

IDENTIFICATION

PRODUCT CODE: MAINDEC-11-DCK80-A1-D

PRODUCT NAME: 11/45 STATES TEST

DATE CREATED: 15 MAR 1972

MAINTAINER: DIAGNOSTIC GROUP

AUTHOR: JOHN ADAMS

COPYRIGHT (c) 1972
DIGITAL EQUIPMENT CORPORATION
MAYNARD, MASS

1,0 ABSTRACT

THIS PROGRAM TESTS THAT 11/45 INSTRUCTIONS ARE EXECUTED PROPERLY IN THE THREE 11/45 STATES, (KERNEL, SUPERVISOR, AND USER) THE MTPD/I AND MPPD/I INSTRUCTIONS ARE ALSO TESTED; CONDITIONS ARE ALSO TESTED;

2,0 REQUIREMENTS

2,1 EQUIPMENT

BASIC 11/45 SYSTEM

2,2 STORAGE

THIS PROGRAM USES 0 THRU 17500

2,3 PRELIMINARY PROGRAMS

D0AA THRU D0MA

3,0 LOADING PROCEDURE

LOAD PROGRAM USING ABS LOADER

4,0 STARTING PROCEDURE

LOAD ADDRESS 200; PRESS START; THE PROGRAM WILL LOOP AND RING BELL ON PASS COMPLETION;

5,0 OPERATING PROCEDURE

5,1 SWITCH SETTINGS

NONE

5,2 SUBROUTINE ABSTRACTS

5,2,1 SCOPE

SCOPE IS A MOVE PC,R1 AND STORES THE PC+2 IN R1.

5,2,2 HLT

HLT IS A HALT INSTRUCTION;

6,0 ERRORS

ALL ERRORS WILL CAUSE A HALT TRAP AND INTERRUPT ERRORS WILL CAUSE A HALT AT VECTOR+2.

6,1 ERROR RECOVERY

PRESS CONTINUE TO PROCEED TO NEXT TEST

6,2 ERROR LOOPING

TO LOOP ON AN ERROR, PLACE A BRANCH TO THE PREVIOUS SCOPE INSTRUCTION IN PLACE OF THE HALT INSTRUCTION. NOTE THAT IF THE ERROR IS INTERMITTANT THAT THE TEST WILL DROP THRU THE HALT AND PROCEED TO THE NEXT TEST, THEREFORE, TO LOOP THE TEST CONTINUOUSLY REPLACE THE BEQ ;+4 INSTRUCTION IMMEDIATELY PRECEDING THE HALT WITH A BRANCH BACK TO THE PREVIOUS SCOPE;

TO LOOP ON TRAP FAILURES, PATCH IN THE FOLLOWING ROUTINE AT THE ADDRESS OF THE TRAP VECTOR;

```
TRAPVEC|      TRAPVEC+4
TRAPVEC+2|    0
TRAPVEC+4|    012716 ;MOVE SCOPE ADDRESS TO STACK
TRAPVEC+6|    ADDRESS ;ADDRESS OF PREVIOUS SCOPE
```

TRAPVEC+101 000006 ;RETURN TO TEST AT SCOPE
RESTORE ALL LOCATIONS BEFORE PROCEEDING TO NEXT TEST,

7.0 RESTRICTIONS
NONE

8.0 MISCELLANEOUS
ON TRAP ERRORS THE STACK POINTER(R6) WILL CONTAIN THE
ADDRESS WHERE THE TRAP OCCURED;

8.1 EXECUTION TIME
THIS PROGRAM TAKES ABOUT 1 MINUTE;

8.2 STACK POINTER
THIS PROGRAM INITIALLY SETS THE STACK POINTER AT 500,

.TITLE MAINDEC-11-DCK80-A PROCESSOR STATES TEST
.NLIST MC,MD,SEC
.ABS

TEST DCK80A THIS TEST TESTS FEATURES OF THE THREE PROCESSOR STATES AND INCLUDES
TRAPS FROM ALL STATES TO ALL OTHER STATES, AND MFP/MTP INSTRUCTIONS IN ALL
STATES AND PREVIOUS STATES.
NOTE: ALL TESTS ARE ENTERED AND EXITED IN KERNEL MODE.

STARTING PROCEDURE
LOAD ADDRESS=200
PRESS START
KERNEL STACK POINTER IS AT 500
SUPER STACK POINTER IS AT 600
USER STACK POINTER IS AT 700
BELL WILL RING WHEN TEST IS COMPLETE

000000	REGISTER ASSIGNMENTS	
000001	R0=X0	
000002	R1=X1	
000003	R2=X2	
000004	R3=X3	
000005	R4=X4	
000006	R5=X5	
000007	PC=X7	
000008	R10=X8	
000009	R11=X9	
000010	R12=X2	
000011	R13=X3	
000012	R14=X4	
000013	R15=X5	
000014		
000015		
000016	STACK POINTERS	
000017	KSP=X6	KERNEL STACK POINTER
000018	SSP=X6	SUPERVISOR STACK POINTER
000019	USP=X6	USER STACK POINTER
000020	HLT=HALT	
010701	SCOPE=010701	MOVE PC TO R1
000023	TRT=X3	TRACE TRAP
000140	PRTY3=140	
000200	PRTY4=200	
000340	PRTY7=340	
000024	VECTOR ADDRESSES	
000025	ERRVEC=X4	ADDRESS OF ERROR VECTOR
000026	EMTVEC=X3	ADDRESS OF EMT VECTOR
000027	TRAPVEC=X3	ADDRESS OF TRAP VECTOR
000028	IOIVVEC=X2	ADDRESS OF IOT VECTOR
000029	TSITVEC=X1	ADDRESS OF TTY BIT TRAP VECTOR
000030	TRIVC=X4	ADDRESS OF TRACE TRAP
000031	TPVEC=X4	ADDRESS OF TTY PRINTER INTERRUPT VECTOR
000032	PIRVEC=X4	ADDRESS OF PIRQ VECTOR
000033	HARDWARE REGISTER ASSIGNMENTS	
177776	PSW=177776	ADDRESS OF STATUS REGISTER

177774	SLR=177774	ADDRESS OF STACK LIMIT REGISTER
177772	PIRQ=177772	ADDRESS OF PROGRAM INTERRUPT REQUEST
177770	UBREAK=177770	ADDRESS OF MICRO BREAK REGISTER
177560	TKS=177560	ADDRESS OF KEYBOARD CSR
177562	TKB=177562	ADDRESS OF KEYBOARD BUFFER
177564	TPS=177564	ADDRESS OF TELEPRINTER CSR
177566	TPB=177566	ADDRESS OF TELEPRINTER BUFFER
177570	SWR=177570	ADDRESS OF CONSOL SWITCH REGISTER
177570	DISPLAY=177570	ADDRESS OF CONSOL DISPLAY REGISTER
000500	INITIAL STACK POINTER SETTINGS	
000600	KPTR=500	KERNEL INITIAL STACK POINTER VALUE
000700	SPTR=600	SUPERVISOR INITIAL STACK POINTER VALUE
000800	UPTR=700	USER INITIAL STACK POINTER VALUE
000900	YELPTR=1000	STACK POINTER VALUE FOR YELLOW OVFLW
000736	REDPTR=736	STACK POINTER VALUE FOR RED OVFLW
100000	MISC. BIT ASSIGNMENTS	
040000	BIT15=100000	
020000	BIT14=40000	
000100	BIT13=20000	
000100	BIT6=100	
140000	STATUS REGISTER BIT ASSIGNMENTS	
100000	UM=140000	USER MODE
040000	IM=100000	ILLEGAL MODE
000000	SM=040000	SUPERVISOR MODE
000000	KM=0	KERNEL MODE
030000	PUM=030000	PREVIOUS USER MODE
010000	PSM=010000	PREVIOUS SUPERVISOR MODE
000000	PKM=0	PREVIOUS KERNEL MODE
004000	REG=004000	REGISTER BIT
000020	TBIT=20	TTY BIT IN PSW
000001	C=1	IC BIT IN PS
000002	V=2	IV BIT IN PS
000004	Z=4	I2 BIT IN PS
000010	N=8	IN BIT IN PS
010000	PIR4=10000	LEVEL 4 REQUEST IN PIRQ
000000	,00	
000200	,200	
000200 000107 000000	JMP START	GO START
001000	,1000	
001000	ITACS	
001000 000000	ICNTI 0	CONTAINS PASS COUNT
001002 000000	TEMPL 0	
001012	,0,+6	

```

001012 012706 000500 START: MOV #KPTR,KSP
001016 000667 177776 CLR ICNT
ITEST THAT PROCESSOR POWERED UP OK FOR THE TEST
001022 032737 174000 177776 PWRUP: BIT #UM+PUM+REG,#PSW IIS STATUS CORRECT
001030 001377 BNE I LOOP HERE IF NOT
001032 012706 000500 BEGIN: MOV #KPTR,KSP INITIALIZE THE STACK POINTER
001036 016737 177736 177576 MOV ICNT,#DISP LDISP PASS COUNT IN LIGHT REGISTER
001044 032737 000400 177576 BIT #AB,#MSW LOAD MICRO BREAK REGISTER
001052 001403 BEQ #10
001054 113737 177576 177776 MOV #MSW,#UBREAK ILOAD MICRO BREAK REG WITH SR027

```

ICHECK THAT THE SPL INSTRUCTION IS A /NOP/ IN SUPERVISORY/USER MODE,
SUPERVISORY MODE,

```

001062 010701 T0: SCOPE
001064 012737 040340 177776 MOV #SM+PRTY7,#PSW ISUPERVISORY MODE, PRIORITY LEVEL 7
001072 000230 SPL 0 ITRY TO SET PRIORITY LEVEL #0
001074 013700 177776 MOV #PSW,R0 IGET PSW
001100 000037 177776 CLR #PSW
001104 022700 040340 CMP #SM+PRTY7,R0
001110 001401 BEQ #4
001112 000000 HLT IERROR: INCORRECT STATUS AFTER SPL

```

USER MODE

```

001114 010701 T1: SCOPE
001116 012737 140000 177776 MOV #UM,#PSW IUSER MODE,PRIORITY LEVEL 0
001124 000237 SPL 7 ITRY TO SET PRIORITY LEVEL 7
001126 013700 177776 MOV #PSW,R0 IGET PSW
001132 000037 177776 CLR #PSW IKERNEL MODE!!!
001136 022700 140000 CMP #UM,R0 ITEST THAT SPL DID NOT ALTER PSW
001142 001401 BEQ #4
001144 000000 HLT IERROR: SPL CHANGED STATUS WORD

```

ICHECK THAT RESET IS A /NOP/ IN SUPERVISORY/USER MODE
SUPERVISORY MODE

```

001146 010701 T2: SCOPE
001150 012737 070340 177776 MOV #SM+PUM+PRTY7,#PSW IPRESET STATUS
001156 052767 000100 176374 BIS #BIT0,TKS ISET IE BIT IN TKS
001164 000005 RESET IRESET
001166 013700 177776 MOV #PSW,R0 IGET STATUS WORD
001172 016702 176302 TKSR2 IGET TKS
001176 000037 177776 CLR #PSW IKERNEL MODE!!!
001202 000667 176302 CLR TKS ICLEAR IE BIT
001206 022700 070340 CMP #SM+PUM+PRTY7,R0 ITEST THAT STATUS DID NOT CHANGE
001212 001401 BEQ #4
001214 000000 HLT IERROR: STATUS CHANGED BY RESET
001216 032702 000100 BIT #BIT0,R2 ITEST THAT IE BIT DID NOT CLEAR
001222 001001 BNE #4
001224 000000 HLT IERROR: RESET CLEARED IE BIT IN TKS

```

USER MODE

```

001226 010701 T3: SCOPE
001230 012737 154340 177776 MOV #UM+PSW+R0+PRTY7,#PSW IPRESET STATUS

```

```

001236 052767 000100 176314 BIS #BIT0,TKS ISET IE BIT IN TKS
001244 000005 RESET IRESET
001246 013700 177776 MOV #PSW,R10 IGET STATUS WORD
001252 016702 176302 TKSR2 IGET TKS
001256 000667 176276 CLR TKS ICLEAR IE BIT
001262 042737 140000 177776 BIC #UM,#PSW IKERNEL MODE!!!
001270 022700 154340 CMP #UM+PSW+REG+PRTY7,R10 ICHECK STATUS AFTER RESET
001274 001401 BEQ #4
001276 000000 HLT IERROR: INCORRECT STATUS AFTER RESET
001300 032702 000100 BIT #BIT0,R12 ICHECK IE BIT AFTER RESET
001304 001001 BNE #4
001306 000000 HLT IERROR: IE BIT WAS CLEARED BY RESET
001310 000037 177776 CLR #PSW

```

ITEST A TRAP FROM SUPERVISOR TO KERNEL MODE

```

001314 010701 T4: SCOPE
001316 012706 000500 MOV #KPTR,KSP ISET KERNEL STACK POINTER
001322 012767 001362 176504 MOV #T4A,TRAPVEC
001330 012767 000397 176500 MOV #PRTY7+17,TRAPVEC+2
001336 012737 040000 177776 MOV #SM,#PSW ISUPERVISORY MODE!!!
001344 012706 000600 MOV #SPTR,SP ISET SUPERVISORS STACK POINTER
001350 000257 CCC ICLEAR CONDITION CODES
001352 104400 TRAP
001354 000037 177776 T4AA: CLR #PSW
001360 000000 HALT IERROR: DID NOT TRAP
001362 013700 177776 T4A: MOV #PSW,R0
001366 000037 177776 CLR #PSW
001372 022700 010357 CMP #KM+PSW+PRTY7+17,R0 IIS NEW STATUS CORRECT?
001376 001401 BEQ #4
001400 000000 HLT IERROR: INCORRECT NEW STATUS
001402 022767 001394 177064 CMP #T4AA,KPTR+4 I WAS RETURN ADDRESS SAVED ON KERNEL'S
001410 001401 BEQ #4 ISTACK?
001412 000000 HLT
001414 022767 040000 177054 CMP #SM,KPTR-2 I WAS OLD STATUS SAVED ON KERNEL'S
001422 001401 BEQ #4 ISTACK?
001424 000000 HLT
001426 022706 000474 CMP #KPTR-4,KSP
001432 001401 BEQ #4
001434 000000 HLT
001436 012737 040000 177776 MOV #SM,#PSW IENTER SUPERVISORY MODE TO GET
001444 010600 MOV SSP,R0 ISUPERVISOR STACK POINTER
001446 000037 177776 CLR #PSW
001452 022700 000000 CMP #SPTR,R0
001456 001401 BEQ #4
001460 000000 HLT
001462 012767 000036 176344 MOV #TRAPVEC+2,TRAPVEC
001470 000667 176342 CLR TRAPVEC+2

```

ITEST TRAP FROM USER MODE TO KERNEL MODE

```

001474 010701 T5: SCOPE
001476 012706 000500 MOV #KPTR,KSP ISET KERNEL STACK PTR
001482 012737 001540 000022 MOV #T5A,#IOTVEC ISET IOT TRAP VECTOR
001490 000667 176306 CLR IOTVEC-2 IKERNEL MODE AFTER IOT
001494 012737 100340 177776 MOV #UM+PSW+PRTY7,#PSW IUSER MODE!!!

