

PDP11/45

STATES 11/45

MD-11-DCKBO-A

EP DCKBO A-DL A

OCT 1976

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FICHE 1 OF 1

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MAINDEC-11-DCKBO-A PROCESSOR STATES TEST
DCKBOA.P11

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IDENTIFICATION

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

PRODUCT NAME: 11/45 STATES TEST

DATE CREATED: 15 MAR 1972

MAINTAINER: DIAGNOSTIC GROUP

AUTHOR: JOHN ADAMS

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MAYNARD, MASS

11/45 STATES TEST
DCKBOA.P11

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- 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 MFPD/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
DORA THRU DORA
- 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.

000006
000000
010701
000003
000140
000200
000340

USP=26
HLT=HALT
SCOPE=010701
TRT=3
PTY3=140
PTY4=200
PTY7=340

;USER STACK POINTER
;MOVE PC TO R1
;TRACE TRAP...

000004
000030
000034
000020
000014
000014
000064
000240

;VECTOR ADDRESSES
ERRVEC=4
EMTVEC=30
TRAPVEC=34
IOTVEC=20
TBITVEC=14
TRTVEC=14
TPVEC=64
PIRVEC=240

;ADDRESS OF ERROR VECTOR
;ADDRESS OF EMT VECTOR
;ADDRESS OF TRAP VECTOR
;ADDRESS OF IOT VECTOR
;ADDRESS OF 'T' BIT TRAP VECTOR
;ADDRESS OF 'TRACE' TRAP
;ADDRESS OF TTY PRINTER INTERRUPT VECTOR
;ADDRESS OF PIRG VECTOR

177776
177774
177772
177770
177560
177562
177564
177566
177570
177570

;HARDWARE REGISTER ASSIGNMENTS
PSW=177776
SLR=177774
PIRQ=177772
UBREAK=177770
TKS=177560
TKB=177562
TPS=177564
TPB=177566
SMR=177570
DISPLAY=177570

;ADDRESS OF STATUS REGISTER
;ADDRESS OF STACK LIMIT REGISTER
;ADDRESS OF PROGRAM INTERRUPT REQUEST
;ADDRESS OF MICRO BREAK REGISTER
;ADDRESS OF KEYBOARD CSR
;ADDRESS OF KEYBOARD BUFFER
;ADDRESS OF TELEPRINTER CSR
;ADDRESS OF TELEPRINTER BUFFER
;ADDRESS OF CONSOL SWITCH REGISTER
;ADDRESS OF CONSOL DISPLAY REGISTER

000500
000600
000700
001000
000736

;INITIAL STACK POINTER SETTINGS
KPTR=500
SPTR=600
LPTTR=700
YELPTR=1000
REDPTR=736

;KERNEL INITIAL STACK POINTER VALUE
;SUPERVISOR INITIAL STACK POINTER VALUE
;USER INITIAL STACK POINTER VALUE
;STACK POINTER VALUE FOR 'YELLOW' OVFLW
;STACK POINTER VALUE FOR 'RED' OVFLW

100000
040000
020000
000100

;MISC. BIT ASSIGNMENTS
BIT15=100000
BIT14=40000
BIT13=20000
BIT6=100

140000
100000
040000
000000
030000
010000
000000
004000
000020
000001
000002
000004
000010

;STATUS REGISTER BIT ASSIGNMENTS
UM=140000
SM=100000
SM=040000
KM=0
PUM=030000
PSM=010000
PKM=0
REG=004000
TBIT=20
C=1
V=2
Z=4
N=10

;USER MODE
;ILLEGAL MODE
;SUPERVISOR MODE
;KERNEL MODE
;PREVIOUS USER MODE
;PREVIOUS SUPERVISOR MODE
;PREVIOUS KERNEL MODE
;REGISTER BIT
;'T' BIT IN PSW
;'C' BIT IN PSW
;'V' BIT IN PSW
;'Z' BIT IN PSW
;'N' BIT IN PS

	010000		PIR4=10000		;LEVEL 4 REQUEST IN PIR4
	000000		. = 0		
000200	000200	000606	. = 200		
	000167		JMP	START	;GO START
	001000		. = 1000		
			;TAGS		
001000	000000		ICNT: 0		;CONTAINS PASS COUNT
001002	000000		TEMP: 0		
	001012		. = . + 6		

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001012 012706 000500 START: MOV 8KPTR,KSP
001016 005067 177756 CLR ICNT
:TEST THAT PROCESSOR POWERED UP OK FOR THE TEST
001022 032737 174000 177776 PMRUP: BIT 8UM+PUM+REG,8PSW ;IS STATUS CORRECT
001030 001377 BNE . ;LOOP HERE IF NOT

001032 012706 000500 BEGIN: MOV 8KPTR,KSP ;INITIALIZE THE STACK POINTER
001036 016737 177736 177570 MOV ICNT,8DISP ;DISPLAY PASS COUNT IN LIGHT REGISTER
001044 032737 000400 177570 BIT 8400,8SMR ;LOAD MICRO BREAK REGISTER
001052 001403 BEQ +10
001054 113737 177570 177770 MOVB 8SMR,8SUBREAK ;LOAD MICRO BREAK REG WITH SRO-7

;CHECK THAT THE SPL INSTRUCTION IS A 'NOP' IN SUPERVISORY/USER MODE.
;SUPERVISORY MODE.
001062 010701 TD: SCOPE
001064 012737 040340 177776 MOV 8SM+PRTY7,8PSW ;SUPERVISORY MODE, PRIORITY LEVEL 7
001072 000230 SPL 0 ;TRY TO SET PRIORITY LEVEL =0
001074 013700 177776 MOV 8PSW,R0 ;GET PSM
001100 005037 177776 CLR 8PSW
001104 022700 040340 CMP 8SM+PRTY7,R0
001110 001401 BEQ +4
001112 000000 HLT ;ERROR! INCORRECT STATUS AFTER SPL

;USER MODE
001114 010701 †1: SCOPE
001116 012737 140000 177776 MOV 8UM,8PSW ;USER MODE, PRIORITY LEVEL 0
001124 000237 SPL 7 ;TRY TO SET PRIORITY LEVEL 7
001126 013700 177776 MOV 8PSW,R0 ;GET PSM
001132 005037 177776 CLR 8PSW ;KERNEL MODE!!!
001136 022700 140000 CMP 8UM,R0 ;TEST THAT SPL DID NOT ALTER PSM
001142 001401 BEQ +4
001144 000000 HLT ;ERROR! SPL CHANGED STATUS WORD

;CHECK THAT RESET IS A 'NOP' IN SUPERVISORY/USER MODE
;SUPERVISORY MODE
001146 010701 †2: SCOPE
001150 012737 070340 177776 MOV 8SM+PUM+PRTY7,8PSW ;PRESET STATUS
001156 052767 000100 176374 BIS 8BIT6,TKS ;SET IE BIT IN TKS
001164 000005 RESET ;RESET
001166 013700 177776 MOV 8PSW,R0 ;GET STATUS WORD
001172 016702 176352 MOV TKS,R2 ;GET TKS
001176 005037 177776 CLR 8PSW ;KERNEL MODE !!!
001202 005067 176352 CLR TKS ;CLEAR IE BIT
001206 022700 070340 CMP 8SM+PUM+PRTY7,R0 ;TEST THAT STATUS DID NOT CHANGE
001212 001401 BEQ +4
001214 000000 HLT ;ERROR! STATUS CHANGED BY RESET
001216 032702 000100 BIT 8BIT6,R2 ;TEST THAT IE BIT DID NOT CLEAR
001222 001001 BNE +4
001224 000000 HLT ;ERROR! RESET CLEARED IE BIT IN TKS

;USER MODE
001226 010701 †3: SCOPE
001230 012737 154340 177776 MOV 8UM+PSM+REG+PRTY7,8PSW ;PRESET STATUS
001236 052767 000100 176314 BIS 8BIT6,TKS ;SET IE BIT IN TKS
001244 000005 RESET ;RESET

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001246 013700 177776      MOV      2@PSW,R10      ;GET STATUS WORD
001252 016702 176302      MOV      TKS,R12      ;GET TKS
001256 005067 176276      CLR      TKS          ;CLEAR IE BIT
001262 042737 140000 177776 BIC      8UM,2@PSW     ;KERNEL MODE!!!
001270 022700 154340      CMP      8UM+PSW+REG+PRTY7,R10 ;CHECK STATUS AFTER RESET
001274 001401      BEQ      .+4
001276 000000      HLT
001300 032702 000100      BIT      8BIT6,R12    ;ERROR! INCORRECT STATUS AFTER RESET
001304 001001      BNE      .+4          ;CHECK IE BIT AFTER RESET
001306 000000      HLT
001310 005037 177776      CLR      2@PSW        ;ERROR! IE BIT WAS CLEARED BY RESET

:TEST A TRAP FROM SUPERVISOR TO KERNEL MODE
T4:  SCOPE
001314 010701      MOV      8KPTR,KSP    ;SET KERNEL STACK POINTER
001316 012706 000500      MOV      8T4A,TRAPVEC
001322 012767 001362 176504      MOV      8PRTY7+17,TRAPVEC+2
001330 012767 000357 176500      MOV      8SM,2@PSW    ;SUPERVISORY MODE!!!
001336 012737 040000 177776      MOV      8SPTR,SSP    ;SET SUPERVISORS STACK POINTER
001344 012706 000600      CCC      ;CLEAR CONDITION CODES
001352 104400      TRAP
001354 005037 177776      T4AA:  CLR      2@PSW
001360 000000      HLT      ;ERROR! DID NOT TRAP
001362 013700 177776      T4A:   MOV      2@PSW,R0
001366 005037 177776      CLR      2@PSW
001372 022700 010357      CMP      8KM+PSW+PRTY7+17,R0 ;IS NEW STATUS CORRECT?
001376 001401      BEQ      .+4
001400 000000      HLT      ;ERROR! INCORRECT NEW STATUS
001402 022767 001354 177064      CMP      8T4AA,KPTR-4 ;WAS RETURN ADDRESS SAVED ON KERNEL'S
001410 001401      BEQ      .+4          ;STACK?
001412 000000      HLT
001414 022767 040000 177054      CMP      8SM,KPTR-2   ;WAS OLD STATUS SAVED ON KERNEL'S
001422 001401      BEQ      .+4          ;STACK?
001424 000000      HLT
001426 022706 000474      CMP      8KPTR-4,KSP
001432 001401      BEQ      .+4
001434 000000      HLT
001436 012737 040000 177776      MOV      8SM,2@PSW    ;ENTER SUPERVISORY MODE TO GET
001444 010600      MOV      SSP,R0      ;SUPERVISOR STACK POINTER
001446 005037 177776      CLR      2@PSW
001452 022700 000600      CMP      8SPTR,R0
001456 001401      BEQ      .+4
001460 000000      HLT
001462 012767 000036 176344      MOV      8TRAPVEC+2,TRAPVEC
001470 005067 176342      CLR      TRAPVEC+2

:TEST TRAP FROM USER MODE TO KERNEL MODE
T5:  SCOPE
001474 010701      MOV      8KPTR,KSP    ;SET KERNEL STACK PTR
001476 012706 000500      MOV      8T5A,2@IOTVEC ;SET IOT TRAP VECTOR
001502 012737 001540 000020      CLR      IOTVEC+2    ;KERNEL MODE AFTER IOT
001510 005067 176306      MOV      8UM+PSW+PRTY7,2@PSW ;USER MODE!!!
001514 012737 150340 177776      MOV      8UPTR,USP    ;SET USER STACK PTR
001522 012706 000700      SCC      ;PRESET CONDITION CODES
001526 000277      IOT      ;TRAP USER MODE TO KERNEL MODE
001530 000004      IOT
001532 005037 177776      T5AA:  CLR      2@PSW    ;KERNEL MODE!!!

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:TEST TRAP FROM USER TO USER MODE
↑7: SCOPE
002022 010701                                MOV      @T7A,@TRTVEC ;SET TRACE TRAP VECTOR
002024 012737 002062 000014                MOV      @UM+REG,@TRTVEC+2 ;USER MODE AFTER TRAP
002032 012737 140000 000016                MOV      @UM,@PSW ;USER MODE!!!
002040 012737 140000 177776                MOV      @UPTR,USP ;SET USER STACK PTR
002046 012706 000700                        TRT      ;TRACE TRAP
002052 000003                                HLT      ;KERNEL MODE!!!
002054 005037 177776                        T7AA:   CLR      @PSW ;ERROR! TRT FAILED TO TRAP
002060 000000                                HLT      ;SAVE STATUS AFTER TRAP
002062 013700 177776                        T7A:   MOV      @PSW,R10
002066 010602                                MOV      USP,R12 ;SAVE USER STACK PTR
002070 042737 140000 177776                BIC      @UM,@PSW ;KERNEL MODE!!!
002076 022767 002054 176570                CMP      @T7AA,UPTR-4 ;CHECK RETURN PC ON USER STACK
002104 001401                                BEQ      .+4
002106 000000                                HLT      ;ERROR! INCORRECT RETURN PC ON USER STACK
002110 022700 174000                        CMP      @UM+PUM+REG,R10 ;CHECK STATUS AFTER TRT TRAP
002114 001401                                BEQ      .+4
002116 000000                                HLT      ;ERROR! INCORRECT STATUS AFTER TRT TRAP
002120 012767 000016 175666                MOV      @TRTVEC+2,TRTVEC
002126 005067 175664                        CLR

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:TEST TRAP SEQUENCE FROM SUPERVISOR TO SUPERVISOR
↑10: SCOPE
002132 010701                                MOV      @T10A,@EMTVEC ;SET EMT TRAP VECTOR
002134 012737 002172 000030                MOV      @SM,@EMTVEC+2 ;SUPER MODE AFTER EMT
002142 012737 040000 000032                MOV      @SM,@PSW ;SUPER MODE!!!
002150 012737 040000 177776                MOV      @SPTR,SSP ;SET SUPER STACK PTR
002156 012706 000600                        EMT+377 ;TRAP SUPER TO SUPER
002162 104377                                CLR      @PSW ;KERNEL MODE!!!
002164 005037 177776                        T10AA:  HLT      ;ERROR! EMT FAILED TO TRAP
002170 000000                                HLT      ;SAVE STATUS AFTER EMT TRAP
002172 013700 177776                        T10A:  MOV      @PSW,R0
002176 005037 177776                        CLR      @PSW ;KERNEL MODE!!!
002202 022767 002164 176364                CMP      @T10AA,SPTR-4 ;CHECK RETURN PC ON SUPER STACK
002210 001401                                BEQ      .+4
002212 000000                                HLT      ;ERROR! INCORRECT RETURN PC ON SUPER STACK AFTER TRAP
002214 022700 050000                        CMP      @SM+PSW,R0 ;CHECK STATUS AFTER TRAP
002220 001401                                BEQ      .+4
002222 000000                                HLT      ;ERROR! INCORRECT STATUS AFTER TRAP
002224 012737 000032 000030                MOV      @EMTVEC+2,@EMTVEC
002232 005037 000032                        CLR

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:TEST TRAP SEQUENCE SUPERVISOR TO USER
↑11: SCOPE
002236 010701                                MOV      @T11A,TRAPVEC ;SET TARP TRAP VECTOR
002240 012767 002306 175566                MOV      @UM,TRAPVEC+2 ;USER MODE AFTER TARP
002246 012767 140000 175562                MOV      @UM,@PSW ;USER MODE
002254 012737 140000 177776                MOV      @UPTR,USP ;SET USER STACK PTR
002262 012706 000700                        MOV      @SM,@PSW ;SUPERVISORY MODE!!!
002266 012737 040000 177776                SCC      ;PRE SET CONDITION CODES
002274 000277                                TRAP+377 ;TRAP SUPER TO USER
002276 104777                                CLR      @PSW ;KERNEL MODE!!!
002300 005037 177776                        T11AA:  HLT      ;ERROR! TRAP FAILED TO TRAP
002304 000000                                HLT      ;SAVE STATUS AFTER TRAP
002306 013700 177776                        T11A:  MOV      @PSW,R0
002312 010602                                MOV      USP,R2 ;SAVE USER STACK PTR
002314 005037 177776                        CLR      @PSW ;KERNEL MODE!!!
002320 022722 002300                        CMP      @T11A,(R2)+ ;CHECK RETURN PC ON USER STACK

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002324 001401 BEQ .+4
002326 000000 HLT ;ERROR! INCORRECT RETURN PC ON USER STACK
002330 022712 040017 CMP #SM+17,(R2) ;CHECK SAVED STATUS
002334 001401 BEQ .+4
002336 000000 HLT ;ERROR! SAVED STATUS ON USER STACK INCORRECT
002340 022700 150000 CMP #UM+PSM,RO ;CHECK STATUS AFTER TRAP
002344 001401 BEQ .+4
002346 000000 HLT ;ERROR! STATUS AFTER TRAP INCORRECT
002350 012767 000036 175456 MOV #TRAPVEC+2,TRAPVEC
002356 005067 175454 CLR TRAPVEC+2

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:TEST THAT THE 'HALT' INSTRUCTION CAUSES A TRAP TO LOCATION 4 IN
:SUPERVISORY MODE.

