODE	#ELEMENTS	STARTING LOCATION WITHIN BUFFER
1	8	1
2	1	9
.	.	.
.	.	.
.	.	.
20	7	115
.	.	.
.	.	.
.	.	.
36	5	299

Table A-2. Global Mapping Table

A.3 THE INTERMEDIATE MAPPING

The process of mapping statcodes into the large holding buffer solves the problem of retrieving and storing only the most current statistics subject to the current refresh time. We now describe an orderly way of mapping the statistical counts stored in the large holding buffer into smaller internal storage areas. There will be one storage area for each tabular display. These areas will be referred to as "screen character vectors".

A tabular display consists of data items possessing the following characteristics:

- o each item is contained within a unique statcode
- o each item occupies a unique element position within its statcode
- o each item occupies a unique element position with the large holding buffer
- o each item consists of a well-defined number of displayable characters

For each tabular display, an ancillary table called the Raw Screen Data Table is constructed. This table has as many rows as there are displayable data items on the tabular display. The i′th row in the table corresponds to the i′th data item filled in on the tabular display. Each row of the table contains three pieces of information:

a) the statcode of the data item
b) the data item′s element position within the statcode
c) the number of displayable characters for the data item

From this readily obtainable information, an operator can refer to any data item displayed on a screen via its statcode and element number within the statcode. This convenient table is included for convenience and is illustrated in Table A-3 for the Internal Operations Summary Display. For clarity's sake, not all 42 displayable data items are presented. The role of the intermediate mapping function is displayed in the central portion of Table A-1.

SCREEN ELEMENT NUMBER	STATCODE DESIGNATOR	STATCODE ELEMENT NUMBER	NUMBER OF DISPLAYABLE CHARACTERS
1	1	4	3
2	7	15	3
3	7	16	3
4	34	1	3
.	.	.	.
.	.	.	.
.	.	.	.
39	27	12	4
40	28	25	4
41	28	26	4
42	33	2	4

Table A-3. ISO Display: Screen Data Table

A.4 THE LOCAL MAPPING

The information contained in the Raw Screen Data Table allows displays to be defined quickly and easily. However, one final transformation is needed to convert the statcode designator and the statcode element number into a pointer which references the large holding buffer. Such a transformation requires the Raw Screen Data Table as input and generates a Screen Mapping Matrix on a one-to-one basis as output. With this output, a direct route is established between the large holding buffer and the set of tabular displays.

Specifically, each Screen Mapping Matrix has as many rows as its corresponding Raw Screen Data Table. Each row of this matrix contains the following information:

- o screen element number (destination)
- o element number within the large holding buffer (source)
- o number of displayable characters in the element

It is this final mapping process utilized by STATFORM that populates the tabular displays with values. This local mapping process is depicted on the right-hand side of Table A-1.

The Screen Mapping Matrix corresponding to the Raw Screen Data Table is given in Table A-4.

SCREEN ELEMENT NUMBER	BUFFER ELEMENT NUMBER	NUMBER OF DISPLAYABLE CHARACTERS
1	4	3
2	73	3
3	74	3
4	279	3
.	.	.
.	.	.
.	.	.
39	180	4
40	209	4
41	210	4
42	275	4

Table A-4. ISO Display: Screen Mapping Matrix

To summarize, the above procedures are equivalent to a composition of functions. The first function maps a statcode into the large holding buffer via the Global Mapping Table. The second function maps elements of the large holding buffer into their respective tabular display locations using the Screen Mapping Matrices. An intermediate transformation is needed to map each Raw Screen Data Table (operator oriented) into its Screen Mapping Matrix (program oriented).

In actual use, these procedures were quite flexible. The original statcode definitions changed several times. The amount of effort needed to accommodate these changes was minimal and took the form of making changes to several of the tables. No changes were made to the existing STATFORM software, an attest to STATFORM'S flexibility.