```

```

001522 012706 000700      MOV    #UPTR,USP      ISET USER STACK PTR
001526 000277      SCC                    IPRESET CONDITION CODES
001530 000004      IOT                    ITRAP USER MODE TO KERNEL MODE
001532 005037 177776      T5AA1 CLR    ##PSW          IKERNEL MODE!!!
001536 000000      HLT                    IERROR! FAILED TO TRAP
001540 013700 177776      T5A1  MOV    ##PSW,R0   ISAVE STATUS
001544 005037 177776      CLR    ##PSW          IKERNEL MODE!!!
001550 022700 030000      CMP    #KM+PUM,R0     ICHECK STATUS AFTER IOT
001554 001401      BEQ    ,+4
001556 000000      HLT                    IERROR! INCORRECT STATUS AFTER IOT
001560 022767 001532 176700  CMP    #T5AA,KPTR=4   ICHECK KERNEL STACK PTR
001566 001401      BEQ    ,+4
001570 000000      HLT                    IERROR! INCORRECT KSP AFTER IOT
001572 022767 150357 176670  CMP    #UM+PSM+PRTY7+17,KPTR=2 ICHECK SAVED STATUS ON IOT
001580 001401      BEQ    ,+4
001602 000000      HLT                    IERROR! INCORRECT STATUS SAVED ON STACK AFTER IOT
001604 022706 000474      CMP    #KPTR=4,KSP    ICHECK RETURN PC ON IOT
001610 001401      SEQ    ,+4
001612 000000      HLT                    IINCORRECT RETURN PC SAVED ON STACK
001614 012737 140000 177776      MOV    #UM,##PSW      IUSER MODE!!!
001622 010600      MOV    USP,R0
001624 005037 177776      CLR    ##PSW          IKERNEL MODE!!!
001630 022700 000700      CMP    #UPTR,R0       ICHECK THAT USER STACK PTR
001634 001401      BEQ    ,+4             IAS NOT AFFECTED BY IOT TRAP
001636 000000      HLT                    IERROR! USP WAS CHANGED ON IOT
001640 012737 000022 000020  MOV    #IOTVEC+2,##IOTVEC

)TEST TRAP FROM USER MODE TO SUPERVISOR MODE
T61  SCOPE
001646 010701      MOV    #T6A,##EMTVEC  ISET EMT TRAP VECTOR
001650 012737 001720 000030  MOV    #SM,##EMTVEC+2 ISUPER MODE AFTER EMT
001664 012737 044000 177776      MOV    #SM+REG,##PSW  ISUPER MODE!!!
001672 012706 000000      MOV    #SPTR,SSP      ISET SUPER STACK PTR
001676 012737 144000 177776      MOV    #UM+REG,##PSW  IUSER MODE!!!
001704 012706 000700      MOV    #UPTR,USP      ISET USER STACK POINTER
001710 104000      EMT                    ITRAP USER TO SUPERVISOR
001712 005037 177776      T6AA1 CLR    ##PSW          IKERNEL MODE!!!
001716 000000      HLT                    IERROR! EMT FAILED TO TRAP
001720 013700 177776      T6A1  MOV    ##PSW,R0   ISAVE STATUS AFTER EMT TRAP
001724 010600      MOV    SSP,R2         ISAVE SUPER STACK PTR
001726 005037 177776      CLR    ##PSW          IKERNEL MODE!!!
001732 022700 070000      CMP    #SM+PUM,R0     ICHECK STATUS AFTER EMT TRAP
001736 001401      BEQ    ,+4
001740 000000      HLT                    IERROR! INCORRECT STATUS AFTER EMT TRAP
001742 022767 001712 176624  CMP    #T6AA,SPTR=4   ICHECK RETURN PC ON SUPER STACK
001750 001401      BEQ    ,+4
001752 000000      HLT                    IERROR! INCORRECT RETURN PC ON SUPER STACK AFTER EMT
001754 022767 144000 176614  CMP    #UM+REG,SPTR=2 ICHECK STATUS SAVED ON SUPER STACK
001762 001401      BEQ    ,+4
001764 000000      HLT                    IERROR! INCORRECT STATUS SAVED ON STACK HLT
001766 022700 000074      CMP    #SPTR=4,R2     ICHECK SUPER STACK PTR AFTER EMT
001772 001401      BEQ    ,+4
001774 000000      HLT                    IERROR! INCORRECT SSP AFTER EMT TRAP
001776 012737 140000 177776      MOV    #UM,##PSW      IUSER MODE!!!

```

```

002004 010600      MOV    USP,R0         ISAVE USER STACK PTR
002006 005037 177776      CLR    ##PSW          IKERNEL MODE!!!
002012 022700 000700      CMP    #UPTR,R0       ICHECK THAT USP WAS NOT CHANGED ON TRAP
002016 001401      SEQ    ,+4
002020 000000      HLT                    IERROR! INCORRECT USP AFTER EMT TRAP

)TEST TRAP FROM USER TO USER MODE
T71  SCOPE
002022 010701      MOV    #T7A,##TRTVEC  ISET TRACE TRAP VECTOR
002024 012737 002062 000014  MOV    #UM+REG,##TRTVEC+2 IUSER MODE AFTER TRAP
002032 012737 140000 000010  MOV    #UM,##PSW      IUSER MODE!!!
002040 012737 140000 177776      MOV    #UPTR,USP      ISET USER STACK PTR
002046 012706 000700      TRT                    ITRACE TRAP
002052 000003      CLR    ##PSW          IKERNEL MODE!!!
002054 005037 177776      T7AA1 HLT                    IERROR! TRT FAILED TO TRAP
002060 000000      HLT                    ISAVE STATUS AFTER TRAP
002062 013700 177776      T7A1  MOV    ##PSW,R10   ISAVE STATUS AFTER TRAP
002066 010600      MOV    USP,R12        ISAVE USER STACK PTR
002070 042737 140000 177776  BIC    #UM,##PSW      IKERNEL MODE!!!
002076 022767 002054 176570  CMP    #T7AA,UPTR=4   ICHECK RETURN PC ON USER STACK
002104 001401      BEQ    ,+4
002106 000000      HLT                    IERROR! INCORRECT RETURN PC ON USER STACK
002110 022700 174000      CMP    #UM+PUM+REG,R10 ICHECK STATUS AFTER TRT TRAP
002114 001401      BEQ    ,+4
002116 000000      HLT                    IERROR! INCORRECT STATUS AFTER TRT TRAP
002120 012767 000016 175660  MOV    #TRTVEC+2,TRTVEC
002126 005067 175664      CLR    TRTVEC+2

)TEST TRAP SEQUENCE FROM SUPERVISOR TO SUPERVISOR
T101 SCOPE
002132 010701      MOV    #T10A,##EMTVEC ISET EMT TRAP VECTOR
002134 012737 002172 000030  MOV    #SM,##EMTVEC+2 ISUPER MODE AFTER EMT
002142 012737 040000 000032  MOV    #SM,##PSW      ISUPER MODE!!!
002150 012737 040000 177776      MOV    #SPTR,SSP      ISET SUPER STACK PTR
002156 012706 000000      EMT+377               ITRAP SUPER TO SUPER
002162 104377      CLR    ##PSW          IKERNEL MODE!!!
002164 005037 177776      T10AA1 HLT                    IERROR! EMT FAILED TO TRAP
002170 000000      HLT                    ISAVE STATUS AFTER EMT TRAP
002172 013700 177776      T10A1 MOV    ##PSW,R0       ISAVE STATUS AFTER EMT TRAP
002176 005037 177776      CLR    ##PSW          IKERNEL MODE!!!
002202 022767 002164 176364  CMP    #T10AA,SPTR=4   ICHECK RETURN PC ON SUPER STACK
002210 001401      BEQ    ,+4
002212 000000      HLT                    IERROR! INCORRECT RETURN PC ON SUPER STACK AFTER TRAP
002214 022700 000000      CMP    #SM+PSM,R0     ICHECK STATUS AFTER TRAP
002220 001401      BEQ    ,+4
002222 000000      HLT                    IERROR! INCORRECT STATUS AFTER TRAP
002224 012737 000032 000030  MOV    #EMTVEC+2,##EMTVEC
002232 005037 000032      CLR    ##EMTVEC+2

)TEST TRAP SEQUENCE SUPERVISOR TO USER
T111 SCOPE
002236 010701      MOV    #T11A,TRAPVEC  ISET TRAP TRAP VECTOR
002240 012767 002106 175566  MOV    #UM,TRAPVEC+2  IUSER MODE AFTER TRAP
002246 012767 140000 175562  MOV    #UM,##PSW      IUSER MODE
002254 012737 140000 177776      MOV    #UPTR,USP      ISET USER STACK PTR
002262 012706 000700      MOV    #SM,##PSW      ICFERVISORY MODE!!!
002266 012737 040000 177776      MOV    #SM,##PSW

```

002274	000277			SCC		IPRE SET CONDITION CODES
002276	104777			TRAP+377		ITRAP SUPER TO USER
002300	005037	177776	T11AA1	CLR	#PPSW	IKERNEL MODE!!!
002304	000000			HLT		IEERROR: TRAP FAILED TO TRAP
002306	013700	177776	T11A1	MOV	#PPSW,R0	ISAVE STATUS AFTER TRAP
002312	010602			MOV	USP,R2	ISAVE USER STACK PTR
002314	005037	177776		CLR	#PPSW	IKERNEL MODE!!!
002320	022722	002300		CMP	#T11AA,(R2)+	ICHECK RETURN PC ON USER STACK
002324	001401			BEQ	,+4	
002326	000000			HLT		IEERROR: INCORRECT RETURN PC ON USER STACK
002330	022712	040017		CMP	#SM+17,(R2)	ICHECK SAVED STATUS
002334	001401			BEQ	,+4	
002336	000000			HLT		IEERROR: SAVED STATUS ON USER STACK INCORRECT
002340	022700	150000		CMP	#UM+PSM,R0	ICHECK STATUS AFTER TRAP
002344	001401			BEQ	,+4	
002346	000000			HLT		IEERROR: STATUS AFTER TRAP INCORRECT
002350	012767	000036	175456	MOV	#TRAPVEC+2,TRAPVEC	
002356	005067	175454		CLR	TRAPVEC+2	

ITEST THAT THE 'HALT' INSTRUCTION CAUSES A TRAP TO LOCATION 4 IN
ISUPERVISORY MODE:

002360	010701			T121	SCOPE	
002364	012737	002420	000004	MOV	#T12A,#ERRVEC	ISSET ERROR TRAP VECTOR
002372	005067	175410		CLR	ERRVEC+2	IKERNEL MODE ON TRAP
002376	012700	000500		MOV	#KPTR,KSP	ISSET KERNEL STACK PTR
002400	012737	040000	177776	MOV	#SM,#PPSW	ISUPER MODE!!!
002410	000000			HLT		IHALT TRAPS IN SUPERVISORY MODE
002412	005037	177776		T12AA1	CLR	IKERNEL MODE!!!
002416	000000			HLT		IEERROR: HALT DID NOT TRAP
002420	013700	177776		T12A1	MOV	#PPSW,R0
002424	005037	177776		CLR	#PPSW	ISAVE STATUS AFTER TRAP
002430	022700	010000		CMP	#KM+PSM,R0	IKERNEL MODE!!!
002434	001401			BEQ	,+4	ICHECK STATUS AFTER TRAP
002436	000000			HLT		IEERROR: INCORRECT STATUS AFTER TRAP
002440	022767	002412	176026	CMP	#T12AA,KPTR-4	ICHECK RETURN PC
002446	001401			BEQ	,+4	
002450	000000			HLT		IEERROR: INCORRECT RETURN PC ON KERNEL STACK

IUSER MODE

002452	010701			T131	SCOPE	
002454	012737	002504	000004	MOV	#T13A,#ERRVEC	ISSET ERROR TRAP VECTOR
002462	012706	000000		MOV	#KPTR,KSP	ISSET KERNEL STACK PTR
002466	012737	140000	177776	MOV	#UM,#PPSW	IUSER MODE!!!
002474	000000			HLT		IHALT TRAP TO 4 IN USER MODE
002476	005037	177776		T13AA1	CLR	#PPSW
002502	000000			HLT		
002504	013700	177776		T13A1	MOV	#PPSW,R0
002510	005037	177776		CLR	#PPSW	ISAVE STATUS AFTER TRAP
002514	022700	030000		CMP	#KM+PSM,R0	IKERNEL MODE!!!
002520	001401			BEQ	,+4	ICHECK STATUS AFTER TRAP
002522	000000			HLT		IEERROR: INCORRECT STATUS AFTER TRAP
002524	022767	002476	175742	CMP	#T13AA,KPTR-4	ICHECK RETURN PC
002532	001401			BEQ	,+4	
002534	000000			HLT		IEERROR: INCORRECT RETURN PC ON KERNEL STACK

002536	012737	000006	000004	MOV	#ERRVEC+2,#ERRVEC	
ITEST INTERRUPT SEQUENCE SUPERVISOR TO KERNEL MODE						
002544	010701			T141	SCOPE	
002546	000237			SPL	7	ISSET PROCESSOR PRIORITY LEVEL 7
002550	012767	002624	175306	MOV	#T14A,TPVEC	ILOAD TELEPRINTER
002556	012767	004200	175302	MOV	#REG+PRTY4,TPVEC+2	IVECTOR ADDRESSES
002564	012706	000000		MOV	#KPTR,KSP	ISSET KERNEL STACK
002570	052737	070000	177776	BIS	#SM+PUM,#PPSW	ISUPERVISORY MODE,PREVIOUS USER MODE
002576	012706	000000		MOV	#SPTR,SSP	
002602	052737	000100	175644	BIS	#BIT6,#PTPS	ISSET IE BIT IN TELEPRINTER
002610	042737	000340	177776	BIC	#PRTY7,#PPSW	IALLOW INTERRUPT
002616	005037	177776		T14AA1	CLR	IKERNEL MODE
002622	000000			HLT		IEERROR: NO INTERRUPT
002624	013700	177776		T14A1	MOV	#PPSW,R10
002630	042737	140000	177776	BIC	#UM,#PPSW	
002636	042737	000100	175644	BIC	#BIT6,#PTPS	ICLEAR IE BIT IN TELEPRINTER
002644	022700	014200		CMP	#KM+PSM+REG+PRTY4,R10	ICHECK 'NEW' STATUS
002650	001401			BEQ	,+4	
002652	000000			HLT		IEERROR: 'NEW' STATUS IS INCORRECT
002654	022700	000076		CMP	#KPTR,#KSP	
002660	001401			BEQ	,+4	
002662	000000			HLT		
002664	022767	002616	175602	CMP	#T14AA,KPTR-4	
002672	001401			BEQ	,+4	
002674	000000			HLT		
002676	022767	070000	175572	CMP	#SM+PUM,KPTR-2	
002704	001401			BEQ	,+4	
002706	000000			HLT		
002710	012767	000066	175140	MOV	#TPVEC+2,TPVEC	
002716	005067	175144		CLR	TPVEC+2	

