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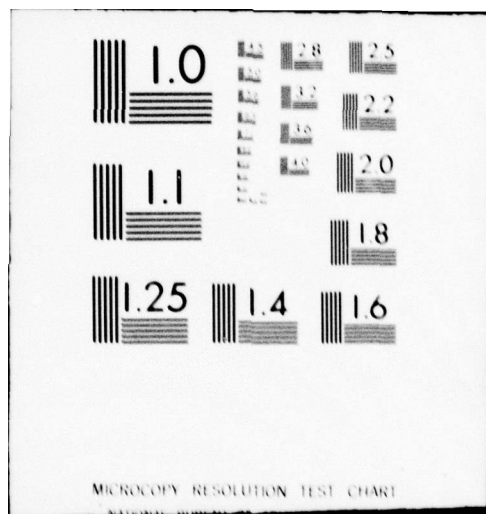
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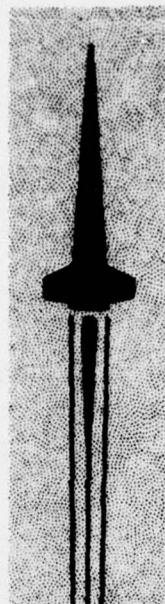
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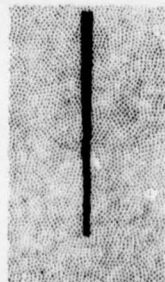
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TECHNICAL REPORT T-78-64

**EVALUATION OF DATA GENERATOR FOR
THREAD/PROGRAM UNIT TESTING**

Charles L. Lewis, Farley W. Spruell, Wayne L. Jones
Guidance and Control Directorate
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threads/program units make it unfeasible to develop a computer program which automatically creates the ENVGEN data set. MRT data retrieval and SAPB software test computer program listings are included.

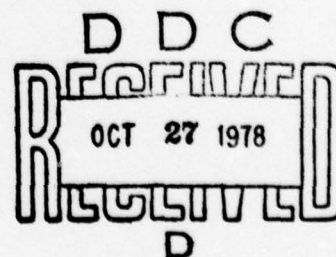
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1. INTRODUCTION

Utilizing actual field test data or other hardware related test data as the driver for computer software testing represents a logical way to determine the software's performance under realistic conditions. For the PATRIOT Missile System, this would constitute extracting data from Mission Recording Tapes (MRT's) and reformatting it into an Environment Generator (ENVGEN) data set. This report documents the results of a study in which two representative program units (BIDR and SAPB) were evaluated to determine the feasibility/problems associated with developing and applying this type of test tool.

2. GENERAL OBSERVATIONS OF K-6 DATA COLLECTION

MRT data collection is designed primarily to verify real time mission test performance. The amount of data collected is limited by tape write speed. The data collection capability was never expected to be all-inclusive, with every WCC software parameter being printed out every program pass.

In addition, changing requirements for each mission result in different amounts and type of data being taken, both from mission to mission and

within each mission. For example, during a test where actual missile intercept of a target is the objective, MRT data would naturally be concentrated on the guidance phases of operation and the WCC parameters affecting guidance. Conversely, for tests primarily involving acquisition and track of targets in a complex environment, MRT data taking will be concentrated on the search and track modes of the test.

These wide variations in data collected on MRT's and the diverse input requirements of the various WCC threads/program units would intuitively preclude any development of a general purpose, computer program designed to automatically extract data from a MRT and reformat the data for use in the ENVGEN data base for utilization as a test tool with the WCC simulator. This observation is further supported by an examination of the MRT data collection points scattered throughout the WCC software. In general, any thread/program unit of interest may have data collected prior to entry and/or also after exit for each pass through the WCC software. In order to create a test ENVGEN data representing a single instant of real time, data taken after exit from the thread/program unit of interest must be used as input for the next pass through the unit. Since a typical

thread/program unit will have some data taken before and after a pass through the unit, proper temporal mixing of the MRT data for reformatting a test input tape must be done on a program unit by program unit basis. Again, this indicates more of a case-by-case manual data gathering and compilation of any MRT based ENVGEN data sets, with any automatic computer program development to do this being too large and complex to be cost effective.

3. STUDY RESULTS

The Beam Interference Detection and Response (BIDR) and Select Autopilot Band (SAPB) program units were examined as possible candidates for testing with a MRT generated ENVGEN data base. The program unit BIDR, which maintains effective radar search beam utilization in presence of interference, and assists in locating targets marked by this interference, is relatively complex, with many options, etc., and requires a diverse array of input data for proper operation. On the other hand, the guidance system program unit SAPB, which selects the missile autopilot band and the maximum allowable missile lateral acceleration, is considerably less complex than BIDR with straight-forward input and initialization requirements. Noting the methods, difficulties, etc.,

encountered in the effort to develop MRT based ENVGEN data base test tapes for these program units should reveal the major considerations necessary for most other threads/program unit.

A. Program Unit BIDR Evaluation Results

The required inputs for BIDR was obtained from the FCG-2 Search Functional Specification¹ *Table 1*. These input requirements were compared with the MRT data collection modes and other conditions/constraints shown in the K6 data collection table² *Table 2*. The COMPOOL set/use tables were utilized to determine which of the required BIDR inputs were constants and thus unchanged from the basic ENVGEN data load and which were program variables whose values could change, and therefore, after program initiation must be supplied from a MRT.

The breakdown of BIDR input data into applicable MRT data collection

1. Draft FCG-2 Search Functional Specification, ASD-7504, Raytheon Corp., Bedford, Mass., December 31, 1975 (Unclassified)
2. ASD-10274, Attachment 1, Raytheon Corp., Bedford, Mass., 3 August 1977 (Unclassified)

TABLE 1. BIDR INPUT REQUIREMENTS

Inputs required by BIDR are listed, grouped according to the file or record in which they appear.

Search beam record:

MOCK - monitor clock
 BMDG - beam degraded indicator
 BONOFF - beam on-off indicator
 BNUM - beam number
 CNUM - column number
 RGS - receiver gain state
 BRRAM ϕ - first word of the BRRAM (word ϕ)
 CSC - control sidelobe cancellation
 - beam record RAM copied into the RIB

CFAR Alarm Test Variables Table (part of beam record)

CFC1 through CFC4 - beam-dependent CFAR comparison variables.

RDR: FTYPE - functional type of the radar action
 RTYPE - radar action type
 MCTIME - major cycle time of the radar action being processed
 NSCH - number of unsuccessful attempts to schedule the request
 RSCTR - sector identification
 RAM - address of the related beam record RAM
 - various items copied into the output RDR

RAM (input RAM for the environment action):

R1RAM ϕ - first word of the input RAM (word ϕ)
 RRAT1 - radar action time, fraction of a major cycle
 - various items copied into the output RAM
 - entire RAM copied for ALPR

RRM: NRW1 - number of remaining words in the RRM
 NREG1 - contents of the N-register
 CFAR11 through CFAR41 - CFAR alarm indicators
 SB11 through SB41
 SEML11 through SEML41
 GB11 through GB41
 GEML11 through GEML41
 COIN11 through COIN41
 PTRNG - point range of alarms (copied for ALPR)

TABLE 1. (Continued)

SRPTBL (Search RTYPE Parameters Table):

- SBLNZ - search bottoming level for non-zero PFA
- SSDCNZ - search SPG detection control for non-zero PFA ($PFA = 10^{-6}$)
- RMINRC - minimum instrumented range in range cells
- SBLZ - search bottoming level for zero PFA
- SSDCZ - search SPG detection control for zero PFA
- GBC - guard band blanking control
- SLBOFS - sidelobe blanking offset in range cells (constant part of SRP11)

RAP (Track RTYPE Parameters Table):

- RAP11 - SPG detection control for $PFA = 10^{-3}$
- RAP18 - maximum instrumented range

Surveillance State File:

- SCPEN - state control parameter-frequency diversity enabled

ILD Logic Constants Table:

- CMC1 through CMC7 - IID logic constants

CFAR Alarm Test constants Table:

- CFC1S through CFC4S - beam-independent CFAR comparison constants

Radar Load Table:

- RLT - radar load counts

Search RTYPE Inhibit Table:

- SRTINT - RTYPE-enabled indicators (complement of the DPSR form)

Beam Monitor Count Table:

- MOCKC - initial counts for the monitor clock

BIDR Constants Table:

- BC1 through BC6 - constants used by BIDR

RIB auxiliary storage:

- see section 3.2.1.2

TABLE 2. K6 DATA COLLECTION

RS	DATA COLLECTED	ENTRY TO	MODE	OTHER CONDITIONS/CONSTRAINTS
DC01 { 1 2	MDR Uplink RDR, GRAM, GRRM	DNLK DNLK	3 3	
DC02 { 3 4 5	TVM, RDR, RAM, RRM PDR, RAM, RRM, TDR PDR, RAM, RRM	DNLK CMUP CMUP	3 2 0.1.2	RTYPE - 4 (a) CMUP queued by CMUP, or (b) NREG - -3
DC03 { 6 7 8	RDR, RAM1, RRM1 RDR, RAM1, RRM1 RDR, RAM1, RRM1	BIDR BIDR BIDR	1 0.2 2	(a) NREG - -2 or -3. FTYPE - V(ENVM)
DC04 { 9 10 11	RDR, RAM1, RRM1 RDR, RAM1, RRM1 RDR, RAM, RRM, TDR	ALPR (MALV) ALPR (MALV) NTRK	1.2 0.1.2 1.2	FTYPE - V(TDLN), V(VAL) (a) NREG - -2 or -3 FTYPE - V(AAA), V(VAL), V(RACQ), V(TRUP)
DC05 { 12 13	RDR, RAM, RRM, TDR RDR, RAM, RRM, TDR	NTRK NTRK	0.1 3	NREG - -2 or -3 Target Hooked or ETP - 1, FTYPE - V(TRUP) OR V(RACQ)
DC06 { 14 15	RDR, RAM, RRM RDR, RAM, RRM	SMRR SMRR	0 0.1.2	SMQ#0 Invalid RRM SMQ#0
DC07 16	RDR, RAM, RRM	SMDR	0.1.2	SMDR queued by SMDM
DC08 17	SIMPTB	After SMIR & SMAB	0.1.2	
DC09 18	PARETB, SIMPTB, RDR, RIB	SMAB	All	X1#0
DC10 { 19 19a	AAACTL, FSSPP, FSSCDB, SCPTBL, SIMPTB*, RAPARS, RSF, PARETB, BYTMDS, MCILL, RMT	RARE	0.1.2	
DC11 20	FRSMID	RARE	All	In Mode 3 EPCNT ≤ 1
DC12 21	SRAMTO, RDR ENGAT, MDR EIMATB	After BIDR CLIP	0.1.2 3	NREG > -1 FTYPE - V(ENVR), BRCHNG NOΦ LTYPE - 1
DC13 { 22 23	LCSTAT, FSSPLG MML, CQT, DEST, MAF TDRADR, RCMQ	After CLIP CATS	All 0	In Mode 3 EPCNT ≤ 1
DC14 24	MCI, RCD, AUDTBL	After SMCP	All	If number of words collected < 2250
DC15 25	CCIN, CCOUT	After CATS	All	
DC16 26	MDR, TDR SRAMTO**, MCATR, MCILL, MCQUID, DIFS, MCBEAM, MCTVMD, ROUTTO, RTYPCT, CMCLMF, TVMBIT, CMCLPT, CMFRES, CFC 1-4***, DRINDEX SRAMTO, CMCLMP, CMCLPT N/A CMRTES, CFC 1-4	After PLCC N/A	3	Premission Recording Postmission Recording
DC17 27	ASCGFE RDR, RIB	After DASP After DASP	All 0.3	EPCNT - Φ EPCNT - Φ
DC18 28	MCILL	After GIC	3	Once per flight after Missile Constraint set
DC19 29	TREFF	ROAQ	All	
DC20 30	RDR, RIB	IFRP	0.1.2	
DC23 35	SDR	TRAP and STRP	2	Vin QUTASK
* Simple items - as in SIMPTB table in EDCPSI compool ** RMDIO, RMNST, and MUMTCT *** ARRAYS ** SRAMT1 - SRAMT5				

TABLE 3. BIDR INPUT BREAKDOWN

Inputs required by BIDR are listed, grouped according to the file or record in which they appear.

Search beam record: DC 11 SRAMTO - Available at data, (Mode 0,1,2) collection DC 11 after BIDR, FTYPE = V(ENVN) NREG -1 BRCHNG NQ0

MOCK - monitor clock - can be changed in BIDR (B **BIDR1B)
 BMDG - beam degraded indicator - can be changed in BIDR (S***ROVLZD, B BIDR1B, CMUP2G)
 BEAMON - beam on-off indicator - can be changed in BIDR (S ROVLZD, U ****SRAPZC B, BIDR1B, CMUP2G)
 BNUM - beam number - not changed in BIDR (U ALPR2F, BIDR1B)
 CNUM - column number - not changed in BIDR (U ALPR2F, BIDR1B)
 RGS - receiver gain state - not changed in BIDR (U BIDR1B)
 BRRAM0 - first word of the BRRAM (word 0) - can be changed in BIDR (B BIDR1B)
 CSC - control sidelobe cancellation - can be changed in BIDR (B BIDR1B)
 - beam record RAM copied into the RIB

CFAR Alarm Test Variables Table (part of beam record) DC 11

CFC1 through CFC4 - beam-dependent CFAR comparison variables.
 ARRAY Constants - function of beam no. and column for RTYPE 4-7 from ENVGEN (S CMUP2G, U BIDR1B)
 RDR: FTYPE - functional type of the radar action - RDR - Available at data collection DC03 before BIDR
 RTYPE - radar action type - DC3 Mode 2, FTYPE = V(ENVN)
 MCTIME - major cycle time of the radar action being processed
 NSCH - number of unsuccessful attempts to schedule the request
 RSCTR - sector identification
 RAM - address of the related beam record RAM
 - various items copied into the output RDR

RAM (input RAM for the environment action): DC 3
 R1RAM0 - first word of the input RAM (word 0)
 RRAT1 - radar action time, fraction of a major cycle
 - various items copied into the output RAM
 - entire RAM copied for ALPR
 - RRMST Available at data collection DC03 before BIDR, Mode 2, FTYPE = V(ENVN)
 RIB

RRM: NRW1 - number of remaining words in the RRM DC 3
 NREG1 - contents of the N- register
 CFAR11 through CFAR41 - CFAR alarm indicators
 SB11 through SB41
 SBML11 through SBML41
 GB11 through GB41
 GBML11 through GBML41
 COIN11 through COIN41
 PTRNG - point range of alarms (copied for ALPR)
 - interference indicators
 - RAMSTD Available at data collection DC03 before BIDR, Mode 2, FTYPE = V(ENVN)

SRPTBL (Search RTYPE Parameters Table):
 SBLNZ - search bottoming level for non-zero PFA - constant
 SSDCNZ - search SPG detection control for non-zero PFA (PFA = 10⁻⁴) - constant
 RMINRC - minimum instrumented range in range cells - constant (U BIDR1B, CMUP2G)
 SBLZ - search bottoming level for zero PFA - constant
 SSDCZ - search SPG detection control for zero PFA - constant
 GBC - guard band blanking control - constant
 SLBOFS - sidelobe blanking offset in range cells - constant
 (constant part of SRP11)

RAP (Track RTYPE Parameters Table): RTYPCT
 RAP11 - SPG detection control for PFA = 10⁻³ - constant
 RAP18 - maximum instrumented range - constant

Surveillance State File: SCPTBL DC 10
 SCPEN - state control parameter-frequency diversity enabled (S DISH1H, U ALPR2F, BIDR1B, - - - -)

IID Logic Constants Table: CMC
 CMC1 through CMC7 - IID logic constants - constants (U BIDR1B)

CFAR Alarm test Constants Table: CFC
 CFC1S through CFC4S - beam-independent CFAR comparison constants - constants (U BIDR1B)

Radar Load Table: ARRAY DC 10
 RLT - radar load counts - can be changed in BIDR (U DCRL0B, B BIDR1B)

Search RTYPE Inhibit Table: ARRAY
 SRTINT - RTYPE-enabled indicators (complement of the DPSR form) - constant (U BIDR1B)

Beam Monitor Count Table: ARRAY
 MOCKC - initial counts for the monitor clock - constant (U BIDR1B)

TABLE 3. (Continued)

BIDR Constants Table: * JTEM
 BC1 through BC6 - constants used by BIDR - constant (U BIDR1B)

RIB auxiliary storage:
 see section 3.2.1.2

DC* - DC value indicates data collection point
 .. - B indicates parameter both used and set in stated program
 ... - S indicates parameter set in stated program
 - U indicates parameter used in stated program.

sources and set/use definitions is shown in *Table 3*. From this table, it is observed that the Maximum MRT information was created only when $FTYPE = V$ (ENVM), $NREG > -1$ and $BRCHING NQ\phi$. For this case, Radar Data Record (RDR) and Radar Input Buffer (RIB) data is collected at entry to BIDR and the Search Beam Record (SRAMTO) data is collected upon exit of BIDR. Also, the Surveillance State File (SCPTBL) and the Radar Load Table (RLT) data is collected earlier upon exit from RARE.

The remaining input data needed by BIDR is constant and can be generated by a nominal build with ENVGEN. However, it should be noted that several parameters collected in SRAMTO upon exit from BIDR can be changed in BIDR itself. Thus, to use the SRAMTO data as input to BIDR, it must be data from the immediate previous pass through BIDR. In addition, two input variables from SRAMTO, the beam degraded indicator (BMDG) and the beam on-off indicator (BEAMON) can also be changed in ROVLQD prior to entry of BIDR. There is no data collected to show these parameters.

The impact of these specific missing inputs (BMDG and BEAMON) on utilization of a MRT modified ENVGEN data tape for WCC simulator tests was discussed with

experts in the operation of the BIDR software. It was determined that while educated guesses for these missing values should produce useful test programs with the WCC simulator, it was not recommended unless the test was of the highest priority, since several combinations of inputs might have to be run.

B. Program Unit SAPB Evaluation Results

Initial evaluation of the SAPB unit and its initialization requirements indicated the necessary input data was available on applicable MRT's. A data extraction program utilizing the general purpose MRT driver previously developed for MSSC was developed for the 1108 computer. This program was then utilized to supply the required input to the SAPB single unit software test program recently made operational on the MSSC 1108 computer. This allows a thorough analysis of the SAPB software, under actual test conditions, through traces, snapshots, dumps, etc, to determine if the software is responding correctly.

(1) **Program Discussion.** The General Purpose MRT Driver program scans the input MRT until the MCI range of interest is located. The contents of the appropriate MRT table are searched for data of interest. For example, if SAPB was to be tested, the Missile Data Record (MDR) and the

Major Cycle Guidance Record (MCGUID) would be located. Once these tables/records are located the following data is removed.

From MDR Table:

- MCID - Major Cycle Interrupt (MCI)
- TGO - Time-to-go to intercept
- TM1 - Time to Major Cycle of Next U/L for Missile Away
- FMODE - Fuse Request Flag
- MDTDT - Engaged target number
- VM - Magnitude of Missile Velocity

- PUMPH - Predicted Missile H position

- PUMPX - Predicted Missile X position

- PUMPZ - Predicted Missile Z position

From MCGUID Table:

- HR - Radar Altitude above sea level

- TBSI - TGO after which auto pilot band is prohibited.

This data is used to generate a card deck or Fastran file which is used as input to the program to be tested (SAPB).

The data retrieval program requires the user to determine which software unit is to be tested. A demonstration of the program was set up using the SAPB unit. SAPB requires data to be

retrieved from an MDR and MCGUID table. The particular data required is listed in section (1) above.