APPENDIX B

STATCODES AND THEIR ASSOCIATED STATISTICS

STATCODE = 1 SYSTEM = SWIC SENSOR = PPE

BUFFER LOCATION	ELEMENT NUMBER	DESCRIPTION
1	1	TW MESSAGES GENERATED
2	2	AA MESSAGES GENERATED
3	3	QU MESSAGES GENERATED
4	4	TOTAL EVENTS GENERATED
5	5	WARNING SUMMARIES GENERATED
6	6	# MISSILES LAUNCHED
7	7	# OBJECTS
8	8	# OBJECTS IN BOOST

STATCODE = 2 SYSTEM = SWIC SENSOR = PPE

BUFFER LOCATION	ELEMENT NUMBER	DESCRIPTION
9	1	***** NOT IN USE AT THIS TIME *****

STATCODE = 3 SYSTEM = SWIC SENSOR = PPE

BUFFER LOCATION	ELEMENT NUMBER	DESCRIPTION
10	1	TW MESSAGES SENT
11	2	AA MESSAGES SENT
12	3	QU MESSAGES SENT
13	4	WARNING SUMMARY MESSAGES
14	5	TOTAL EVENT MESSAGES SENT
15	6	TW MESSAGES WAITING
16	7	AA MESSAGES WAITING
17	8	QU MESSAGES WAITING
18	9	WARNING SUMMARY MESSAGES WAITING
19	10	TOTAL EVENT MESSAGES WAITING
20	11	OBJECTS IN EVENTS
21	12	OBJECTS IN SUMMARY
22	13	WARNING SUMMARY AVERAGE DELAY
23	14	AA AVERAGE DELAY
24	15	TW AVERAGE DELAY
25	16	QU AVERAGE DELAY
26	17	WARNING SUMMARY PEAK DELAY
27	18	AA PEAK DELAY
28	19	TW PEAK DELAY
29	20	QU PEAK DELAY

STATCODE = 4 SYSTEM = SWIC SENSOR = PPW

BUFFER LOCATION	ELEMENT NUMBER	DESCRIPTION
30	1	TW MESSAGES GENERATED
31	2	AA MESSAGES GENERATED
32	3	QU MESSAGES GENERATED
33	4	TOTAL MESSAGES GENERATED
34	5	WARNING SUMMARIES GENERATED
35	6	#MISSILES LAUNCHED
36	7	#OBJECTS
37	8	#OBJECTS IN BOOST

STATCODE = 5 SYSTEM = SWIC SENSOR = PPW

BUFFER LOCATION	ELEMENT NUMBER	DESCRIPTION
38	1	***** NOT IN USE AT THIS TIME *****

STATCODE = 6 SYSTEM = SWIC SENSOR = PPW

BUFFER LOCATION	ELEMENT NUMBER	DESCRIPTION
39	1	TW MESSAGES SENT
40	2	AA MESSAGES SENT
41	3	QU MESSAGES SENT
42	4	WARNING SUMMARY MESSAGES
43	5	TOTAL EVENT MESSAGES SENT
44	6	TW MESSAGES WAITING
45	7	AA MESSAGES WAITING
46	8	QU MESSAGES WAITING
47	9	WARNING SUMMARY MESSAGES WAITING
48	10	TOTAL EVENT MESSAGES WAITING
49	11	OBJECTS IN EVENTS
50	12	OBJECTS IN SUMMARY
51	13	WARNING SUMMARY AVERAGE DELAY
52	14	AA AVERAGE DELAY
53	15	TW AVERAGE DELAY
54	16	QU AVERAGE DELAY
55	17	WARNING SUMMARY PEAK DELAY
56	18	AA PEAK DELAY
57	19	TW PEAK DELAY
58	20	QU PEAK DELAY

STATCODE = 7 SYSTEM = CURNT SENSOR = PPE

BUFFER LOCATION	ELEMENT NUMBER	DESCRIPTION
59	1	#MISSILES LAUNCHED
60	2	#OBJECTS
61	3	#OBJECTS IN BOOST
62	4	#RPTD OF AA
63	5	#RPTD OF TW
64	6	#SENT TO COM CHANNEL (AA)
65	7	#SENT TO COM CHANNEL (TW)
66	8	#WAITING FOR COM CHANNEL (AA)
67	9	#WAITING FOR COM CHANNEL (TW)
68	10	AVERAGE DELAY (AA)
69	11	AVERAGE DELAY (TW)
70	12	PEAK DELAY (AA)
71	13	PEAK DELAY (TW)
72	14	TOTAL EVENTS REPORTED
73	15	TOTAL EVENTS SENT TO COM CHANNEL
74	16	TOTAL EVENTS WAITING