ITEST INTERRUPT SEQUENCE USER TO KERNEL MODE

002722	010701			T151	SCOPE	
002724	012706	000500		MOV	#KPTR,KSP	ISSET KERNEL STACK POINTER
002730	012737	170340	177776	MOV	#UM+PUM+PRTY7,#PPSW	IUSER MODE!!!
002736	012737	003000	000240	MOV	#T15A,#PIRVEC	ILOAD PROGRAM INTERRUPT RQST VEC
002744	012737	010200	000242	MOV	#KM+PSM+PRTY4,#PIRVEC+2	
002752	012706	000700		MOV	#UPT,USP	ISSET USER STACK POINTER
002756	042737	000220	177776	BIC	#PRTY4,#PPSW	ISSET PRIORITY LEVEL=3
002764	012737	010000	177772	MOV	#PIR4,#PIRQ	IREQUEST AN INTERRUPT AT LEVEL 4
002772	005037	177776		T15AA1	CLR	IKERNEL MODE!!!
002776	000000			HLT		IEERROR: NO INTERRUPT REQUEST
003000	013700	177776		T15A1	MOV	#PPSW,R0
003004	005067	174762		CLR	PIRQ	ISDISABLE REQUEST
003010	005037	177776		CLR	#PPSW	
003014	022700	030200		CMP	#KM+PUM+PRTY4,R0	ITEST THAT 'NEW' PSW IS CORRECT
003020	001401			BEQ	,+4	I(##PIRVEC+2)
003022	000000			HLT		IEERROR: 'NEW' PSW NOT = TO (##PIRVEC+2)
003024	022767	002772	175442	CMP	#T15AA,KPTR-4	ISIS RETURN ADDRESS ON KERNEL STACK
003032	001401			BEQ	,+4	
003034	000000			HLT		IEERROR: RETURN ADDRESS NOT ON KERNEL STACK
003036	022767	170140	175432	CMP	#UM+PUM+PRTY3,KPTR+2	ITEST THAT 'OLD' PSW WAS SAVED ON
003044	001401			BEQ	,+4	IKERNEL STACK

```

003046 000000          HLT          IERROR:
003050 012737 000242 000240  MOV      #PIRVEC+2,#PIRVEC
003056 005037 000242          CLR      #PIRVEC+2

          ITEST THAT THERE IS NO STACK OVERFLOW IN SUPERVISORY MODE:
003062 010701          T16I  SCOPE
003064 012737 001000 177774  MOV      #1000,#SLR      ISET STACK LIMIT=1400
003072 012737 070000 177776  MOV      #SM+PUM,#PSW    I SUPERVISORY MODE
003100 012736 000000          MOV      #SPTR,SSP      I SUPERVISOR STACK
003104 012710 125252          MOV      #125252,(SSP)  I PRE SET STACK
003110 012737 003302 000030  MOV      #T160,#EMTVEC  IENTER SUPERVISORY MODE ON EMT
003116 012737 040000 000032  MOV      #SM,#EMTVEC+2
003124 012737 003330 000004  MOV      #T16ERR,#ERRVEC
003132 005067 175644          CLR      TEMP          ICLEAR INDICATOR LOCATION
003136 004767 000000          JSR      7,T160        IGO TO T160
003142 052767 000001 175632  T16AI  BIS      #1,TEMP      ISET INDICATOR BIT
003150 004567 000000          JSR      5,T160
003154 052767 000002 175620  T16CI  BIS      #2,TEMP      ISET INDICATOR BIT
003162 052737 004000 177776  BIS      #REG,#PSW     ISELECT R10=R15
003170 004767 000000          JSR      7,T160
003174 052767 000004 175000  T16DI  BIS      #4,TEMP      ISET INDICATOR BIT
003202 004567 000000          JSR      R15,T16E
003206 052767 000010 175560  T16EI  BIS      #10,TEMP     ISET INDICATOR BIT
003214 014614          MOV      -(SSP),(SSP)
003216 052767 000020 175550  BIS      #20,TEMP      ISET INDICATOR BIT
003224 012767 003250 174632  MOV      #T16F,TPVEC   ILOAD TELEPRINTER VECTOR
003232 012767 044000 174620  MOV      #SM+REG,TPVEC+2 IAND (NEW) STATUS
003240 052737 000100 177564  BIS      #BIT6,#TPS     IGENERATE AN INTERRUPT (VIA TELEPRINTER)
003246 000021          WAIT          IWAIT FOR INTERRUPT
003250 042737 000100 177564  T16FI  BIC      #BIT6,#TPS
003256 012767 000066 174600  MOV      #TPVEC+2,TPVEC
003264 005067 174976          CLR      TPVEC+2
003270 052767 000040 175504  BIS      #40,TEMP      ISET INDICATOR BIT
003276 104377          EMT+377      IEMT TRAP
003300 000000          HLT
003302 052767 000100 175472  T16GI  BIS      #100,TEMP     ISET INDICATOR BIT
003310 005037 177776          CLR      #PSW         IKERNEL MODE!!!
003314 022767 000177 175460  CMP      #177,TEMP     ITEST THAT ALL INSTRUCTIONS WHICH COULD
003322 001401          BEQ      ,+4          ICAUSE OVERFLOW DID NOT OVERFLOW,
003324 000000          HLT          IERROR!
003326 000403          BR      T16X         IEXIT TEST
003330 005037 177776          T16ERRI CLR      #PSW
003334 000000          HLT          IERROR: STACK OVERFLOWED IN SUPER
          ISUPERVISORY MODE TEMP GIVES THE INST-
          IINSTRUCTION WHICH CAUSED THE OVERFLOW,
          ICLEAR STACK LIMIT

003336 005037 177774          T16XI  CLR      #SLR
003342 012737 000032 000030  MOV      #EMTVEC+2,#EMTVEC
003350 005037 000032          CLR

          IUSER MODE
003354 010701          T17I  SCOPE
003356 012737 000400 177774  MOV      #400,#SLR     ISET STACK LIMIT #1000
003364 012737 150000 177776  MOV      #UM+PSM,#PSW  IUSER MODE!!!
003372 012737 003022 000004  MOV      #T17ERR,#ERRVEC
    
```

```

003400 012700 000700          MOV      #UPTR,USP     ISET USER STACK POINTER
003404 005067 175372          CLR      TEMP          ICLEAR INDICATOR LOCATION
003410 004767 000006          JSR      7,T17B        IGO TO T17B
003414 052767 000400 175360  T17AI  BIS      #400,TEMP     IPUSH ONTO USER STACK
003422 052767 000001 175352  T17BI  BIS      #1,TEMP      ISET ERROR INDICATOR BIT
003430 004567 000006          JSR      5,T17C
003434 052767 001000 175340  T17CI  BIS      #1000,TEMP    IPUSH ONTO USER STACK
003442 052767 000002 175332  BIS      #2,TEMP      ISET ERROR INDICATOR BIT
003450 000546          BIS      R5,=(SSP)    ISET INDICATOR BIT
003452 052767 000004 175322  BIS      #4,TEMP      IPUSH ONTO USER STACK
003460 052737 004000 177770  BIS      #REG,#PSW     ISET INDICATOR BIT
003466 004767 000006          JSR      #REG,#PSW    ISELECT R10=R15
003472 052767 002000 175302  JSR      7,T17D        IPUSH ONTO USER STACK
003500 052767 000010 175274  T17DI  BIS      #2000,TEMP    ISET ERROR INDICATOR BIT
003506 012702 003522          MOV      #T17E,R12
003512 000202          RTS          ISET UP RETURN FOR RTS
003514 052767 004000 175260  R12      IGO TO T16E
003522 052767 000020 175252  T17EI  BIS      #4000,TEMP   ISET INDICATOR TO SHOW ERROR
003530 004567 000006          JSR      #20,TEMP
003534 052767 010000 175240  JSR      R15,T17F
003542 052767 000040 175232  T17FI  BIS      #10000,TEMP   ISET ERROR INDICATOR BIT
003550 012767 003574 174256  MOV      #40,TEMP
003556 012767 144000 174252  MOV      #T17G,TRAPVEC ISET UP TRAP VECTOR FOR TRAP
003564 104400          MOV      #UM+REG,TRAPVEC+2
003566 052767 320000 175200  TRAP     I#20000,TEMP
003574 052767 000100 175200  T17GI  BIS      #100,TEMP
003602 005037 177776          CLR      #PSW         IKERNEL MODE!!!
003606 022767 000177 175160  CMP      #177,TEMP
003614 001401          BEQ      ,+4
003616 000000          HLT
003620 000403          HLT
003622 005037 177776          T17ERRI BR      T17X
003626 000000          CLR      #PSW
003630 005037 177774          HLT
003634 012767 000036 174172  T17XI  CLR      #SLR
003642 005067 174170          MOV      #TRAPVEC+2,TRAPVEC
          CLR

          ITEST TRAP & RETURN SUPERVISOR-KERNEL-SUPERVISOR
003646 010701          T20I  SCOPE
003650 012704 000500          MOV      #KPTR,KSP
003654 012737 004000 000022  MOV      #REG,#IOTVEC+2
003662 012737 003744 000020  MOV      #T20A,#IOTVEC
003670 012737 044200 177774  MOV      #SM+REG+PRTY4,#PSW
003676 005000          CLR      R10
003680 000004          IOT
003682 013767 177776 175072  T20AAI MOV      #PSW,TEMP    IGET RETURN STATUS FROM IOT TRAP
003690 042737 140000 177776  MOV      #UM,#PSW     IKERNEL MODE!!!
003700 022767 003702 174550  BIC      #T20AAI,KPTR-4 ICHECK THAT RETURN ADDRESS WAS
003706 001401          BEQ      ,+4          ISAVED ON KERNEL STACK ON IOT TRAP
003710 000000          HLT          IERROR!
003714 022767 044204 174540  CMP      #SM+REG+PRTY4+2,KPTR-2 ICHECK THAT STATUS WAS SAVED
003716 001401          BEQ      ,+4          ICORRECTLY ON KERNEL STACK
003720 000000          HLT          IERROR! INCORRECT STATUS SAVED
003722 022767 044204 175032  CMP      #SM+REG+PRTY4+2,TEMP ICHECK STATUS RETURNED BY RTT
    
```


003750	001401			BEQ	,+4	
003752	000000			HLT		ERROR
003754	005200			INC	R10	ICHECK THAT COM R10 WAS EXECUTED
003756	001404			BEQ	T21	
003760	000000			HLT		ERROR! COM R10 NOT EXECUTED AT T20A
003762	000402			BR	T21	GO TO NEXT TEST
003764	005100	T20A1		COM	R10	
003766	000000			RTT		

TEST THAT MTPD/1 POPS WORD OFF THE THE APPROPRIATE STACK (AS
DETERMINED BY BITS 15&14 IN PSW.)
MTPD, KERNEL MODE

003770	010701			T211	SCOPE	
003772	005037	177776		CLR	##PSW	
003774	012706	000500		MOV	##KPTR,KSP	ISSET KERNEL STACK POINTER
004002	012700	177777		MOV	##1,R0	IPRE-SET R0
004006	005016			CLR	(KSP)	IPUT 0 ON THE STACK
004010	012737	010011	177776	MOV	##PSW+N+C,##PSW	IPRE SET STATUS
004016	106600			R0	MTPD	IR0-(KSP)+
004020	013702	177776		MOV	##PSW,R2	IGET STATUS
004024	022702	010000		CMP	##PSW+2+C,R2	ICHECK STATUS AFTER MTPD
004030	001401			BEQ	,+4	
004032	000000			HLT		ERROR! INCORRECT STATUS
004034	022706	000502		CMP	##KPTR+2,KSP	IDID KSP INCREMENT BY 2
004040	001401			BEQ	,+4	
004042	000000			HLT		ERROR! KSP DID NOT POP
004044	005700			TST	R0	IDID WORD ON STACK (0) GET TO R0?
004046	001401			BEQ	,+4	
004050	000000			HLT		ERROR! MTPD DID NOT POP 0 OFF IKSP INTO R0

MTP1, KERNEL MODE

004052	010701			T221	SCOPE	
004054	005037	177776		CLR	##PSW	IKERNEL MODE!!!
004060	012706	000500		MOV	##KPTR,KSP	ISSET KERNEL STACK PTR
004064	005022			CLR	R2	IPRESET R2
004066	012716	177777		MOV	##1,(KSP)	IPRESET DATA ON THE STACK
004072	012737	030000	177776	MOV	##PUM+2+V,##PSW	IPRESET STATUS
004100	006602			R0	MTP1	IR2-(KSP)+
004102	013700	177776		MOV	##PSW,R0	IGET STATUS
004106	022700	030010		CMP	##PUM+N,R0	ICHECK STATUS
004112	001401			BEQ	,+4	
004114	000000			HLT		ERROR! INCORRECT STATUS
004116	022706	000502		CMP	##KPTR+2,KSP	ICHECK STACK PTR AFTER MTP1
004122	001401			BEQ	,+4	
004124	000000			HLT		ERROR! INCORRECT STACK PTR
004126	005202			INC	R2	ICHECK THAT MTP1 MOVED DATA
004130	001401			BEQ	,+4	IFROM STACK TO R2
004132	000000			HLT		ERROR!

MTPD, SUPERVISORY MODE

004134	010701			T231	SCOPE	
004136	005003			CLR	R3	IPRESET R3
004140	012737	040000	177776	MOV	##M+REG,##PSW	IDOPER MODE!!!

004146	012706	000600		MOV	##SPTR,SSP	ISSET SUPER STACK PTR
004152	052716	177777		BIS	##1,(SSP)	IPRESET DATA ON SUPER STACK
004156	005003			CLR	R10	IPRESET R10
004160	000201			SEC		ISSET IC
004162	106600			MTPD	R10	IR10-(SSP)+
004164	013700	177776		MOV	##PSW,R10	ISAVE STATUS
004170	010602			MOV	SSP,R12	ISAVE SUPER STACK POINTER
004172	042737	140000	177776	BIC	##M,##PSW	IKERNEL MODE!!!
004200	022700	044011		CMP	##M+REG+N+C,R10	ICHECK STATUS RESULT
004204	001401			BEQ	,+4	
004206	000000			HLT		ERROR! INCORRECT STATUS AFTER MTPD
004210	022702	000602		CMP	##SPTR+2,R12	ICHECK SUPER STACK POINTER
004214	001401			BEQ	,+4	
004216	000000			HLT		ERROR! INCORRECT SUPER STACK POINTER
004220	005203			INC	R10	ICHECK RESULT OF MTPD
004222	001401			BEQ	,+4	
004224	000000			HLT		ERROR! MTPD FAILED TO LOAD R10
004226	005037	177776		CLR	##PSW	IKERNEL MODE!!!, R0-R5
004232	005703			TST	R3	ICHECK THAT R3 WAS NOT CHANGED
004234	001401			BEQ	,+4	
004236	000000			HLT		ERROR! MTPD CHANGED INCORRECT REGISTER

MTP1, SUPERVISORY MODE

004240	010701			T241	SCOPE	
004242	012737	070000	177776	MOV	##M+PUM,##PSW	ISUPER MODE!!!,PREV USER MODE!!
004250	012706	000600		MOV	##SPTR,SSP	ISSET SUPER STACK PTR
004254	005016			CLR	(SSP)	IPRESET DATA ON SUPER STACK
004256	012704	177777		MOV	##1,R4	IPRESET R4
004262	000262			SEV		ISSET IV
004264	006604			MTP1	R4	IR4-(SSP)+
004266	013700	177776		MOV	##PSW,R0	ISAVE STATUS
004272	010602			MOV	SSP,R2	ISAVE SUPER STACK PTR
004274	005037	177776		CLR	##PSW	IKERNEL MODE!!!
004300	022700	070004		CMP	##M+PUM+2,R0	ICHECK STATUS AFTER MTP1
004304	001401			BEQ	,+4	
004306	000000			HLT		ERROR! INCORRECT STATUS AFTER MTP1
004310	022702	000602		CMP	##SPTR+2,R2	ICHECK SUPER STACK PTR AFTER MTP1
004314	001401			BEQ	,+4	
004316	000000			HLT		ERROR! INCORRECT SUPER STACK PTR AFTER MTP1
004320	005704			TST	R4	ICHECK THAT DATA WAS MOVED
004322	001401			BEQ	,+4	IFROM SUPER STACK TO R4
004324	000000			HLT		ERROR! MTP1 FAILED TO MOVE DATA TO R4

MTPD, USER MODE

004326	010701			T251	SCOPE	
004330	012737	150000	177776	MOV	##M+PSW,##PSW	ISUPER MODE!!!
004336	012706	000700		MOV	##UPTR,USP	ISSET USER STACK PTR
004342	022710	177777		BIC	##1,(USP)	IPRESET DATA ON USER STACK
004346	000261			SEC		ISSET IC
004350	042705	177777		BIC	##1,R5	IPRESET R5
004354	106600			MTPD	R5	IR5-(USP)+
004356	013700	177776		MOV	##PSW,R0	ISAVE STATUS AFTER MTPD
004362	010602			MOV	USP,R2	ISAVE USER STACK PTR

```

004364 005037 177776 CLR #PSW (KERNEL MODE!!!)
004370 022700 150011 CMP #UH+PSW+N+C,R0 (CHECK STATUS AFTER MTPD)
004374 001401 BEQ ,+4
004376 000000 HLT (ERROR! INCORRECT STATUS AFTER MTPD)
004400 022702 000702 CMP #UPTR+2,R2 (CHECK USER STACK PTR AFTER MTPD)
004404 001401 BEQ ,+4
004406 000000 HLT (ERROR! INCORRECT USP AFTER MTPD)
004410 005209 INC R5 (CHECK THAT MTPD MOVED DATA FROM)
004412 001401 BEQ ,+4 (USER STACK TO R5)
004414 000000 HLT (ERROR! MTPD FAILED)
    
```

```

MTPD1, USER MODE
T26: SCOPE
004416 010701 MOV #UH,#PSW (USER MODE!!!)
004420 012737 140000 177776 MOV #UPTR,USP (SET USER STACK PTR)
004426 012706 000700 BIC #1,(USP) (PRESET DATA ON USER STACK)
004432 042716 177777 BIS #1,R0 (PRESET R0)
004442 000277 SCC (PRESET STATUS (ALL CC'S=0))
004444 006600 MTPD R0 (R0=(USP)+)
004446 013702 177776 MOV #PSW,R2 (SAVE STATUS AFTER MTPD)
004452 010603 MOV USP,R3 (SAVE USP AFTER MTPD)
004454 005037 177776 CLR #PSW (KERNEL MODE!!!)
004460 022702 140004 CMP #UH+2,R2 (CHECK STATUS AFTER MTPD)
004464 001401 BEQ ,+4
004466 000000 HLT (ERROR! INCORRECT STATUS AFTER MTPD)
004470 022703 000702 CMP #UPTR+2,R3 (CHECK USP AFTER MTPD)
004474 001401 BEQ ,+4
004476 000000 HLT (ERROR! INCORRECT USP AFTER MTPD)
004500 005700 TST R0 (CHECK THAT MTPD MOVED DATA ON)
004502 001401 BEQ ,+4 (USER STACK TO R0)
004504 000000 HLT (ERROR! MTPD FAILED)
    
```