The SAPB Test Procedures (MICG-2014-627 dated 6/5/75) were used to demonstrate the feasibility of single unit software testing. The SAPB software test source program was compiled and assembled into WCC assembly code. The data for SAPB was removed from the MRT and set up as Data Set 2. Data Set 1 is the ENVGEN data required to initialize SAPB.

The selection of different software elements for test will require the data retrieval program to be modified such that the required data will be collected.

(2) **Input.** The inputs required for the data retrieval program are as follows:

- Mission Recording Tape
- Major Cycle Range

(3) **Output.** The output from the data retrieval program are as follows:

- Listing of the retrieved data
- Punch Cards or Fastran File of the retrieved data

(4) **Program Limitations.** The required input data must be available on the MRT.

(5) MRT Data Retrieval Program for SAPB Flowchart. A flowchart of the MSSC 1108 computer program set up to strip specific data (i.e., SAPB input data) from a MRT is presented - Appendix A.

(6) MRT Data Retrieval Program for SAPB Program Listing. Appendix B contains the MSSC 1108 computer program listing for the data retrieval program.

(7) SAPB Test Deck Listing. A listing of the SAPB software test program recently made operational on the MSSC 1108 computer is presented in Appendix C.

(8) SAPB Software Test Program Output. The output from the test demonstration program using program unit SAPB is made up of the following items:

- List of variable not defined in compool (Data Set 1) and SAPB variables taken from MRT (Data Set 2).

- A detailed print out of the driver program (a set of WCC control cards) used to test SAPB. The driver is responsible for the following tasks:

- Sets up the environment for simulation (MEM, PROC and PRESET).

- Loads program unit to be tested.

- Sets up simulation core map (OCTAL x, y where x is compool block no. and y is address placed in BAT table at Location x in BAT table).

- Sets up linkage to System Service Procedures (OCTAL x, y where y is an address for the system service procedures to be placed in the BAT table at location x).

- Sets up linkage to all Math Package Procedures (set up same as d).

- Snap BAT TABLE.

- Loads all system ENVGEN and K7 MATH PACKAGE

- Set LOCAL STORAGE.

- Set all dedicated index registers (use panel command).

- Generates timing information.

- Snap MAP and NMAX.

- Load variables not set in compool.

- Load input variables required by SAPB.

- Turns count on for all processors.

— Executes test program.

• After WCC SIMULATION is started the following items are printed:

— PANEL, Index registers, and BAT Table.

— Driver program cards as they are executed.

— Snap of NMAX and MAP.

— Instruction count.

— Timing information.

— A typical output of the above items is shown in Appendix D.

4. CONCLUSIONS-RECOMMENDATIONS

Reformatting of existent MRT data into an ENVGEN data base for use as a test tool with the WCC simulator may or may not be feasible on a case-by-case basis. For example, the lack of certain necessary MRT data and inconsistencies in MRT data retrieval timing make BIDR unsuitable for MRT-aided ENVGEN data set testing.

However, the technique is very acceptable for the simpler SAPB program unit, where no missing data or data retrieval timing problems existed for the applicable MRT's.

The wide variations in data collected on MRT's and the input requirements of the various threads/program units make it unfeasible to develop a computer program which automatically creates the ENVGEN data set.

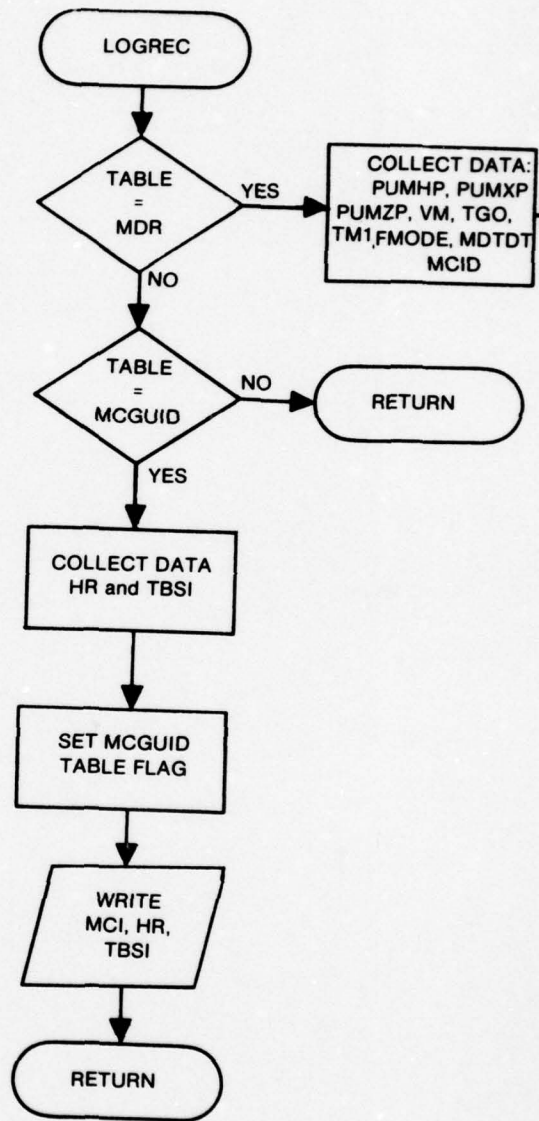
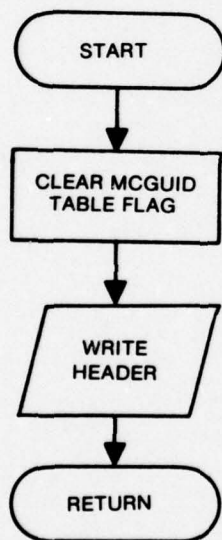
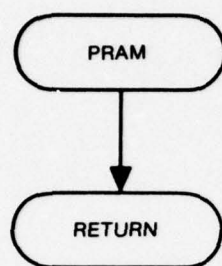
It is recommended that a case-by-case evaluation be made of any thread/program unit chosen to be tested with a MRT created ENVGEN data set. Following the techniques shown in the BIDR and SAPB program unit evaluations, one can:

• Determine if it is feasible to create a MRT based ENVGEN data set for the thread/program unit in question, and

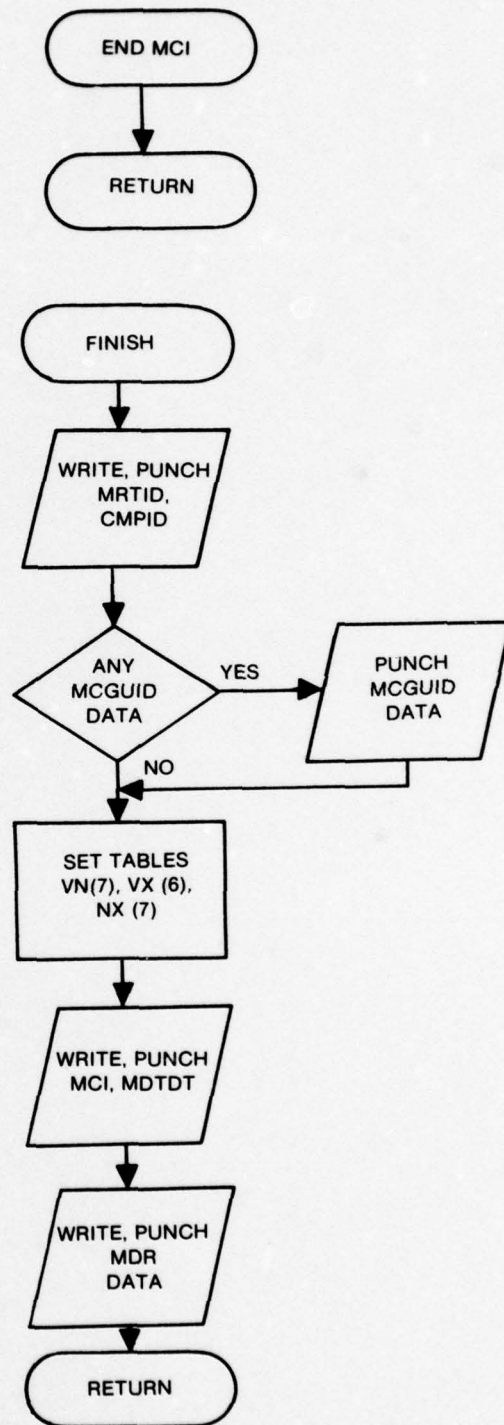
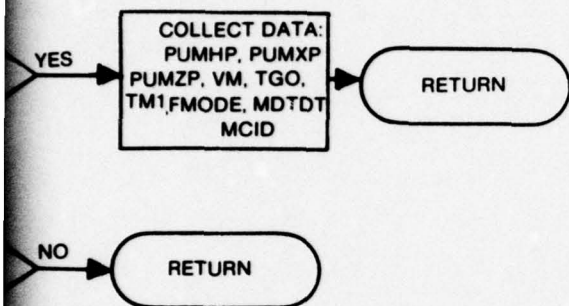
• If feasible, outline a computer program for the WCC simulator to construct and utilize the MRT based ENVGEN data set.