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002362 010701 T12: SCOPE
002364 012737 002420 000004 MOV #T12A,#ERRVEC ;SET ERROR TRAP VECTOR
002372 005067 175410 CLR ERRVEC+2 ;KERNEL MODE ON TRAP
002376 012706 000500 MOV #KPTR,KSP ;SET KERNEL STACK PTR
002402 012737 040000 177776 MOV #SM,#PSW ;SUPER MODE!!!
002410 000000 HLT ;HALT TRAPS IN SUPERVISORY MODE
002412 005037 177776 T12AA: CLR #PSW ;KERNEL MODE!!!
002416 000000 HLT ;ERROR! HALT DID NOT TRAP
002420 013700 177776 T12A: MOV #PSW,RO ;SAVE STATUS AFTER TRAP
002424 005037 177776 CLR #PSW ;KERNEL MODE!!!
002430 022700 010000 CMP #KM+PSM,RO ;CHECK STATUS AFTER TRAP
002434 001401 BEQ .+4
002436 000000 HLT ;ERROR! INCORRECT STATUS AFTER TRAP
002440 022767 002412 176026 CMP #T12AA,KPTR-4 ;CHECK RETURN PC
002446 001401 BEQ .+4
002450 000000 HLT ;ERROR! INCORRECT RETURN PC ON KERNEL STACK

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:USER MODE

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002452 010701 T13: SCOPE
002454 012737 002504 000004 MOV #T13A,#ERRVEC ;SET ERROR TRAP VECTOR
002462 012706 000500 MOV #KPTR,KSP ;SET KERNEL STACK PTR
002466 012737 140000 177776 MOV #UM,#PSW ;USER MODE!!!
002474 000000 HLT ;HALT TRAP TO 4 IN USER MODE
002476 005037 177776 T13AA: CLR #PSW
002502 000000 HLT
002504 013700 177776 T13A: MOV #PSW,RO
002510 005037 177776 CLR #PSW
002514 022700 030000 CMP #KM+PUM,RO
002520 001401 BEQ .+4
002522 000000 HLT
002524 022767 002476 175742 CMP #T13AA,KPTR-4
002532 001401 BEQ .+4
002534 000000 HLT
002536 012737 000006 000004 MOV #ERRVEC+2,#ERRVEC

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:TEST INTERRUPT SEQUENCE SUPERVISOR TO KERNEL MODE

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002544 010701 T14: SCOPE
002546 000237 SPL 7 ;SET PROCESSOR PRIORITY LEVEL 7
002550 012767 002624 175306 MOV #T14A,TPVEC ;LOAD TELEPRINTER
002556 012767 004200 175302 MOV #REG+PTY4,TPVEC+2 ;VECTOR ADDRESSES
002564 012706 000500 MOV #KPTR,KSP ;SET KERNEL STACK
002570 052737 070000 177776 BIS #SM+PUM,#PSW ;SUPERVISORY MODE,PREVIOUS USER MODE
002576 012706 000600 MOV #SPTR,SSP

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002602 052737 000100 177564      BIS      @BIT6,@@TPS      ;SET IE BIT IN TELEPRINTER
002610 042737 000340 177776      BIC      @PTY7,@@PSW    ;ALLOW INTERRUPT
002616 005037 177776      CLR      @@PSW          ;KERNEL MODE
002622 000000      HLT                               ;ERROR NO INTERRUPT
002624 013700 177776      T14AA:  MOV      @@PSW,R10
002630 042737 140000 177776      BIC      @UM,@@PSW
002636 042737 000100 177564      BIC      @BIT6,@@TPS    ;CLEAR IE BIT IN TELEPRINTER
002644 022700 014200      CMP      @KM+@PSM+@REG+@PTY4,R10 ;CHECK 'NEW' STATUS
002650 001401      BEQ      .+4
002652 000000      HLT                               ;ERROR! 'NEW' STATUS IS INCORRECT
002654 022706 000474      CMP      @KPTR-4,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+@UM,KPTR-2
002704 001401      BEQ      .+4
002706 000000      HLT
002710 012767 000066 175146      MOV      @TPVEC+2,TPVEC
002716 005067 175144      CLR      TPVEC+2

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:TEST INTERRUPT SEQUENCE USER TO KERNEL MODE
T15: SCOPE
002722 010701      MOV      @KPTR,KSP      ;SET KERNEL STACK POINTER
002724 012706 000500      MOV      @UM+@UM+@PTY7,@@PSW ;USER MODE!!!
002730 012737 170340 177776      MOV      @T15A,@@PIRVEC ;LOAD PROGRAM INTERRUPT RQST VEC.
002736 012737 003000 000240      MOV      @KM+@PSM+@PTY4,@@PIRVEC+2
002744 012737 010200 000242      MOV      @UPTR,USP      ;SET USER STACK POINTER
002752 012706 000700      BIC      @PTY4,@@PSW    ;SET PRIORITY LEVEL=3
002756 042737 000200 177776      MOV      @PIR4,@@PIRQ  ;REQUEST AN INTERRUPT AT LEVEL 4
002764 012737 010000 177772      T15AA:  CLR      @@PSW    ;KERNEL MODE!!!
002772 005037 177776      HLT                               ;ERROR! NO INTERRUPT REQUEST
002776 000000      T15A:  MOV      @@PSW,R0    ;GET 'NEW' PSW
003000 013700 177776      CLR      PIRQ           ;DISABLE REQUEST
003004 005067 174762      CLR      @@PSW
003010 005037 177776      CMP      @KM+@UM+@PTY4,R0 ;TEST THAT 'NEW' PSW IS CORRECT
003014 022700 030200      BEQ      .+4            ;(@@PIRVEC+2)
003020 001401      HLT                               ;ERROR! 'NEW' PSW NOT = TO (@@PIRVEC+2)
003022 000000      CMP      @T15AA,KPTR-4 ;IS RETURN ADDRESS ON KERNEL STACK
003024 022767 002772 175442      BEQ      .+4
003032 001401      HLT                               ;ERROR! RETURN ADDRESS NOT ON KERNEL STACK
003034 000000      CMP      @UM+@UM+@PTY3,KPTR-2 ;TEST THAT 'OLD' PSW WAS SAVED ON
003036 022767 170140 175432      BEQ      .+4            ;KERNEL STACK
003044 001401      HLT                               ;ERROR!
003046 000000      MOV      @PIRVEC+2,@@PIRVEC
003050 012737 000242 000240      CLR      @@PIRVEC+2
003056 005037 000242

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:TEST THAT THERE IS NO STACK OVERFLOW IN SUPERVISORY MODE.
T16: SCOPE
003062 010701      MOV      @1000,@@SLR    ;SET STACK LIMIT=1400
003064 012737 001000 177774      MOV      @SM+@UM,@@PSW ;SUPERVISORY MODE
003072 012737 070000 177776      MOV      @SPTR,SSP     ;SET SUPERVISOR STACK
003100 012706 000600      MOV      @125252,(SSP) ;PRE SET STACK
003104 012716 125252      MOV      @T16G,@@EMTVEC
003110 012737 003302 000030      MOV      @SM,@@EMTVEC+2 ;ENTER SUPERVISORY MODE ON EMT
003116 012737 040000 000032

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003506 012702 003522      MOV      #T17E,R12      ;SET UP RETURN FOR RTS
003512 000202      RTS      R12          ;GO TO T16E
003514 052767 004000 175260  T17E:    BIS      #4000,TEMP    ;SET INDICATOR TO SHOW ERROR
003522 052767 000020 175252      BIS      #20,TEMP
003530 004567 000006      JSR      R15,T17F
003534 052767 010000 175240  T17F:    BIS      #10000,TEMP   ;SET ERROR INDICATOR BIT
003542 052767 000040 175232      BIS      #40,TEMP
003550 012767 003574 174256  T17G:    MOV      #T17G,TRAPVEC ;SET UP TRAP VECTOR FOR TRAP
003556 012767 144000 174252      MOV      #UM+REG,TRAPVEC+2
003564 104400      TRAP
003566 052767 020000 175206  T17G:    BIS      #20000,TEMP
003574 052767 000100 175200      BIS      #100,TEMP
003602 005037 177776      CLR      @#PSW        ;KERNEL MODE!!!
003606 022767 000177 175166      CMP      #177,TEMP
003614 001401      BEQ     .+4
003616 000000      HLT
003620 000403      BR      T17X
003622 005037 177776  T17ERR: CLR      @#PSW
003626 000000      HLT          ;ERROR! OVERFLOW OCCURED
003630 005037 177774  T17X:   CLR      @#SLR
003634 012767 000036 174172      MOV      #TRAPVEC+2,TRAPVEC
003642 005067 174170      CLR      TRAPVEC+2

;TEST TRAP & RETURN SUPERVISOR-KERNEL-SUPERVISOR
003646 010701      T20:    SCOPE
003650 012706 000500      MOV      #KPTR,KSP
003654 012737 004000 000022      MOV      #REG,@#IOTVEC+2
003662 012737 003764 000020      MOV      #T20A,@#IOTVEC
003670 012737 044200 177776      MOV      #SM+REG+PTY4,@#PSW
003676 005000      CLR      R10
003700 000004      IOT
003702 013767 177776 175072  T20AA:  MOV      @#PSW,TEMP    ;GET RETURN STATUS FROM IOT TRAP
003710 042737 140000 177776      BIC      #UM,@#PSW    ;KERNEL MODE!!!
003716 022767 003702 174550      CMP      #T20AA,KPTR-4 ;CHECK THAT RETURN ADDRESS WAS
003724 001401      BEQ     .+4          ;SAVED ON KERNEL STACK ON IOT TRAP
003726 000000      HLT          ;ERROR!
003730 022767 044204 174540      CMP      #SM+REG+PTY4+Z,KPTR-2 ;CHECK THAT STATUS WAS SAVED
003736 001401      BEQ     .+4          ;CORRECTLY ON KERNEL STACK
003740 000000      HLT          ;ERROR! INCORRECT STATUS SAVED
003742 022767 044204 175032      CMP      #SM+REG+PTY4+Z,TEMP ;CHECK STATUS RETURNED BY RTT
003750 001401      BEQ     .+4
003752 000000      HLT          ;ERROR
003754 005200      INC     R10          ;CHECK 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  T20A:  COM     R10
003766 000006      RTT

;TEST THAT MTPD/I POPS WORD OFF THE THE APPROPRIATE STACK (AS
;DETERMINED BY BITS 15&14 IN PSW.)
;MTPD, KERNEL MODE
003770 010701      T21:    SCOPE
003772 005037 177776      CLR      @#PSW
003776 012706 000500      MOV      #KPTR,KSP    ;SET KERNEL STACK POINTER
004002 012700 177777      MOV      #-1,R0      ;PRE-SET R0

```

004006	005016			CLR	(KSP)	:PUT 0 ON THE STACK
004010	012737	010011	177776	MOV	#PSW+N+C, @PSW	:PRE SET STATUS
004016	106600			MTPD	R0	:R0+(KSP)+
004020	013702	177776		MOV	@PSW, R2	:GET STATUS
004024	022702	010005		CMP	#PSW+Z+C, R2	:CHECK STATUS AFTER MTPD
004030	001401			BEQ	.+4	
004032	000000			HLT		:ERROR! INCORRECT STATUS
004034	022706	000502		CMP	#KPTR+2, KSP	:DID KSP INCREMENT BY 2
004040	001401			BEQ	.+4	
004042	000000			HLT		:ERROR! KSP DID NOT POP
004044	005700			TST	R0	:DID WORD ON STACK (0) GET TO R0?
004046	001401			BEQ	.+4	
004050	000000			HLT		:ERROR! MTPD DID NOT POP 0 OFF :KSP INTO R0

:MTP1, KERNEL MODE

004052	010701			t22:	SCOPE	
004054	005037	177776		CLR	@PSW	:KERNEL MODE!!!
004060	012706	000500		MOV	#KPTR, KSP	:SET KERNEL STACK PTR
004064	005002			CLR	R2	:PRESET R2
004066	012716	177777		MOV	0-1, (KSP)	:PRESET DATA ON THE STACK
004072	012737	030006	177776	MOV	#PUM+Z+V, @PSW	:PRESET STATUS
004100	006602			MTP1	R2	:R2+(KSP)+
004102	013700	177776		MOV	@PSW, R0	:GET STATUS
004106	022700	030010		CMP	#PUM+N, R0	:CHECK STATUS
004112	001401			BEQ	.+4	
004114	000000			HLT		:ERROR! INCORRECT STATUS
004116	022706	000502		CMP	#KPTR+2, KSP	:CHECK STACK PTR AFTER MTP1
004122	001401			BEQ	.+4	
004124	000000			HLT		:ERROR! INCORRECT STACK PTR
004126	005202			INC	R2	:CHECK THAT MTP1 MOVED DATA
004130	001401			BEQ	.+4	:FROM STACK TO R2
004132	000000			HLT		:ERROR!

:MTPD, SUPERVISORY MODE

004134	010701			t23:	SCOPE	
004136	005003			CLR	R3	:PRESET R3
004140	012737	044000	177776	MOV	#SM+REG, @PSW	:SUPER MODE!!!
004146	012706	000600		MOV	#SPTR, SSP	:SET SUPER STACK PTR
004152	052716	177777		BIS	0-1, (SSP)	:PRESET DATA ON SUPER STACK
004156	005003			CLR	R13	:PRESET R13
004160	000261			SEC		:SET 'C'
004162	106603			MTPD	R13	:R13+(SSP)+
004164	013700	177776		MOV	@PSW, R10	:SAVE STATUS
004170	010602			MOV	SSP, R12	:SAVE SUPER STACK POINTER
004172	042737	140000	177776	BIC	#UM, @PSW	:KERNEL MODE!!!
004200	022700	044011		CMP	#SM+REG+N+C, R10	:CHECK STATUS RESULT
004204	001401			BEQ	.+4	
004206	000000			HLT		:ERROR! INCORRECT STATUS AFTER MTPD
004210	022702	000602		CMP	#SPTR+2, R12	:CHECK SUPER STACK POINTER
004214	001401			BEQ	.+4	
004216	000000			HLT		:ERROR! INCORRECT SUPER STACK POINTER
004220	005203			INC	R13	:CHECK RESULT OF MTPD
004222	001401			BEQ	.+4	
004224	000000			HLT		:ERROR! MTPD FAILED TO LOAD R13