STATCODE = 8 SYSTEM = CURNT SENSOR = PPE

BUFFER LOCATION	ELEMENT NUMBER	DESCRIPTION
75	1	***** NOT IN USE AT THIS TIME *****

STATCODE = 9   SYSTEM = CURNT   SENSOR = PPW

BUFFER LOCATION	ELEMENT NUMBER	DESCRIPTION
76	1	#MISSILES LAUNCHED
77	2	#OBJECTS
78	3	#OBJECTS IN BOOST
79	4	#RPTD OF AA
80	5	#RPTD OF TW
81	6	#SENT TO COM CHANNEL (AA)
82	7	#SENT TO COM CHANNEL (TW)
83	8	#WAITING FOR COM CHANNEL (AA)
84	9	#WAITING FOR COM CHANNEL (TW)
85	10	AVERAGE DELAY (AA)
86	11	AVERAGE DELAY (TW)
87	12	PEAK DELAY (AA)
88	13	PEAK DELAY (TW)
89	14	TOTAL EVENTS REPORTED
90	15	TOTAL EVENTS SENT TO COM CHANNEL
91	16	TOTAL EVENTS WAITING

STATCODE = 10   SYSTEM = CURNT   SENSOR = PPE

BUFFER LOCATION	ELEMENT NUMBER	DESCRIPTION
92	1	***** NOT IN USE AT THIS TIME *****

STATCODE = 11   SYSTEM = SWIC   SENSOR = PPE

BUFFER LOCATION	ELEMENT NUMBER	DESCRIPTION
93	1	***** NOT IN USE AT THIS TIME *****

STATCODE = 12 SYSTEM = SWIC SENSOR = PPW

BUFFER LOCATION	ELEMENT NUMBER	DESCRIPTION
94	1	***** NOT IN USE AT THIS TIME *****

STATCODE = 13 SYSTEM = SWIC SENSOR = PPE

BUFFER LOCATION	ELEMENT NUMBER	DESCRIPTION
95	1	***** NOT IN USE AT THIS TIME *****

STATCODE = 14 SYSTEM = SWIC SENSOR = PPW

BUFFER LOCATION	ELEMENT NUMBER	DESCRIPTION
96	1	***** NOT IN USE AT THIS TIME *****

STATCODE = 15 SYSTEM = SWIC SENSOR = SPS

BUFFER LOCATION	ELEMENT NUMBER	DESCRIPTION
97	1	***** NOT IN USE AT THIS TIME *****

STATCODE = 16 SYSTEM = CURNT SENSOR = PPE

BUFFER LOCATION	ELEMENT NUMBER	DESCRIPTION
98	1	TOTAL EVENT MESSAGES RETRANSMITTED
99	2	#AA EVENTS RETRANSMITTED
100	3	#TW EVENTS RETRANSMITTED

STATCODE = 17 SYSTEM = CURNT SENSOR = PPW

BUFFER LOCATION	ELEMENT NUMBER	DESCRIPTION
101	1	TOTAL EVENT MESSAGES RETRANSMITTED
102	2	#AA EVENTS RETRANSMITTED
103	3	#TW EVENTS RETRANSMITTED

STATCODE = 18 SYSTEM = CURNT SENSOR = SPS

BUFFER LOCATION	ELEMENT NUMBER	DESCRIPTION
104	1	TOTAL EVENT MESSAGES RETRANSMITTED
105	2	#ML EVENTS RETRANSMITTED
106	3	#SL EVENTS RETRANSMITTED
107	4	#ND EVENTS RETRANSMITTED