TEST THAT MTPD O/I POPS WORD OFF STACK (AS DETERMINED BY BITS 15 & 14 INTO STACK POINTER (AS DETERMINED BY BITS 13 & 12), (SSP=(KSP)+,MTPD.

```

T27: SCOPE
004506 010701 MOV #M,#PSW (SUPER MODE!!!)
004510 012737 040000 177776 CLR SSP (PRE SET SUPERVISORS STACK POINTER)
004516 005006 MOV #KH+PSH,#PSW (KERNEL MODE!!!, PREV SUPER MODE!!)
004520 012737 010000 177776 MOV #KPTR,KSP (SET KERNEL STACK POINTER)
004526 012706 000500 MOV #SPTR,(KSP)
004532 012716 000600 SCC (PRESET CC'S)
004536 000277 MTPD SSP (SSP=(KSP)+)
004540 106600 MOV #PSW,R2 (SAVE STATUS)
004542 013702 177776 MOV #M,#PSW (SUPER MODE!!!)
004546 012737 040000 177776 MOV SSP,R0 (GET SUPER STACK POINTER)
004554 010600 CLR #PSW (KERNEL MODE!!!)
004556 005037 177776 CMP #SPTR,R0 (CHECK THAT SUPER STACK POINTER WAS)
004562 022700 000600 BEQ ,+4 (SET BY MTPD INST.)
004566 001401 HLT (ERROR! MTPD FAILED TO SET SUPER STACK POINTER)
004570 000000 MOV #PSW+R0,R2 (CHECK STATUS AFTER MTPD)
004572 022702 010001 CMP #PSW+R0,R2 (CHECK STATUS AFTER MTPD)
004576 001401 BEQ ,+4
004600 000000 HLT (ERROR! INCORRECT STATUS AFTER MTPD)
    
```

```

(IUSP=(KSP)+,MTPD
T30: SCOPE
004602 010701 MOV #UH,#PSW (USER MODE!!!)
004604 012737 140000 177776 CLR USP (PRESET USER STACK POINTER)
004612 005006 MOV #KH+PUM,#PSW (KERNEL MODE!!!, PREV USER MODE!!)
004614 012737 030000 177776 MOV #KPTR,KSP (SET KERNEL STACK POINTER)
004622 012706 000500 MOV #UPTR,(KSP)
004626 012716 000700 SCC (PRESET CC'S)
004632 000277 MTPD USP (USP=(KSP)+)
004634 106600 MOV #PSW,R2 (SAVE CC'S)
004636 013702 177776 MOV #UH,#PSW (USER MODE!!!)
004642 012737 140000 177776 MOV USP,R0 (GET USER STACK POINTER)
004650 010600 CLR #PSW (KERNEL MODE!!!)
004652 005037 177776 CMP #UPTR,R0 (CHECK THAT MTPD SET USER STACK)
004656 001401 BEQ ,+4 (POINTER PROPERLY)
004664 000000 HLT (ERROR!)
004666 022706 000502 CMP #KPTR+2,KSP (CHECK KERNEL STACK POINTER)
004672 001401 BEQ ,+4
004674 000000 HLT
    
```

```

(KSP=(KSP)+,MTPD
T31: SCOPE
004700 012706 000500 MOV #REDPTR,(KSP) (PRESET DATA ON KERNEL STACK)
004704 012716 000736 MTPD KSP (KSP=(KSP)+)
004710 106600 CMP #REDPTR,KSP (CHECK THAT MTPD MOVED DATA ON)
004712 022706 000736 BEQ ,+4 (KERNEL STACK TO KERNEL STACK PTR)
004716 001401 HLT (ERROR! MTPD FAILED)
    
```

```

(ISSP=(SSP)+,MTPD
T31A: SCOPE
004722 010701 MOV #SH+PSM,#PSW (SUPER MODE!!!, PREV SUPER MODE!!)
004724 012737 050000 177776 CLR SSP (SET SUPER STACK POINTER)
004732 005006 MOV #SPTR,#R0 (PUT NEW STACK POINTER VALUE ON STACK)
004734 012737 000600 000000 SCC (PRESET CC'S)
004742 000277 MTPD SSP (SSP=(SSP)+)
004744 106600 MOV #PSW,R2 (SAVE RESULT STATUS)
004746 013702 177776 MOV SSP,R0 (SAVE NEW SUPER STACK POINTER)
004752 010600 CLR #PSW (KERNEL MODE!!!)
004754 005037 177776 CMP #SPTR,R0 (CHECK THAT MTPD SET SUPER STACK)
004760 022700 000600 BEQ ,+4 (POINTER PROPERLY)
004764 001401 HLT (ERROR!)
004766 000000 CMP #SH+PSM+C,R2 (CHECK STATUS RESULT)
004770 022702 050001 BEQ ,+4
004774 001401 HLT (ERROR! INCORRECT STATUS AFTER MTPD)
004776 000000
    
```

```

(IUSP=(SSP)+,MTPD
T31B: SCOPE
005000 010701 MOV #UH,#PSW (USER MODE!!!)
005002 012737 140000 177776 MOV #UPTR,USP (SET USER STACK POINTER)
005010 012706 000700 MOV #SH+PUM,#PSW (SUPER MODE!!!, PREV USER MODE!!)
005014 012737 070000 177776 MOV #KPTR,KSP (SET SUPER STACK POINTER)
005022 012706 000500
    
```

```

005026 005046 CLR -(SSP) ;PUSH NEW USER STACK POINTER ONTO
005030 000277 SCO ;SUPER STACK
005032 000244 CLE ;PRESET CC'S
005034 100600 MTPD ;
005036 013700 177776 MOV ##PSW,R2 ;USP=(SSP)+
005042 010600 177776 MOV SSP,R0 ;SAVE RESULT STATUS
005044 022737 140000 177776 BIS #UM,##PSW ;SAVE SUPER STACK POINTER
005052 013600 MOV USP,R3 ;USER MODE!!!
005054 005037 177776 CLR ##PSW ;GET USER STACK POINTER
005060 022700 070000 CMP #SM+PUM+Z+C,R2 ;KERNEL MODE!!!
005064 001401 BEQ ,+4 ;CHECK RESULT STATUS
005066 000000 HLT ;
005070 022700 000600 CMP #SPTR,R0 ;ERROR! INCORRECT STATUS AFTER MTPD
005074 001401 BEQ ,+4 ;CHECK SUPER STACK POINTER
005076 000000 HLT ;
005100 005703 TST R3 ;ERROR! INCORRECT SUPER STACK POINTER
005102 001401 BEQ ,+4 ;CHECK USER STACK POINTER
005104 000000 HLT ;ERROR! MTPD FAILED TO SET USER STACK POINTER

;USP=(USP)+,MTPD
005106 010701 T31C1 SCOPE
005110 012737 170000 177776 MOV #UM+PUM,##PSW ;USER MODE!!!, PREV USER MODE!!
005116 012700 000700 MOV #UPTR,USP ;SET USER STACK POINTER
005122 005016 CLR (USP) ;PUT NEW STACK VALUE ON STACK
005124 000257 CCC ;PRESET CC'S
005126 100600 MTPD USP ;USP=(USP)+

005130 013700 177776 MOV ##PSW,R0 ;SAVE CC'S
005134 010600 MOV USP,R2 ;SAVE USER STACK POINTER
005136 005037 177776 CLR ##PSW ;KER TL MODE!!!
005142 022700 170000 CMP #UM+PUM+Z,R0 ;CHECK STATUS
005146 001401 BEQ ,+4
005150 000000 HLT ;ERROR! INCORRECT STATUS AFTER MTPD
005152 005702 TST R2 ;CHECK NEW STACK POINTER VALUE
005154 001401 BEQ ,+4
005156 000000 HLT ;ERROR! MTPD FAILED TO SET USER STACK POINTER

;SSP=(KSP)+,MTPD
005160 010701 T32: SCOPE
005162 012737 040000 177776 MOV #SM,##PSW ;SUPERVISORY MODE!!!
005170 005006 CLR SSP ;PRESET SUPER STACK POINTER
005172 000237 177776 ASB ##PSW
005176 000237 177776 ASB ##PSW ;KERNEL MODE!!!, PREV SUPER MODE!!
005202 012716 000600 MOV #SPTR,(KSP)
005206 000600 MTPD SSP ;SSP=(RSP)+
005210 000337 177776 ASL ##PSW
005214 000337 177776 ASL ##PSW ;SUPERVISORY MODE!!!
005220 010600 173556 MOV SSP,TEMP ;GET SUPER STACK POINTER
005224 005037 177776 CLR ##PSW ;KERNEL MODE!!!
005230 022700 000600 173544 CMP #SPTR,TEMP ;CHECK THAT TOP WORD ON USP (#SPTR)
005236 001401 BEQ ,+4 ;WAS SET INTO SUPER STACK POINTER (SSP)
005240 000000 HLT ;ERROR!

```

```

;USP=(KSP)+,MTPD
005242 010701 T32A1 SCOPE
005244 012737 140000 177776 MOV #UM,##PSW ;USER MODE
005252 012700 177777 MOV #+1,USP ;PRESET USER STACK POINTER
005256 012737 030000 177776 CLR #KM+PUM,##PSW ;CURRENT KERNEL,PREVIOUS USER
005264 005046 -(KSP) ;PRESET DATA ON KERNEL STACK
005266 000600 MTPD USP ;USP=(KSP)+
005270 012737 140000 177776 MOV #UM,##PSW ;USER MODE!!!
005276 010600 MOV USP,R0 ;GET USER STACK POINTER
005300 005037 177776 CLR ##PSW ;KERNEL MODE!!!
005304 005700 TST R0 ;CHECK THAT DATA ON KERNEL STACK
005306 001401 BEQ ,+4 ;WAS MOVED TO USER STACK PTR
005310 000000 HLT ;ERROR! MTPD FAILED

;USP=(SSP)+,MTPD
005312 010701 T33: SCOPE
005314 012737 140000 177776 MOV #UM,##PSW ;USER MODE!!!
005322 005006 CLR USP ;PRE SET USR STACK POINTER
005324 012737 070000 177776 MOV #SM+PUM,##PSW ;CURRENT SUPERVISOR,PREVIOUS USER
005332 012746 000700 MOV #UPTR,=(SSP) ;PRESET DATA ON SUPER STACK
005336 000600 MTPD USP ;USP=(SSP)+
005340 012737 140000 177776 MOV #UM,##PSW ;USER MODE!!!
005346 010600 MOV USP,R0 ;SAVE USER STACK PTR
005350 005037 177776 CLR ##PSW ;KERNEL MODE!!!
005354 022700 000700 CMP #UPTR,R0 ;CHECK THAT MTPD MOVED DATA FROM
005360 001401 BEQ ,+4 ;SUPER STACK TO USER STACK PTR
005362 000000 HLT ;ERROR! MTPD FAILED

;SSP=(SSP)+,MTPD
005364 010701 T34: SCOPE
005366 012737 000000 177776 MOV #SM+PSM,##PSW ;SUPER MODE!!!,PREV SUPER MODE!!
005374 005006 CLR SSP ;SET SUPER STACK PTR
005376 012716 000600 MOV #SPTR,(SSP) ;PRESET DATA ON SUPER STAC
005402 000600 MTPD SSP ;SSP=(SSP)+
005404 010600 MOV SSP,R0 ;GET SUPER STACK PTR
005406 005037 177776 CLR ##PSW ;KERNEL MODE!!!
005412 022700 000600 CMP #SPTR,R0 ;CHECK THAT MTPD MOVED DATA ON
005416 001401 BEQ ,+4 ;SUPER STACK TO SUPER STACK PTR
005420 000000 HLT ;ERROR! MTPD FAILED

;USP=(USP)+
005422 010701 T35: SCOPE
005424 012737 170000 177776 MOV #UM+PUM,##PSW ;USER MODE!!!,PREV USER MODE!!
005432 012700 000600 MOV #SPTR,USP ;SET USER STACK PTR
005436 012716 000700 MOV #UPTR,(USP) ;PRESET DATA ON USER STACK
005442 000600 MTPD USP ;USP=(USP)+
005444 010600 MOV USP,R0 ;SAVE USER STACK PTR IN R0
005446 005037 177776 CLR ##PSW ;KERNEL MODE!!!
005452 005700 000600 CMP #UPTR,R0 ;CHECK THAT MTPD MOVED DATA ON
005456 001401 BEQ ,+4 ;USER STACK TO USER STACK PTR
005460 000000 HLT ;ERROR! MTPD FAILED

```

TEST THAT MTPD: TRAPS ON AN ODD ADDRESS DESTINATION
;KERNEL MODE

```

005462 010701 T361 SCOPE
025464 005037 177776 CLR #PSW
005470 012706 000500 MOV #KPTR,KSP
005474 012716 177777 MOV #1,(KSP)
005500 012737 005520 000004 MOV #T36A,#ERRVEC
005506 005067 172274 CLR ERRVEC+2
005512 106667 172261 MTPD
005516 000000 T36AA1 HLT ;TRAPS ON ODD ADDRESS
005520 022706 000496 T36A1 CMP #KPTR=2,KSP ;ERROR: DID NOT TRAP
005524 001401 BEQ #4 ;IS KSP CORRECT?(1 POP AND 2
005526 000000 HLT ;PUSHES)
005530 022767 005516 172740 CMP #T36AA,KPTR=2 ;ERROR: INCORRECT VALUE IN KSP
005536 001401 BEQ #4 ;CHECK RETURN PC ON STACK
005540 000000 HLT ;ERROR: RETURN PC NOT ON STACK
    
```

!SUPERVISORY MODE

```

005542 010701 T371 SCOPE
005544 012737 044000 177776 MOV #SM+REG,#PSW
005552 005000 CLR R10 ;PRESET R10
005554 042737 004000 177776 BIC #REG,#PSW ;R0-R5
005562 012700 000001 MOV #1,R0 ;R0 CONTAINS AN ODD ADDRESS
005566 012706 000600 MOV #SPTR,SSP ;SET SUPERVISOR'S STACK POINTER
005572 012716 177777 MOV #1,(SSP) ;=1 IS THE DATA TO BE MOVED
005576 012737 005622 000004 MOV #T37A,#ERRVEC ;LOAD ERROR VECTOR
005604 012737 040000 000006 MOV #SM,#ERRVEC+2
005612 106620 MTPD ;TRAPS ON ODD ADDRESS
005614 005037 177776 T37AA1 CLR #PSW
005620 000000 HLT ;ERROR: DID NOT TRAP
005622 010602 T37A1 MOV SSP,R2 ;GET SUPERVISOR STACK POINTER
005624 005037 177776 CLR #PSW ;KERNEL MODE!!!
005630 022702 000576 CMP #SPTR=2,R2 ;CHECK SUPER STACK PTR AFTER
005634 001401 BEQ #4 ;MTPD AND TRAP
005636 000000 HLT ;ERROR: INCORRECT SSP
005640 022767 005614 172730 CMP #T37AA,SPTR=2 ;CHECK RETURN PC ON SUPER STACK
005646 001401 BEQ #4
005650 000000 HLT ;ERROR: INCORRECT RETURN PC ON STACK
005652 022706 000003 CMP #3,R0 ;CHECK AUTO-INC OF R0
005656 001401 BEQ #4
005660 000000 HLT ;ERROR: R0 FAILED TO AUTO-INC
    
```

!USER MODE

```

005662 010701 T401 SCOPE
005664 012737 170000 177776 MOV #UM+PUM,#PSW ;USER MODE!!!, PREV USER MODE!!!
005672 005002 CLR R2
005674 052737 004000 177776 BIS #REG,#PSW ;SELECT R10-R15
005702 012702 000001 MOV #1,R12
005706 012706 000700 MOV #UPTR,USP ;SET USER STACK POINTER
005712 012716 125252 MOV #125252,(USP) ;PRESET USER STACK
005716 012737 005742 000004 MOV #T40A,#ERRVEC ;LOAD ERROR VECTOR
005724 012737 144000 000006 MOV #UM+REG,#ERRVEC+2
005732 006642 MTPD ;=(R12)
005734 005037 177776 T40AA1 CLR #PSW ;=(R12)-(USP)+!SHOULD TRAP ON ODD ADRS.
005740 000000 HLT ;KERNEL MODE!!!
005742 022602 T40A1 MOV USP,R10 ;ERROR DID NOT TRAP
    
```

```

005744 042737 140000 177776 BIC #UM,#PSW ;KERNEL MODE!!!
005752 022700 000676 CMP #UPTR=2,R10 ;CHECK THAT USER STACK POINTER
005756 001401 BEQ #4 ;PUSHED PROPERLY (1 POP, 2 PUSHES)
005760 000000 HLT ;ERROR: INCORRECT USER STACK POINTER
005762 022737 174010 000700 CMP #UM+PUM+REG+N,#UPTR ;CHECK THAT CORRECT STATUS WAS
005770 001401 BEQ #4 ;SAVED ON USER STACK (N IS DATA POPPED)
005772 000000 HLT ;ERROR: INCORRECT STATUS SAVED ON USER STACK
005774 022767 005734 172674 CMP #T40AA,UPTR=2 ;CHECK THAT RETURN ADDRESS WAS
006002 001401 BEQ #4 ;SAVED ON USER STACK
006004 000000 HLT ;ERROR: RETURN PC NOT ON USER STACK
006006 022702 177777 CMP #1,R12 ;DID R12 DECREMENT BY 2
006012 001401 BEQ #4
006014 000000 HLT ;ERROR: AUTO-DEC FAILED
006016 005037 177776 CLR #PSW
    
```

!TEST THAT MTPD CAN LOAD MEMORY ADDRESSES.

```

006022 010701 !KERNEL MODE
006024 005037 177776 T411 SCOPE
006030 012700 177777 CLR #PSW ;KERNEL MODE!!!
006034 012737 004070 000004 MOV #1,R0 ;PRESET R0
006042 005067 171740 000004 CLR ERRVEC+2 ;SET ERROR VECTOR
006046 052737 004000 177776 BIS #REG,#PSW
006054 005000 CLR R10 ;R10-R15
006056 012746 000602 MOV #2,(KSP) ;PRESET R10
006062 000261 SEC ;PRESET DATA ON STACK
006064 106620 MTPD ;SET FC
006066 000401 BR ;(R10)+
006070 000000 T41A1 HLT ;(R10)+=(KSP)+
006072 103401 HLT ;ERROR: TRAPPED
006074 000000 BCS #4 ;MTPD D? SHOULD NOT AFFECT CARRY.
006076 022767 000002 171674 CMP #2,0 ;BIT ERROR: CARRY BIT NOT CLEARED;
006104 001401 BEQ #4 ;CHECK THAT DATA WAS MOVED
006106 000000 HLT ;FROM KERNEL STACK TO MEM ADDRESS
    
```

```

006110 010701 T41B1 SCOPE
006112 012737 004000 177776 MOV #REG,#PSW ;KERNEL MODE!!!
006120 012737 006146 000004 MOV #T41B,#ERRVEC ;LOAD ERROR VECTOR
006126 012706 000500 MOV #KPTR,KSP ;SET KERNEL STACK POINTER
006132 012716 177777 MOV #1,(KSP) ;LOAD KERNEL STACK
006136 000257 CCC ;PRESET CC'S
006140 106637 001002 MTPD ;#TEMP=(KSP)+
006144 000401 BR #4
006146 000000 T41B01 HLT ;ERROR: TRAPPED
006150 013700 177776 MOV #PSW,R10 ;SAVE CC'S
006154 022700 004010 CMP #REG+N,R10 ;CHECK RESULT STATUS
006160 001401 BEQ #4
006162 000000 HLT ;ERROR: INCORRECT STATUS AFTER MTPD
006164 005257 001002 INC #TEMP ;CHECK RESULT
006170 001401 BEQ #4
006172 000000 HLT ;ERROR: MTPD FAILED
    
```

```

SUPERVISORY MODE
T421 SCOPE
006174 010701
006176 005037 177776 CLR ##PSW
006202 012702 052525 MOV #S2525,R2
006206 012737 006250 000004 MOV #T42A,#ERRVEC
006214 052737 044000 177776 BIS #SM+REG,#PSW
006222 012702 001002 MOV #TEMP,R12
006226 012767 177777 172546 MOV #=1,TEMP
006234 012706 000000 MOV #SPTR,9SP

006240 005016 CLR (SSP)
006242 000262 SEV
006244 006622 HTP1 (R12)+ ;(R12)+*(SSP)+
006246 000401 BR ,+4
006250 000000 HLT ;ERROR TRAPPED ON ODD ADDRESS
T42A1 MOV ##PSW,R10 ;GET CC'S
006256 013702 177776 177776 BIC #UH,#PSW
006264 022700 044004 CMP #SM+REG+2,R10
006270 001401 BEQ ,+4
006272 000000 HLT
006274 005767 172502 TST TEMP
006300 001401 BEQ ,+4
006302 000000 HLT

T43B1 SCOPE
006304 010701 MOV #=1,TEMP ;PRESET TEMP
006306 012767 177777 172466 MOV #T43B8,#ERRVEC ;LOAD ERROR VECTOR
006314 012737 006346 000004 MOV #SM+PUM+REG,#PSW ;SUPER MODE!!!, PREV USER MODE!!
006322 012737 074000 177776 MOV #SPTR,SSP ;GET SUPER STACK POINTER
006330 012706 000000 CLR =(SSP) ;PRESET SUPER STACK
006334 005046 CCC ;PRESET CC'S
006336 000297 MTPD TEMP ;TEMP=(SSP)+
006340 106667 172436 BR ,+4
006344 000401 HLT ;ERROR! TRAPPED
T43B81 MOV ##PSW,R12 ;SAVE CC'S
006346 000000 MOV SSP,R10 ;SAVE SUPER STACK POINTER
006350 013702 177776 CMP #SM+PUM+REG+2,R12 ;CHECK STATUS RESULT
006354 010600 BEQ ,+4
006356 022702 074004 HLT ;ERROR! INCORRECT STATUS
006362 001401 CMP #SPTR,R10 ;CHECK SUPER STACK POINTER
006364 000000 BEQ ,+4
006366 022700 000000 HLT ;ERROR! INCORRECT SUPER STACK POINTER
006372 001401
006374 000000

USER MODE
T431 SCOPE
006376 010701
006400 005037 177776 CLR ##PSW
006404 012703 177777 MOV #=1,R3
006410 012737 006450 000004 MOV #T43A,#ERRVEC
006416 012737 144000 177776 MOV #UM+REG,#PSW
006424 012703 001004 MOV #TEMP+2,R13
006430 005067 172346 CLR TEMP
006434 012706 000700 MOV #UPTR,USP
006440 052716 177777 BIS #=1,(USP)
006444 000000 HTP1 =(R13)-(USP)+