```

004226 005037 177776          CLR      J@PSW          ;KERNEL MODE!!!, R0-R5
004232 005703                TST      R3            ;CHECK THAT R3 WAS NOT CHANGED
004234 001401                BEQ      .+4
004236 000000                HLT
                                ;ERROR! MTPD CHANGED INCORRECT REGISTER

                                ;MTPD, SUPERVISORY MODE
004240 010701                t24: SCOPE
004242 012737 070000 177776    MOV      @SM+PUM, J@PSW ;SUPER MODE!!!, PREV USER MODE!!
004250 012706 000600                MOV      @SPTR, SSP    ;SET SUPER STACK PTR
004254 005016                CLR      (SSP)         ;PRESET DATA ON SUPER STACK
004256 012704 177777                MOV      @-1, R4       ;PRESET R4
004262 000262                SEV
004264 006604                MTPD      R4           ;SET 'V'
004266 013700 177776                MOV      J@PSW, R0     ;R4+(SSP)+
004272 010602                MOV      SSP, R2       ;SAVE STATUS
004274 005037 177776                CLR      J@PSW        ;SAVE SUPER STACK PTR
004300 022700 070004                CMP      @SM+PUM+2, R0 ;KERNEL MODE!!!
004304 001401                BEQ      .+4           ;CHECK STATUS AFTER MTPD
004306 000000                HLT
004310 022702 000602                CMP      @SPTR+2, R2  ;ERROR! INCORRECT STATUS AFTER MTPD
004314 001401                BEQ      .+4           ;CHECK SUPER STACK PTR AFTER MTPD
004316 000000                HLT
004320 005704                TST      R4            ;ERROR! INCORRECT SUPER STACK PTR AFTER MTPD
004322 001401                BEQ      .+4           ;CHECK THAT DATA WAS MOVED
004324 000000                HLT                    ;FROM SUPER STACK TO R4
                                ;ERROR! MTPD FAILED TO MOVE DATA TO R4

                                ;MTPD, USER MODE
004326 010701                t25: SCOPE
004330 012737 150000 177776    MOV      @UM+PSM, J@PSW ;USER MODE!!!
004336 012706 000700                MOV      @UPTR, USP    ;SET USER STACK PTR
004342 052716 177777                BIS      @-1, (USP)   ;PRESET DATA ON USER STACK
004346 000261                SEC
004350 042705 177777                BIC      @-1, RS      ;SET 'C'
004354 106605                MTPD      RS          ;PRESET RS
004356 013700 177776                MOV      J@PSW, R0     ;RS+(USP)+
004362 010602                MOV      USP, R2       ;SAVE STATUS AFTER MTPD
004364 005037 177776                CLR      J@PSW        ;SAVE USER STACK PTR
004370 022700 150011                CMP      @UM+PSM+H+C, R0 ;KERNEL MODE!!!
004374 001401                BEQ      .+4           ;CHECK STATUS AFTER MTPD
004376 000000                HLT
004400 022702 000702                CMP      @UPTR+2, R2  ;ERROR! INCORRECT STATUS AFTER MTPD
004404 001401                BEQ      .+4           ;CHECK USER STACK PTR AFTER MTPD
004406 000000                HLT
004410 005205                INC      RS            ;ERROR! INCORRECT USP AFTER MTPD
004412 001401                BEQ      .+4           ;CHECK THAT MTPD MOVED DATA FROM
004414 000000                HLT                    ;USER STACK TO RS
                                ;ERROR! MTPD FAILED

                                ;MTPD, USER MODE
004416 010701                t26: SCOPE
004420 012737 140000 177776    MOV      @UM, J@PSW   ;USER MODE!!!
004426 012706 000700                MOV      @UPTR, USP   ;SET USER STACK PTR
004432 042716 177777                BIC      @-1, (USP)   ;PRESET DATA ON USER STACK
004436 052700 177777                BIS      @-1, R0      ;PRESET R0
004442 000257                CCC
004444 006600                MTPD      R0          ;PRESET STATUS (ALL CC'S=0)
                                ;R0+(USP)+

```

004446 013702 177776
 004452 010603
 004454 005037 177776
 004460 022702 140004
 004464 001401
 004466 000000
 004470 022703 000702
 004474 001401
 004476 000000
 004500 005700
 004502 001401
 004504 000000

MOV 2@PSW,R2
 MOV USP,R3
 CLR 2@PSW
 CMP 2@UM+2,R2
 BEQ .+4
 HLT
 CMP 2@UPTR+2,R3
 BEQ .+4
 HLT
 TST R0
 BEQ .+4
 HLT

:SAVE STATUS AFTER MTP1
 :SAVE USP AFTER MTP1
 :KERNEL MODE!!!
 :CHECK STATUS AFTER MTP1
 :ERROR! INCORRECT STATUS AFTER MTP1
 :CHECK USP AFTER MTP1
 :ERROR! INCORRECT USP AFTER MTP1
 :CHECK THAT MTP1 MOVED DATA ON
 :USER STACK TO R0
 :ERROR! MTP1 FAILED

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

004506 010701
 004510 012737 040000 177776
 004516 005006
 004520 012737 010000 177776
 004526 012706 000500
 004532 012716 000600
 004536 000277
 004540 106606
 004542 013702 177776
 004546 012737 040000 177776
 004554 010600
 004556 005037 177776
 004562 022700 000600
 004566 001401
 004570 000000
 004572 022702 010001
 004576 001401
 004600 000000

t27: SCOPE
 MOV 2@SM,2@PSW
 CLR SSP
 MOV 2@KIP+PSW,2@PSW
 MOV 2@KPTR,KSP
 MOV 2@SPTR,(KSP)
 SCC
 MTPD SSP
 MOV 2@PSW,R2
 MOV 2@SM,2@PSW
 MOV SSP,R0
 CLR 2@PSW
 CMP 2@SPTR,R0
 BEQ .+4
 HLT
 CMP 2@PSW+C,R2
 BEQ .+4
 HLT

:SUPER MODE!!!
 :PRE SET SUPERVISORS STACK POINTER
 :KERNEL MODE!!! PREV SUPER MODE!!
 :SET KERNEL STACK POINTER
 :PRESET CC'S
 :SSP+(KSP)+
 :SAVE STATUS
 :SUPER MODE!!!
 :GET SUPER STACK POINTER
 :KERNEL MODE!!!
 :CHECK THAT SUPER STACK POINTER WAS
 :SET BY MTPD INST.
 :ERROR! MTPD FAILED TO SET SUPER STACK POINTER
 :CHECK STATUS AFTER MTPD
 :ERROR! INCORRECT STATUS AFTER MTPD

:USP+(KSP)+, MTPD

004602 010701
 004604 012737 140000 177776
 004612 005006
 004614 012737 030000 177776
 004622 012706 000500
 004626 012716 000700
 004632 000277
 004634 106606
 004636 013702 177776
 004642 012737 140000 177776
 004650 010600
 004652 005037 177776
 004656 022700 000700
 004662 001401
 004664 000000
 004666 022706 000502
 004672 001401
 004674 000000

t30: SCOPE
 MOV 2@UM,2@PSW
 CLR USP
 MOV 2@KIP+UM,2@PSW
 MOV 2@KPTR,KSP
 MOV 2@UPTR,(KSP)
 SCC
 MTPD USP
 MOV 2@PSW,R2
 MOV 2@UM,2@PSW
 MOV USP,R0
 CLR 2@PSW
 CMP 2@UPTR,R0
 BEQ .+4
 HLT
 CMP 2@KPTR+2,KSP
 BEQ .+4
 HLT

:USER MODE!!!
 :PRESET USER STACK POINTER
 :KERNEL MODE!!! PREV USER MODE!!
 :SET KERNEL STACK POINTER
 :PRESET CC'S
 :USP+(KSP)+
 :SAVE CC'S
 :USER MODE!!!
 :GET USER STACK POINTER
 :KERNEL MODE!!!
 :CHECK THAT MTPD SET USER STACK
 :POINTER PROPERLY
 :ERROR!
 :CHECK KERNEL STACK POINTER

Address	PC	PSW	SPSR	Instruction	Comments
004676	010701			:KSP+(KSP)+, MTPD	
004700	012706	000500		†31: SCOPE	
004704	012716	000736		MOV #KPTR, KSP	
004710	106606			MOV #REDPTR, (KSP)	:PRESET DATA ON KERNEL STACK
004712	022706	000736		MTPD KSP	:KSP+(KSP)+
004716	001401			CMP #REDPTR, KSP	:CHECK THAT MTPD MOVED DATA ON
004720	000000			BEQ .+4	:KERNEL STACK TO KERNEL STACK PTR
				HLT	:ERROR! MTPD FAILED
004722	010701			:SSP+(SSP)+	
004724	012737	050000	177776	†31A: SCOPE	
004732	005006			MOV #SM+PSM, @PSW	:SUPER MODE!!! PREV SUPER MODE!!
004734	012737	000600	000000	CLR SSP	:SET SUPER STACK POINTER
004742	000277			MOV #SPTR, @0	:PUT NEW STACK POINTER VALUE ON STACK
004744	106606			SCC	:PRESET CC'S
004746	013702	177776		MTPD SSP	:SSP+(SSP)+
004752	010600			MOV @PSW, R2	:SAVE RESULT STATUS
004754	005037	177776		MOV SSP, R0	:SAVE NEW SUPER STACK POINTER
004760	022700	000600		CLR @PSW	:KERNEL MODE!!!
004764	001401			CMP #SPTR, R0	:CHECK THAT MTPD SET SUPER STACK
004766	000000			BEQ .+4	:POINTER PROPERLY
004770	022702	050001		HLT	:ERROR!
004774	001401			CMP #SM+PSM+C, R2	:CHECK STATUS RESULT
004776	000000			BEQ .+4	:ERROR! INCORRECT STATUS AFTER MTPD
				HLT	
005000	010701			:USP+(SSP)+, MTPD	
005002	012737	140000	177776	†31B: SCOPE	
005010	012706	000700		MOV #UM, @PSW	:USER MODE!!!
005014	012737	070000	177776	MOV #UPTR, USP	:SET USER STACK POINTER
005022	012706	000600		MOV #SM+PUM, @PSW	:SUPER MODE!!! PREV USER MODE!!
005026	005046			MOV #SPTR, SSP	:SET SUPER STACK POINTER
				CLR -(SSP)	:PUSH NEW USER STACK POINTER ONTO
					:SUPER STACK
					:PRESET CC'C
005030	000277			SCC	
005032	000244			CLZ	
005034	106606			MTPD USP	:USP+(SSP)+
005036	013702	177776		MOV @PSW, R2	:SAVE RESULT STATUS
005042	010600			MOV SSP, R0	:SAVE SUPER STACK POINTER
005044	052737	140000	177776	BIS #UM, @PSW	:USER MODE!!!
005052	010603			MOV USP, R3	:GET USER STACK POINTER
005054	005037	177776		CLR @PSW	:KERNEL MODE!!!
005060	022702	070005		CMP #SM+PUM+Z+C, R2	:CHECK RESULT STATUS
005064	001401			BEQ .+4	
005066	000000			HLT	:ERROR! INCORRECT STATUS AFTER MTPD
005070	022700	000600		CMP #SPTR, R0	:CHECK SUPER STACK POINTER
005074	001401			BEQ .+4	
005076	000000			HLT	:ERROR! INCORRECT SUPER STACK PINTER
005100	005703			TST R3	:CHECK USER STACK POINTER
005102	001401			BEQ .+4	
005104	000000			HLT	:ERROR! MTPD FAILED TO SET USER STACK POINTER
005106	010701			:USP+(USP)+, MTPD	
005110	012737	170000	177776	†31C: SCOPE	
005116	012706	000700		MOV #UM+PUM, @PSW	:USER MODE!!! PREV USER MODE!!
				MOV #UPTR, USP	:SET USER STACK POINTER

005122	005016			CLR	(USP)	:PUT NEW STACK VALUE ON STACK	
005124	000257			CCC		:PRESET CC'S	
005126	106606			MTPD	USP	:USP+(USP)+	
005130	013700	177776		MOV	@PSW,RO	:SAVE CC'S	
005134	010602			MOV	USP,R2	:SAVE USER STACK POINTER	
005136	005037	177776		CLR	@PSW	:KERNEL MODE!!!	
005142	022700	170004		CHP	@UM+PUM+Z,RO	: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			↑32:	SCOPE		
005162	012737	040000	177776	MOV	@SM,@PSW	:SUPERVISORY MODE!!!	
005170	005006			CLR	SSP	:PRESET SUPER STACK POINTER	
005172	006237	177776		ASR	@PSW		
005176	006237	177776		ASR	@PSW	:KERNEL MODE!!!, PREV SUPER MODE!!	
005202	012716	000600		MOV	@SPTR,(KSP)		
005206	006606			MTPD	SSP	:SSP+(KSP)+	
005210	006337	177776		ASL	@PSW		
005214	006337	177776		ASL	@PSW	:SUPERVISORY MODE!!!	
005220	010667	173556		MOV	SSP,TEMP	:GET SUPER STACK POINTER	
005224	005037	177776		CLR	@PSW	:KERNEL MODE!!!	
005230	022767	000600	173544	CHP	@SPTR,TEMP	:CHECK THAT TOP WORD ON KSP (@SPTR)	
005236	001401			BEQ	+.4	:WAS SET INTO SUPER STACK POINTER (SSP)	
005240	000000			HLT		:ERROR!	
				:USP+(KSP)+, MTPD			
005242	010701			↑32A:	SCOPE		
005244	012737	140000	177776	MOV	@UM,@PSW	:USER MODE	
005252	012706	177777		MOV	@-1,USP	:PRESET USER STACK POINTER	
005256	012737	030000	177776	MOV	@UM+PUM,@PSW	:CURRENT KERNEL,PREVIOUS USER	
005264	005046			CLR	-(KSP)	:PRESET DATA ON KERNEL STACK	
005266	006606			MTPD	USP	:USP+(KSP)+	
005270	012737	140000	177776	MOV	@UM,@PSW	:USER MODE!!!	
005276	010600			MOV	USP,RO	:GET USER STACK POINTER	
005300	005037	177776		CLR	@PSW	:KERNEL MODE!!!	
005304	005700			TST	RO	: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			↑33:	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	006606			MTPD	USP	:USP+(SSP)+	
005340	012737	140000	177776	MOV	@UM,@PSW	:USER MODE!!!	
005346	010600			MOV	USP,RO	:SAVE USER STACK PTR	
005350	005037	177776		CLR	@PSW	:KERNEL MODE!!!	
005354	022700	000700		CHP	@UPTR,RO	:CHECK THAT MTPD MOVED DATA FROM	
005360	001401			BEQ	+.4	:SUPER STACK TO USER STACK PTR	

005362 000000

HLT

;ERROR! MTP1 FAILED

005364 010701

:SSP+(SSP)+ MTP1
↑34: SCOPE

005366 012737 050000 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 006606

MTP1 SSP

;SSP+(SSP)+

005404 010600

MOV SSP, RO

;GET SUPER STACK PTR

005406 005037 177776

CLR @#PSW

;KERNEL MODE!!!

005412 022700 000600

CHP #SPTR, RO

;CHECK THAT MTP1 MOVED DATA ON

005416 001401

BEQ .+4

;SUPER STACK TO SUPER STACK PTR

005420 000000

HLT

;ERROR! MTP1 FAILED

005422 010701

:USP+(USP)+
↑35: SCOPE

005424 012737 170000 177776

MOV #UM+PUM, @#PSW

;USER MODE!!! PREV USER MODE!!

005432 012706 000600

MOV #SPTR, USP

;SET USER STACK PTR

005436 012716 000700

MOV #UPTR, (USP)

;PRESET DATA ON USER STACK

005442 006606

MTP1 USP

;USP+(USP)+

005444 010600

MOV USP, RO

;SAVE USER STACK PTR IN RO

005446 005037 177776

CLR @#PSW

;KERNEL MODE!!!

005452 022700 000700

CHP #UPTR, RO

;CHECK THAT MTP1 MOVED DATA ON

005456 001401

BEQ .+4

;USER STACK TO USER STACK PTR

005460 000000

HLT

;ERROR! MTP1 FAILED

:TEST THAT MTPD/I TRAPS ON AN ODD ADDRESS DESTINATION

:KERNEL MODE
↑36: SCOPE

005462 010701

CLR @#PSW

005464 005037 177776

MOV #KPTR, KSP

005470 012706 000500

MOV #-1, (KSP)

005474 012716 177777

MOV #T36A, @#ERRVEC

005500 012737 005520 000004

CLR ERRVEC+2

005506 005067 172274

MTPD -1

;TRAPS ON ODD ADDRESS

005512 106667 172261

T36AA: HLT

;ERROR! DID NOT TRAP

005516 000000

T36A: CHP

;IS KSP CORRECT?(1 POP AND 2

005520 022706 000476

BEQ .+4

;PUSHES)
;ERROR! INCORRECT VALUE IN KSP

005524 001401

HLT

005526 000000

CHP #T36AA, KPTR-2

;CHECK RETURN PC ON STACK

005530 022767 005516 172740

BEQ .+4

;ERROR! RETURN PC NOT ON STACK

005536 001401

HLT

:SUPERVISORY MODE
↑37: SCOPE

005542 010701

MOV #SM+REG, @#PSW

;PRESET R10

005544 012737 044000 177776

CLR R10

;RO-R5

005552 005000

BIC #REG, @#PSW

;RO CONTAINS AN ODD ADDRESS

005554 042737 004000 177776

MOV #1, RO

;SET SUPERVISOR'S STACK POINTER

005562 012700 000001

MOV #SPTR, SSP

; -1 IS THE DATA TO BE MOVED

005566 012706 000600

MOV #-1, (SSP)

;LOAD ERROR VECTOR

005572 012716 177777

MOV #T37A, @#ERRVEC

005576 012737 005622 000004

MOV #SM, @#ERRVEC+2

;TRAPS ON ODD ADDRESS

005604 012737 040000 000006

MTPD (RO)+

005612 106620

T37AA: CLR

;ERROR! DID NOT TRAP

005614 005037 177776

BEQ .+4

005620 000000

HLT