STATCODE = 19   SYSTEM = SWIC   SENSOR = PPE

BUFFER LOCATION	ELEMENT NUMBER	DESCRIPTION
108	1	#MSGS RECEIVED IN ERROR
109	2	#WS RECEIVED CORRECT
110	3	#OP MSGS RECEIVED CORRECT
111	4	#AA EVENT MSGS RECEIVED CORRECT
112	5	#TW EVENT MSGS RECEIVED CORRECT
113	6	#QU EVENT MSGS RECEIVED CORRECT
114	7	#STATUS MSGS RECEIVED CORRECT

STATCODE = 20   SYSTEM = SWIC   SENSOR = PPW

BUFFER LOCATION	ELEMENT NUMBER	DESCRIPTION
115	1	#MSGS RECEIVED IN ERROR
116	2	#WS RECEIVED CORRECT
117	3	#OP MSGS RECEIVED CORRECT
118	4	#AA EVENT MSGS RECEIVED CORRECT
119	5	#TW EVENT MSGS RECEIVED CORRECT
120	6	#QU EVENT MSGS RECEIVED CORRECT
121	7	#STATUS MSGS RECEIVED CORRECT

STATCODE = 21   SYSTEM = SWIC   SENSOR = SPS

BUFFER LOCATION	ELEMENT NUMBER	DESCRIPTION
122	1	#MSGS RECEIVED IN ERROR
123	2	#WS MSGS RECEIVED CORRECT
124	3	#DTR SUMMARY MSGS RECEIVED CORRECT
125	4	#L/A SUMMARY MSGS RECEIVED CORRECT
126	5	#NUD SUMMARY MSGS RECEIVED CORRECT
127	6	#MML SUMMARY MSGS RECEIVED CORRECT
128	7	#OPERATOR SUMMARY MSGS RECEIVED CORRECT
129	8	#AOI SUMMARY MSGS RECEIVED CORRECT
130	9	#TYPE B CONUS NDET MSGS RECEIVED CORRECT
131	10	#TYPE B NON-CONUS NDET MSGS RECEIVED CORRECT
132	11	#MLCH MSGS RECEIVED CORRECT
133	12	#MLCH FINAL MSGS RECEIVED CORRECT
134	13	#SLCH MSGS RECEIVED CORRECT
135	14	#STATUS MSGS RECEIVED CORRECT

STATCODE = 22   SYSTEM = CURNT   SENSOR = PPE

BUFFER LOCATION	ELEMENT NUMBER	DESCRIPTION
136	1	ELEMENT NOT CURRENTLY USED
137	2	#EVENT MSGS RECEIVED CORRECT
138	3	#CONFIDENCE MSGS RECEIVED CORRECT
139	4	#COM STATUS MSGS RECEIVED CORRECT

STATCODE = 23   SYSTEM = CURNT   SENSOR = PPW

BUFFER LOCATION	ELEMENT NUMBER	DESCRIPTION
140	1	ELEMENT NOT CURRENTLY USED
141	2	#EVENT MSGS RECEIVED CORRECT
142	3	#CONFIDENCE MSGS RECEIVED CORRECT
143	4	#COM STATUS MSGS RECEIVED CORRECT

STATCODE = 24   SYSTEM = CURNT   SENSOR = SPS

BUFFER LOCATION	ELEMENT NUMBER	DESCRIPTION
144	1	ELEMENT NOT CURRENTLY USED
145	2	#SLCH MSGS RECEIVED CORRECT
146	3	#NDET MSGS RECEIVED CORRECT
147	4	#MLCH MSGS RECEIVED CORRECT
148	5	#MLCH FINAL MSGS RECEIVED CORRECT

STATCODE = 25   SYSTEM = CURNT   SENSOR = SPS

BUFFER LOCATION	ELEMENT NUMBER	DESCRIPTION
149	1	#MISSILES LAUNCHED
150	2	#RPTED OF MSG TYPE ML (16+17)
151	3	#RPTED OF MSG TYPE SL (30)
152	4	#RPTED OF MSG TYPE ND (32)
153	5	#SENT TO CC OF MSG TYPE ML
154	6	#SENT TO CC OF MSG TYPE SL
155	7	#SENT TO CC OF MSG TYPE ND
156	8	#WAITING FOR CC OF MSG TYPE ML
157	9	#WAITING FOR CC OF MSG TYPE SL
158	10	#WAITING FOR CC OF MSG TYPE ND
159	11	AVG DELAY ML
160	12	AVG DELAY SL
161	13	AVG DELAY ND
162	14	PEAK DELAY ML
163	15	PEAK DELAY SL
164	16	PEAK DELAY ND
165	17	TOTAL EVENTS REPORTED
166	18	TOTAL EVENTS SENT TO CC
167	19	TOTAL EVENTS WAITING FOR CC