APPENDIX A

MRT DATA RETRIEVAL PROGRAM FLOWCHART



APPENDIX A - MRT DATA RETRIEVAL PROGRAM FLOWCHART



APPENDIX B

MRT DATA RETRIEVAL PROGRAM LISTING

```

*FOR,IS      MRT-DATA
C
C
C      SUBROUTINE      DATA
C
COMMON/FLAGS / MCIFST, MCILST, RECFST, RECLST, IRUNID(27), STOP MRT100
COMMON/TABLES/ XXXXX, LRSIZE, TESTNO, ICPU, IENTRY, INST, IEXIT,
*          YYY,KT, NIXS(6)
COMMON/XMCIX / MCI, IRIGH, IRIGH, IRIGS, IRIGMS
COMMON/IUMRT / MRTID(2), NREEL, CNPID(2), TDATE, TTIME MRT104
C
REAL      WFLTS      " FLOATING POINT FUNCTION
LOGICAL    LEQUAL     " LOGICAL      FUNCTION
C
C      . . . . .
C      ENTRY PRAM( KEY, KARD, CARD )
C      DIMENSION KARD(12), CARD(12)
C
C      RETURN
C      . . . . .
C      ENTRY START
C
C      LOGICAL FMCGU
C      FMCGU = .FALSE.
C
C      WRITE(6,902)
C      902 FORMAT('DATA FOR SAPB'///)
C
C      RETURN
C      . . . . .
C      ENTRY LOGREC( TABLE , NENT , B )
C      DIMENSION B(1)
C
C      IF( LEQUAL( TABLE , 'MDR...' , 6 ) ) GO TO 800
C      IF( LEQUAL( TABLE , 'MCGUID' , 6 ) ) GO TO 900
C
C      RETURN
C      . . . . .
C      MCGUID
C
C      900 CONTINUE
C      HR = WFLTS( B(020) ) " RADAR ALTITUDE ABOVE SEA LEVEL
C      TBSI = WFLTS( B(100) ) " TGO AFTER WHICH AP BAND PROHIB.
C
C      FMCGU = .TRUE.
C      WRITE(6,910) MCI, HR, TBSI
C      910 FORMAT('/ MCI=',I6,5X,'HR=',F10.1,5X,'TBSI=',F10.1/)
C      RETURN
C
C      . . . . .
C      MDR...
C
C      DATA MDR/0/, MDMDIC/94/, MDMSL/111/, MDSTAT/223/, MDR000/152/
C
C      INTEGER FMODE
C

```

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MRT DATA RETRIEVAL PROGRAM LISTING (Continued)

```

000 CONTINUE
PUMHP = WFLTS( B(MDMSL+00) ) * PREDICTED MISSILE M-POSITION
PUMXP = WFLTS( B(MDMSL+14) ) * PREDICTED MISSILE X-POSITION
PUMZP = WFLTS( B(MDMSL+17) ) * PREDICTED MISSILE Z-POSITION
VM = WFLTS( B(MDMSL+39) ) * MAGNITUDE OF MISSILE VELOCITY
TGO = WFLTS( B(MDMSL+7) ) * TIME-TO-BO-TO-INTERCEPT
TM1 = WFLTS( B(MDSTAT+8) ) * TIME TO MC OF NEXT U/L MRT MSL AWAY
PHODE = INTU( B(MDSTAT+0), 1, 3 ) * FUZE REQUEST FLAG
MDTDT = INTS( B(MDR000+1), 24, 0 ) * ENGAGED TARGET NUMBER
MCID = MCI

C
RETURN
C . . . . .
C
ENTRY END MCI
C
RETURN
C . . . . .
C
ENTRY FINISH
C
DIMENSION VN(8), VX(8), NX(8)
EQUIVALENCE ( VX , NX )
C
WRITE(6,903) MRTID, CMPID
PUNCH 903, MRTID, CMPID
903 FORMAT(3H ' ', ' SAPM', 3H ' ')
* 3H ' ', ' MRT ID = ', 2A6, ' CUMPOOL ID = ', 2A6, 3H ' ')
IF( FMCGU ) PUNCH 912, MR, TBSI
912 FORMAT(1X, 'MR=' , F12.1, ' S'/1X, 'TBSI=' , F10.1, ' S')
C
VN(1) = 'PUMHP'
VX(1) = PUMHP
VN(2) = 'PUMXP'
VX(2) = PUMXP
VN(3) = 'PUMZP'
VX(3) = PUMZP
VN(4) = 'VM'
VX(4) = VM
VN(5) = 'TGO'
VX(5) = TGO
VN(6) = 'TM1'
VX(6) = TM1
VN(7) = 'PHODE'
NX(7) = PHODE
C
WRITE(6,920) MCID, MDTDT
PUNCH 920, MCID, MDTDT
920 FORMAT(3H ' ', ' MCI=' , 10, 5X, 'MDTDT=' , 13, 3H ' ')
C
WRITE(6,922) ( VN(J), VX(J), J=1,6 )
PUNCH 922, ( VN(J), VX(J), J=1,6 )
922 FORMAT(1X, A6, ' ', F10.1, ' S')
C
WRITE(6,924) ( VN(J), NX(J), J=7,7 )
PUNCH 924, ( VN(J), NX(J), J=7,7 )
924 FORMAT(1X, A6, ' ', F10.1, ' S')
C
RETURN
END

```

APPENDIX C

SAPB SOFTWARE TEST PROGRAM LISTING

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SAPB SOFTWARE TEST PROGRAM LISTING

```

*ASG,CP  SAPB.
*USE    PGM,,SAPB.
*ASG,AX  ED=CC,
*ASG,A   K78C=COMPOOL.
*PMT,I
*ED=CC,JOV,IOL  SAPB,SOURCE,SAPB,ASH,,K78C=COMPOOL.
          ASSEMB(PZ)  S
OPTIM     S
          START SAPB,0(61000) S
                                                    000200
                                                    000301
                                                    000302
!-----!000400
!-----!000401
!-----!000402
!-----!000500
!-----!000501
!-----!000600
!-----!000700
!-----!000800
!-----!001000
ITEM PRG'VM  M  S P SM(ANYTHING) S
ITEM ALT    F      S 'MISSILE ALTITUDE'  001200
ITEM AMB    F      S 'BANUSH PANAMTR'    001300
ITEM AYI    F      S 'SPEED OF SOUND AT ALT' 001400
ITEM CB     F      S 'AERODYN COEF'      001500
ITEM C01    F      S                      001600
ITEM C02    F      S                      001700
ITEM CN     F      S 'NORMAL FORCE COEF'   001800
ITEM FNACH  F      S 'WORKING VARIABLE'   001900
ITEM FRACH  F      S 'WORKING VARIABLE'   002000
ITEM GNACH  F      S 'MISSILE MACH'      002100
ITEM IMB    I 23 U S                      002200
ITEM IYY    F      S 'PITCH MOMENT'      002300
ITEM KP1    I 23 U S                      002400
ITEM MM     F      S 'MISSILE MASS'      002500
ITEM MR     F      S 'WORKING VARIABLE'   002600
ITEM MR1    F      S                      002700
ITEM MR2    F      S                      002800
ITEM MR3    F      S                      002900
ITEM MR5    F      S                      002901
ITEM NP1    I 23 U S                      003000
ITEM NSTAB  F      S 'LATERAL ACCEL'     003100
ITEM QM     F      S 'DYNAMIC PRESS'     003200
ITEM NHOI   F      S 'ATMOSPHERIC DENSITY' 003300
ITEM S4     I 23 U S                      003400
ITEM SN     I 23 U S                      003500
ITEM TALF   F      S 'WORKING ALT VARIABLE' 003600
ITEM TEC01  F      S                      003700
ITEM TEC02  F      S                      003800
ITEM TEMP   F      S 'WORKING VARIABLE'   003900
ITEM TEMP1  F      S                      004000
!-----!004002
!-----!004004
!-----!004006
OVERLAY MM = MR1 = MR2 = MR3 = MR5 = TEMP = TEMP1 S 004008
OVERLAY ALT = TEC01 = TEC02 = AMB S 004000
OVERLAY GNACH = CB = MM S 004000
!-----!004010
!-----!004012

```

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SAPB SOFTWARE TEST PROGRAM LISTING (Continued)

```

CORRECT FOR RADAR ALTITUDE ABOVE SEA LEVEL
TALT=PUMXP+PUMXP+PUMZP+PUMZP  S
ALT = PUMXP + HR + (TALT/(P2*REARTH))  S IF2 = 2.0
IF TESTM NU FR  S IMPLEMENTED FOR PURPOSES
  BEGIN
    ALT = ALT + MMUDE*F4000  S IF TEST INTEGRATION
  END

IMB =INT(EHA)-1  S IF FIND INDEX N1
IF ALT GU EHA(SIMB)  S
  BEGIN
    SN =IMB  S
    NP1 =IMB  S
    GOTO SET1  S
  END
  FOR N = IMB-1,-1,0  S
    BEGIN
      IF EHA(SNS)GR ALT  S
        TEST  S
        SNEN  S
        NP1 = N+1  S
        TEMP =ALT-EHA(SNS)  S IF INPLT FOR ALT RATIOLOOKUP1
        FRACH = TEMP/(EHA(SNP1)-EHA(SNS))  S
        MR = FRACH*(EAS(SNP1)-EAS(SNS))  S
        AYI = EAS(SNS)+MR  S IF CALC SPEED OF SOUND1
        MR1 = FRACH*(EHO(SNP1)-EHO(SNS))  S IF CALC DENSITY1
        MHUI = EHO(SNS)+MR1  S
        CN = ECN(SNS)+FRACH*(ECN(SNP1)-ECN(SNS))  S
        ECN(SNS)  S IF COMPUTE LIFT COEF1
      GOTO SET2  S
    END
    SN = 0  S
    NP1 = 0  S
SET1.  AYI =EAS(SNS)  S
        MHUI =EHO(SNS)  S
        CN = ECN(SNS)  S
        FRACH = F0  S
SET2.  GMACH = VM/AYI  S
        MRS = F0  S
        IF TESTM NU FR  S
          BEGIN
            GMACH = GMACH + F4  S
            MRS = GMACH*GMACH*AYI*AYI  S
          END
        UM = (F15*MHUI)*(VM*VM + MRS)  S
        IF T0S1 GU T60 ON FMUDE  S
          GOTO SET3  S
          GOTO SET4  S
SET3.  MAP =MAPA  S
        GOTO SET9  S
SET4.  IF GMACH GU EMACH(SIMB)  S IF CALC AP BAND1

```

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SAPB SOFTWARE TEST PROGRAM LISTING (Continued)