```

005622 010602          T37A:  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 022700 000003    CMP    @3,RO      ;CHECK AUTO-INC OF RO
005656 001401          BEQ    .+4
005660 000000          HLT                    ;ERROR! RO FAILED TO AUTO-INC

;USER MODE
T40:  SCOPE
005662 010701          MOV    @UM+PUM,@#PSW ;USER MODE!!!, PREV USER MODE!!
005664 012737 170000 177776  CLR    R2          ;SELECT R10-R15
005672 005002          BIS    @REG,@#PSW
005674 052737 004000 177776  MOV    @1,R12
005702 012702 000001          MOV    @UPTR,USP    ;SET USER STACK POINTER
005706 012706 000700          MOV    @125252,(USP) ;PRESET USER STACK
005712 012716 125252          MOV    @T40A,@ERRVEC ;LOAD ERROR VECTOR
005716 012737 005742 000004  MOV    @UM+REG,@ERRVEC+2
005724 012737 144000 000006  MTPD  -(R12)      ;-(R12)+(USP)+; SHOULD TRAP ON ODD ADDS
005732 006642          CLR    @#PSW      ;KERNEL MODE!!!
005734 005037 177776    HLT                    ;ERROR DID NOT TRAP
005740 000000          MOV    USP,R10    ;GET USERS STACK POINTER
005742 010600          BIC    @UM,@#PSW  ;KERNEL MODE!!!
005744 042737 140000 177776  CMP    @UPTR-2,R10 ;CHECK THAT USER STACK POINTER
005752 022700 000676          BEQ    .+4        ;PUSHED PROPERLY (1 POP, 2 PUSHES)
005756 001401          HLT                    ;ERROR! INCORRECT USER STACK POINTER
005760 000000          CMP    @UM+PUM+REG+N,@#UPTR ;CHECK THAT CORRECT STATUS WAS
005762 022737 174010 000700  BEQ    .+4        ;SAVED ON USER STACK ('N' IS DATA POPPED)
005770 001401          HLT                    ;ERROR! INCORRECT STATUS SAVED ON USER STACK
005772 000000          CMP    @T40AA,UPTR-2 ;CHECK THAT RETURN ADDRESS WAS
005774 022767 005734 172674  BEQ    .+4        ;SAVED ON USER STACK
006002 001401          HLT                    ;ERROR! RETURN PC NOT ON USER STACK
006004 000000          CMP    @-1,R12    ;DID R12 DECREMENT BY 2
006006 022702 177777          BEQ    .+4
006012 001401          HLT                    ;ERROR! AUTO-DEC FAILED
006014 000000          CLR    @#PSW
006016 005037 177776

;TEST THAT MTP D/I CAN LOAD MEMORY ADDRESSES.
;KERNEL MODE
T41:  SCOPE
006022 010701          CLR    @#PSW      ;KERNEL MODE!!!
006024 005037 177776    MOV    @-1,RO     ;PRESET RO
006030 012700 177777          MOV    @T41A,@ERRVEC ;SET ERROR VECTOR
006034 012737 006070 000004  CLR    ERRVEC+2
006042 005067 171740          BIS    @REG,@#PSW
006046 052737 004000 177776  CLR    R10        ;R10-R15
006054 005000          MOV    @2,-(KSP)  ;PRESET R10
006056 012746 000002          SEC                    ;PRESET DATA ON STACK
006062 000261          MTPD  (R10)+     ;SET 'C'
006064 106620          BR    .+4        ;(R10)+(KSP)+
006066 000401          HLT                    ;ERROR! TRAPPED
006070 000000          BCS   .+4
006072 103401          ;MTP D/I SHOULD NOT AFFECT CARRY

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```

006074 000000          HLT                               ;BIT ERROR! CARRY BIT BUT CLEARED.
006076 022767 000002 171674  CMP      #2,0                ;CHECK THAT DATA WAS MOVED
006104 001401          BEQ      .+4                    ;FROM KERNEL STACK TO MEM ADDRESS
006106 000000          HLT

006110 010701          T41B: SCOPE
006112 012737 004000 177776  MOV      @REG,@PSW          ;KERNEL MODE!!!
006120 012737 006146 000004  MOV      @T41BB,@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
006140 106637 001002          MTPD    @TEMP            ;@TEMP+(KSP)+

006144 000401          T41BB: BR      .+4
006146 000000          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 005237 001002          INC      @TEMP          ;CHECK RESULT
006170 001401          BEQ      .+4
006172 000000          HLT                               ;ERROR! MTPD FAILED

: SUPERVISORY MODE
006174 010701          T42: SCOPE
006176 005037 177776          CLR      @PSW
006202 012702 052525          MOV      @52525,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 000600          MOV      @SPTR,SSP

006240 005016          CLR      (SSP)
006242 000262          SEV
006244 006622          MTPD    (R12)+          ;(R12)++(SSP)+
006246 000401          BR      .+4
006250 000000          T42A: HLT                               ;ERROR TRAPPED ON ODD ADDRESS
006252 013700 177776          MOV      @PSW,R10        ;GET CC'S
006256 042737 140000 177776  BIC      @UM,@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

006304 010701          T43B: SCOPE
006306 012767 177777 172466  MOV      @-1,TEMP        ;PRESET TEMP
006314 012737 006346 000004  MOV      @T43BB,@ERRVEC  ;LOAD ERROR VECTOR
006322 012737 074000 177776  MOV      @SM+PUM+REG,@PSW ;CHECK MODE!!! PREV USER MODE!!
006330 012706 000600          MOV      @SPTR,SSP      ;SET SUPER STACK POINTER
006334 005046          CLR      -(SSP)         ;PRESET SUPER STACK
006336 000257          CCC
006340 106667 172436          MTPD    TEMP            ;PRESET CC'S
                                ;TEMP+(SSP)+

```

```

006344 000401
006346 000000
006350 013702 177776
006354 010600
006356 022702 074004
006362 001401
006364 000000
006366 022700 000600
006372 001401
006374 000000
T4388: BR .+4
          HLT
          MOV @PSW,R12 ;ERROR! TRAPPED
          MOV SSP,R10 ;SAVE CC'S
          CMP @SN+PUN+REG+Z,R12 ;SAVE SUPER STACK POINTER
          BEQ .+4 ;CHECK STATUS RESULT
          HLT ;ERROR! INCORRECT STATUS
          CMP @SPTR,R10 ;CHECK SUPER STACK POINTER
          BEQ .+4
          HLT ;ERROR! INCORRECT SUPER STACK POINTER

```

```

:USER MODE
T43: SCOPE
006376 010701
006400 005037 177776
006404 012703 177777
006410 012737 006450 000004
006416 012737 144000 177776
006424 012703 001004
006430 005067 172346
006434 012706 000700
006440 052716 177777
006444 006643
006446 000401
006450 000000
006452 013700 177776
006456 042737 140000 177776
006464 122700 000010
006470 001401
006472 000000
006474 005167 172302
006500 001401
006502 000000
006504 012737 000006 000004
006512 005067 171270
T43A: HLT ;ERROR TRAPPED
        MOV @PSW,R10
        BIC @SN,@PSW ;KERNEL MODE!!!
        CMPB @N,R10
        BEQ .+4
        HLT
        COM TEMP
        BEQ .+4
        HLT
        MOV @ERRVEC+2,@ERRVEC
        CLR ERRVEC+2

```

:TEST THAT MFP D/I PUSHES DESTINATION REGISTER DATA ONTO THE APPROPRIATE STACK
:(AS DETERMINED BY PSM BITS 15 & 14)

:KERNEL MODE MFPD

```

T44: SCOPE
006516 010701
006520 012706 000500
006524 012716 125252
006530 005027 000000
006534 012737 004000 177776
006542 012700 177777
006546 000261
006550 106500
006552 013702 177776
006556 022702 004011
006562 001401
006564 000000
006566 022706 000476
006572 001401
006574 000000
006576 005116
006600 001401
T44: MOV @KPTR,KSP
        MOV @125252,(KSP)
        CLR @R0
        MOV @REG,@PSW
        MOV @-1,R10
        SEC
        MFPD R10 ;-(KSP)+R10,(R10)=-1
        MOV @PSW,R12 ;GET STATUS RESULT
        CMP @REG+N+C,R12
        BEQ .+4
        HLT ;ERROR! INCORRECT STATUS RESULT
        CMP @KPTR-2,KSP ;DID KERNEL STACK POINTER GET
        BEQ .+4 ;PUSHED?
        HLT ;ERROR!
        COM (KSP) ;TEST THAT CORRECT DATA(-1) GOT
        BEQ .+4 ;PUSHED ONTO KERNEL STACK

```



```

: SUPERVISORY MODE, MFPD
†46: SCOPE
006670 010701
006672 012737 040340 177776 MOV #SM+PRTY7, @PSW
006700 012706 000600 MOV #SPTR, SSP
006704 012702 177777 MOV @-1, R2
006710 012716 052525 MOV #52525, (SSP)
006714 052737 004000 177776 BIS #REG, @PSW
006722 005002 CLR R12
006724 000262 SEV
006726 106502 MFPD R12 ;-(SSP)+R12, (R12)=0

006730 013700 177776 MOV @PSW, R10
006734 010603 MOV SSP, R13
006736 042737 140000 177776 BIC #UM, @PSW
006744 022700 044344 CMP #SM+REG+PRTY7+Z, R10 ;CHECK 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, MFPI
†47: SCOPE
006772 010701
006774 012737 040200 177776 MOV #SM+PRTY4, @PSW
007002 012706 000600 MOV #SPTR, SSP
007006 012705 177777 MOV @-1, R5
007012 012716 125252 MOV #125252, (SSP)
007016 052737 004000 177776 BIS #REG, @PSW
007024 012705 052525 MOV #52525, R15
007030 000277 SCC
007032 006505 MFPI R15 ;-(SSP)+R15, (R15)=52525

007034 013700 177776 MOV @PSW, R10
007040 010604 MOV SSP, R14
007042 042737 140000 177776 BIC #UM, @PSW
007050 022700 044201 CMP #SM+REG+PRTY4+C, R10 ;CHECK STATUS RESULT
007054 001401 BEQ .+4
007056 000000 HLT
007060 022704 000576 CMP #SPTR-2, R14
007064 001401 BEQ .+4
007066 000000 HLT
007070 022767 052525 171500 CMP #52525, SPTR-2
007076 001401 BEQ .+4
007100 000000 HLT

```

007102	010701			:USER MODE MFPD		
007104	005003			↑50: SCOPE		
007106	012737	144000	177776	CLR R3	:PRESET	
007114	012706	000700		MOV #UM+REG, #PSW	:USER MODE, R10-R15	
007120	012726	125252		MOV #UPTR, USP	:SET USER'S STACK POINTER	
007124	012703	177777		MOV #125252, (USP)+	:PRESET STACK	
007130	000257			MOV #-1, R13	:	
007132	106503			CCC		
				MFPD R13	;- (USP)+R13 (R13)=-1	
007134	013700	177776		MOV #PSW, R10		
007140	010604			MOV USP, R14		
007142	042737	140000	177776	BIC #UM, #PSW		
007150	022700	144010		CMP #UM+REG+N, R10		
007154	001401			BEQ .+4		
007156	000000			HLT		
007160	022704	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 MFPI		
007202	010701			↑51: SCOPE		
007204	005005			CLR R5		
007206	012737	144000	177776	MOV #UM+REG, #PSW	:USER MODE!!!	
007214	012706	000700		MOV #UPTR, USP	:SET USER STACK POINTER	
007220	012716	177777		MOV #-1, (USP)	:PRESET USER STACK	
007224	012705	000700		MOV #UPTR, R15	:PRESET R15	
007230	000277			SCC	:PRESET CONDITION CODES	
007232	006505			MFPI R15	;- (USP)+R15	
007234	013700	177776		MOV #PSW, R10	:GET STATUS RESULT	
007240	010602			MOV USP, R12	:GET USER STACK POINTER	
007242	042737	140000	177776	BIC #UM, #PSW	:KERNEL MODE!!!	
007250	022700	144001		CMP #UM+REG+C, R10	:CHECK STATUS RESULT AFTER MFPI INST	
007254	001401			BEQ .+4		
007256	000000			HLT		
007260	022702	000676		CMP #UPTR-2, R12	:ERROR! INCORRECT STATUS AFTER MFPI	
007264	001401			BEQ .+4		
007266	000000			HLT		
007270	022712	000700		CMP #UPTR, (R12)		
007274	001401			BEQ .+4		
007276	000000			HLT		

: TEST THAT MFPD/I PUSHES DESTINATION MEMORY DATA ONTO THE APPROPRIATE
: STACK.