```

```

006446 000401 BR ,+4
006450 000000 T43A1 HLT ,+4 ;ERROR TRAPPED
006452 013700 177776 MOV ##PSW,R10 ;KERNEL MODE!!!
006456 042737 140000 177776 BIC #UH,#PSW
006464 122700 000010 CMPB #N,R10
006470 001401 BEQ ,+4
006472 000000 HLT
006474 005167 172302 COM TEMP
006500 001401 BEQ ,+4
006502 000000 HLT
006504 012737 000004 000004 MOV #ERRVEC+2,#ERRVEC
006512 005067 171270 CLR _ERRVEC+2

;TEST THAT MFP D/I PUSHES DESTINATION REGISTER DATA ONTO THE APPROPRIATE STACK
;IAS DETERMINED BY PSW BITS 15-614)
;KERNEL MODE,MFPD
T441 SCOPE
006516 010701
006520 012706 000500 MOV #KPTR,KSP
006524 012716 125252 MOV #125252,(KSP)
006530 005027 000000 CLR #R0
006534 012737 004000 177776 MOV #REG,#PSW
006542 012700 177777 MOV #=1,R10
006546 000211 SEG
006550 106500 MFPD R10 ;I=(KSP)+R10,(R10)+=1

006552 013702 177776 MOV ##PSW,R12
006556 022702 004011 CMP #REG+N+C,R12 ;GET STATUS RESULT
006562 001401 BEQ ,+4
006564 000000 HLT ;ERROR! INCORRECT STATUS RESULT
006566 022706 000476 CMP #KPTR+2,KSP ;DID KERNEL STACK POINTER GET
006572 001401 BEQ ,+4 ;PUSHED?
006574 000000 HLT ;ERROR!
006576 005116 COM (KSP) ;TEST THAT CORRECT DATA(=1) GOT
006580 001401 BEQ ,+4 ;PUSHED ONTO KERNEL STACK
006602 000000 HLT ;ERROR! =1 NOT PUSHED ONTO KERNEL STACK

;KERNEL MODE,MFPD
T451 SCOPE
006604 010701
006606 012706 000500 MOV #KPTR,KSP
006612 012716 052525 MOV #S2525,(KSP)
006616 005004 CLR R4 ;PRE SET STACK
006620 012737 004001 177776 MOV #REG+C,#PSW ;PRESET (WRONG) REGISTER
006626 012704 125252 MOV #125252,R14 ;SELECT R10-R15,SET C
006632 006504 MFPD R14 ;LOAD DATA TO BE MOVED
;I=(KSP)+R14,(R14)+125252

006634 013700 177776 MOV ##PSW,R10
006640 022700 004011 CMP #REG+N+C,R10 ;CHECK STATUS RESULT
006644 001401 BEQ ,+4
006650 022706 000476 HLT ;ERROR! INCORRECT STATUS
006654 001401 CMP #KPTR+2,KSP ;CHECK PUSH
006656 000000 BEQ ,+4
006660 022716 125252 HLT ;ERROR! KSP DID NOT PUSH DOWN
006664 001401 CMP #125252,(KSP) ;CHECK DATA ON THE STACK
006666 000000 BEQ ,+4
006668 000000 HLT ;ERROR! INCORRECT DATA ON THE STACK

```

IF DATA=0 THEN INCORRECT REGISTER
I(R4), IF DATA=52525 NO DATA PUSHED
ON THE STACK,

```

;SUPERVISORY MODE,MFPD
T46: SCOPE
006670 010701                                MOV     #SH+PTY7,#PSW
006672 012737 040340 177776                 MOV     #SPTR,SSP
006700 012706 000000                        MOV     #=1,R2
006704 012702 177777                        MOV     #52525,(SSP)
006710 012716 052525                          BIS     #REG,#PSW
006714 022737 004000 177776                 CLR     R12
006722 005002                                SEV
006724 002042                                HFPD   R12           j={SSP}=R12,(R12)=0
006726 106502

006730 013700 177776                        MOV     #PSW,R10
006734 010603                                MOV     SSP,R13
006736 042737 140000 177776                 BIC     #UM,#PSW
006744 022700 044344                        CMP     #SH+REG+PTY7+E,R10  ICHECK STATUS RESULT
006750 001401                                BEQ     ,+4
006752 000000                                HLT
006754 022703 000576                        CMP     #SPTR=2,R13
006760 001401                                BEQ     ,+4
006762 000000                                HLT
006764 005713                                TST    (R13)
006766 001401                                BEQ     ,+4
006770 000000                                HLT

;SUPERVISORY MODE,MFP1
T47: SCOPE
006772 010701                                MOV     #SH+PTY4,#PSW
006774 012737 040200 177776                 MOV     #SPTR,SSP
007002 012706 000000                        MOV     #=1,R5
007006 012705 177777                        MOV     #125252,(SSP)
007012 012716 125252                          BIS     #REG,#PSW
007016 022737 004000 177776                 MOV     #52525,R15
007024 012705 052525                          SCC
007030 020277                                HFP1   R15           j={SSP}=R15,(R15)=52525
007032 006505

007034 013700 177776                        MOV     #PSW,R10
007040 010604                                MOV     SSP,R14
007042 042737 140000 177776                 BIC     #UM,#PSW
007050 022700 044201                        CMP     #SH+REG+PTY4+C,R10  ICHECK STATUS RESULT
007054 001401                                BEQ     ,+4
007056 000000                                HLT
007060 022704 000576                        CMP     #SPTR=2,R14
007064 001401                                BEQ     ,+4
007066 000000                                HLT
007070 022707 052525 171500                 CMP     #52525,SPTR=2
007076 001401                                BEQ     ,+4
007100 000000                                HLT
    
```

```

USER MODE, HFPD
T51: SCOPE
007102 010701          CLR      R3          I/PRESET
007104 005003          MOV      #UM+REG, #PSW I/USER MODE, R10=R15
007106 012737 144000 177776 MOV      #UPTR, USP   I/SET USER'S STACK POINTER
007114 012706 000700          MOV      #125252, (USP)+ I/PRESET STACK
007120 012726 125252          MOV      #=1, R13     I
007124 012733 177777          CCC
007130 000257          MFPD      R13        I=(USP)+R13 (R13)=1
007132 100503

007134 013700 177776          MOV      #PSW, R10
007140 010604          MOV      USP, R14
007142 042737 140000 177776 BIC      #UM, #PSW
007150 022770 144010          CMP      #UM+REG+N, R10
007154 001401          BEQ      ,+4
007156 000000          HLT
007160 022774 000700          CMP      #UPTR, R14
007164 001401          BEQ      ,+4
007166 000000          HLT
007170 005214          INC      (R14)
007172 001401          BEQ      ,+4
007174 000000          HLT
007176 005037 177776          CLR      #PSW

USER MODE, HFP1
T51: SCOPE
007202 010701          CLR      R5
007204 005003          MOV      #UM+REG, #PSW I/USER MODE!!!
007206 012737 144000 177776 MOV      #UPTR, USP   I/SET USER STACK POINTER
007214 012706 000700          MOV      #=1, (USP)   I/PRESET USER STACK
007220 012716 177777          MOV      #UPTR, R15  I/PRESET R15
007224 012705 000700          SCC
007230 000277          SCG      I/PRESET CONDITION CODES
007232 006505          HFPI      R15       I=(USP)+R15

007234 013700 177776          MOV      #PSW, R10          I/GET STATUS RESULT
007240 010602          MOV      USP, R12          I/GET USER STACK POINTER
007242 042737 140000 177776 BIC      #UM, #PSW        I/KERNEL MODE!!!
007250 022700 144001          CMP      #UM+REG+C, R10  I/CHECK STATUS RESULT AFTER HFPI INST
007254 001401          BEQ      ,+4
007256 000000          HLT
007260 022702 000676          CMP      #UPTR=2, R12
007264 001401          BEQ      ,+4
007266 000000          HLT
007270 022712 000700          CMP      #UPTR, (R12)
007274 001401          BEQ      ,+4
007276 000000          HLT
    
```

```

I/TEST THAT HFPD/I PUSHES DESTINATION MEMORY DATA ONTO THE APPROPRIATE
I/STACK,
I/KERNEL
MODE, HFPD
T51: SCOPE
007300 010701          CLR      #PSW          I/KERNEL MODE!!!
007302 005037 177776          MOV      #TEMP, R0     I/PRESET R0
007306 012700 001002          BIS      #REG, #PSW    I/SELECT R10=R15
007312 052737 004000 177776 MOV      #TEMP+2, R10  I/PRESET R10
007320 012700 001004          MOV      #=1, TEMP
007324 012767 177777 171450 CLR      TEMP+2
007332 005067 171446          MOV      #KPTR, KSP   I/SET KERNEL STACK POINTER
007336 012706 000500          MOV      #125252, (KSP) I/PRESET KERNEL STACK
007342 012716 125252          MFPD      (R10)+     I=(KSP)+(R10)+, R10=TEMP+2, TEMP+2=0
007346 100520

007350 013702 177776          MOV      #PSW, R12
007354 022702 004004          CMP      #REG+2, R12
007360 001401          BEQ      ,+4
007362 000000          HLT
007364 022706 000476          CMP      #KPTR=2, KSP
007370 001401          BEQ      ,+4
007372 000000          HLT
007374 003710          TST      (KSP)
007376 001401          BEQ      ,+4
007400 000000          HLT

I/SUPERVISORY MODE, HFP1
T51: SCOPE
007402 010701          MOV      #SM+UM, #PSW  I/SUPERVISORY MODE!!!
007404 012737 070000 177776 MOV      #TEMP+2, R2   I/PRESET R2
007412 012702 001004          BIS      #REG, #PSW   I/SELECT R10=R15
007416 052737 004000 177776 MOV      #TEMP+4, R12  I/PRESET R12
007424 012702 001000          CLR      TEMP
007430 005067 171346          MOV      #TEMP+2, TEMP+2
007434 012767 001004 171342 MOV      #SPTR, SSP   I/SET SUPERVISORY STACK POINTER
007442 012706 000600          MOV      #52525, (SSP) I/PRESET SUPER STACK
007446 012716 052525          MFPD      #=(R12)    I=(SSP)+(R12), R12=TEMP+4, TEMP+2=TEMP+2
007452 006552

007454 013700 177776          MOV      #PSW, R10
007460 010603          MOV      SSP, R13
007462 042737 140000 177776 BIC      #UM, #PSW
007470 022700 074000          CMP      #SM+UM+REG, R10 I/CHECK STATUS AFTER HFPI INST,
007474 001401          BEQ      ,+4
007476 000000          HLT
007500 022703 000574          CMP      #SPTR=2, R13  I/ERROR! INCORRECT STATUS AFTER HFPI
007504 001401          BEQ      ,+4       I/CHECK SUPER STACK POINTER
007506 000000          HLT
007510 022713 001004          CMP      #TEMP+2, (R13) I/ERROR! INCORRECT SSP AFTER HFPI
007514 001401          BEQ      ,+4       I/CHECK THAT PROPER DATA WAS PUSHED
007516 000000          HLT                I/ONTO SUPERVISORY STACK
I/ERROR! INCORRECT DATA ON SUPER STACK
    
```

```

USER MODE HFPI
T54: SCOPE
007520 010701          MOV #UM+PSW,#PSW
007522 012737 150000 177776 MOV #TEMP+2,R3
007530 012703 001004          BIS #REG+PRTY7,#PSW
007534 052737 004340 177776 MOV #TEMP+4,R13
007542 012703 001006          CLR TEMP
007546 005067 171230          MOV #=1,TEMP+2
007552 012767 177777 171224 MOV #UPTR,USP
007560 012706 000700          MOV #125252,(USP)
007564 012716 125252          HFPI =2(R13)      (=USP+2(R13),R13=#TEMP+4,TEMP+2=#1
007570 006563 177776

007574 013700 177776          MOV #PSW,R10
007600 010632          MOV USP,R12
007602 042737 140000 177776 BIC #UM,#PSW
007610 022700 154350          CMP #UM+PSW+REG+PRTY7+R10
007614 001401          BEQ ,+4
007616 000000          HLT
007620 022702 000676          CMP #UPTR=2,R12
007624 001401          BEQ ,+4
007626 000000          HLT
007630 005112          COM (R12)
007632 001401          BEQ ,+4
007634 000000          HLT

```

ITEST OVERFLOW (YELLOW) USING MFPO INSTRUCTION

```

T55: SCOPE
007640 012737 014000 177776 MOV #PSW+REG,#PSW      (KERN MODE!!!,PREV SUPER MODE
007646 012706 001000          MOV #YELPTR,KSP        (SET STACK PTR AT TOP OF YELLOW ZONE
007652 012767 177777 171222 MOV #=1,TEMP            (PRESET DATA
007660 005066 177776          CLR =2(KSP)            (PRESET STACK DATA
007664 012737 000004 000004 MOV #T55A,#ERRVEC      (LOAD ERROR TRAP VECTOR
007672 005037 000004          CLR #ERRVEC+2
007676 012737 000400 177774 MOV #400,#SLR          (SET STACK LIMIT #1000
007704 106997 171072          MFPO TEMP              (PUSH TEMP ONTO KERNEL STACK
                                                                (SHOULD OVERFLOW STACK
                                                                (ERROR! FAILED TO TRAP ON OVERFLOW
                                                                (CHECK THAT MFPO PUSHED DATA
007710 000000          T55AA: HLT
007712 022767 177777 171056 T55A: CMP #=1,YELPTR=2
007720 001401          BEQ ,+4
007722 000000          HLT
007724 022767 014010 171042 CMP #PSW+REG+R1,YELPTR=4
007732 001401          BEQ ,+4
007734 000000          HLT
007736 022767 007710 171026 CMP #T55A,YELPTR=6
007744 001401          BEQ ,+4
007746 000000          HLT
007750 005037 177774          CLR #SLR
                                                                (ERROR! INCORRECT STATUS SAVED
                                                                (CHECK SAVED PC ON STACK
                                                                (ERROR! INCORRECT PC SAVED ON STACK
                                                                (CLEAR STACK LIMIT REGISTER