BEGIN		000400
SK = IMB	5	000500
KP1 = IMB	5	000600
GOTO SET5	5	000700
END		000800
FOR K = IMB-1, -1, 0	5	000900
BEGIN		001000
IF EMACH LS EMACH(SKS)	5	001100
TEST	5	001200
SK = SK	5	001300
KP1 = KP1	5	001400
TEMP1 = EMACH - EMACH(SKS)	5	001500
EMACH = TEMP1 / (EMACH(SKP15) - EMACH(SKS))	5	001600
GOTO SET6	5	001700
END		001800
SK = 0	5	001900
KP1 = 0	5	010000
		010100
SET5. FRACH = FB	5	010102
		010104
SET6. TECB1 = ECB(SSN, SKS)	5	010200
MR2 = FRACH * (ECB(SSN1, SKS) - TECB1)	5	010300
CB1 = TECB1 + MR2	5	010400
TECB2 = ECB(SSN, KP15)	5	010500
MR3 = FRACH * (ECB(SSN1, KP15) - TECB2)	5	010600
CB2 = TECB2 + MR3	5	010700
CB = FRACH * (CB2 - CB1) + CB1	5	010800
IF TM1 LS T80	5	010900
BEGIN		011000
IYY = AIYY + BIYY * TM1	5	011100
GOTO SET7	5	011200
END		011300
IYY = CIYY	5	011400
		011402
SET7. AMB = WM * MAC * ARACB / IYY	5	011500
FOR M = 0, 1, 10	5	011600
BEGIN		011700
IF AMB LS EMB(SMS)	5	011800
BEGIN		011900
IMB = 11 - M	5	012000
GOTO SET8	5	012100
END		012200
IMB = 0	5	012300
		012400
		012402
SET8. IF TM1 LG T80 AND IMB GR IMBMAX	5	012500
IMB = IMBMAX	5	012600
MAP = EMAP(SIMBS)	5	012700
		012800
SET9. IF TM1 LS T80	5	012900
BEGIN		013000
MM = MB0 + M00T * (T80 - TM1)	5	013100
GOTO SETA	5	013200
END		013300
MM = MBL	5	013400
		013400
SETA. NSTAB = WM * ARACN / MM	5	013500
IF NSTAB LS MSAL	5	013600
BEGIN		013700
NMAX = NSTAB	5	013800

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SAPB SOFTWARE TEST PROGRAM LISTING (Continued)

```

GOTO SETB                      S                      013900
END                              S                      014000
NHAX = MSAL                     S                      014100
SETB.  NELESE                     S                      014102
        TENH                      S                      014200
*ASG,A  EDWABIN.
*ASG,T  EOBJTT.,F
*USE    PGM.,EOBJTT.
*ASG,T  ESRCE.
*PMT,I
*ED=CC,JOV,IEU  ESRCE,AA,EOBJTT,SAPE,,,K70C=COMPOUL.
ASSEMB(F)  S
START SAPE S
EMA(S0S)=0.0,1000.0,2000.0,4000.0,7010.0,8992.0,10973.0,
        13990.0,16978.0,21001.0,23988.0,30576.0      S
EAS(S0S)= 340.3,336.4,328.0,320.6,312.3,303.9,295.3,
        295.1,295.1,295.1,295.1,317.5      S
ERHU(S0S)= 1.2250,1.1117,.9094,.7360,.5693,.4670,.3661,
        .2263,.1428,.0760,.0476,.0065      S
EMACH(S0S)= 0.0,0.5,1.0,1.5,2.0,2.5,3.0,3.5,4.0,4.5,
        5.0,6.0      S
ECN(S0S)= 5.0,5.0,5.0,7.65,7.65,7.50,7.25,7.0,
        6.75,6.5,6.25,5.85      S
EMAP(S0S)= 1,2,3,4,5,6,7,8,9,10,11,12      S
ECB(S0,0S)= 57.9,57.9,57.9,57.9,57.9,57.9,57.9,57.9,
        57.9,57.9,57.9,57.9      S
ECB(S0,1S)= 57.9,57.9,57.9,57.9,57.9,57.9,57.9,57.9,
        57.9,57.9,57.9,57.9      S
ECB(S0,2S)= 45.8,45.8,45.8,45.8,45.8,45.8,45.8,49.9,45.8,
        45.8,45.8,45.8,45.8      S
ECB(S0,3S)= 37.2,35.5,35.5,34.9,34.9,34.9,34.9,37.8,34.9,
        34.9,34.9,34.9,34.9      S
ECB(S0,4S)= 27.5,26.4,27.5,27.5,28.0,28.1,29.8,29.2,
        30.4,29.8,28.1,28.1      S
ECB(S0,5S)= 22.9,23.5,23.5,23.5,25.2,26.9,27.5,26.9,
        26.4,27.5,24.1,26.4      S
ECB(S0,6S)= 19.5,19.5,20.0,21.2,21.2,22.9,26.9,25.8,
        26.4,26.4,26.4,26.4      S
ECB(S0,7S)= 16.0,16.0,16.0,17.2,19.5,20.6,24.1,25.8,
        26.9,26.4,26.4,24.1      S
ECB(S0,8S)= 13.8,13.8,14.3,14.9,16.0,17.7,22.3,22.9,
        27.5,26.4,26.9,25.8      S
ECB(S0,9S)= 13.8,14.3,14.3,14.3,15.5,17.2,21.8,21.8,
        26.9,26.9,27.5,28.1      S
ECB(S0,10S)= 14.3,14.9,14.9,15.5,15.5,16.6,19.5,21.2,
        25.2,20.1,26.9,33.2      S
ECB(S0,11S)= 14.3,14.9,15.5,15.5,16.0,16.6,18.9,20.6,
        25.2,29.8,29.8,29.8      S
EMB(S0S)= 25.4,41.0,65.0,90.0,123.0,123.0,168.0,230.0,
        314.0,430.0,775.0      S
MAPA= 4      S
REANTH= 6378000.0      S
TBO= 11.4      S
AIYY= 1540.2      S
BIYY= -5.148      S
CIYY= 940.5      S
ARA= 0.1297      S
MAC= 0.4054      S
MDOT= 4.3592      S

```

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SAPB SOFTWARE TEST PROGRAM LISTING (Continued)

```

MSAL= 294.4 3
MSUB= 324.0 3
IMHMAX= 11 3
PUMHPS= 1103.0 3
PUMHPS= 100000.0 3
PUMHPS= 24382.0 3
HMS= 1000.0 3
VMS= 1700.0 3
THSIS= 1.0 3
FMUOE= 0 3
TGU= 100.0 3
TMI= 0.0 3
ENDSET 1 3
!! SAPB !!
!! HRT 10 = 113129 COMPUL 10 = 00580NR01P7B !!
HMS= 1004.0 3
TOSIS= 0.0 3
!! MCIS= 1000 MUTUT= 1 !!
PUMHPS= 3302.9 3
PUMHPS= 14770.0 3
PUMHPS= 10000.0 3
VMS= 1107.4 3
TGU= 0.0 3
TMI= 0.0 3
FMUOE= 0 3
ENDSET 1 3
TERM 3
**HRT,1
**ADD,A EUNARUNIVER.
**ELT EUNARUNIVER,ONG,EUNARUNIVER,SIM
-137,139
-133,143
**HRT,3 EUNARUNIVER,SIM
**USE PROG.,SAPB.
**USE EUBJ.,EUBJIT.
**CALL,FUN EUNARUNIVER,SIM,UNY,SAPB
**HRT,1
**FIN
**

```

APPENDIX D

SAPB SOFTWARE TEST PROGRAM OUTPUT

000001	JUVIAL SAM-U COMPILER, VERSION 014 10 JAN 76	25 APR 78 AT	15.22.25	PAGE 1
000002	ASSEMBLER) 3			
000003	STANT SAPE 3			

[illegible]

SAPB SOFTWARE TEST PROGRAM OUTPUT (Continued)

Eq V04						PAGE	2
000048	000028	MDUT= 4.3592	\$			SET	1
000049	000029	MSAL= 2584.8	\$			SET	1
000050	000030	MSO= 394.0	\$			SET	1
000051	000031	IMHMAX= 11	\$			SET	1
000052	000032	PUMP= 9163.0	\$			SET	1
000053	000033	PUMP= 100000.0	\$			SET	1
000054	000034	PUMP= 24382.0	\$			SET	1
000055	000035	PM= 1000.0	\$			SET	1
000056	000036	VM= 1700.0	\$			SET	1
000057	000037	TMSJ= 1.0	\$			SET	1
000058	000038	FMUUE= 0	\$			SET	1
000059	000039	TGUE= 100.0	\$			SET	1
000060	000040	TMI= 9.0	\$			SET	1
000061	000041	EMDSET= 1	\$			SET	1
000062	000042	** SAPU **				SET	2
000063	000043	** MWT ID= MISS28				SET	2
000064	000044	HR= 1234.0	\$			SET	2
000065	000045	TMSJ=	\$			SET	2
000066	000046	** MCJ= 1000				SET	2
000067	000047	PUMP= 3352.0	\$			SET	2
000068	000048	PUMP= 12770.0	\$			SET	2
000069	000049	PUMP= 16450.0	\$			SET	2
000070	000050	VM= 1157.4	\$			SET	2
000071	000051	TMI= 5.8	\$			SET	2
000072	000052	TMI= 20.6	\$			SET	2
000073	000053	EMUUE=	\$			SET	2
000074	000054	ENUSET= 2	\$			SET	2
000075	000055	TERM	\$			SET	2
TERMINATION TIME 15125104							
GALD.P TEMPU.							
GALDCC.ASMIF							
ASM SOURCE.SAPE							