```

: KERNEL MODE, MFPD
T52:
007300 010701 177776
007302 005037 001002
007306 012700 004000 177776
007312 052737 001004
007320 012700 001004
007324 012767 177777 171450
007332 005067 171446
007336 012706 000500
007342 012716 125252
007346 106520
                                MFPD
                                (R10)+
                                ;-(KSP)+(R10)+,R10=TEMP+2,TEMP+2=0

007350 013702 177776
007354 022702 004004
007360 001401
007362 000000
007364 022706 000476
007370 001401
007372 000000
007374 005716
007376 001401
007400 000000

: SUPERVISORY MODE, MFPI
T53:
007402 010701 177776
007404 012737 070000 177776
007412 012702 001004
007416 052737 004000 177776
007424 012702 001006
007430 005067 171346
007434 012767 001004 171342
007442 012706 000600
007446 012716 052525
007452 006552
                                MFPI
                                ;-(SSP)+(R12),R12=TEMP+4,TEMP+2=TEMP+2

007454 013700 177776
007460 010603
007462 042737 140000 177776
007470 022700 074000
007474 001401
007476 000000
007500 022703 000576
007504 001401
007506 000000
007510 022713 001004
007514 001401
007516 000000

                                MOV #SM+PUM, #PSW ;SUPERVISORY MODE!!!
                                MOV #TEMP+2, R2 ;PRESET R2
                                BIS #REG, #PSW ;SELECT R10-R15
                                MOV #TEMP+4, R12 ;PRESET R12
                                CLR TEMP
                                MOV #TEMP+2, TEMP+2
                                MOV #SPTR, SSP ;SET SUPERVISORY STACK POINTER
                                MOV #52525, (SSP) ;PRESET SUPER STACK
                                MFPI ;-(SSP)+(R12),R12=TEMP+4,TEMP+2=TEMP+2

                                MOV #PSW, R10 ;GET CONDITION CODE RESULTS
                                MOV SSP, R13
                                BIC #UM, #PSW
                                CMP #SM+PUM+REG, R10 ;CHECK STATUS AFTER MFPI INST.
                                BEQ .+4
                                HLT ;ERROR! INCORRECT STATUS AFTER MFPI
                                CMP #SPTR-2, R13 ;CHECK SUPER STACK POINTER
                                BEQ .+4
                                HLT ;ERROR! INCORRECT SSP AFTER MFPI
                                CMP #TEMP+2, (R13) ;CHECK THAT PROPER DATA WAS PUSHED
                                BEQ .+4 ;ONTO SUPERVISORY STACK
                                HLT ;ERROR! INCORRECT DATA ON SUPER STACK

```

```

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

007574 013700 177776 MOV @PSM,R10
007600 010602 177776 MOV USP,R12
007602 042737 140000 177776 BIC @UM,@PSM
007610 022700 154350 177776 CMP @UM+PSM+REG+PRTY7+N,R10
007614 001401 BEQ .+4
007616 000000 HLT
007620 022702 000676 177776 CMP @UPTR-2,R12
007624 001401 BEQ .+4
007626 000000 HLT
007630 005112 COM (R12)
007632 001401 BEQ .+4
007634 000000 HLT

;TEST OVERFLOW (YELLOW) USING MFPD INSTRUCTION

007636 010701 014000 177776 T55: SCOPE
007640 012737 001000 177776 MOV @PSM+REG,@PSM ;KERNEL MODE!!! PREV SUPER MODE
007646 012706 001000 171122 MOV @YELPTR,KSP ;SET STACK PTR AT TOP OF YELLOW ZONE
007652 012767 177777 171122 MOV @-1,TEMP ;PRESET DATA
007660 005066 177776 171122 CLR -2(KSP) ;PRESET STACK DATA
007664 012737 007712 000004 MOV @T55A,@ERRVEC ;LOAD ERROR TRAP VECTOR
007672 005037 000006 177776 CLR @ERRVEC+2
007676 012737 000400 177774 MOV @400,@SLR ;SET STACK LIMIT =1000
007704 106567 171072 MFPD TEMP ;PUSH TEMP ONTO KERNEL STACK
;SHOULD OVERFLOW STACK
;ERROR! FAILED TO TRAP ON OVERFLOW
007710 000000 T55AA: HLT ;CHECK THAT MFPD PUSHED DATA
007712 022767 177777 171056 T55A: CMP @-1,YELPTR-2 ;ONTO STACK
007720 001401 BEQ .+4 ;ERROR! MFPD FAILED TO PUSH DATA
007722 000000 HLT ;CHECK SAVED STATUS ON TRAP
007724 022767 014010 171042 CMP @PSM+REG+N,YELPTR-4
007732 001401 BEQ .+4
007734 000000 HLT ;ERROR! INCORRECT STATUS SAVED
007736 022767 007710 171026 CMP @T55AA,YELPTR-6 ;CHECK SAVED PC ON STACK
007744 001401 BEQ .+4
007746 000000 HLT ;ERROR! INCORRECT PC SAVED ON STACK
007750 005037 177774 CLR @SLR ;CLEAR STACK LIMIT REGISTER

```

```

:TEST OVERFLOW (RED) USING MFPI INSTRUCTION
T56:  SCOPE
007754 010701          000004      MOV      @T56A,@ERRVEC ;SET ERROR TRAP VECTOR
007756 012737 010030 000004      MOV      @PUM+REG+PRTY7,@PSW ;KERNEL MODE!!!,PREV USER MODE!!
007764 012737 034340 177776      MOV      @REDPTR,KSP ;SET STACK PTR TO TOP OF RED ZONE
007772 012706 000736          177776      MOV      @-1,-2(KSP) ;PRESET RED LOCATION=-1
007776 012766 177777 177776      CLR      TEMP ;(TEMP)WILL BE THE DATA MOVED
010004 005067 170772          ;TO RED LOCATION
010010 012703 001004          MOV      @TEMP+2,R13 ;LOAD INDEX REGISTER
010014 012737 000400 177774      MOV      @400,@SLR ;SET STACK LIMIT=1000
010022 006563 177776          MFPI     -2(R13) ;-(KSP)+TEMP SHOULD OVER
;FLOW (RED)
010026 000000          T56AA:  HLT ;ERROR! FAILED TO TRAP ON 'RED'
;OVERFLOW
010030 022737 177777 000734      T56A:  CMP      @-1,@REDPTR-2 ;TEST THAT MFPI DID NOT WRITE
010036 001401          BEQ     .+4 ;INTO 'RED' LOCATION
010040 000000          HLT ;ERROR!
010042 005706          TST     KSP ;STACK SHOULD HAVE GONE TO 0
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,@0 ;ERROR!
010070 001401          BEQ     .+4 ;AND RETURN IN 0
010072 000000          HLT ;ERROR! INCORRECT PC IN 0
010074 005037 177774          CLR     @SLR
010100 012737 000006 000004      MOV      @ERRVEC+2,@ERRVEC;RESTORE ERROR VECTOR

```

```

:TEST TRAP & RETURN USER-KERNEL-USER
T57:  SCOPE
010106 010701          000500      MOV      @KPTR,KSP ;SET KERNEL STACK POINTER
010110 012706 000500          MOV      @REG,@TRAPVEC+2
010114 012767 004000 167714      MOV      @T57A,@TRAPVEC
010122 012767 010212 167704      MOV      @PUM+REG,@PSW ;USER MODE!!!
010130 012737 144000 177776      CLR     R12
010136 005002          TRAP ;TRAP & ENTER KERNEL MODE
010140 104400          T57AA:  MOV      @PSW,TEMP ;KERNEL MODE!!!
010142 013767 177776 170632      BIC     @1,@PSW
010150 042737 140000 177776      CMP      @T57AA,KPTR-4 ;CHECK THAT RETURN ADDRESS IS ON
010156 022767 010142 170310      BEQ     .+4 ;KERNEL STACK
010164 001401          HLT ;ERROR!RETURN ADDRESS NOT ON STACK
010166 000000          CMP      @PUM+REG+Z,TEMP ;CHECK THAT CORRECT PSW WAS
010170 022767 144004 170604      BEQ     .+4 ;RESTORED ON THE RETURN
010176 001401          HLT ;ERROR! INCORRECT STATUS WAS RETURNED
010200 000000          ;BY KERNEL FROM TRAP
010202 005102          COM     R12 ;CHECK THAT TRAP ROUTINE WAS EXECUTED
010204 001401          BEQ     .+4
010206 000000          HLT ;ERROR! KERNEL DID NOT DO COM R12
; (AT T57A)
010210 000402          BR      T57EX ;EXIT TEST
010212 005102          T57A:  COM     R12 ;COMPLEMENT R12
010214 000002          RTI ;AND EXIT
010216 000240          T57EX:  NOP

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;TEST THAT MFPD/I CAN PUSH ONTO CURRENT STACK (AS DETERMINED BY PS15 &
;PS14) THE PREVIOUS MODES STACK POINTER (AS DETERMINED BY PS13 &PS12)
;-(KSP)+KSP,MFPD
t60: SCOPE
010220 010701 177776 CLR @PSW ;KERNEL MODE!!!, PREV KERNEL MODE!!
010222 005037 000500 MOV @KPTR,KSP ;SET KERNEL STACK POINTER
010226 012706 000500 MFPD KSP ;-(KSP)+KSP
010232 106506 000500 170234 CMP @KPTR,KPTR-2 ;TEST THAT VALUE OF KERNEL STACK POINTER
010234 022767 000500 BEQ .+4 ;WAS PUSHED ONTO KERNEL STACK
010242 001401 HLT ;ERROR!
010244 000000

;-(KSP)+SSP,MFPD
t61:SCOPE
010246 010701 014000 177776 MOV @KH+PSW+REG,@PSW ;KERNEL MODE!!!, PREV SUPER MODE!!
010250 012737 000500 MOV @KPTR,KSP ;SET KERNEL STACK POINTER
010256 012706 000500 CLR (KSP)
010262 005016 177776 MTPD SSP ;SET SUPER STACK POINTER SSP+(KSP)+
010264 006606 177776 COM -2(KSP) ;PRESET KERNEL STACK
010266 005166 000500 MFPD SSP ;-(KSP)+SSP
010272 106506 000500 CMP @KPTR,KSP ;CHECK THAT KERNEL STACK POINTER
010274 022706 000500 BEQ .+4 ;IS CORRECT
010300 001401 HLT ;ERROR! INCORRECT KERNEL STACK POINTER
010302 000000 TST (KSP) ;CHECK THAT VALUE OF SUPER STACK POINTER
010304 005716 BEQ .+4 ;WAS PUSHED ONTO KERNEL STACK
010306 001401 HLT ;ERROR!
010310 000000

;-(KSP)+USP,MFPD
t62: SCOPE
010312 010701 034000 177776 MOV @KH+PUN+REG,@PSW ;KERNEL MODE!!!, PREV USER MODE!!
010314 012737 000500 MOV @KPTR,KSP ;SET KERNEL STACK POINTER
010322 012706 000500 MOV @-1,(KSP)
010326 012716 177777 MTPD USP ;SET USER STACK POINTER USP+(KSP)+
010332 106606 177776 COM -2(KSP) ;PRESET KERNEL STACK
010334 005166 177776 MFPD USP ;-(KSP)+USP
010340 106506 177777 CMP @-1,(KSP) ;CHECK THAT USER STACK POINTER WAS
010342 022716 177777 BEQ .+4 ;PUSHED ONTO KERNEL STACK
010346 001401 HLT ;ERROR!
010350 000000

;-(SSP)+SSP,MFPD
t63: SCOPE
010352 010701 014000 177776 MOV @KH+PSW+REG,@PSW ;KERNEL MODE!!!, PREV SUPER MODE!!
010354 012737 000500 MOV @KPTR,KSP ;SET KERNEL STACK POINTER
010362 012706 000500 MOV @SPTR,(KSP) ;SET KERNEL STACK
010366 012716 000630 MTPD SSP ;PUSH TOP WORD ON KERNEL STACK (@SPTR)
010372 106606 040000 177776 BIS @SH,@PSW ;SUPER MODE!!!, PREV SUPER MODE!!
010402 106506 140000 177776 MFPD SSP ;-(SSP)+SSP
010404 042737 140000 177776 BIC @UH,@PSW ;KERNEL MODE!!!, PREV SUPER MODE!!
010412 106506 000576 MFPD SSP ;PUSH SUPER STACK POINTER ONTO KERNEL STACK
010414 022716 000576 CMP @SPTR-2,(KSP) ;CHECK THAT SUPER STACK POINTER WAS
010420 001401 BEQ .+4 ;PUSHED PROPERLY (ONCE)
010422 000000 HLT ;ERROR!
010424 022767 000600 170144 CMP @SPTR,SPTR-2 ;CHECK THAT VALUE OF SUPER STACK PONTER
010432 001401 BEQ .+4 ;WAS PUSHED ONTO SUPER STACK
010434 000000 HLT ;ERROR!

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:-(SSP)+USP MFPO
↑64: SCOPE
010436 010701          MOV      @PSW+REG,@PSW ;KERNEL MODE!!!,PREV SUPER MODE!!
010440 012737 014000 177776 MOV      @KPTR,KSP ;SET KERNEL STACK POINTER
010446 012706 000500          MOV      @SPTR,(KSP)
010452 012716 000600          MTPD    SSP ;SET SUPER STACK POINTER
010456 106606          BIS      @PUN,@PSW ;KERNEL MODE!!!,PREV USER MODE!!
010460 052737 030000 177776 CLR      (KSP)
010466 005016          MTPD    USP ;SET USER STACK POINTER=0
010470 106606          BIS      @SM,@PSW ;SUPER MODE!!!,PREV USER MODE!!
010472 052737 040000 177776 MOV      @-1,@SPTR-2 ;PRESET SUPER STACK
010500 012767 177777 170070 MFPO     USP ;PUSH USER STACK POINTER ONTO SUPER STACK
010506 106506          BIC      @UM+BIT13,@PSW ;KERNEL MODE!!!,PREV SUPER MODE!!
010510 042737 160000 177776 MFPO     SSP ;PUSH SUPER STACK POINTER ONTO KERNEL STACK
010516 106506          CMP     @SPTR-2,(KSP) ;CHECK THAT SUPER STACK POINTER WAS
010520 022716 000576          BEQ     .+4 ;PUSHED ONCE
010524 001401          HLT
010526 000000          TST     SPTR-2 ;ERROR!
010530 005767 170042          BEQ     .+4 ;CHECK THAT USER STACK POINTER
010534 001401          HLT ;WAS PUSHED ONTO SUPER STACK
010536 000000          HLT ;ERROR!