```

ITEST OVERFLOW (RED) USING HFPI INSTRUCTION

```

T56: SCOPE
007754 010701          MOV #T56A,#ERRVEC      (SET ERROR TRAP VECTOR
007756 012737 010030 000004 MOV #PUM+REG+PRTY7,#PSW (KERN MODE!!!,PREV USER MODE!!
007764 012737 034340 177776 MOV #REDPTR,KSP        (SET STACK PTR TO TOP OF RED ZONE
007772 012706 000736          MOV #=1,-2(KSP)       (PRESET RED LOCATION=#1
007776 012766 177777 177776 MOV #TEMP          (TEMP) WILL BE THE DATA MOVED
010004 005067 170772          CLR TEMP              (TO RED LOCATION
                                                                (LOAD INDEX REGISTER
                                                                (SET STACK LIMIT=1000
                                                                (=KSP)+TEMP SHOULD OVER
                                                                (FLOW (RED)
                                                                (ERROR! FAILED TO TRAP ON (RED)
                                                                (OVERFLOW
010010 012703 001004          MOV #TEMP+2,R13
010014 012737 000400 177774 MOV #400,#SLR          (SET STACK LIMIT=1000
010022 006563 177776          HFPI =2(R13)          (=KSP)+TEMP SHOULD OVER
                                                                (FLOW (RED)
                                                                (ERROR! FAILED TO TRAP ON (RED)
                                                                (OVERFLOW
010026 000000          T56AA: HLT
010030 022737 177777 000734 T56A: CMP #=1,#REDPTR=2
010036 001401          BEQ ,+4
010040 000000          HLT
010042 005700          TST KSP
010044 001401          BEQ ,+4
010046 000000          HLT
010050 022737 034344 000002 CMP #PUM+REG+PRTY7+2,#2 (OLD STATUS SHOULD BE IN 2
010056 001401          BEQ ,+4
010060 000000          HLT
010062 022737 010026 000000 CMP #T56AA,#400
010070 001401          BEQ ,+4
010072 000000          HLT
010074 005037 177774          CLR #SLR
010100 012737 000006 000004 MOV #ERRVEC+2,#ERRVEC (RESTORE ERROR VECTOR

```

ITEST TRAP & RETURN USER=KERNEL=USER

```

T57: SCOPE
010106 010701          MOV #KPTR,KSP          (SET KERNEL STACK POINTER
010110 012706 000900          MOV #REG,TRAPVEC+2
010114 012747 004000 167714 MOV #T57A,TRAPVEC
010122 012767 010212 167704 MOV #UM+REG,#PSW
010130 012737 144000 177776 MOV R12
010136 005000          CLR R12
010140 104400          TRAP
                                                                (TRAP & ENTER KERNEL MODE
010142 013767 177776 170632 T57AA: MOV #PSW,TEMP
010150 042737 140000 177776 BIC #UM,#PSW
010156 022767 010142 170310 CMP #T57AA,KPTR=4
010164 001401          BEQ ,+4
010166 000000          HLT
010170 022767 144004 170604 CMP #UM+REG+2,TEMP
010176 001401          BEQ ,+4
010200 000000          HLT
                                                                (CHECK THAT RETURN ADDRESS IS ON
                                                                (KERNEL STACK
                                                                (ERROR! RETURN ADDRESS NOT ON STACK
                                                                (CHECK THAT CORRECT PSW WAS
                                                                (RESTORED ON THE RETURN
                                                                (ERROR! INCORRECT STATUS WAS RETURNED
                                                                (BY KERNEL FROM TRAP
                                                                (CHECK THAT TRAP ROUTINE WAS EXECUTED
010202 005102          COM R12
010204 001401          BEQ ,+4
010206 000000          HLT
                                                                (ERROR! KERNEL DID NOT DO COM R12
                                                                (AT T57A)
010210 000402          BR T57EX
010212 005102          T57A: COM R12
010214 000002          RTI
                                                                (EXIT TEST
                                                                (IMPLEMENT R12
                                                                (AND EXIT

```

13


```

010216 000240 T57EXI NOP
)TEST THAT MFPP/1 CAN PUSH ONTO CURRENT STACK (AS DETERMINED BY PS15 &
)PS14) THE PREVIOUS MODES STACK POINTER (AS DETERMINED BY PS13 &PS12)
I=(KSP)-KSP,MFPD
T60: SCOPE
CLR #PSW ;(KERNEL MODE!!!, PREV KERNEL MODE!!
MOV #KPTR,KSP ;)SET KERNEL STACK POINTER
MFPD KSP ;I=(KSP)-KSP
CMP #KPTR,KPTR=2 ;)TEST THAT VALUE OF KERNEL STACK POINTER
BEQ ,+4 ;)WAS PUSHED ONTO KERNEL STACK
HLT ;)ERROR!

I=(KSP)-SSP,MFPD
T61:SCOPE
MOV #KM+PSM+REG,#PSW ;(KERNEL MODE!!!, PREV SUPER MODE!!
MOV #KPTR,KSP ;)SET KERNEL STACK POINTER
CLR (KSP)
MTPD SSP ;)SET SUPER STACK POINTER SSP=(KSP)+
COM -2(KSP) ;)PRESET KERNEL STACK
MFPD SSP ;I=(KSP)-SSP
CMP #KPTR,KSP ;)CHECK THAT KERNEL STACK POINTER
BEQ ,+4 ;)IS CORRECT
HLT ;)ERROR! INCORRECT KERNEL STACK POINTER
TST (KSP) ;)CHECK THAT VALUE OF SUPER STACK POINTER
BEQ ,+4 ;)WAS PUSHED ONTO KERNEL STACK
HLT ;)ERROR!

I=(KSP)-USP,MFPD
T62: SCOPE
MOV #KM+PUM+REG,#PSW ;(KERNEL MODE!!!, PREV USER MODE!!
MOV #KPTR,KSP ;)SET KERNEL STACK POINTER
MOV #1,(KSP)
MTPD USP ;)SET USER STACK POINTER USP=(KSP)+
COM -2(KSP) ;)PRESET KERNEL STACK
MFPD USP ;I=(KSP)-USP
CMP #1,(KSP) ;)CHECK THAT USER STACK POINTER WAS
BEQ ,+4 ;)PUSHED ONTO KERNEL STACK
HLT ;)ERROR!

I=(SSP)-SSP,MFPD
T63: SCOPE
MOV #KM+PSM+REG,#PSW ;(KERNEL MODE!!!, PREV SUPER MODE!!
MOV #KPTR,KSP ;)SET KERNEL STACK POINTER
MOV #SPTR,(KSP) ;)SET KERNEL STACK
MTPD SSP ;)PUSH TOP WORD ON KERNEL STACK (#SPTR)
;INTO SUPER STACK POINTER SSP=(KSP)+
;SUPER MODE!!!, PREV SUPER MODE!!
BIS #SM,#PSW ;I=(SSP)-SSP
MFPD SSP ;(KERNEL MODE!!!, PREV SUPER MODE!!
MFPD SSP ;)PUSH SUPER STACK POINTER ONTO KERNEL STACK
MFPD SSP ;)CHECK THAT SUPER STACK POINTER WAS
CMP #SPTR=2,(KSP) ;)PUSHED PROPERLY (ONCE)
BEQ ,+4 ;)ERROR!
HLT

```

```

010424 022767 000600 170144 CMP #SPTR,SPTR=2 ;)CHECK THAT VALUE OF SUPER STACK POINTER
BEQ ,+4 ;)WAS PUSHED ONTO SUPER STACK
HLT ;)ERROR!

I=(SSP)-USP,MFPD
T64: SCOPE
MOV #PSM+REG,#PSW ;(KERNEL MODE!!!, PREV SUPER MODE!!
MOV #KPTR,KSP ;)SET KERNEL STACK POINTER
MOV #SPTR,(KSP)
MTPD SSP ;)SET SUPER STACK POINTER
BIS #PUM,#PSW ;(KERNEL MODE!!!, PREV USER MODE!!
CLR (KSP)
MTPD USP ;)SET USER STACK POINTER=0
BIS #SM,#PSW ;)SUPER MODE!!!, PREV USER MODE!!
MFPD USP ;)PRESET SUPER STACK
MFPD USP ;)PUSH SUPER STACK POINTER ONTO SUPER STACK
BIC #UM+BIT13,#PSW ;(KERNEL MODE!!!, PREV SUPER MODE!!
MFPD SSP ;)PUSH SUPER STACK POINTER ONTO KERNEL STACK
MFPD SSP ;)CHECK THAT SUPER STACK POINTER WAS
CMP #SPTR=2,(KSP) ;)PUSHED ONCE
BEQ ,+4 ;)ERROR!
HLT ;)CHECK THAT USER STACK POINTER
TST SPTR=2 ;)WAS PUSHED ONTO SUPER STACK
BEQ ,+4 ;)ERROR!
HLT

I=(USP)-USP,MFPD
T65: SCOPE
MOV #PUM,#PSW ;(KERNEL MODE!!!, PREV USER MODE!!
MOV #KPTR,KSP ;)SET KERNEL STACK POINTER
MOV #UPTR,(KSP)
MTPD USP ;)SET USER STACK POINTER
CLR UPTR=2
BIS #UM,#PSW ;)USER MODE!!!, PREV USER MODE!!!
MFPD USP ;)PUSH USER STACK POINTER ONTO USER STACK
MFPD USP ;(KERNEL MODE!!!, PREV USER MODE!!
MFPD USP ;)PUSH USER STACK POINTER ONTO KERNEL STACK
CMP #UPTR=2,(KSP) ;)CHECK THAT USER STACK POINTER WAS
BEQ ,+4 ;)PUSHED PROPERLY (ONCE)
HLT ;)ERROR!
TST ;)ERROR!
CMP #UPTR,UPTR=2 ;)CHECK THAT USER STACK POINTER IS ON THE
BEQ ,+4 ;)USERS STACK
HLT ;)ERROR!

I=(KSP)-KSP,MFPD
T66: SCOPE
CLR #PSW ;(KERNEL MODE!!!, PREV KERNEL MODE!!
MOV #KPTR,KSP ;)SET KERNEL STACK POINTER
MFPD KSP ;)PUSH KERNEL STACK POINTER ONTO KERNEL
;STACK
CMP #KPTR,KPTR=2 ;)CHECK RESULT
BEQ ,+4 ;)ERROR!
HLT

I=(KSP)-SSP,MFPD

```

010765	010701		T671	SCOPE		
010668	012737	014000	177776	MOV	#PSW+REG,##PSW	(KERNEL MODE!!!, PREV SUPER MODE!!)
010666	012706	000500		MOV	#KPTR,KSP	(SET KERNEL STACK POINTER
010672	005016			CLR	(KSP)	
010674	006606			MTP1	SSP	(SET SUPER STACK POINTER
010676	005166	177776		COM	-2(KSP)	(PRESET KERNEL STACK
010702	006506			MFP1	SSP	(PUSH SUPER STACK POINTER ONTO KERNEL STACK
010704	022706	000500		CMP	#KPTR,KSP	(CHECK THAT KERNEL STACK POINTER IS CORRECT
010710	001401			BEQ	,+4	
010712	000000			HLT		(ERROR! INCORRECT KERNEL STACK POINTER
010714	005716			TST	(KSP)	(CHECK THAT SUPER STACK POINTER
010716	001401			REQ	,+4	(WAS PUSHED ONTO KERNEL STACK
010720	000000			HLT		(ERROR!
I=(KSP)-USP,MFP1						
010722	010701		T701	SCOPE		
010724	012737	034000	177776	MOV	#PUM+REG,##PSW	(KERNEL MODE!!!, PREV USER MODE!!)
010732	012706	000500		MOV	#KPTR,KSP	(SET KERNEL STACK POINTER
010736	012716	177777		MOV	##1,(KSP)	
010742	006606			MTP1	USP	(SET USER STACK POINTER
010744	005166	177776		COM	-2(KSP)	(PRESET KERNEL STACK
010750	006506			MFP1	USP	(PUSH USER STACK POINTER ONTO KERNEL STACK
010752	022716	177777		CMP	##1,(KSP)	(CHECK RESULT
010756	001401			BEQ	,+4	
010760	000000			HLT		(ERROR! USER STACK POINTER NOT ON KERNEL STACK
I=(SSP)-SSP,MFP1						
010762	010701		T711	SCOPE		
010764	012737	014000	177776	MOV	#PSW+REG,##PSW	(KERNEL MODE!!!, PREV SUPER MODE!!)
010772	012706	000500		MOV	#KPTR,KSP	(SET KERNEL STACK POINTER
010776	012716	000600		MOV	#SPTR,(KSP)	
011002	006606			MTP1	SSP	(SET SUPER STACK
011004	052737	040000	177776	BIS	#SM,##PSW	(SUPER MODE!!!, PREV SUPER MODE!!)
011012	006506			MFP1	SSP	(PUSH SUPER STACK POINTER ONTO SUPER STACK
011014	042737	100000	177776	BIC	#UM,##PSW	(KERNEL MODE!!!, PREV SUPER MODE!!)
011022	006506			MFP1	SSP	(GET SUPER STACK POINTER
011024	022716	000576		CMP	#SPTR=2,(KSP)	(CHECK THAT SUPER STACK POINTER WAS
011030	001401			BEQ	,+4	(PUSHED PROPERLY (ONCE)
011032	000000			HLT		(ERROR! INCORRECT SUPER STACK POINTER
(ON KERNEL STACK)						
011034	022767	000600	167534	CMP	#SPTR,SPTR=2	(CHECK THAT SUPER STACK POINTER WAS
011042	001401			BEQ	,+4	(PUSHED ONTO SUPER STACK
011044	000000			HLT		(ERROR!
I=(SSP)-USP,MFP1						
011046	010701		T721	SCOPE		
011050	012737	014000	177776	MOV	#PSW+REG,##PSW	(KERNEL MODE!!!, PREV SUPER MODE!!)
011056	012706	000500		MOV	#KPTR,KSP	(SET KERNEL STACK POINTER
011062	012716	000600		MOV	#SPTR,(KSP)	
011066	006606			MTP1	SSP	(SET SUPER STACK POINTER
011070	052737	030000	177776	BIS	#UM,##PSW	(KERNEL MODE!!!, PREV USER MODE!!)
011076	005016			CLR	(KSP)	
011100	006606			MTP1	USP	(SET USER STACK POINTER = 0
011102	052737	040000	177776	BIS	#SM,##PSW	(SUPER MODE!!!, PREV SUPER MODE!!)

011110	006506			MFP1	USP	(PUSH USER STACK POINTER ONTO SUPER STACK
011112	042737	100000	177776	BIC	#UM=0[13,##PSW	(KERNEL MODE!!!, PREV SUPER MODE!!)
011120	006506			MFP1	SSP	(PUSH SUPER STACK POINTER ONTO KERNEL STACK
011122	022716	000576		CMP	#SPTR=2,(KSP)	(CHECK THAT SUPER STACK POINTER IS
011126	001401			BEQ	,+4	(CORRECT
011130	000000			HLT		(ERROR!
011132	009767	167440		TST	SPTR=2	(CHECK THAT USER STACK POINTER IS ON
011136	001401			BEQ	,+4	(SUPER STACK
011140	000000			HLT		(ERROR!
I=(USP)-USP,MFP1						
011142	010701		T731	SCOPE		
011144	012737	034000	177776	MOV	#PUM+REG,##PSW	(KERNEL MODE!!!, PREV SUPER MODE!!)
011152	012706	000500		MOV	#KPTR,KSP	(SET KERNEL STACK POINTER
011156	012716	000700		MOV	#UPTR,(KSP)	
011162	006606			MTP1	USP	(SET USER STACK POINTER
011164	009067	167506		CLR	UPTR=2	(PRESET USER STACK
011170	052737	140000	177776	BIS	#UM,##PSW	(USER MODE!!!, PREV USER MODE!!)
011176	006506			MFP1	USP	(CHECK THAT SUPER STACK POINTER IS
011200	042737	140000	177776	BIC	#UM,##PSW	(KERNEL MODE!!!
011206	006506			MFP1	USP	(GET USER STACK POINTER
011210	022716	000676		CMP	#UPTR=2,(KSP)	(CHECK THAT USER STACK POINTER WAS
011214	001401			BEQ	,+4	(PUSHED ONCE
011216	000000			HLT		(ERROR!
011220	022767	000700	167450	CMP	#UPTR,UPTR=2	(CHECK THAT USER STACK POINTER WAS PUSHED
011226	001401			BEQ	,+4	(ONTO USER STACK
011230	000000			HLT		(ERROR!
I TEST THAT ILLEGAL MODE DOES NOT HANG BUS						
011232	010701		T741	SCOPE		
011234	012737	100000	177776	MOV	#IM,##PSW	(ILLEGAL MODE!!!
011242	013700	177776		MOV	##PSW,R0	(GET ILLEGAL MODE
011246	005037	177776		CLR	##PSW	(KERNEL MODE!!!
011252	022700	100000		CMP	#IM,R0	(CHECK THAT ILLEGAL MODE WAS SET
011256	001401			BEQ	,+4	(INTO STATUS
011260	000000			HLT		
I TEST THAT KERNEL CAN GET DATA FROM SUPER STACK						
011262	010701		T751	SCOPE		
011264	012737	014000	177776	MOV	#KM+PSW+REG,##PSW	(KERNEL MODE!!!, PREV SUPER MODE!!)
011272	012706	000500		MOV	#KPTR,KSP	(SET KERNEL STACK POINTER
011276	012716	000600		MOV	#SPTR,(KSP)	
011302	100600			MTP1	SSP	(GET SUPER STACK POINTER
011304	009767	177777	167506	MOV	##1,SPTR	(PRESET SUPER STACK
011312	005016			CLR	(KSP)	(PRESET KERNEL
011314	005016	177776		CLR	-2(KSP)	(STACK
011320	000277			SCD		(PRESET CONDITION CODES
011322	106506			MFP1	SSP	(GET SUPER STACK POINTER
011324	106576	000000		MFP1	0(KSP)	(LIKE MOV 0(6),=6)
011330	000240			NOF		
011332	013700	177776		MOV	##PSW,R12	(SAVE STATUS RESULT
011336	022767	000600	167134	CMP	#SPTR,KPTR	(TEST THAT SUPER STACK POINTER WAS PUSH-
011344	001401			BEQ	,+4	(ONTO KERNEL STACK BY MFP1 SSP INST;
011346	000000			HLT		(ERROR!