STATCODE = 26   SYSTEM = CURNT   SENSOR = SPS

BUFFER LOCATION	ELEMENT NUMBER	DESCRIPTION
168	1	***** NOT USED AT THIS TIME *****

STATCODE = 27 SYSTEM = SWIC SENSOR = SPS

BUFFER LOCATION	ELEMENT NUMBER	DESCRIPTION
169	1	#WARNING SUMMARIES GENERATED
170	2	#TIME TO IMPACT SUMMARIES GENERATED
171	3	#LAUNCH AZIMUTH SUMMARIES GENERATED
172	4	#CONUS NUDETS SUMMARIES GENERATED
173	5	#BLUE LAUNCH SUMMARIES GENERATED
174	6	#AOI SUMMARIES GENERATED
175	7	#SAT. TYPE B CONUS EVENT MSGS RECEIVED
176	8	#SAT. TYPE B NON-CONUS EVENT MSGS RECEIVED
177	9	#MULTIPLE EVENT INITIAL MSGS RECEIVED
178	10	#MULTIPLE EVENT FINAL MSGS RECEIVED
179	11	#SAT. TYPE A EVENT MSGS RECEIVED
180	12	TOT NUMBER OF SUMMARY MSGS GENERATED
181	13	TOT NUMBER OF EVENT MSGS GENERATED
182	14	TOT NUMBER OF NUDET MSGS GENERATED
183	15	TOT MULT EVENT MSGS GENERATED
184	16	TOTAL NUMBER OF LAUNCHES

STATCODE = 28 SYSTEM = SWIC SENSOR = SPS

BUFFER LOCATION	ELEMENT NUMBER	DESCRIPTION
185	1	#WS MSGS SENT
186	2	#MS MSGS WAITING
187	3	WS AVG DELAY
188	4	WS PEAK DELAY
189	5	#TIME TO IMPACT SUMMARY MSGS SENT
190	6	#TIME TO IMPACT SUMMARY MSGS WAITING
191	7	TIME TO IMPACT SUMMARY AVG DELAY
192	8	TIME TO IMPACT SUMMARY PEAK DELAY
193	9	#LAUNCH AZIMUTH SUMMARY MSGS SENT
194	10	#LAUNCH AZIMUTH SUMMARY MSGS WAITING
195	11	LAUNCH AZIMUTH SUMMARY AVG DELAY
196	12	LAUNCH AZIMUTH SUMMARY PEAK DELAY
197	13	#CONUS NUDETS SUMMARY MSGS SENT
198	14	#CONUS NUDETS SUMMARY MSGS WAITING
199	15	CONUS NUDETS SUMMARY AVG DELAY
200	16	CONUS NUDETS SUMMARY PEAK DELAY
201	17	#BLUE LAUNCH SUMMARY MSGS SENT
202	18	#BLUE LAUNCH SUMMARY MSGS WAITING
203	19	BLUE LAUNCH SUMMARY MSG AVG DELAY
204	20	BLUE LAUNCH SUMMARY MSG PEAK DELAY
205	21	#AOI SUMMARY MESSAGES SENT
206	22	#AOI SUMMARY MESSAGES WAITING
207	23	AOI SUMMARY MSG AVG DELAY
208	24	AOI SUMMARY MSG PEAK DELAY
209	25	TOTAL SUMMARY MSGS SENT
210	26	TOTAL SUMMARY MSGS WAITING
211	27	AVERAGE AVERAGE DELAY
212	28	AVERAGE PEAK DELAY