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:-(USP)+USP MFPO
↑65: SCOPE
010540 010701          MOV      @PUN,@PSW ;KERNEL MODE!!!,PREV USER MODE!!
010542 012737 030000 177776 MOV      @KPTR,KSP ;SET KERNEL STACK POINTER
010550 012706 000500          MOV      @UPTR,(KSP)
010554 012716 000700          MTPD    USP ;SET USER STACK POINTER
010560 106606          CLR      UPTR-2
010562 005067 170110          BIS      @UM,@PSW ;USER MODE!!!,PREV USER MODE!!!
010566 052737 140000 177776 MFPO     USP ;PUSH USER STACK POINTER ONTO USER STACK
010574 106506          BIC      @UM,@PSW ;KERNEL MODE!!!,PREV USER MODE!!
010576 042737 140000 177776 MFPO     USP ;PUSH USER STACK POINTER ONTO KERNEL STACK
010604 106506          CMP     @UPTR-2,(KSP) ;CHECK THAT USER STACK POINTER WAS
010606 022716 000676          BEQ     .+4 ;PUSHED PROPERLY (ONCE)
010612 001401          HLT ;ERROR!
010614 000000          CMP     @UPTR,UPTR-2 ;CHECK THAT USER STACK POINTER IS ON THE
010616 022767 000700 170052 BEQ     .+4 ;USERS STACK
010624 001401          HLT ;ERROR!
010626 000000          HLT

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:-(KSP)+KSP MFPI
↑66: SCOPE
010630 010701          CLR      @PSW ;KERNEL MODE!!!,PREV KERNEL MODE!!
010632 005037 177776          MOV      @KPTR,KSP ;SET KERNEL STACK POINTER
010636 012706 000500          MFPI    KSP ;PUSH KERNEL STACK POINTER ONTO KERNEL
010642 006506          ;STACK
010644 022767 000500 167624 CMP     @KPTR,KPTR-2 ;CHECK RESULT
010652 001401          BEQ     .+4
010654 000000          HLT ;ERROR!

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:-(KSP)+SSP MFPI
↑67: SCOPE
010656 010701          MOV      @PSW+REG,@PSW ;KERNEL MODE!!!,PREV SUPER MODE!!
010660 012737 014000 177776 MOV      @KPTR,KSP ;SET KERNEL STACK POINTER
010666 012706 000500          CLR      (KSP)
010672 005016          MTPD    SSP ;SET SUPER STACK POINTER
010674 006606          COM     -2(KSP) ;PRESET KERNEL STACK
010676 005166 177776

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010702	006506			MFPI	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			BEQ	+.4		:WAS PUSHED ONTO KERNEL STACK
010720	000000			HLT			:ERROR!
:-(KSP)+USP MFPI							
010722	010701			170: 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			MTPI	USP		:SET USER STACK POINTER
010744	005166	177776		COM	-2(KSP)		:PRESET KERNEL STACK
010750	006506			MFPI	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
:-(SSP)+SSP MFPI							
010762	010701			171: 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			MTPI	SSP		:SET SUPER STACK
011004	052737	040000	177776	BIS	#SM, @#PSW		:SUPER MODE!!! PREV SUPER MODE!!
011012	006506			MFPI	SSP		:PUSH SUPER STACK POINTER ONTO SUPER STACK
011014	042737	140000	177776	BIC	#UM, @#PSW		:KERNEL MODE!!! PREV SUPER MODE!!
011022	006506			MFPI	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
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!
:-(SSP)+USP MFPI							
011046	010701			172: 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			MTPI	SSP		:SET SUPER STACK POINTER
011070	052737	030000	177776	BIS	#PUM, @#PSW		:KERNEL MODE!!!, PREV USER MODE!!
011076	005016			CLR	(KSP)		
011100	006606			MTPI	USP		:SET USER STACK POINTER = 0
011102	052737	040000	177776	BIS	#SM, @#PSW		:SUPER MODE!!! PREV SUPER MODE!!
011110	006506			MFPI	USP		:PUSH USER STACK POINTER ONTO SUPER STACK
011112	042737	160000	177776	BIC	#UM+BIT13, @#PSW		:KERNEL MODE!!!, PREV SUPER MODE!!!
011120	006506			MFPI	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	005767	167440		TST	SPTR-2		:CHECK THAT USER STACK POINTER IS ON
011136	001401			BEQ	+.4		:SUPER STACK

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011140 000000          HLT          ;ERROR!

;-(USP)+USP,MFPI
†73:  SCOPE
011142 010701          MOV      @PUM+REG,@PSW ;KERNEL MODE!!!,PREV SUPER MODE!!
011144 012737 034000 177776      MOV      @KPTR,KSP      ;SET KERNEL STACK POINTER
011152 012706 000500          MOV      @UPTR,(KSP)
011156 012716 000700          MTPD    USP            ;SET USER STACK POINTER
011162 006606          CLR      UPTR-2        ;PRESET USER STACK
011164 005067 167506          BIS      @UM,@PSW      ;USER MODE!!!,PREV USER MODE!!
011170 052737 140000 177776      MFPI    USP            ;-(USP)+USP
011176 006506          BIC      @UM,@PSW      ;KERNEL MODE!!!
011200 042737 140000 177776      MFPI    USP            ;GET USER STACK POINTER
011206 006506          CMP      @UPTR-2,(KSP) ;CHECK THAT USER STACK POINTER WAS
011210 022716 000676          BEQ     .+4            ;PUSHED ONCE
011214 001401          HLT
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!

;TEST THAT ILLEGAL MODE DOES NOT HANG BUS.
†74:  SCOPE
011232 010701          MOV      @IM,@PSW      ;ILLEGAL MODE!!!
011234 012737 100000 177776      MOV      @PSW,R0      ;GET ILLEGAL MODE
011242 013700 177776          CLR      @PSW
011246 005037 177776          CMP      @IM,R0        ;KERNEL MODE!!
011252 022700 100000          BEQ     .+4            ;CHECK THAT ILLEGAL MODE WAS SET
011256 001401          HLT
011260 000000          HLT          ;INTO STATUS

;TEST THAT KERNEL CAN GET DATA FROM SUPER STACK
†75:  SCOPE
011262 010701          MOV      @KM+PSW+REG,@PSW ;LERNEL MODE!!!,PREV SUPER MODE!!
011264 012737 014000 177776      MOV      @KPTR,KSP      ;SET KERNEL STACK POINTER
011272 012706 000500          MOV      @SPTR,(KSP)
011276 012716 000600          MTPD    SSP            ;SET SUPER STACK POINTER
011302 106606          MOV      @-1,SPTR      ;PRESET SUPER STACK
011304 012767 177777 167266      CLR      (KSP)         ;PRESET KERNEL
011312 005016          CLR      -2(KSP)       ;STACK
011314 005066 177776          SCC
011320 000277          MFPD    SSP            ;PRESET CONDITION CODES
011322 106506          MFPD    @PSW,R12      ;GET SUPER STACK POINTER
011324 106576 000000          NOP
011330 000240          MOV      @PSW,R12      ;LIKE MOV @(@),-(@)
011332 013702 177776          CMP      @SPTR,KPTR    ;SAVE STATUS RESULT
011336 022767 000600 167134      BEQ     .+4            ;TEST THAT SUPER STACK POINTER WAS PUSH-
011344 001401          HLT          ;ONTO KERNEL STACK BY MFPD SSP INST.
011346 000000          HLT          ;ERROR!
011350 022706 000476          CMP      @KPTR-2,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      @KM+PSW+REG+N+C,R12 ;CHECK STATUS RESULT
011372 001401          BEQ     .+4
011374 000000          HLT          ;ERROR! INCORRECT STATUS

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:TEST THAT KERNEL CAN GET DATA FROM USER STACK
↑76: SCOPE
011376 010701          MOV      #KH+PUM+REG, @#PSW      ;KERNEL MODE!!!  PREV SUPER MODE!!
011400 012737 034000 177776  MOV      #KPTR, KSP              ;SET KERNEL STACK POINTER
011406 012706 000500          MOV      #UPTR, (KSP)
011412 012716 000700          MTPD    USP                      ;SET USER STACK POINTER
011416 106606          CLR      UPTR                    ;PRESET USER STACK
011420 005067 167254          CLR      (KSP)                  ;PRESET KERNEL STACK
011424 005016          MOV      @-1, -2(KSP)
011426 012766 177777 177776  MFPD    USP                      ;-(KSP)+USP
011434 106506          MFPD    @ (KSP)                 ;LIKE MOV @ (6), -(6)
011436 106576 000000          NOP
011442 000240          MOV      @#PSW, R13             ;SAVE STATUS RESULT
011444 013703 177776          CMP      #UPTR, KPTR            ;CHECK THAT USER STACK POINTER WAS
011450 022767 000700 167022  BEQ      .+4                     ;PUSHED ONTO KERNEL STACK
011456 001401          HLT
011460 000000          CMP      #KPTR-2, KSP           ;CHECK THAT KERNEL STACK POINTER IS POS-
011462 022706 000476          BEQ      .+4                     ;ITIONED PROPERLY
011466 001401          HLT                               ;ERROR! INCORRECT KERNEL STACK POINTER
011470 000000          TST     (KSP)                   ;CHECK THAT CORRECT DATA
011472 005716          BEQ      .+4                     ;WAS PUSHED ONTO KERNEL STACK
011474 001401          HLT                               ;ERROR!
011476 000000          CMP      #KH+PUM+REG+2, R13     ;CHECK STATUS
011500 022703 034004          BEQ      .+4
011504 001401          HLT                               ;ERROR! INCORRECT STATUS
011506 000000

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:TEST THAT SUPERVISOR CAN GET DATA FROM USER STACK
↑77: SCOPE
011510 010701          MOV      #SM+PUM+REG, @#PSW     ;SUPER MODE!!!  PREV USER MODE!!
011512 012737 074000 177776  MOV      #SPTR, SSP              ;SET SUPER STACK POINTER
011520 012706 000600          MOV      #UPTR, (SSP)
011524 012716 000700          MTPD    USP                      ;SET USER STACK POINTER
011530 106606          CLR      @#UPTR                 ;PRESET USER STACK
011532 005037 000700          CLR      (SSP)                  ;AND SUPER STACK
011536 005016          MOV      @-1, -2(SSP)
011540 012766 177777 177776  SCC
011546 000277          MFPD    USP                      ;PRESET CC'S
011550 106506          MFPD    @ (SSP)                 ;GET USER STACK POINTER
011552 106576 000000          NOP                               ;LIKE MOV @-(6), -(6)
011556 000240          MOV      @#PSW, R14             ;SAVE STATUS
011560 013704 177776          MOV      #PSW+REG, @#PSW        ;KERNEL MODE!!!  PREV SUPER MODE!!
011564 012737 014000 177776  MOV      #KPTR, KSP              ;SET KERNEL STACK POINTER
011572 012706 000500          MFPD    SSP                      ;PUSH SUPER STACK POINTER ONTO KERNEL STACK
011576 106506          CMP      #SPTR-2, (KSP)         ;CHECK THAT SUPER STACK POINTER IS POS-
011600 022716 000576          BEQ      .+4                     ;ITIONED PROPERLY (1 POP, 2 PUSHES)
011604 001401          HLT                               ;ERROR! INCORRECT SUPER STACK POINTER
011606 000000          CMP      #UPTR, @#SPTR          ;CHECK THAT MFPD USP PUSHED USER STACK
011610 022737 000700 000600  BEQ      .+4                     ;ONTO SUPER STACK
011616 001401          HLT                               ;ERROR!
011620 000000          TST     @#SPTR-2               ;CHECK THAT DATA ON USER STACK WAS PUSH-
011622 005737 000576          BEQ      .+4                     ;ONTO SUPER STACK (MFPD @ (SSP))
011626 001401          HLT                               ;ERROR!
011630 000000          CMP      #SM+PUM+REG+Z+C, R14   ;CHECK STATUS RESULT
011632 022704 074005          BEQ      .+4
011636 001401          HLT                               ;ERROR! INCORRECT STATUS AFTER MFPD @ (SSP)
011640 000000

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: TEST THAT INTERRUPT SEQUENCE USER TO SUPERVISOR (VIA TTY)
T100:  SCOPE
011642 010701
011644 012737 040000 177776      MOV      #SM, @PSW          ; SUPER MODE!!!
011652 012706 000600          MOV      @SPTR, SSP       ; SET SUPER STACK POINTER
011656 012737 000340 177776      MOV      @PRTY?, @PSW     ; KERNEL MODE!!!, PRIORITY LEVEL 7
011664 012737 000100 177564      MOV      @BIT6, @TPS      ; SET IE BIT IN TELEPRINTER STATUS
011672 012737 011722 000064      MOV      @T100A, @TPVEC  ; LOAD INTERRUPT VECTOR
011700 012767 044000 166160      MOV      @SM+REG, TPVEC+2; AND 'NEW' STATUS
011706 012737 140000 177776      MOV      @UM, @PSW       ; USER MODE!!!, ALLOW TTY INTERRUPT
011714 005037 177776      T100AA: CLR      @PSW      ; KERNEL MODE!!!
011720 000000          HLT                      ; ERROR! INTERRUPT FAILED
011722 013767 177776 167052      T100A:  MOV      @PSW, TEMP  ; SAVE 'NEW' STATUS
011730 012737 010000 177776      MOV      @PSW, @PSW      ; KERNEL MODE!!!, PREV SUPER MODE!!
011736 005067 166622          CLR      TPS             ; CLEAR IE BIT
011742 106506          MFPD      SSP           ; PUSH SUPER STACK PTR ONTO KERNEL STACK
011744 022767 074000 167030      CMP      @SM+PUM+REG, TEMP; CHECK THAT 'NEW' STATUS IS CORRECT
011752 001401          BEQ      .+4
011754 000000          HLT
011756 022716 000574          CMP      @SPTR-4, (KSP) ; CHECK SUPER STACK POINTER
011762 001401          BEQ      .+4           ; (2 PUSHES)
011764 000000          HLT
011766 022737 011714 000574      CMP      @T100AA, @SPTR-4; CHECK RETURN PC ON SUPER STACK
011774 001401          BEQ      .+4
011776 000000          HLT
012000 022767 140000 166570      CMP      @UM, SPTR-2    ; ERROR! RETURN PC NOT ON SUPER STACK
012006 001401          BEQ      .+4           ; CHECK THAT STATUS WAS SAVED ON
012010 000000          HLT                    ; SUPER STACK
                                ; ERROR! OLD STATUS NOT ON SUPER STACK