15

```

011350 022706 000470 CMP #KPTR=Z,KSP ;TEST THAT KERNEL STACK POINTER IS
011354 001401 BEQ ,+4 ;POSITIONED PROPERLY
011356 000000 HLT ;ERROR! INCORRECT KERNEL STACK POINTER
011360 005216 INC (KSP) ;CHECK THAT DATA WAS MOVED TO KERNEL
011362 001401 BEQ ,+4 ;STACK
011364 000000 HLT ;ERROR! INCORRECT DATA MOVED TO STACK
011366 022702 014011 CMP #KH+PSH+REG+N+C,R12 ;CHECK STATUS RESULT
011372 001401 BEQ ,+4
011374 000000 HLT ;ERROR! INCORRECT STATUS

```

TEST THAT KERNEL CAN GET DATA FROM USER STACK

```

011376 010701 T761 SCOPE
011400 012737 034000 177776 MOV #KH+PUM+REG,#PSW ;KERNEL MODE!!!, PREV SUPER MODE!!
011406 012706 000500 MOV #KPTR,KSP ;SET KERNEL STACK POINTER
011412 012716 000700 MOV #UPTR,(KSP)
011416 106600 HTPD USP ;SET USER STACK POINTER
011420 005087 167254 CLR UPTR ;PRESET USER STACK
011424 005010 CLR (KSP) ;PRESET KERNEL STACK
011426 012766 177777 177776 MOV #L,-2(KSP)
011434 106500 HFPD USP ;L=(KSP)-USP
011436 106576 000000 HFPD #KSP ;LIKE MOV 0(6),-(6)
011442 000240 NOP
011444 012731 177776 MOV #PSW,R13 ;SAVE STATUS RESULT
011450 022767 000700 167022 CMP #UPTR,KPTR ;CHECK THAT USER STACK POINTER WAS
011456 001401 BEQ ,+4 ;PUSHED ONTO KERNEL STACK
011460 000000 HLT ;ERROR!
011462 022706 000470 CMP #KPTR=Z,KSP ;CHECK THAT KERNEL STACK POINTER IS POS-
011466 001401 BEQ ,+4 ;ITIONED PROPERLY
011470 000000 HLT ;ERROR! INCORRECT KERNEL STACK POINTER
011472 005716 TST (KSP) ;CHECK THAT CORRECT DATA
011474 001401 BEQ ,+4 ;WAS PUSHED ONTO KERNEL STACK
011476 000000 HLT ;ERROR!
011500 022703 034004 CMP #KH+PUM+REG+Z,R13 ;CHECK STATUS
011504 001401 BEQ ,+4
011506 000000 HLT ;ERROR! INCORRECT STATUS

```

TEST THAT SUPERVISOR CAN GET DATA FROM USER STACK

```

011510 010701 T771 SCOPE
011512 012737 074000 177776 MOV #SH+PUM+REG,#PSW ;SUPER MODE!!!, PREV USER MODE!!
011520 012706 000600 MOV #SPTR,SSP ;SET SUPER STACK POINTER
011524 012716 000700 MOV #UPTR,(SSP)
011530 106600 HTPD USP ;SET USER STACK POINTER
011532 005037 000700 CLR #UPTR ;PRESET USER STACK
011536 005010 CLR (SSP) ;AND SUPER STACK
011540 012766 177777 177776 MOV #L,-2(SSP)
011546 000277 SCC ;PRESET CC'S
011550 106506 HFPD USP ;GET USER STACK POINTER
011552 106576 000000 HFPD #SSP ;LIKE MOV 0-(6),-(6)
011556 000240 NOP
011560 013704 177776 MOV #PSW,R14 ;SAVE STATUS
011564 012737 014000 177776 MOV #PSH+REG,#PSW ;KERNEL MODE!!!, PREV SUPER MODE!!
011572 012706 000500 MOV #KPTR,KSP ;SET KERNEL STACK POINTER
011576 106506 HFPD SSP ;PUSH SUPER STACK POINTER ONTO KERNEL STACK
011600 022710 000370 CMP #SPTR=Z,(KSP) ;CHECK THAT SUPER STACK POINTER IS POS-

```

```

011604 001401 BEQ ,+4 ;ITIONED PROPERLY (1 POP, 2 PUSHES)
011606 000000 HLT ;ERROR! INCORRECT SUPER STACK POINTER
011610 022737 000700 000600 CMP #UPTR,#SPTR ;CHECK THAT HFPD USP PUSHED USER STACK
011620 000000 BEQ ,+4 ;ONTO SUPER STACK
011622 005737 000570 TST #SPTR=2 ;ERROR!
011626 001401 BEQ ,+4 ;CHECK THAT DATA ON USER STACK WAS PUSH-
011630 000000 HLT ;ONTO SUPER STACK (HFPD #SSP)
011632 022704 074003 CMP #SH+PUM+REG+Z+C,R14 ;CHECK STATUS RESULT
011636 001401 BEQ ,+4
011640 000000 HLT ;ERROR! INCORRECT STATUS AFTER HFPD #SSP)

```

TEST THAT INTERRUPT SEQUENCE USER TO SUPERVISOR (VIA TTY)

```

011642 010701 T1001 SCOPE
011644 012737 040000 177776 MOV #SH,#PSW ;SUPER MODE!!!
011652 012706 000600 MOV #SPTR,SSP ;SET SUPER STACK POINTER
011656 012737 000340 177776 MOV #PRTY7,#PSW ;KERNEL MODE!!!, PRIORITY LEVEL 7
011664 012737 000100 177564 MOV #BIT0,#ATPS ;SET IE BIT IN TELEPRINTER STATUS
011672 012737 011722 000064 MOV #T100A,#TPVEC ;LOAD INTERRUPT VECTOR
011680 012767 044000 166160 MOV #SH+REG,TPVEC+2 ;AND /NEW/ STATUS
011686 012737 140000 177776 MOV #UH,#PSW ;USER MODE!!!, ALLOW TTY INTERRUPT
011694 005037 177776 T100AA1 CLR #PSW ;KERNEL MODE!!!
011698 000000 HLT ;ERROR! INTERRUPT FAILED
011702 013767 177776 167052 T100A1 MOV #PSW,TEMP ;SAVE /NEW/ STATUS
011706 012737 010000 177776 MOV #PSH,#PSW ;KERNEL MODE!!!, PREV SUPER MODE!!
011714 005067 167022 CLR TPS ;CLEAR IE BIT
011722 005037 HFPD SSP ;PUSH SUPER STACK PTR ONTO KERNEL STACK
011730 022767 074000 167030 CMP #SH+PUM+REG,TEMP ;CHECK THAT /NEW/ STATUS IS CORRECT
011736 000000 BEQ ,+4
011742 005037 HLT ;ERROR! INCORRECT STATUS AFTER INTERRUPT
011744 022767 000570 167030 CMP #SPTR=4,(KSP) ;CHECK SUPER STACK POINTER
011748 000000 BEQ ,+4 ; (2 PUSHES)
011752 022716 000570 011714 000574 T100AA1 CMP #T100AA,#SPTR=4 ;ERROR! INCORRECT SUPER STACK POINTER
011756 000000 BEQ ,+4 ;CHECK RETURN PC ON SUPER STACK
011762 001401 HLT ;ERROR! RETURN PC NOT ON SUPER STACK
011764 000000 HLT ;CHECK THAT STATUS WAS SAVED ON
011766 022737 000574 166570 CMP #UH,#SPTR=2 ;SUPER STACK
011774 001401 BEQ ,+4 ;ERROR! OLD STATUS NOT ON SUPER STACK
011776 000000 HLT
012000 022767 166000 166570 CMP #UH,#SPTR=2
012006 001401 BEQ ,+4
012010 000000 HLT

```

TEST TRAP & RETURN USER-SUPER-USER

```

012012 010701 T1011 SCOPE
012014 012737 074000 177776 MOV #SH+PUM+REG,#PSW ;SUPER MODE!!!, PREV USER MODE!!
012022 012706 000600 MOV #SPTR,SSP ;SET SUPER STACK POINTER
012026 012737 012100 000020 MOV #T101A,#T10TVEC ;LOAD 101 TRAP VECTOR
012034 012737 044000 000022 MOV #SH+REG,#T10TVEC+2 ;AND /NEW/ STATUS
012042 005002 CLR R12
012044 012737 144000 177776 MOV #UH+REG,#PSW ;USER MODE!!!
012052 000004 IDT ;TRAP
012054 013767 177776 166720 T101AA1 MOV #PSW,TEMP ;SAVE /OLD/ STATUS RETURN BY R12
012062 012737 014000 177776 MOV #PSH+REG,#PSW ;KERNEL MODE!!!, PREV SUPER MODE!!
012070 022767 012054 166470 CMP #T101AA,SPTR=4 ;CHECK THAT RETURN PC WAS SAVED ON SUPER
012076 001401 BEQ ,+4 ;STACK
012080 000000 HLT ;ERROR! RETURN PC NOT SAVED ON SUPER STACK

```

```

012102 022767 144000 166466      CMP      #UM+REG,SPTR-2  ;CHECK /OLD/ STATUS SAVED ON SUPER STACK
012110 001401      BEQ      ,+4
012112 000000      HLT
012114 022767 174000 166660      CMP      #UM+PUM+REG,TEMP
012122 001401      BEQ      ,+4
012124 000000      HLT
012126 106506      MFPD     SSP          ;GET SUPER STACK POINTER
012130 022716 000600      CMP      #SPTR,(KSP)  ;CHECK SUPER STACK POINTER
012134 001401      BEQ      ,+4          ;2 PUSHES, 2 POPPS
012136 000000      HLT
012140 001002      COM      R12         ;CHECK THAT COM R12 WAS EXECUTED
012142 001401      BEQ      ,+4          ;IN IOT ROUTINE AT T101A
012144 000000      HLT
012146 000402      BR       T101EX      ;ERROR!
                                ;EXIT TEST

012150 001002      T101A  COM      R12         ;COMPLEMENT E12
012152 000002      RTI
012154 000240      T101EX NOP

;CHECK THAT MTPD CAN LOAD MEMORY ADDRESS DM=7,PC
T102I SCOPE
012156 010701      MOV      #KM+PSH,#PSW  ;KERNEL MODE!!!; PREV SUPER MODE!!!
012160 012737 010000 177776      MOV      #KPTR,KSP     ;SET KERNEL STACK PTR
012166 012706 000500      CLR      (KSP)         ;PUT DATA ON STACK
012172 005016      MOV      #TEMP,#TEMP+2 ;LOAD ADDRESS
012174 012737 001002 001004      MOV      #=5,TEMP     ;PRESET DATA
012202 012767 177777 166572      SCC
012210 000277      MFPD     #TEMP+2      ;TEMP=(KSP)+
012212 106677 166566      MOV      #PSW,R3      ;CHECK CC'S
012216 013703 177776      CMP      #KM+PSH+2+C,R3 ;CHECK CC'S
012222 022703 010000      BEQ      ,+4
012226 001401      HLT
012230 000000      HLT
012232 005737 000000      TST     #TEMP
012236 001401      BEQ      ,+4
012240 000000      HLT
                                ;ERROR! INCORRECT RESULT

;CHECK THAT MTPD CAN LOAD MEMORY ADDRESS DM=7
T103I SCOPE
012242 010701      MOV      #KM+PUM+REG,#PSW ;KERNEL MODE!!!
012244 012737 034000 177776      MOV      #KPTR,KSP     ;SET KERNEL STACK PTR
012252 012706 000500      MOV      #=1,(KSP)    ;LOAD DATA ONTO STACK
012256 012710 177777      MOV      #=2,R12     ;LOAD INDEX REGISTER
012262 012704 177776      CLR      TEMP         ;PRESET DATA
012266 005067 166510      MOV      #TEMP,TEMP+2  ;TEMP=(KSP)+
012272 012767 001002 166504      MFPD     #TEMP+4(R14) ;SAVE STATUS RESULT
012300 006674 001000      MTPD     #PSW,R13     ;CHECK THAT KSP POPPED
012304 013703 177776      CMP      #KPTR+2,KSP
012310 001401      BEQ      ,+4
012316 000000      HLT
012320 022703 034010      CMP      #PUM+REG+N,R13 ;CHECK STATUS RESULT
012324 001401      BEQ      ,+4
012326 000000      HLT
012330 000000      INC     TEMP
                                ;CHECK RESULT

```

```

012334 001401      BEQ      ,+4
012336 000000      HLT
                                ;ERROR! INCORRECT RESULT

;TEST THAT MTPD/I CAN LOAD PC
T104I SCOPE
012340 010701      MOV      #KM+PSH,#PSW  ;KERNEL MODE!!!
012342 012737 010000 177776      MOV      #KPTR,KSP     ;SET KERNEL STACK PTR
012350 012706 000500      MOV      #T104A,(KSP) ;PUT NEW PC ON STACK
012354 012716 012366      SCC
012360 000277      MFPD     PC          ;PRESET CC'S
012362 106607      HLT
012364 000000      HLT
012366 100001      T104A  BPL      ,+4   ;ERROR! MTPD FAILED TO SET PC
012370 000000      HLT
012372 103401      BCS      ,+4
012374 000000      HLT
                                ;ERROR! 'N' FAILED TO CLEAR IN STATUS
                                ;ERROR! 'C' WAS CLEARED BY MTPD

;SUPERVISORY MODE
T105I SCOPE
012376 010701      MOV      #SM+PUM+REG,#PSW ;SUPER MODE!!!
012400 012737 074000 177776      MOV      #SPTR,SSP     ;SET SUPER STACK
012406 012706 000600      MOV      #T105A,(SSP) ;PUT NEW PC ON STACK
012412 012716 012430      SCC
012416 000277      MFPD     PC          ;PRESET CC'S
012420 006607      HLT
012422 005037 177776      CLR      #PSW
012426 000000      HLT
                                ;KERNEL MODE!!!
                                ;ERROR! MTPD FAILED TO LOAD PC

012430 013704 177776      T105A  MOV      #PSW,R14 ;SAVE STATUS RESULT
012434 042737 140000 177776      BIT     #UM,#PSW     ;KERNEL MODE!!!
012442 022704 074001      CMP      #SM+PUM+REG+C,R14 ;CHECK STATUS RESULT
012446 001401      BEQ      ,+4
012450 000000      HLT
                                ;ERROR! INCORRECT STATUS RESULT

;USER MODE
T106I SCOPE
012452 010701      MOV      #UM+PUM,#PSW  ;USER MODE!!!
012454 012737 170000 177776      MOV      #UPTR,USP     ;SET USER STACK PTR
012462 012706 000700      MOV      #T106A,(USP) ;PUT NEW PC ON STACK
012466 012716 012504      SCC
012472 000277      MFPD     PC          ;PRESET CC'S
012476 106607 177776      HLT
012478 005037      CLR      #PSW
012502 000000      HLT
                                ;KERNEL MODE!!!
                                ;ERROR! MTPD FAILED TO LOAD PC

012504 013705 177776      T106A  MOV      #PSW,R5 ;SAVE STATUS
012510 005037 177776      CLR      #PSW
012514 022705 170001      CMP      #UM+PUM+C,R5 ;CHECK STATUS
012520 001401      BEQ      ,+4
012522 000000      HLT

;TEST ERROR TRAP (ODD ADDRESS) #MPO#
T107I SCOPE
012524 010701      CLR      #PSW
012526 005037 177776      MOV      #KPTR,KSP     ;KERNEL MODE!!!
012532 012706 000500      MOV      #T107A,#ERRVEC ;SET KERNEL STACK PTR
012536 012737 012554 000004      MOV      #=1,#ERRVEC  ;LOAD ERROR VECTOR
012544 000277      SCC
012546 106567 165227      MFPD     1
012552 000000      HLT
                                ;ODD ADDRESS SHOULD TRAP
                                ;ERROR! FAILED TO TRAP ON ODD ADDRESS