SAPB SOFTWARE TEST PROGRAM OUTPUT (Continued)

```

EUSO*W(12,11,5101)
1  *SAPB  *LUNASHIN.
2  *USE  *PMP* *LUNASHIN.
3  *SAPB  *LUNASHIN.
4  *SAPB  *LUNASHIN.
5  *SAPB  *LUNASHIN.
6  *SAPB  *LUNASHIN.
7  *SAPB  *LUNASHIN.
8  *SAPB  *LUNASHIN.
9  *SAPB  *LUNASHIN.
10 *SAPB  *LUNASHIN.
11 *SAPB  *LUNASHIN.
12 *SAPB  *LUNASHIN.
13 *SAPB  *LUNASHIN.
14 *SAPB  *LUNASHIN.
15 *SAPB  *LUNASHIN.
16 *SAPB  *LUNASHIN.
17 *SAPB  *LUNASHIN.
18 *SAPB  *LUNASHIN.
19 *SAPB  *LUNASHIN.
20 *SAPB  *LUNASHIN.
21 *SAPB  *LUNASHIN.
22 *SAPB  *LUNASHIN.
23 *SAPB  *LUNASHIN.
24 *SAPB  *LUNASHIN.
25 *SAPB  *LUNASHIN.
26 *SAPB  *LUNASHIN.
27 *SAPB  *LUNASHIN.
28 *SAPB  *LUNASHIN.
29 *SAPB  *LUNASHIN.
30 *SAPB  *LUNASHIN.
31 *SAPB  *LUNASHIN.
32 *SAPB  *LUNASHIN.
33 *SAPB  *LUNASHIN.
34 *SAPB  *LUNASHIN.
35 *SAPB  *LUNASHIN.
36 *SAPB  *LUNASHIN.
37 *SAPB  *LUNASHIN.
38 *SAPB  *LUNASHIN.
39 *SAPB  *LUNASHIN.
40 *SAPB  *LUNASHIN.
41 *SAPB  *LUNASHIN.
42 *SAPB  *LUNASHIN.
43 *SAPB  *LUNASHIN.
44 *SAPB  *LUNASHIN.
45 *SAPB  *LUNASHIN.
46 *SAPB  *LUNASHIN.
47 *SAPB  *LUNASHIN.
48 *SAPB  *LUNASHIN.
49 *SAPB  *LUNASHIN.
50 *SAPB  *LUNASHIN.
51 *SAPB  *LUNASHIN.
52 *SAPB  *LUNASHIN.
53 *SAPB  *LUNASHIN.
54 *SAPB  *LUNASHIN.
55 *SAPB  *LUNASHIN.
56 *SAPB  *LUNASHIN.

```

SAPB SOFTWARE TEST PROGRAM OUTPUT (Continued)

57	UCIAL 129.040130023	• LINK TO 1006
58	UCIAL 123.040130023	• LINK TO 1006
59	UCIAL 148.040130023	• LINK TO 0767
60	UCIAL 149.040130023	• LINK TO 1006
61	UCIAL 150.040130023	• LINK TO EFES
62	UCIAL 161.040130023	• LINK TO FIED
63	UCIAL 176.040130023	• LINK TO ETFL
64	UCIAL 171.040130023	• LINK TO FETM
65	UCIAL 161.040130023	• LINK TO IFUR
66	UCIAL 162.040130023	• LINK TO ASIEIB
67	UCIAL 163.040130023	• LINK TO IFFR
68	UCIAL 151.040130023	• LINK TO 05E10R
69	UCIAL 175.040130023	• LINK TO US-10UR
70	UCIAL 176.040130023	• LINK TO AS-10UR
71	UCIAL 177.040130023	• LINK TO US-10UR
72	UCIAL 178.040130023	• LINK TO 1006UR
73	UCIAL 179.040130023	• LINK TO UKLEUR
74	UCIAL 201.040130023	• LINK TO AS-10UR
75	UCIAL 201.040130023	• LINK TO US-10UR
76	UCIAL 202.040130023	• LINK TO AS-10UR
77	UCIAL 203.040130023	• LINK TO US-10UR
78	UCIAL 206.040130023	• LINK TO 05UR1B
79	UCIAL 206.040130023	• LINK TO 05UR1B
80	UCIAL 210.040130023	• LINK TO 05UR1B
81	UCIAL 216.040130023	• LINK TO 05UR1B
82	UCIAL 215.040130023	• LINK TO AS-10UR
83	UCIAL 240.040130023	• LINK TO 1006UR
84	UCIAL 230.040130023	• LINK TO 1006UR
85	UCIAL 237.040130023	• LINK TO AS-10UR
86	UCIAL 238.040130023	• LINK TO AS-10UR
87	UCIAL 239.040130023	• LINK TO AS-10UR
88	UCIAL 240.040130023	• LINK TO AS-10UR
89	UCIAL 243.040130023	• LINK TO 05UR1B
90	UCIAL 245.040130023	• LINK TO AS-10UR
91	UCIAL 246.040130023	• LINK TO 05UR1B
92	UCIAL 247.040130023	• LINK TO 05UR1B
93	UCIAL 248.040130023	• LINK TO 05UR1B
94	UCIAL 251.040130023	• LINK TO 05UR1B
95	UCIAL 253.040130000	• LINK TO 05UR1B
96	REMARK.....	LINK USER WITH ALL MATH PACKAGE PROCEDURES
97	REMARK.....	
98	REMARK.....	
99	UCIAL 103.040002300	• LINK TO ACOS
100	UCIAL 103.040002301	• LINK TO ASIN
101	UCIAL 103.040002302	• LINK TO ATAN
102	UCIAL 106.040002303	• LINK TO COS
103	UCIAL 107.040002304	• LINK TO SIN
104	UCIAL 106.040002305	• LINK TO TAN
105	UCIAL 109.040002306	• LINK TO LOG
106	UCIAL 110.040002307	• LINK TO EXP
107	PAUSE 1.013776	• PAUSE TO SHAP MAT TABLE
108	SNIP 1.013776	• SHAP MAT TABLE
109	SNIP 1.013776	• CALCUL SHAP FOR SURP
110	SNIP 1.013776	• DEACTIVATE SHAP
111	REMARK.....	
112	REMARK.....	LOAD ALL SYSTEMS ENGINE AND K7 MATH PACKAGE
113	REMARK.....	

[illegible]

SAPB SOFTWARE TEST PROGRAM OUTPUT (Continued)

```

DASG:A EUDABIN. 100000000000
PAL BANNING

DUSE PAM:EUDABIN.

DASG:A EUDSIMCC2. 0400000000200
PAL BANNING

QUIT EUDSIMCC2.
V02H0% 21376

REMARK. .... USE MEMORIES 0112 .
MEM 0112 .

PHUC 11.0.04000.02155 . BAT AT ZERO:CPU11ST LEVEL LOCAL STOR .
PHESET UN00000000 . FILL MEMORY WITH TWO TO LOC ZERO .
ASSIGN PGM:PH04 . ASSIGN PROGRAM BINARY FILE .
LOADF SAPB:021U00 . LOAD PROGRAM UNDER TEST .

REMARK. ....
REMARK. .... SET SIMULATION CORE MAP .....
MEMARK. ....

OCTAL 11.03000 . COMPOOL BLOCK 1 .
OCTAL 21.04000 . COMPOOL BLOCK 2 .
OCTAL 31.05300 . COMPOOL BLOCK 3 .
OCTAL 41.05000 . COMPOOL BLOCK 6 .
OCTAL 12.06500 . COMPOOL BLOCK 12 .
OCTAL 13.06000 . COMPOOL BLOCK 13 .
OCTAL 14.07200 . COMPOOL BLOCK 14 .
OCTAL 71.022700 . COMPOOL BLOCK 71 .
OCTAL 73.034700 . COMPOOL BLOCK 73 .
OCTAL 77.032100 . COMPOOL BLOCK 77 .
OCTAL 133.050700 . COMPOOL BLOCK 133
  
```

SAPB SOFTWARE TEST PROGRAM OUTPUT (Continued)

OCTAL 135,051500	• COMPOOL BLOCK 135	•
OCTAL 108,032200	• COMPOOL BLOCK 168	•
OCTAL 173,022400	• COMPOOL BLOCK 173	•
REMARKS.....	LINK USER WITH ALL SYSTEM SERVICE PROCEDURES	
REMARKS.....		
OCTAL 20,040130023	• LINK TO 6005	•
OCTAL 00,040130023	• LINK TO LACK	•
OCTAL 07,040130023	• LINK TO MTHL	•
OCTAL 08,040130023	• LINK TO 6001	•
OCTAL 09,040130023	• LINK TO LORTB0	•
OCTAL 70,040130023	• LINK TO 6002	•
OCTAL 72,040130023	• LINK TO 6003	•
OCTAL 70,040130023	• LINK TO CUC	•
OCTAL 79,040130023	• LINK TO CUPY	•
OCTAL 82,040130023	• LINK TO CUML	•
OCTAL 85,040130023	• LINK TO LASA	•
OCTAL 90,040130023	• LINK TO 6004	•
OCTAL 92,040130023	• LINK TO EMSI	•
OCTAL 93,040130023	• LINK TO ECEL	•
OCTAL 94,040130023	• LINK TO EDCM	•
OCTAL 95,040130023	• LINK TO EL6U	•
OCTAL 96,040130023	• LINK TO LTPU	•
OCTAL 100,040130023	• LINK TO LFIL	•
OCTAL 111,040130023	• LINK TO ELP	•
OCTAL 112,040130023	• LINK TO ETHC	•
OCTAL 113,040130023	• LINK TO EILD	•
OCTAL 114,040130023	• LINK TO EVLC	•
OCTAL 115,040130023	• LINK TO T840	•

SAPB SOFTWARE TEST PROGRAM OUTPUT (Continued)