STATCODE = 29 SYSTEM = SWIC SENSOR = SPS

BUFFER LOCATION	ELEMENT NUMBER	DESCRIPTION
213	1	#SAT. TYPE B CONUS EVENT MSGS SENT
214	2	#SAT. TYPE B CONUS EVENT MSGS WAITING
215	3	SAT. TYPE B CONUS EVENT MSG AVG DELAY
216	4	SAT. TYPE B CONUS EVENT MSG PEAK DELAY
217	5	#SAT. TYPE B NON-CONUS EVENT MSGS SENT
218	6	#SAT. TYPE B NON-CONUS EVENT MSGS WAITING
219	7	SAT. TYPE B NON-CONUS EVENT MSG AVG DELAY
220	8	SAT. TYPE B NON-CONUS EVENT MSG PEAK DELAY
221	9	#MULTIPLE EVENT INITIAL MSG MSGS SENT
222	10	#MULTIPLE EVENT INITIAL MSG MSGS WAITING
223	11	MULTIPLE EVENT INITIAL MSG AVG DELAY
224	12	MULTIPLE EVENT INITIAL MSG PEAK DELAY
225	13	#MULTIPLE EVENT FINAL MSG MSGS SENT
226	14	#MULTIPLE EVENT FINAL MSG MSGS WAITING
227	15	MULTIPLE EVENT FINAL MSG AVG DELAY
228	16	MULTIPLE EVENT FINAL MSG PEAK DELAY
229	17	#SAT. TYPE A EVENT MSGS SENT
230	18	#SAT. TYPE A EVENT MSGS WAITING
231	19	SAT. TYPE A EVENT MSG AVG DELAY
232	20	SAT. TYPE A EVENT MSG PEAK DELAY
233	21	TOTAL NUDETS MSG MSGS SENT
234	22	TOTAL NUDETS MSG MSGS WAITING
235	23	TOTAL NUDETS MSG MSGS AVG AVERAGE DELAY
236	24	TOTAL NUDETS MSG MSGS AVG PEAK DELAY
237	25	TOTAL MULTI-EVENT MSGS SENT
238	26	TOTAL MULTI-EVENT MSGS WAITING
239	27	TOTAL MULTI-EVENT AVG AVERAGE DELAY
240	28	TOTAL MULTI-EVENT AVG PEAK DELAY
241	29	TOTAL EVENT MSGS SENT
242	30	TOTAL EVENT MSGS WAITING

STATCODE = 30 SYSTEM = SWIC SENSOR = SPS

BUFFER LOCATION	ELEMENT NUMBER	DESCRIPTION
243	1	***** NOT IN USE AT THIS TIME *****

STATCODE = 31 SYSTEM = SWIC SENSOR = PPE

BUFFER LOCATION	ELEMENT NUMBER	DESCRIPTION
244	1	#EVENT MSGS RECEIVED CORRECT
245	2	#SUMMARY MSGS RECEIVED CORRECT
246	3	ELEMENT NOT CURRENTLY USED
247	4	#MISSILES IN EVENT MSGS
248	5	ELEMENT NOT CURRENTLY USED
249	6	#OBJECTS IN EVENT MSGS
250	7	#OBJECTS IN SUMMARY MSGS
251	8	#MULTIPLE RADAR REPORTS
252	9	#OBJECTS IN TW EVENT
253	10	#MISSILES IN TW EVENT
254	11	#OBJECTS IN AA EVENT
255	12	#MISSILES IN AA EVENT
256	13	#OBJECTS IN QU EVENT
257	14	#MISSILES IN QU EVENT
258	15	#EVENT MSGS IN SUMMARIES

STATCODE = 32   SYSTEM = SWIC   SENSOR = PPW

BUFFER LOCATION	ELEMENT NUMBER	DESCRIPTION
259	1	#EVENT MSGS RECEIVED CORRECT
260	2	#SUMMARY MSGS RECEIVED CORRECT
261	3	ELEMENT NOT CURRENTLY USED
262	4	#MISSILES IN EVENT MSGS
263	5	ELEMENT NOT CURRENTLY USED
264	6	#OBJECTS IN EVENT MSGS
265	7	#OBJECTS IN SUMMARY MSGS
266	8	#MULTIPLE RADAR REPORTS
267	9	#OBJECTS IN TW EVENT
268	10	#MISSILES IN TW EVENT
269	11	#OBJECTS IN AA EVENT
270	12	#MISSILES IN AA EVENT
271	13	#OBJECTS IN QU EVENT
272	14	#MISSILES IN QU EVENT
273	15	#EVENT MSGS IN SUMMARIES