: TEST TRAP & RETURN USER-SUPER-USER
T101:  SCOPE
012012 010701
012014 012737 074000 177776      MOV      @SM+PUM+REG, @PSW; SUPER MODE!!!, PREV USER MODE!!
012022 012706 000600          MOV      @SPTR, SSP     ; SET SUPER STACK POINTER
012026 012737 012150 000020      MOV      @T101A, @IOTVEC; LOAD IOT TRAP VECTOR
012034 012737 044000 000022      MOV      @SM+REG, @IOTVEC+2; AND 'NEW' STATUS
012042 005002          CLR      R12
012044 012737 144000 177776      MOV      @UM+REG, @PSW  ; USER MODE!!!
012052 000004          IOT
012054 013767 177776 166720      T101AA: MOV      @PSW, TEMP    ; TRAP
012062 012737 014000 177776      MOV      @PSW+REG, @PSW ; SAVE 'OLD' STATUS RETURN BY RTI
012070 022767 012054 166476      CMP      @T101AA, SPTR-4; KERNEL MODE!!!, PREV SUPER MODE!!
012076 001401          BEQ      .+4           ; CHECK THAT RETURN PC WAS SAVED ON SUPER
                                ; STACK
012100 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; ERROR! INCORRECT STATUS SAVED
                                ; CHECK RETURNED 'OLD' STATUS
012122 001401          BEQ      .+4
012124 000000          HLT
012126 106506          MFPD      SSP           ; ERROR! RETURNED 'OLD' STATUS INCORRECT
012130 022716 000600          CMP      @SPTR, (KSP)  ; GET SUPER STACK POINTER
012134 001401          BEQ      .+4           ; CHECK SUPER STACK POINTER
                                ; (2 PUSHES, 2 POPS)
012136 000000          HLT                    ; ERROR! INCORRECT SSP AFTER TRAP & RETURN
012140 005102          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

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012150 005102      T101A: COM      R12      ;COMPLEMENT E12
012152 000002      RTI              ;RETURN

012154 000240      T101EX: NOP

;CHECK THAT MTPD CAN LOAD MEMORY ADDRESS DM=7,PC
†102: SCOPE
012156 010701      MOV      %KM+PSM,%PSM ;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      %-1,TEMP     ;PRESET DATA
012202 012767 177777 166572  MOV      %TEMP,%TEMP+2 ;PRESET CC'S
012210 000277      SCC              ;PRESET CC'S
012212 106677 166566  MTPD      %TEMP+2     ;TEMP+(KSP)+
012216 013703 177776  MOV      %PSW,R3      ;CHECK CC'S
012222 022703 010005  CMP      %KM+PSM+Z+C,R3 ;CHECK CC'S
012226 001401      BEQ      .+4
012230 000000      HLT
012232 005737 001002  TST      %TEMP        ;ERROR! INCORRECT CC'S AFTER MTPD
012236 001401      BEQ      .+4          ;CHECK RESULT
012240 000000      HLT                  ;ERROR! INCORRECT RESULT

;CHECK THAT MTPD CAN LOAD MEMORY ADDRESS DM=7
†103: SCOPE
012242 010701      MOV      %KM+PUM+REG,%PSM ;KERNEL MODE!!!
012244 012737 034000 177776  MOV      %KPTR,KSP    ;SET KERNEL STACK PTR
012252 012706 000500      MOV      %-1,(KSP)   ;LOAD DATA ONTO STACK
012256 012716 177777      MOV      %-2,R14     ;LOAD INDEX REGISTER
012262 012704 177776      CLR      TEMP        ;PRESET DATA
012266 005067 166510  MOV      %TEMP,%TEMP+2 ;TEMP+(KSP)+
012272 012767 001002 166504  MTPD      %TEMP+4(R14) ;TEMP+(KSP)+
012300 006674 001006  MOV      %PSW,R13    ;SAVE STATUS RESULT
012304 013703 177776  CMP      %KPTR+2,KSP ;CHECK THAT KSP POPPED
012310 022706 000502  BEQ      .+4
012314 001401      HLT
012316 000000      HLT                  ;ERROR! INCORRECT STACK PTR
012320 022703 034010  CMP      %PUM+REG+N,R13 ;CHECK STATUS RESULT
012324 001401      BEQ      .+4
012326 000000      HLT                  ;ERROR! INCORRECT STATUS
012330 005267 166446  INC      TEMP        ;CHECK RESULT
012334 001401      BEQ      .+4
012336 000000      HLT                  ;ERROR! INCORRECT RESULT

;TEST THAT MTPD/I CAN LOAD PC
†104: SCOPE
012340 010701      MOV      %KM+PSM,%PSM ;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              ;PRESET CC'S
012360 000277      MTPD      PC         ;PC+(KSP)+
012362 106607      HLT                  ;ERROR! MTPD FAILED TO SET PC
012364 000000      BPL      .+4
012366 100001      HLT                  ;ERROR! 'N' FAILED TO CLEAR IN STATUS
012370 000000      BCS      .+4
012372 103401      HLT                  ;ERROR! 'C' WAS CLEARED BY MTPD
012374 000000

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: SUPERVISORY MODE
012376 010701
012400 012737 074000 177776 T105: SCOPE
012406 012706 000600 MOV #SM+PUM+REG, @#PSW ; SUPER MODE!!!
012412 012716 012430 MOV #SPTR, SSP ; SET SUPER STACK
012416 000277 MOV #T105A, (SSP) ; PUT NEW PC ON STACK
012420 006607 SCC ; PRESET CC'S
012422 005037 177776 MTP1 PC ; PC+(SSP)+
012426 000000 CLR @#PSW ; KERNEL MODE!!!
012430 013704 177776 T105A: MOV @#PSW, R14 ; ERROR! MTP1 FAILED TO LOAD PC
012434 042737 140000 177776 BIC #UM, @#PSW ; SAVE STATUS RESULT
012442 022704 074001 CMP #SM+PUM+REG+C, R14 ; KERNEL MODE!!!
012446 001401 BEQ .+4 ; CHECK STATUS RESULT
012450 000000 HLT ; ERROR! INCORRECT STATUS RESULT

: USER MODE
012452 010701
012454 012737 170000 177776 T106: SCOPE
012462 012706 000700 MOV #UM+PUM, @#PSW ; USER MODE!!!
012466 012716 012504 MOV #UPTR, USP ; SET USER STACK PTR
012472 000277 MOV #T106A, (USP) ; PUT NEW PC ON STACK
012474 106607 SCC ; PRESET CC'S
012476 005037 177776 MTPD PC ; PC+(USP)+
012502 000000 CLR @#PSW ; KERNEL MODE!!!
012504 013705 177776 T106A: MOV @#PSW, RS ; ERROR! MTPD FAILED TO LOAD PC
012510 005037 177776 CLR @#PSW ; SAVE STATUS
012514 022705 170001 CMP #UM+PUM+C, RS ; KERNEL MODE!!!
012520 001401 BEQ .+4 ; CHECK STATUS
012522 000000 HLT

: TEST ERROR TRAP (ODD ADDRESS) MFPD/I
012524 010701
012526 005037 177776 T107: SCOPE
012532 012706 000500 CLR @#PSW ; KERNEL MODE!!!
012536 012737 012554 000004 MOV #KPTR, KSP ; SET KERNEL STACK PTR
012544 000277 MOV #T107A, @#ERRVEC ; LOAD ERROR VECTOR
012546 106567 165227 SCC ; PRESET CC'S
012552 000000 MFPD 1 ; ODD ADDRESS SHOULD TRAP
012554 022706 000474 T107AA: HLT ; ERROR! FAILED TO TRAP ON ODD ADDRESS
012560 001401 T107A: CMP #KPTR-4, KSP ; CHECK THAT STACK PTR WAS PUSHED
012562 000000 BEQ .+4 ; PROPERLY (2 PUSHES)
012564 022726 012552 HLT ; ERROR! INCORRECT STACK PTR AFTER ERROR
012570 001401 CMP #T107AA, (KSP)+ ; CHECK RETURN PC ON STACK
012572 000000 BEQ .+4
012574 022716 000017 HLT ; ERROR! RETURN PC NOT ON STACK
012600 001401 CMP #17, (KSP) ; CHECK SAVED STATUS ON STACK
012602 000000 BEQ .+4 ; ERROR! INCORRECT STATUS SAVED ON STACK
012604 010701
012606 012737 040000 177776 T110: SCOPE
012614 012706 000600 MOV #SM, @#PSW ; SUPER MODE!!!
012620 012737 044000 000006 MOV #SPTR, SSP ; SET SUPER STACK
012626 012737 012646 000004 MOV #SM+REG, @#ERRVEC+2 ; LOAD 'NEW' STATUS
012634 106537 177702 MOV #T110A, @#ERRVEC ; AND PC
012640 005037 177776 T110AA: MFPD @#177702 ; 177702 IS NON-EXISTANT ADRS
012644 000000 CLR @#PSW ; KERNEL MODE!!!
HLT ; ERROR! DID NOT TRAP ON NON ADRS

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012646 010603          T110A: MOV    SSP,R13      ;SAVE SUPER STACK PTR
012650 042737 140000 177776 BIC    #UM,#PSW      ;KERNEL MODE!!!
012656 022703 000574      CMP    #SPTR-4,R13   ;CHECK SUPER STACK PTR
012662 001401          BEQ    .+4
012664 000000          HLT
012666 022723 012640      CMP    #T110AA,(R13)+ ;ERROR! INCORRECT SSP AFTER ERROR TRAP
012672 001401          BEQ    .+4           ;CHECK RETURN PC ON SUPER STACK
012674 000000          HLT
012676 022713 040000      CMP    #SM,(R13)     ;ERROR! RETURN PC NOT ON SUPER STACK
012702 001401          BEQ    .+4           ;CHECK SAVED STATUS
012704 000000          HLT                    ;ERROR! INCORRECT STATUS SAVED ON STACK

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:USER MODE, ODD ADDRESS
012706 010701          †111: SCOPE
012710 012737 144000 177776 MOV    #UM+REG,#PSW  ;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 000006 MOV    #UM,#ERRVEC+2
012736 106567 165035      MFPD  -1             ;ODD ADDRESS SHOULD TRAP
012742 005037 177776      T111AA: CLR    #PSW   ;KERNEL MODE!!!
012746 000000          HLT                    ;ERROR! FAILED TO TRAP
012750 010603          T111A: MOV    USP,R3  ;SAVE USER STACK PTR
012752 042737 140000 177776 BIC    #UM,#PSW      ;KERNEL MODE!!!
012760 022703 000674      CMP    #UPTR-4,R3   ;CHECK USER STACK PTR
012764 001401          BEQ    .+4
012766 000000          HLT                    ;ERROR! INCORRECT USER STACK POINTER
012770 022713 012742      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 000006 000004 MOV    #ERRVEC+2,#ERRVEC ;RESTORE ERROR TRAP TO HALT
013006 005067 164774      CLR

```

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:TEST THAT MTPD INSTRUCTION CAN LOAD DATA TO AN ADDRESS VIA THE STACK
:KERNEL MODE, PREVIOUS SUPER MODE
013012 010701          †112: SCOPE
013014 012737 010000 177776 MOV    #KM+PSM,#PSW  ;KERNEL MODE!!!, PREV SUPER MODE!!
013022 012706 000500      MOV    #KPTR,KSP    ;SET KERNEL STACK PTR
013026 012746 000600      MOV    #SPTR,-(KSP)
013032 106606          MTPD  SSP           ;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 STAK
013044 005037 001002      CLR    #TEMP        ;PRESET DATA
013050 106636          MTPD  @(KSP)+       ;MOVE #-1 TO TEMP
013052 022706 000500      CMP    #KPTR,KSP    ;CHECK STACK PTR AFTER MTPD
013056 001401          BEQ    .+4
013060 000000          HLT                    ;ERROR! INCORRECT STACK PTR AFTER MTPD
013062 005267 165714      INC    TEMP          ;CHECK THAT DATA WAS MOVED TO TEMP
013066 001401          BEQ    .+4
013070 000000          HLT                    ;ERROR! DATA NOT IN TEMP
013072 106506          MFPD  SSP           ;GET SUPER STCAK PTR
013074 022716 000600      CMP    #SPTR,(KSP)  ;CHECK THAT SUPER STACK PTR NOT CHANGED
013100 001401          BEQ    .+4           ;BY MTPD INSTRUCTION
013102 000000          HLT                    ;ERROR! SSP WAS CHANGED BY MTPD INST.

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:CHECK THAT MTPD CAN LOAD DATA TO AN ADDRESS VIA THE STACK
:SUPER MODE, PREV USER MODE

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013104 010701 T113: SCOPE
013106 012737 070000 177776 MOV #SM+PUM, @#PSW ; SUPER MODE!!!, PREV USER MODE!!
013114 012706 000600 MOV #SPTR, SSP ; SET SUPER STACK PTR
013120 012746 000700 MOV #UPTR, -(SSP)
013124 106606 MTPD 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 005037 001002 CLR @#TEMP ; PRESET DATA
013142 006676 000000 MTPD @#TEMP ; MOVE #-1 TO TEMP
013146 012737 010000 177776 MOV #PSM, @#PSW ; KERNEL MODE!!!, PREV SUPER MODE!!
013154 106506 MFPD SSP ; GET SUPER STACK PTR
013156 022726 000576 CMP #SPTR-2, (KSP)+ ; CHECK SUPER STACK PTR AFTER MTPD
013162 001401 BEQ .+4
013164 000000 HLT ; ERROR! INCORRECT SUPER STACK PTR
013166 012737 030000 177776 MOV #PUM, @#PSW ; KERNEL MODE!!!, PREV USER MODE!!
013174 106506 MFPD USP ; GET 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 MTPD
013206 005267 165570 INC TEMP ; CHECK THAT DATA WAS MOVED TO TEMP
013212 001401 BEQ .+4
013214 000000 HLT ; ERROR! INCORRECT DATA IN TEMP AFTER MTPD

```

; TEST THAT MFPI CAN GET DATA FROM AN ADDRESS VIA THE STACK

```

; KERNEL MODE, PREV SUPER MODE
013216 010701 T114: SCOPE
013220 012737 010000 177776 MOV #KM+PSM, @#PSW ; KERNEL MODE!!!, PREV SUPER MODE!!
013226 012706 000500 MOV #KPTR, KSP ; SET KERENL STACK PTR
013232 012746 000600 MOV #SPTR, -(KSP)
013236 106606 MTPD SSP ; SET SUPER STACK PTR
013240 005066 177776 CLR -2(KSP) ; PRESET DATA ON THE STACK
013244 012716 001002 MOV #TEMP, (KSP) ; PUT ADDRESS ON THE STACK
013250 012737 177777 001002 MOV #-1, @#TEMP ; LOAD DATA INTO ADDRESS
013256 006576 000000 MFPI @#TEMP ; MOVE TEMP TO STACK
013262 022706 000476 CMP #KPTR-2, KSP ; CHECK STACK PTR AFTER MFPI
013266 001401 BEQ .+4
013270 000000 HLT ; ERROR! INCORRECT STACK PTR AFTER MFPI
013272 022716 177777 CMP #-1, (KSP) ; CHECK DATA ON THE STACK
013276 001401 BEQ .+4
013300 000000 HLT ; ERROR! INCORRECT DATA MOVED ONTO THE STACK
013302 006506 MFPI SSP ; GET SUPER STACK PTR
013304 022726 000600 CMP #SPTR, (KSP)+ ; CHECK THAT SUPER STACK PTR WAS NOT
013310 001401 BEQ .+4 ; BY MFPI
013312 000000 HLT ; ERROR! INCORRECT SSP

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; TEST THAT MFPD CAN GET DATA FROM AN ADDRESS VIA THE STACK