001AL 110,0001,00023	•	LINK TO T00A	•
001AL 117,0001,00023	•	LINK TO T00R	•
001AL 119,0001,00023	•	LINK TO T00U	•
001AL 120,0001,00023	•	LINK TO T006	•
001AL 123,0001,00023	•	LINK TO U0AT00	•
001AL 128,0001,00023	•	LINK TO U0T	•
001AL 129,0001,00023	•	LINK TO T00K	•
001AL 130,0001,00023	•	LINK TO EFES	•
001AL 101,0001,00023	•	LINK TO EIED	•
001AL 170,0001,00023	•	LINK TO ETEL	•
001AL 179,0001,00023	•	LINK TO EFTM	•
001AL 101,0001,00023	•	LINK TO IFUR	•
001AL 102,0001,00023	•	LINK TO ASIFIB	•
001AL 103,0001,00023	•	LINK TO IFFR	•
001AL 191,0001,00023	•	LINK TO OSIFIB	•
001AL 195,0001,00023	•	LINK TO USATUM	•
001AL 190,0001,00023	•	LINK TO ASUMUM	•
001AL 197,0001,00023	•	LINK TO USUMUM	•
001AL 198,0001,00023	•	LINK TO L0UEUM	•
001AL 199,0001,00023	•	LINK TO U0UEUM	•
001AL 200,0001,00023	•	LINK TO AS0IB	•
001AL 201,0001,00023	•	LINK TO US0IB	•
001AL 202,0001,00023	•	LINK TO AS0P1B	•
001AL 203,0001,00023	•	LINK TO US0P1B	•
001AL 206,0001,00023	•	LINK TO U0TAS0	•
001AL 208,0001,00023	•	LINK TO U0AM56	•
001AL 210,0001,00023	•	LINK TO TTEL	•
001AL 210,0001,00023	•	LINK TO AS0600	•
001AL 215,0001,00023	•	LINK TO US0600	•

SAPB SOFTWARE TEST PROGRAM OUTPUT (Continued)

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OCTAL 220,040130023 . LINK TO LINKTU .
OCTAL 230,040130023 . LINK TO LINKMU .
OCTAL 237,040130023 . LINK TO ASTRUR .
OCTAL 238,040130023 . LINK TO USTRUR .
OCTAL 239,040130023 . LINK TO ASTRIB .
OCTAL 240,040130023 . LINK TO USTRIB .
OCTAL 243,040130023 . LINK TO AUDIT3 .
OCTAL 245,040130023 . LINK TO ASGRIB .
OCTAL 246,040130023 . LINK TO USGRIB .
OCTAL 247,040130023 . LINK TO LOKTUR .
OCTAL 248,040130023 . LINK TO ULKUR .
OCTAL 251,040130023 . LINK TO GUALKT .
OCTAL 255,040130000 . LINK TO HELESE .
REMARK.....
REMARK..... LINK USER WITH ALL MATH PACKAGE PROCEDURES .....
OCTAL 103,040002300 . LINK TO ACUS .
OCTAL 104,040002301 . LINK TO ASIN .
OCTAL 105,040002302 . LINK TO ATAN .
OCTAL 106,040002303 . LINK TO COS .
OCTAL 107,040002304 . LINK TO SIN .
OCTAL 108,040002305 . LINK TO TAN .
OCTAL 109,040002306 . LINK TO LOG .
OCTAL 110,040002307 . LINK TO EXP .
PAUSE 1,013776 . PAUSE TO SNAP BAT TABLE .
SNAP 1,013776,0,01770,P . SNAP BAT TABLE .
GOTO 1,013776 . EXECUTE SNAP FOR SURP.
ALL MEMORY MAP
*****

```

SAPB SOFTWARE TEST PROGRAM OUTPUT (Continued)

PROGRAM	ORIGIN	END	EXECUTE
SAPB	061000-061460	061000	
BAT TABLE: 000000-000377			
CPU1	LOCAL STORAGE	: 002000 - 002155	
CPU2	LOCAL STORAGE	: 000000 - 000000	
CPU3	LOCAL STORAGE	: 000000 - 000000	

SAPB SOFTWARE TEST PROGRAM OUTPUT (Continued)

START WCC SIMULATION									
SNAP	REQUEST	PROGRAM	FROM	TO	000777	AT LOCATION	13776	PROCESSOR CPU1	OP ERR:OFF
PAGE# FOR CPU		OVERFLOW:OFF		AREA	CHARGE:	PROCESSOR ADDRESS:		DI	
P1:	00000000	S1:	12000000	A1:	00000000	U1:	00000000	A2:	00000000 Q2:00000000 R6:00000000 RP:00000000
M1:	00000000	K1:	00000000	R2:	00000000	R3:	00000000	R4:	00000000 R5:00000000 L1:00000000 L2:00000000 X3:00000000
T1:	00000000	N1:	00000000	S1:	00000000	P1:	00000000	R3:	00000000 R4:00000000 X1:00000000 X2:00000000 X3:00000000
A1:	00000000	A1:	00000000	A1:	00000000	A2:	00000000	A3:	00000000 X4:00000000 X5:00000000 X6:00000000
A2:	00000000	A1:	00000000	10:	00000000	11:	00000000	12:	00000000 13:00000000 14:00000000 15:00000000
000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
000014	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
000034	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
000054	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
000074	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
000094	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
000114	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
000134	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
000154	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
000174	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
000194	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
000214	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
000234	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
000254	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
000274	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
000294	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
000314	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
000334	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
000354	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
000374	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
000394	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
000414	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
000434	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
000454	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
000474	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
000494	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
000514	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
000534	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
000554	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
000574	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
000594	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
000614	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
000634	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
000654	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
000674	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
000694	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
000714	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
000734	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
000754	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000
000774	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000

PAUSE AT LOCATION 13776 CPU1 TO HEAD MORE INPUT

SNAPU 1:0137776:0:0777 : DEACTIVATE SNAP.