```

```

012554 022706 000474 T107A1 CMP #KPTR=4,(KSP) ;CHECK THAT STACK PTR WAS PUSHED
012568 001401 BEQ ,+4 ;PROPERLY (2 PUSHES)
012582 000000 HLT ;ERROR! INCORRECT STACK PTR AFTER ERROR
012596 022726 012592 CMP #T107AA,(KSP)+ ;CHECK RETURN PC ON STACK
012578 001401 BEQ ,+4
012572 000000 HLT ;ERROR! RETURN PC NOT ON STACK
012574 022716 000017 CMP #17,(KSP) ;CHECK SAVED STATUS ON STACK
012668 001401 BEQ ,+4
012682 000000 HLT ;ERROR! INCORRECT STATUS SAVED ON STACK

;SUPER MODE, TIME OUT
012684 010701 T1101 SCOPE
012686 012737 040000 177776 MOV #SH,#MPSH ;SUPER MODE!!!
012614 012706 000000 MOV #SPTR,SSP ;SET SUPER STACK
012620 012737 044000 000000 MOV #SH+REG,#ERRVEC+2 ;LOAD /NEW/ STATUS
012626 012737 012644 000004 MOV #T110A,#ERRVEC ;AND PC
012634 100537 177702 #177702 ;177702 IS NON-EXISTANT ADDR
012640 000000 HLT ;KERNEL MODE!!!
012644 000000 HLT ;ERROR! DID NOT TRAP ON NON ADDR
012646 010603 T110A1 MOV SSP,R13 ;SAVE SUPER STACK PTR
012650 042737 140000 177776 BIC #UH,#MPSH ;KERNEL MODE!!!
012656 022703 000074 CMP #SPTR=4,R13 ;CHECK SUPER STACK PTR
012662 001401 BEQ ,+4
012664 000000 HLT ;ERROR! INCORRECT SSP AFTER ERROR TRAP
012666 022723 012640 CMP #T110AA,(R13)+ ;CHECK RETURN PC ON SUPER STACK
012672 001401 BEQ ,+4
012674 000000 HLT ;ERROR! RETURN PC NOT ON SUPER STACK
012676 022713 040000 CMP #SH,(R13) ;CHECK SAVED STATUS
012702 001401 BEQ ,+4
012704 000000 HLT ;ERROR! INCORRECT STATUS SAVED ON STACK

;USER MODE,000 ADDRESS
012706 010701 T1111 SCOPE
012710 012737 144000 177776 MOV #UH+REG,#MPSH ;USER MODE!!!
012716 012706 000700 MOV #UPTR,USP ;SET USER STACK PTR
012722 012737 012750 000004 MOV #T111A,#ERRVEC ;LOAD ERROR TRAP VECTOR
012730 012737 140000 000000 MOV #UH,#ERRVEC+2
012736 100567 165015 MFPO ;000 ADDRESS SHOULD TRAP
012742 000000 HLT ;KERNEL MODE!!!
012746 000000 HLT ;ERROR! FAILED TO TRAP
012750 010603 T111A1 MOV USP,R3 ;SAVE USER STACK PTR
012752 042737 140000 177776 BIC #UH,#MPSH ;KERNEL MODE!!!
012760 022703 000000 CMP #UPTR=4,R3 ;CHECK USER STACK PTR
012764 001401 BEQ ,+4
012766 000000 HLT ;ERROR! INCORRECT USER STACK POINTER
012770 022713 012740 CMP #T111AA,(R3) ;CHECK RETURN ADDRESS ON USER STACK
012774 001401 BEQ ,+4
012776 000000 HLT ;ERROR! RETURN PC NOT ON USER STACK
013000 012737 000004 000004 MOV #ERRVEC+2,#ERRVEC ;STORE ERROR TRAP TO HALT
013006 000000 CLR ERRVEC+2

;TEST THAT HTPD INSTRUCTION CAN LOAD DATA TO AN ADDRESS VIA THE STACK
;KERNEL MODE,PREVIOUS SUPER MODE
013012 010701 T1121 SCOPE
013014 012737 010000 177776 MOV #KH+PSH,#MPSH ;KERNEL MODE!!!, PREV SUPER MODE!!

```

```

013022 012706 000500 MOV #KPTR,KSP ;SET KERNEL STACK PTR
013026 012746 000000 MOV #SPTR,=(KSP)
013032 100600 MFPO ;SET SUPER STACK PTR
013034 012746 001002 MOV #TEMP,=(KSP) ;PUT ADDRESS ON THE STACK
013040 012746 177777 MOV #=-1,=(KSP) ;PUT DATA ON THE STACK
013044 000000 CLR #TEMP ;PRESET DATA
013050 100636 MFPO #-(KSP)+ ;MOVE #-1 TO TEMP
013052 022706 000500 CMP #KPTR,KSP ;CHECK STACK PTR AFTER HTPD
013056 001401 BEQ ,+4
013060 000000 HLT ;ERROR! INCORRECT STACK PTR AFTER HTPD
013062 000267 165714 INC TEMP ;CHECK THAT DATA WAS MOVED TO TEMP
013066 001401 BEQ ,+4
013070 000000 HLT ;ERROR! DATA NOT IN TEMP
013072 100506 MFPO SSP ;SET SUPER STACK PTR
013074 022710 000000 CMP #SPTR,(KSP) ;CHECK THAT SUPER STACK PTR NOT CHANGED
013100 001401 BEQ ,+4 ;BY HTPD INSTRUCTION
013102 000000 HLT ;ERROR! SSP WAS CHANGED BY HTPD INST.

;CHECK THAT HTPI CAN LOAD DATA TO AN ADDRESS VIA THE STACK
;SUPER MODE,PREV USER MODE
013104 010701 T1131 SCOPE
013106 012737 070000 177776 MOV #SH+UH,#MPSH ;SUPER MODE!!!, PREV USER MODE!!
013114 012706 000600 MOV #SPTR,SSP ;SET SUPER STACK PTR
013120 012746 000700 MOV #UPTR,=(SSP)
013124 100600 MFPO USP ;SET USER STACK PTR
013126 012746 001002 MOV #TEMP,=(SSP) ;PUT ADDRESS ON THE STACK
013132 012746 177777 MOV #=-1,=(SSP) ;PUT DATA ON THE STACK
013136 000000 CLR #TEMP ;PRESET DATA
013142 000676 MFPO #-(SSP) ;MOVE #-1 TO TEMP
013146 012737 010000 177776 MOV #PSH,#MPSH ;KERNEL MODE!!!, PREV SUPER MODE!!
013154 100506 MFPO SSP ;SET SUPER STACK PTR
013156 022726 000576 CMP #SPTR=2,(KSP)+ ;CHECK SUPER STACK PTR AFTER HTPI
013162 001401 BEQ ,+4
013164 000000 HLT ;ERROR! INCORRECT SUPER STACK PTR
013166 012737 030000 177776 MOV #UH,#MPSH ;KERNEL MODE!!!, PREV SUPER MODE!!
013174 100506 MFPO USP ;SET USER STACK PTR
013176 022726 000700 CMP #UPTR,(KSP)+ ;CHECK THAT USER STACK PTR WAS NOT CHANGED
013202 001401 BEQ ,+4
013204 000000 HLT ;ERROR! USER STACK PTR CHANGED BY HTPI
013206 000267 165714 INC TEMP ;CHECK THAT DATA WAS MOVED TO TEMP
013212 001401 BEQ ,+4
013214 000000 HLT ;ERROR! INCORRECT DATA IN TEMP AFTER HTPI

;TEST THAT HTPF CAN GET DATA FROM AN ADDRESS VIA THE STACK
;KERNEL MODE, PREV SUPER MODE
013216 010701 T1141 SCOPE
013220 012737 010000 177776 MOV #KH+PSH,#MPSH ;KERNEL MODE!!!, PREV SUPER MODE!!
013226 012706 000000 MOV #KPTR,KSP ;SET KERNEL STACK PTR
013232 012746 000600 MOV #SPTR,=(KSP)
013236 100000 MFPO SSP ;SET SUPER STACK PTR
013240 000000 CLR #-(KSP) ;PRESET DATA ON THE STACK
013244 012710 001002 MOV #TEMP,(KSP) ;PUT ADDRESS ON THE STACK
013250 012737 177777 001002 MOV #=-1,#TEMP ;LOAD DATA INTO ADDRESS
013256 000576 MFPO #-(KSP) ;MOVE TEMP TO STACK

```

```

013262 022706 000476      CMP      #KPTR=2,KSP      ICHECK STACK PTR AFTER MFP
013266 001401      BEQ      ,+4
013270 000000      HLT
013272 022716      CMP      #=1,(KSP)      IERROR: INCORRECT STACK PTR AFTER MFP
013276 001401      BEQ      ,+4      ICHECK DATA ON THE STACK
013300 000000      HLT      IERROR: INCORRECT DATA MOVED ONTO THE STACK
013302 006506      MFP      SSP      IGET SUPER STACK PTR
013304 022726 000608      CMP      #SPTR,(KSP)+   ICHECK THAT SUPER STACK PTR WAS NOT
013310 001401      BEQ      ,+4      IBY MFP
013312 000000      HLT      IERROR: INCORRECT SSP
    
```

ITEST THAT MFPD CAN GET DATA FROM AN ADDRESS VIA THE STACK

```

SUPER MODE, PREV USER MODE
T115: SCOPE
013314 010701      MOV      #SM+PUM,#PSW   I(SUPER MODE!!!, PREV USER MODE!!
013316 012737 070000 177776      MOV      #SPTR,SSP     ISET SUPER STACK PTR
013324 012706 000600      MOV      #UPTR,=(SSP)  ISET USER STACK PTR
013330 012746 000700      MTPD    USP           IPUT THE ADDRESS ON THE STACK
013334 106606      CLR      #TEMP,(SSP)+  IPRESET DATA ON THE STACK
013336 012726 001002      MOV      #=1,#TEMP    IPRESET MEMORY DATA
013342 005066 177774      MFPD    @=(SSP)       IMOVE TEMP TO THE STACK
013346 012737 177777 001002      MOV      #KM+PSM,#PSW  IKERNEL MODE!!!, PREV SUPER MODE!!
013354 106556      MFPD    SSP           IGET SUPER STACK PTR
013356 012737 010000 177776      CMP      #SPTR=2,(KSP)+ ICHECK SUPER STACK PTR AFTER MFPD
013364 106506      BEQ      ,+4
013372 001401      HLT      IERROR: INCORRECT SSP
013374 000000      MOV      #KM+PUM,#PSW  IKERNEL MODE!!!, PREV USER MODE!!
013404 106506      MFPD    USP           IGET USER STACK PTR
013406 022726 000700      CMP      #UPTR,(KSP)+  ICHECK THAT USP WAS NOT CHANGED
013412 001401      BEQ      ,+4
013414 000000      HLT      IERROR: USP CHANGED BY MFPD
013416 005237 000976      INC      #SPTR=2      ICHECK DATA ON THE SUPER STACK
013422 001401      BEQ      ,+4
013424 000000      HLT      IERROR: INCORRECT DATA ON SUPER STACK
013426 005037 177776      CLR      #PSW
013428 000000      SCOPE
    
```

ICHECK TRAP SEQUENCE WHEN SUPERVISOR STACK PTR IS ODD,
ITHE TEST TRAPS FROM USER TO SUPERVISOR AND THEN FROM SUPERVISOR TO KERNEL

```

SCOPE
013436 020702      MOV      #KPTR,KSP     ISET KERNEL STACK PTR
013442 012737 013526 000004      MOV      #T116,#ERRVEC ISET ODD ADDRESS ERROR TRAP
013450 005037 000006      CLR      #ERRVEC+2
013454 012737 013520 000000      MOV      #T116A,#IOTVEC
013462 012737 000340 000022      MOV      #SM+PRTY7,#IOTVEC+2
013470 012737 000000 177774      MOV      #SM,#PSW     I(SUPER MODE!!!
013476 012706 000601      MOV      #SPTR+1,SSP   ISET SUPER STACK PTR ODD
013502 012737 144000 177776      MOV      #UM+REG,#PSW  IUSER MODE!!!
013510 000004      IOT
013512 005037 177776      CLR      #PSW         ITRAP TO SUPERVISOR
013516 000000      HLT      IKERNEL MODE!!!
013520 005037 177776      CLR      #PSW         IERROR: IOT FAILED TO TRAP
013522 000000      I(KERNEL MODE!!!
    
```

```

013524 000000      HLT      IERROR: NO ODD ADDRESS TRAP ON ODD SUP-
013526 022706 000474      T116B: CMP      #KPTR=4,KSP   IERVISOR STACK PTR
013532 001401      BEQ      ,+4      ICHECK KERNEL STACK PTR
013534 000000      HLT      IERROR: INCORRECT KERNEL STACK PTR AFTER
013536 022716 013520      CMP      #T116A,(KSP)  IODD ADDRESS TRAP
013542 001401      BEQ      ,+4      ICHECK RETURN PC ON KERNEL STACK
013544 000000      HLT      IERROR: RETURN PC FROM ODD ADDRESS
013546 022766 070340 000002      CMP      #SM+PUM+PRTY7,2(KSP) ITRAP NOT ON KERNEL STACK
013554 001401      BEQ      ,+4      ICHECK STATUS ON STACK
013556 000000      HLT
013560 106506      MFPD    SSP           IERROR: INCORRECT STATUS ON STACK
013562 022716 000976      GMP      #SPTR=3,(KSP) IGET SUPERVISOR STACK PTR
013566 001401      BEQ      ,+4      ICHECK SUPER STACK PTR
013570 000000      HLT      IERROR: INCORRECT SUPER STACK PTR
013572 000037 177776      CLR      #PSW         I(AFTER IOT
013576 012737 000006 000004      MOV      #ERRVEC+2,#ERRVEC IKERNEL MODE!!!
013604 012737 000022 000020      MOV      #IOTVEC+2,#IOTVEC
013612 005037 000022      CLR      #IOTVEC+2

013616 005267 100156      END:   INC      ICONT      IINCREMENT PASS COUNT
013622 026727 100152 012000      CMP      ICONT,#12000  I12000 PASSES COMPLETED?
013630 001402      BEQ      DONE
013632 000167 100174      JMP      BEGIN
013636 012767 000007 163722 DONE: MOV      #7,TPB      IRING BELL
013644 105767 163714      TSTB    TPS
013650 100375      BPL     ,+4
013652 013702 000042      MOV      #442,R2
013656 001404      BEQ     QONE1
013660 004712      JSR     7,(2)
013662 000240      NOP
013664 000240      NOP
013666 000240      NOP
013670 000167 100156      JMP     DONELL
000002      END
    
```

BEGIN	071032	BIT13	022020	BIT14	040000	BIT15	100000
BIT6	000100	C	000001	DISPLA	177570	OOONE	013636
DOONE1	013670	EMPTYEC	000030	END	013010	EMPTYEC	000004
HMT	000000	ICNT	001000	IM	100000	IOVEEC	000020
KM	000000	KPTR	000500	KSP	000000	N	000010
PC	022000	PIRG	177772	PIRVEC	000240	PIR4	010000
PKM	000000	PRTY3	000140	PRTY4	000200	PRTY7	000340
PSM	010000	PSW	177776	PUM	030000	PWRUP	001022
REPTR	000730	REG	004000	R0	000000	R1	000000
R12	000000	R11	000001	R12	000002	R13	000003
R14	000004	R15	000005	R2	000002	R3	000003
R4	000004	R5	000005	SCOPE	010701	SLR	177774
SM	040000	SPTR	000600	SSP	000000	START	001012
SWR	177570	TBIT	000020	TBITVE	000014	TCMP	001002
TKB	177560	YK3	177560	TPE	177560	TPE	177564
TRVEC	000064	TRAPVE	000034	TRT	000003	TRTVEC	000014
T0	001062	T1	001114	T10	002132	T10A	002172
T10AA	002144	T100	011842	T100A	011722	T100AA	011714
T101	012012	T101A	012150	T101AA	012054	T101EX	012194
T102	012150	T103	012242	T104	012340	T104A	012366
T105	012370	T105A	012430	T106	012452	T106A	012504
T107	012524	T107A	012554	T107AA	012552	T11	002236
T11A	002300	T11AA	002300	T110	012604	T110A	012646
T110AA	012640	T111	012706	T111A	012750	T111AA	012742
T112	013012	T113	013104	T114	013210	T115	013314
T116A	013520	T116B	013526	T12	002362	T12A	002420
T12AA	002412	T13	002452	T13A	002504	T13AA	002476
T14	002544	T14A	002624	T14AA	002616	T15	002722
T15A	003000	T15AA	002772	T16	003062	T16A	003136
T16B	003142	T16C	003154	T16D	003174	T16E	003206
T16ERR	003330	T16P	003250	T16G	003302	T16X	003336
T17	003354	T17A	003410	T17B	003422	T17C	003442
T17D	003500	T17C	003522	T17ERR	003622	T177	003542
T17G	003574	T17X	003630	T2	001146	T20	003646
T20A	003764	T20AA	003702	T21	003770	T22	004052
T23	004134	T24	004240	T25	004326	T26	004410
T27	004806	T3	001236	T30	004400	T31	004076
T31A	004722	T32P	005000	T32C	005100	T32T	005100
T32A	005242	T33	005312	T34	005364	T35	005422
T36	005462	T36A	005520	T36AA	005516	T37	005542
T37A	005622	T37AA	005614	T4	001314	T4A	001302
T4AA	001354	T4B	005642	T40A	005742	T40AA	005734
T41	004022	T41A	006070	T41B	006110	T41BB	006146
T42	006070	T42A	006250	T43	006370	T43A	006450
T43B	006304	T43BB	006346	T44	006516	T45	006604
T46	006670	T47	006772	T5	001474	T51	001540
T5AA	001532	T50	007102	T51	007202	T52	007300
T53	007402	T54	007520	T55	007636	T55A	007712
T55AA	007710	T56	007754	T56A	010030	T56AA	010026
T57	010106	T57A	010212	T57AA	010142	T57EX	010216
T6	001046	T6A	001720	T6AA	001712	T60	010220
T61	010246	T62	010312	T63	010352	T64	010436
T65	010348	T66	010630	T67	010656	T7	002022
T7A	002062	T7AA	002054	T78	010722	T7I	010760

T72	011046	T73	011142	T74	011232	T75	011262
T76	011370	T77	011510	UBREAK	177770	UM	140000
JPTR	000700	USP	000000	V	000002	VELPTR	001002
Z	000004		013674				

ERRORS DETECTED: 0

*AINDEC-11-DCKBO-A PROCESSER STATES TEST
DCKBOA

MACY11,610 6-MAR-72 2111I PAGE 41

*DCKBOA,DCKBOA/SOL-DCKBOA
RUN-TIME: 11 19 0 SECONDS
CORE USED: 3K