```

; SUPER MODE, PREV USER MODE
013314 010701 T115: SCOPE
013316 012737 070000 177776 MOV #SM+PUM, @#PSW ; SUPER MODE!!!, PREV USER MODE!!
013324 012706 000600 MOV #SPTR, SSP ; SET SUPER STACK PTR
013330 012746 000700 MOV #UPTR, -(SSP)
013334 106606 MTPD USP ; SET USER STACK PTR
013336 012726 001002 MOV #TEMP, (SSP)+ ; PUT THE ADDRESS ON THE STACK
013342 005066 177774 CLR -4(SSP) ; PRESET DATA ON THE STACK
013346 012737 177777 001002 MOV #-1, @#TEMP ; PRESET MEMORY DATA
013354 106556 MFPD @-(SSP) ; MOVE TEMP TO THE STACK

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013356 012737 010000 177776      MOV      #KM+PSM, @#PSW      ;KERNEL MODE!!!, PREV SUPER MODE!!
013364 106506                      MFPD     SSP                ;GET SUPER STACK PTR
013366 022726 000576              CMP      #SPTR-2, (KSP)+    ;CHECK SUPER STACK PTR AFTER MFPD
013372 001401                      BEQ      .+4
013374 000000                      HLT
013376 012737 030000 177776      MOV      #KM+PUM, @#PSW    ;KERNEL MODE!!!, PREV USER MODE!!
013404 106506                      MFPD     USP                ;GET USER STACK PTR
013406 022726 000700              CMP      #UPTR, (KSP)+     ;CHECK THAT USP WAS NOT CHANGED
013412 001401                      BEQ      .+4
013414 000000                      HLT
013416 005237 000576              INC      @#SPTR-2          ;ERROR! USP CHANGED BY MFPD
013422 001401                      BEQ      .+4               ;CHECK DATA ON THE SUPER STACK
013424 000000                      HLT
013426 005037 177776              CLR      @#PSW             ;ERROR! INCORRECT DATA ON SUPER STACK
013432 010701

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;CHECK TRAP SEQUENCE WHEN SUPERVISOR STACK PTR IS ODD.
;THE TEST TRAPS FROM USER TO SUPERVISOR AND THEN FROM SUPERVISOR TO KERNEL

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013434 010701                      SCOPE
013436 012706 000500              MOV      #KPTR, KSP        ;SET KERNEL STACK PTR
013442 012737 013526 000004      MOV      #T116A, @#ERRVEC  ;SET ODD ADDRESS ERROR TRAP
013450 005037 000006              CLR      @#ERRVEC+2
013454 012737 013520 000020      MOV      #T116A, @#IOTVEC
013462 012737 040340 000022      MOV      #SM+PRTY7, @#IOTVEC+2
013470 012737 040000 177776      MOV      #SM, @#PSW        ;SUPER MPDE!!!
013476 012706 000601              MOV      #SPTR+1, SSP      ;SET SUPER STACK PTR ODD
013502 012737 144000 177776      MOV      #UM+REG, @#PSW   ;USER MODE!!!
013510 000004                      IOT
013512 005037 177776              CLR      @#PSW            ;TRAP TO SUPERVISOR
013516 000000                      HLT                        ;KERNEL MODE!!!
013520 005037 177776      T116A: CLR      @#PSW      ;ERROR! IOT FAILED TO TRAP
013524 000000                      HLT                        ;KERNEL MODE!!!
013526 022706 000474      T116B: CMP      #KPTR-4, KSP  ;ERROR! NO ODD ADDRESS TRAP ON ODD SUP-
013532 001401                      BEQ      .+4               ;ERVISOR STACK PTR
013534 000000                      HLT                        ;CHECK KERNEL STACK PTR
013536 022716 013520              CMP      #T116A, (KSP)    ;ERROR! INCORRECT KERNEL STACK PTR AFTER
013542 001401                      BEQ      .+4               ;ODD ADDRESS TRAP
013544 000000                      HLT                        ;CHECK RETURN PC ON KERNEL STACK
013546 022766 070340 000002      CMP      #SM+PUM+PRTY7, 2(KSP) ;ERROR! RETURN PC FROM ODD ADDRESS
013554 001401                      BEQ      .+4               ;TRAP NOT ON KERNEL STACK
013556 000000                      HLT                        ;CHECK STATUS ON STACK
013560 106506                      MFPD     SSP                ;ERROR! INCORRECT STATUS ON STACK
013562 022716 000575              CMP      #SPTR-3, (KSP)   ;GET SUPERVISOR STACK PTR
013566 001401                      BEQ      .+4               ;CHECK SUPER STACK PTR
013570 000000                      HLT                        ;ERROR! INCORRECT SUPER STACK PTR
013572 005037 177776              CLR      @#PSW            ;AFTER IOT
013576 012737 000006 000004      MOV      #ERRVEC+2, @#ERRVEC ;KERNEL MODE!!!
013604 012737 000022 000020      MOV      #IOTVEC+2, @#IOTVEC
013612 005037 000022              CLR      @#IOTVEC+2
013616 005267 165156      END:   INC      ICNT        ;INCREMENT PASS COUNT

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013622	026727	165152	012000		CMP	ICNT, #12000	;1200G PASSES COMPLETED?
013623	001403				BEG	DONE	
013624	000167	165174			JMP	BEGIN	
013625	012767	000007	163722	DONE:	MOV	#7, TP8	;RING BELL
013626	105767	163714			TSTB	TP8	
013627	100375				BPL	-4	
013628	013702	000042			MOV	#42, R2	;GET DETAPE MONITOR RETURN ADDRESS
013629	001404				BEG	DONE1	;DO NOT RETURN IF (42)=0
013630	004712				JSR	7, (2)	;RETURN TO DETAPE MONITOR
013631	000240				NOP		;OVERLAY AREA FOR
013632	000240				NOP		;ACT11
013633	000240				NOP		
013634	000240				NOP		
013635	000240				NOP		
013636	000240				NOP		
013637	000167	165116		DONE1:	JMP	START	
013638	000001				.END		

CROSS REFERENCE TABLE -- USER SYMBOLS

	1931	1938	1955	1960	1971*	1972*	1974*	1975*	1977	1978	1981	1985	2002
N = 000010	2007	2020*	2034	2038	2042	2046	1075	1140	1162	1181	1255	1352	1377
PC = 000007	1660	1812	1838*	1853*	1838*	1853*							
PIRQ = 177772	137*	1825*	532*	543*	544*								
PIRVEC = 000240	168*	528*	525*										
PIR4 = 010000	164*	524*											
PKH = 000000	205*	528											
PRTY3 = 000140	197*												
PRTY4 = 000200	152*	540											
PRTY7 = 000340	153*	494	505	526	527	534	638	646	649	1220	1232		523
PSH = 010000	154*	234	238	1352	262	271	278	290	299	325	339	499	
	1197	1209	1341	1352	1388	1405	1724	2024	2042				
	196*	271	278	299	325	339	421	447	465	505	525	594	667
	670	750	759	797	809	845	856	950	1339	1352	1364	1377	1453
	1480	1498	1547	1574	1592	1639	1660	1704	1732	1758	1784	1792	1821
PSH = 177776	1923	1953	1970	2000									
	166*	222	234*	236	237*	244*	246	247*	255*	258	260*	271*	274
	277*	284*	291*	295*	297	298*	311*	313*	325*	329*	331	332*	345*
	347*	357*	359*	362*	364	366*	379*	381*	390*	393*	395	397*	411*
	414*	416	417*	431*	433*	436*	438	440*	459*	461*	463	464*	476*
	478*	480	481*	496*	499*	500*	502	503*	523*	527*	529*	531	533*
	549*	560*	578*	583*	594*	606*	622*	627*	638*	641	642*	663*	667*
	669	683*	687*	689	703*	709	711*	722*	729*	735	737*	750*	756
	758*	772*	778	780*	795*	797	802	803*	805*	815*	817*	822	823*
	825*	845*	850	852*	862*	864*	871	873*	875*	888*	894	896*	906*
	908*	909*	912*	913*	915*	922*	924*	927*	929*	936*	938*	941*	943*
	950*	955*	962*	967*	975*	991*	993*	1000*	1003*	1016*	1018*	1025*	1028*
	1041*	1046*	1050*	1065*	1074*	1084*	1087*	1097*	1098*	1109*	1116*	1127*	1130*
	1138	1139*	1156*	1161	1176*	1180	1197*	1201*	1206	1208*	1220*	1224*	1229
	1231*	1245*	1252	1254*	1264*	1268*	1275	1277*	1292*	1294*	1302	1314*	1316*
	1324	1326*	1339*	1341*	1349	1351*	1364*	1388*	1419*	1422	1423*	1444*	1453*
	1468*	1480*	1485*	1487*	1498*	1502*	1505*	1508*	1519*	1524*	1526*	1537*	1547*
	1562*	1574*	1578*	1580*	1592*	1596*	1599*	1601*	1612*	1617*	1619*	1630*	1631
	1632*	1639*	1650	1666*	1676	1692*	1703	1704*	1722*	1724*	1728*	1729*	1731
	1732*	1750*	1755*	1757	1758*	1784*	1791	1801*	1808	1821*	1834*	1839*	1841
	1842*	1849*	1854*	1856	1857*	1864*	1881*	1886*	1889*	1902*	1907*	1910*	1923*
	1945*	1953*	1958*	1970*	1992*	2000*	2005*	2013*	2025*	2027*	2029*	2031*	2050*
PUM = 030000	195*	222	255	262	333	367	401	482	496	514	523	534	540
	549	687	690	729	738	817	864	876	888	897	924	938	962
	1016	1032	1109	1118	1314	1327	1388	1405	1468	1502	1519	1562	1596
	1612	1666	1686	1692	1716	1735	1750	1765	1801	1812	1834	1843	1849
	1858	1945	1958	1992	2005	2042							
PWRUP 001022	222*												
REDPTR = 000736	181*	837	839	1389	1399								
REG = 004000	198*	222	271	278	357	359	373	389	401	494	505	560	568
	606	618	636	638	646	649	703	712	991	993	1018	1023	1032
	1050	1065	1075	1087	1099	1109	1118	1130	1156	1162	1176	1181	1201
	1209	1224	1232	1245	1255	1268	1278	1294	1303	1316	1327	1341	1352
	1364	1377	1388	1405	1417	1419	1427	1453	1468	1480	1498	1547	1562
	1574	1592	1612	1639	1660	1666	1686	1692	1704	1716	1727	1735	1750
	1753	1755	1758	1762	1765	1801	1812	1834	1843	1883	1902	2027	
RO = 000000	131*	236*	238	246*	248	258*	262	297*	299	312*	314	331*	333
	346*	348	364*	367	380*	382	416*	421	438*	447	463*	465	480*
	482	531*	534	665*	668*	676	689*	690	735*	738	756*	759	775*
	777*	787	804*	806	824*	826	851*	853	872*	879	894*	897	928*

T12AA	002412	461#	468	
T13	002452	473#		
T13A	002504	474	480#	
T13AA	002476	478#	485	
T14	002544	491#		
T14A	002624	493	502#	
T14AA	002616	500#	511	
T15	002722	521#		
T15A	003000	524	531#	
T15AA	002772	529#	537	
T16	003062	547#		
T16A	003136	556#		
T16B	003142	556	557#	
T16C	003154	558	559#	
T16D	003174	561	562#	
T16E	003206	563	564#	
T16ERR	003330	554	583#	
T16F	003250	567	571#	
T16G	003302	552	577#	
T16X	003336	582	587#	
T17	003354	592#		
T17A	003410	598#		
T17B	003422	598	600#	
T17C	003442	601	603#	
T17D	003500	607	609#	
T17E	003522	610	613#	
T17ERR	003622	595	627#	
T17F	003542	614	616#	
T17G	003574	617	621#	
T17X	003630	626	629#	
T2	001146	254#		
T20	003646	634#		
T20A	003764	637	656#	
T20AA	003702	641#	643	
T21	003770	653	655	662#
T22	004052	682#		
T23	004134	701#		
T24	004240	728#		
T25	004326	749#		
T26	004416	771#		
T27	004506	794#		
T3	001226	270#		
T30	004602	814#		
T31	004676	835#		
T31A	004722	844#		
T31B	005000	861#		
T31C	005106	887#		
T32	005160	905#		
T32A	005242	921#		
T33	005312	935#		
T34	005364	949#		
T35	005422	961#		
T36	005462	974#		
T36A	005520	978	982#	
T36AA	005516	981#	985	
T37	005542	990#		

T37A	005622	997	1002#
T37AA	005614	1000#	1007
T4	001314	287#	
T4A	001362	289	297#
T4AA	001354	295#	302
T40	005662	1015#	
T40A	005742	1022	1027#
T40AA	005734	1025#	1035
T41	006022	1045#	
T41A	006070	1048	1056#
T41B	006110	1064#	
T41BB	006146	1066	1073#
T42	006174	1083#	
T42A	006250	1086	1096#
T43	006376	1126#	
T43A	006450	1129	1137#
T43B	006304	1106#	
T43BB	006346	1108	1115#
T44	006516	1152#	
T45	006604	1172#	
T46	006670	1196#	
T47	006772	1219#	
T5	001474	321#	
T5A	001540	323	331#
T5AA	001532	329#	336
T50	007102	1243#	
T51	007202	1266#	
T52	007300	1291#	
T53	007402	1313#	
T54	007520	1338#	
T55	007636	1363#	
T55A	007712	1368	1374#
T55AA	007710	1373#	1380
T56	007754	1386#	
T56A	010030	1387	1399#
T56AA	010026	1397#	1408
T57	010106	1415#	
T57A	010212	1418	1436#
T57AA	010142	1422#	1424
T57EX	010216	1435	1438#
T6	001646	354#	
T6A	001720	355	364#
T6AA	001712	362#	370
T60	010220	1443#	
T61	010246	1452#	
T62	010312	1467#	
T63	010352	1479#	
T64	010436	1497#	
T65	010540	1518#	
T66	010630	1536#	
T67	010656	1546#	
T7	002022	387#	
T7A	002062	388	395#
T7AA	002054	393#	398
T70	010722	1561#	
T71	010762	1573#	

TSTB	2060
WAIT	570
.ABS	115
.END	2069
.NLIST	114
.REM	1
.REPT	208
.TITLE	113

ERRORS DETECTED: 0
DEFAULT GLOBALS GENERATED: 0

#DCKBOA,DCKBOA.SEQ/SOL/CRF/DS:ERFZ/EN:ABS=DSKM:DCKBOA.P11
RUN-TIME: 7 15 5 SECONDS
RUN-TIME RATIO: 632/29=21.7
CORE USED: 9K (18 PAGES)