```

REMARK,.....
REMARK,..... LOAD ALL SYSTEM ENVGEN AND K7 MATH PACKAGE .....
REMARK,.....
Assign PRG=PGM * ASSIGN SYSTEM BINARY FILE *
LOADF IN1020,02300 * LOAD K7 MATH PACKAGE *
LOADF K7ENV1,1 * LOAD K7 SYSTEM ENVGEN,
REMARK,.....
REMARK,..... SET LOCAL STORAGE LEVELS .....
REMARK,.....
LOCAL U2000,02150,0 * LOCAL STORAGE LEVEL 1.
LOCAL U2150,02233,02000 * LOCAL STORAGE LEVEL 2.
LOCAL U2233,02233,02150 * LOCAL STORAGE LEVEL 3.
REMARK,.....
REMARK,..... SET ALL DEDICATED INDEX REGISTERS .....
REMARK,.....
PAUSEL 1XU202000,X1=03000,X2=04000,X3=05300,X6=05600,XZ=06500.
PAUSEL 1I320000,I4=07200,I5=0,I6=0,I7=0,I8=0,I9=0,I10=0,I11=0,I12=0,I13=0,I14=0,I15=0,I16=0,I17=0,I18=0,I19=0,I20=0,I21=0,I22=0,I23=0,I24=0,I25=0,I26=0,I27=0,I28=0,I29=0,I30=0,I31=0,I32=0,I33=0,I34=0,I35=0,I36=0,I37=0,I38=0,I39=0,I40=0,I41=0,I42=0,I43=0,I44=0,I45=0,I46=0,I47=0,I48=0,I49=0,I50=0,I51=0,I52=0,I53=0,I54=0,I55=0,I56=0,I57=0,I58=0,I59=0,I60=0,I61=0,I62=0,I63=0,I64=0,I65=0,I66=0,I67=0,I68=0,I69=0,I70=0,I71=0,I72=0,I73=0,I74=0,I75=0,I76=0,I77=0,I78=0,I79=0,I80=0,I81=0,I82=0,I83=0,I84=0,I85=0,I86=0,I87=0,I88=0,I89=0,I90=0,I91=0,I92=0,I93=0,I94=0,I95=0,I96=0,I97=0,I98=0,I99=0,I100=0,I101=0,I102=0,I103=0,I104=0,I105=0,I106=0,I107=0,I108=0,I109=0,I110=0,I111=0,I112=0,I113=0,I114=0,I115=0,I116=0,I117=0,I118=0,I119=0,I120=0,I121=0,I122=0,I123=0,I124=0,I125=0,I126=0,I127=0,I128=0,I129=0,I130=0,I131=0,I132=0,I133=0,I134=0,I135=0,I136=0,I137=0,I138=0,I139=0,I140=0,I141=0,I142=0,I143=0,I144=0,I145=0,I146=0,I147=0,I148=0,I149=0,I150=0,I151=0,I152=0,I153=0,I154=0,I155=0,I156=0,I157=0,I158=0,I159=0,I160=0,I161=0,I162=0,I163=0,I164=0,I165=0,I166=0,I167=0,I168=0,I169=0,I170=0,I171=0,I172=0,I173=0,I174=0,I175=0,I176=0,I177=0,I178=0,I179=0,I180=0,I181=0,I182=0,I183=0,I184=0,I185=0,I186=0,I187=0,I188=0,I189=0,I190=0,I191=0,I192=0,I193=0,I194=0,I195=0,I196=0,I197=0,I198=0,I199=0,I200=0,I201=0,I202=0,I203=0,I204=0,I205=0,I206=0,I207=0,I208=0,I209=0,I210=0,I211=0,I212=0,I213=0,I214=0,I215=0,I216=0,I217=0,I218=0,I219=0,I220=0,I221=0,I222=0,I223=0,I224=0,I225=0,I226=0,I227=0,I228=0,I229=0,I230=0,I231=0,I232=0,I233=0,I234=0,I235=0,I236=0,I237=0,I238=0,I239=0,I240=0,I241=0,I242=0,I243=0,I244=0,I245=0,I246=0,I247=0,I248=0,I249=0,I250=0,I251=0,I252=0,I253=0,I254=0,I255=0,I256=0,I257=0,I258=0,I259=0,I260=0,I261=0,I262=0,I263=0,I264=0,I265=0,I266=0,I267=0,I268=0,I269=0,I270=0,I271=0,I272=0,I273=0,I274=0,I275=0,I276=0,I277=0,I278=0,I279=0,I280=0,I281=0,I282=0,I283=0,I284=0,I285=0,I286=0,I287=0,I288=0,I289=0,I290=0,I291=0,I292=0,I293=0,I294=0,I295=0,I296=0,I297=0,I298=0,I299=0,I300=0,I301=0,I302=0,I303=0,I304=0,I305=0,I306=0,I307=0,I308=0,I309=0,I310=0,I311=0,I312=0,I313=0,I314=0,I315=0,I316=0,I317=0,I318=0,I319=0,I320=0,I321=0,I322=0,I323=0,I324=0,I325=0,I326=0,I327=0,I328=0,I329=0,I330=0,I331=0,I332=0,I333=0,I334=0,I335=0,I336=0,I337=0,I338=0,I339=0,I340=0,I341=0,I342=0,I343=0,I344=0,I345=0,I346=0,I347=0,I348=0,I349=0,I350=0,I351=0,I352=0,I353=0,I354=0,I355=0,I356=0,I357=0,I358=0,I359=0,I360=0,I361=0,I362=0,I363=0,I364=0,I365=0,I366=0,I367=0,I368=0,I369=0,I370=0,I371=0,I372=0,I373=0,I374=0,I375=0,I376=0,I377=0,I378=0,I379=0,I380=0,I381=0,I382=0,I383=0,I384=0,I385=0,I386=0,I387=0,I388=0,I389=0,I390=0,I391=0,I392=0,I393=0,I394=0,I395=0,I396=0,I397=0,I398=0,I399=0,I400=0,I401=0,I402=0,I403=0,I404=0,I405=0,I406=0,I407=0,I408=0,I409=0,I410=0,I411=0,I412=0,I413=0,I414=0,I415=0,I416=0,I417=0,I418=0,I419=0,I420=0,I421=0,I422=0,I423=0,I424=0,I425=0,I426=0,I427=0,I428=0,I429=0,I430=0,I431=0,I432=0,I433=0,I434=0,I435=0,I436=0,I437=0,I438=0,I439=0,I440=0,I441=0,I442=0,I443=0,I444=0,I445=0,I446=0,I447=0,I448=0,I449=0,I450=0,I451=0,I452=0,I453=0,I454=0,I455=0,I456=0,I457=0,I458=0,I459=0,I460=0,I461=0,I462=0,I463=0,I464=0,I465=0,I466=0,I467=0,I468=0,I469=0,I470=0,I471=0,I472=0,I473=0,I474=0,I475=0,I476=0,I477=0,I478=0,I479=0,I480=0,I481=0,I482=0,I483=0,I484=0,I485=0,I486=0,I487=0,I488=0,I489=0,I490=0,I491=0,I492=0,I493=0,I494=0,I495=0,I496=0,I497=0,I498=0,I499=0,I500=0,I501=0,I502=0,I503=0,I504=0,I505=0,I506=0,I507=0,I508=0,I509=0,I510=0,I511=0,I512=0,I513=0,I514=0,I515=0,I516=0,I517=0,I518=0,I519=0,I520=0,I521=0,I522=0,I523=0,I524=0,I525=0,I526=0,I527=0,I528=0,I529=0,I530=0,I531=0,I532=0,I533=0,I534=0,I535=0,I536=0,I537=0,I538=0,I539=0,I540=0,I541=0,I542=0,I543=0,I544=0,I545=0,I546=0,I547=0,I548=0,I549=0,I550=0,I551=0,I552=0,I553=0,I554=0,I555=0,I556=0,I557=0,I558=0,I559=0,I560=0,I561=0,I562=0,I563=0,I564=0,I565=0,I566=0,I567=0,I568=0,I569=0,I570=0,I571=0,I572=0,I573=0,I574=0,I575=0,I576=0,I577=0,I578=0,I579=0,I580=0,I581=0,I582=0,I583=0,I584=0,I585=0,I586=0,I587=0,I588=0,I589=0,I590=0,I591=0,I592=0,I593=0,I594=0,I595=0,I596=0,I597=0,I598=0,I599=0,I600=0,I601=0,I602=0,I603=0,I604=0,I605=0,I606=0,I607=0,I608=0,I609=0,I610=0,I611=0,I612=0,I613=0,I614=0,I615=0,I616=0,I617=0,I618=0,I619=0,I620=0,I621=0,I622=0,I623=0,I624=0,I625=0,I626=0,I627=0,I628=0,I629=0,I630=0,I631=0,I632=0,I633=0,I634=0,I635=0,I636=0,I637=0,I638=0,I639=0,I640=0,I641=0,I642=0,I643=0,I644=0,I645=0,I646=0,I647=0,I648=0,I649=0,I650=0,I651=0,I652=0,I653=0,I654=0,I655=0,I656=0,I657=
```

SAPB SOFTWARE TEST PROGRAM OUTPUT (Continued)

```

SNAP 1.013000-04267.04267.5 .
GOTO 1.013000.

ACC MEMORY MAP
*****

PROGRAM INITIALIZATION AND EXECUTE

SAPB 001000-001000 001000
TIME 002000-002000 002000
BMT TABLE: 000000-000377

CPU1 LOCAL STORAGE: 000000 - 002155
CPU2 LOCAL STORAGE: 000000 - 000000
CPU3 LOCAL STORAGE: 000000 - 000000

START ALL SIMULATION

SNAP REQUEST PROGRAM ---- FROM 000054 TO 000054 AT LOCATION 136004 PROCESSOR CPU1
000054 -030000

SNAP REQUEST PROGRAM ---- FROM 000207 TO 000207 AT LOCATION 136005 PROCESSOR CPU1
000207-0.4267-20

PAUSE AT LOCATION 136005 CPU1 TO READ MORE INPUT

ASSIGN PUMP=000.
LOADF SAPB.1 .
COUNT 0.000 .
GOTO 1.001000 .

START ALL SIMULATION
TIME SNAP START ADDRESS 061000 TIME 10 / END ADDRESS 061056 TIME 0590 / ELAPSED TIME 0580
SNAP REQUEST PROGRAM ---- FROM 000054 TO 000054 AT LOCATION 136004 PROCESSOR CPU1
000054 3

SNAP REQUEST PROGRAM ---- FROM 000207 TO 000207 AT LOCATION 136005 PROCESSOR CPU1
000207 0.4267-03

PAUSE AT LOCATION 136005 CPU1 TO READ MORE INPUT

COUNT 0.000 .

```

SAPB SOFTWARE TEST PROGRAM OUTPUT (Continued)

INSTRUCTION COUNTS ALL PROCESSORS																																																																						
CPUS																																																																						
INST	USAGE	INST	USAGE	INST	USAGE	INST	USAGE	INST	USAGE	INST	USAGE	INST	USAGE	INST	USAGE	INST	USAGE	INST	USAGE	INST	USAGE	INST	USAGE	INST	USAGE																																													
IMP	0	THU	0	JH	9	JH	9	JH	9	JH	9	JH	9	JH	9	JH	9	JH	9	JH	9	JH	9	JH	9																																													
CA	1	CL	0	AND	0	SGR	0	OR	0	XOR	0	52	1	SP	0	OG1	0	OG2	0	OG3	0	OG4	0	OG5	0																																													
SG1	12	SW1	0	SA2	11	SW2	0	AM	0	SBM	0	BC	0	BC	0	BC	0	BC	0	BC	0	BC	0	BC	0																																													
U-S	0	UML	0	THU	40	SGN	39	MHC	0	MP	0	FMVA	0	0	0	0	0	0	0	0	0	0	0	0																																														
ALX	0	SLA	0	LIX	0	SKDX	0	ENVTX	25	ED	6	EM	19	ESB	0	ALA	2	CF	2	CF	2	CF	2	CF	2																																													
LIA	2	SLA	0	FMVFX	25	FA	12	FS	0	AP	0	EFA	0	0	0	0	0	0	0	0	0	0	0	0																																														
SWF	2	MHC	0	AEC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0																																														
TOTAL CPU INSTRUCTIONS EXECUTED 401																																																																						
CPU1 INSTRUCTION REGISTER USAGE																																																																						
NO. OF INSTRUCTIONS 0																																																																						
X0:	140	X1:	17	X2:	17	X3:	0	X4:	0	X5:	0	X6:	0	X7:	0	X8:	0	X9:	0	X10:	0	X11:	0	X12:	0																																													
X13:	31	X14:	7	X15:	0	X16:	0	X17:	0	X18:	0	X19:	0	X20:	0	X21:	0	X22:	0	X23:	0	X24:	0	X25:	0																																													
LOADS SAMPLE 2																																																																						
COUNT 0.0000																																																																						
COUNT 1.000000																																																																						
START MCC SIMULATION																																																																						
TIME	START	ADDRESS	001000	TIME	10	END	ADDRESS	001500	TIME	7025	ELAPSED	TIME	7015																																																									
SubP	ADDRESS	001000	0000	FROM	001000	TO	001500	AT	LOCATION	130005	PROCESSOR	CPU1																																																										
001000	2																																																																					
SubP	ADDRESS	001000	0000	FROM	001000	TO	001500	AT	LOCATION	130005	PROCESSOR	CPU1																																																										
001000	2																																																																					
PAUSE AT LOCATION 130005 CPU1 TO READ MORE INPUT																																																																						
STOP	1.001500																																																																					
STOP	1.001500																																																																					
START MCC SIMULATION																																																																						
MCC SIMULATION DONE AT LOCATION 130023 PROCESSOR CPU1																																																																						

INSTRUCTION CUNIT'S ALL PROCESSORS

[illegible]

SAPB SOFTWARE TEST PROGRAM OUTPUT (Continued)

NAME: MSUM	ALCI: 000000000	PRG: KCI: SCHWELL
TIME: TOTAL: 00:05:07.503		
CPU: 00:00:37.216	I/O: 00:01:20.376	
LEADS: 00:01:09.913	WATS: 00:00:00.050	
IMMS: 706	PAGES: 71	
START: 15:11:24 APR 25, 1978	FIN: 15:29:59 APR 25, 1978	

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