STATCODE = 33   SYSTEM = SWIC   SENSOR = SPS

BUFFER LOCATION	ELEMENT NUMBER	DESCRIPTION
274	1	#EVENT MSGS RECEIVED CORRECT
275	2	#SUMMARY MSGS RECEIVED CORRECT
276	3	#NDET MSGS RECEIVED CORRECT
277	4	#MISSILES IN EVENT MSGS
278	5	#MLCH MSGS RECEIVED CORRECT

STATCODE = 34 SYSTEM = CURNT SENSOR = PPE

BUFFER LOCATION	ELEMENT NUMBER	DESCRIPTION
279	1	#EVENT MSGS RECEIVED CORRECT
280	2	ELEMENT NOT CURRENTLY USED
281	3	ELEMENT NOT CURRENTLY USED
282	4	#MISSILES IN EVENT MSGS
283	5	ELEMENT NOT CURRENTLY USED
284	6	#OBJECTS IN EVENT MSGS
285	7	ELEMENT NOT CURRENTLY USED
286	8	#MULTIPLE RADAR REPORTS
287	9	#OBJECTS IN TW EVENT
288	10	#MISSILES IN TW EVENT

STATCODE = 35 SYSTEM = CURNT SENSOR = PPW

BUFFER LOCATION	ELEMENT NUMBER	DESCRIPTION
289	1	#EVENT MSGS RECEIVED CORRECT
290	2	ELEMENT NOT CURRENTLY USED
291	3	ELEMENT NOT CURRENTLY USED
292	4	#MISSILES IN EVENT MSGS
293	5	ELEMENT NOT CURRENTLY USED
294	6	#OBJECTS IN EVENT MSGS
295	7	ELEMENT NOT CURRENTLY USED
296	8	#MULTIPLE RADAR REPORTS
297	9	#OBJECTS IN TW EVENT
298	10	#MISSILES IN TW EVENT

STATCODE = 36 SYSTEM = CURNT SENSOR = SPS

BUFFER LOCATION	ELEMENT NUMBER	DESCRIPTION
299	1	#EVENT MSG RECEIVED CORRECT
300	2	ELEMENT NOT CURRENTLY USED
301	3	ELEMENT NOT CURRENTLY USED
302	4	#MISSILES IN EVENT MSG
303	5	#MLCH MSGS RECEIVED CORRECT

APPENDIX C

HEADER AND DATA RECORD FORMATS FOR SIFT STATISTICS FILES

Header Record Description

FIELD	TYPE	DESCRIPTION
1	I*2	Month in which file was created
2	I*2	Day on which file was created
3	I*2	Year in which file was created
4	I*2	Time of file creation (hours)
5	I*2	Time of file creation (minutes)
6	I*2	Time of file creation (seconds)
7	I*2	Scenario code
8	I*2	Communications capability code
9	I*2	Sensor code
10	I*2	Transmission rate
11	I*2	Transmission protocol
12	R*4	Bit error rate
13	I*2	Number of outages
14	R*4	Outage start time 1
.	.	.
.	.	.
.	.	.
23	R*4	Outage start time 10
24	R*4	Outage duration 1
.	.	.
.	.	.
.	.	.
33	R*4	Outage duration 10
34	R*4	Transmission delay
35	R*4	Timeout delay

Data Record Description

FIELD	TYPE	DESCRIPTION
1	I*2	Time (in seconds) of record creation
2	I*2	Statcode designator
3	R*4	Statcode element number 1
.	.	.
.	.	.
.	.	.
32	R*4	Statcode element number 30

NOTE: If a particular statcode contains less than 30 statistical counts, the undefined statcode elements are loaded with zeroes.