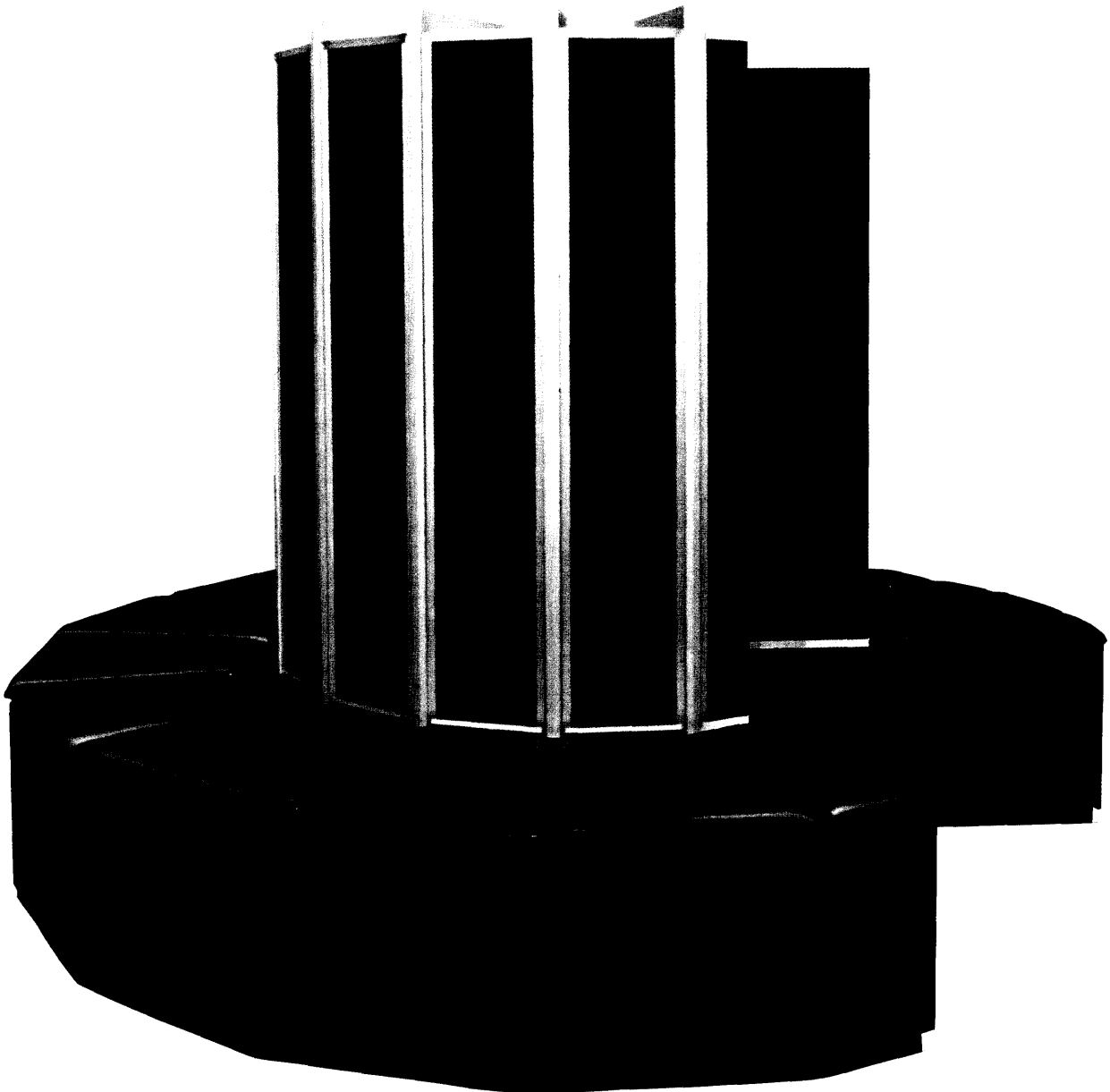


**CRAY**  
**RESEARCH, INC.**

**CRAY-1®**  
**COMPUTER SYSTEM**

OPERATING SYSTEM (COS)  
WORKBOOK

T-0103



FOR TRAINING PURPOSES ONLY



**CRAY-1<sup>®</sup>**

**COMPUTER SYSTEM**

**OPERATING SYSTEM (COS)  
WORKBOOK**

**T-0103**

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<u>Revision</u>	<u>Description</u>
	December, 1979 - Original printing.
A	June, 1980 - obsoletes other revision.
B	January, 1981 - obsoletes other revisions.
C	September, 1981 - obsoletes other revisions. Supports 1.10 release.



# OVERVIEW OF CRAY-1 OPERATING SYSTEM (COS)



## CRAY-1 OPERATING SYSTEM (COS)

- MULTIPROGRAMMING OF USER APPLICATIONS
- SCHEDULING OF APPLICATIONS BY PRIORITY (JOB CLASS)
- MANAGES DISK AND TAPE RESOURCES
- MANAGES FRONT-END COMMUNICATIONS
- MANAGES FILE MAINTENANCE
- MANAGES PROGRAM MAINTENANCE
- CAPABLE OF MODIFICATION AT STARTUP



## COS HARDWARE ELEMENTS

- MCU

  - STARTUP AND RECOVERY OF COS  
FRONT-END COMPUTER SYSTEM

- MASS STORAGE SUBSYSTEM

  - UTILITIES  
DATA  
LIBRARIES  
COPY OF COS (OPTIONAL)  
COS OVERLAYS (OPTIONAL)  
COPIES OF CSP (OPTIONAL)

- CRAY-1 COMPUTER

  - COS RESIDENT  
USER APPLICATIONS EXECUTION AREAS  
USER STATION BUFFERS



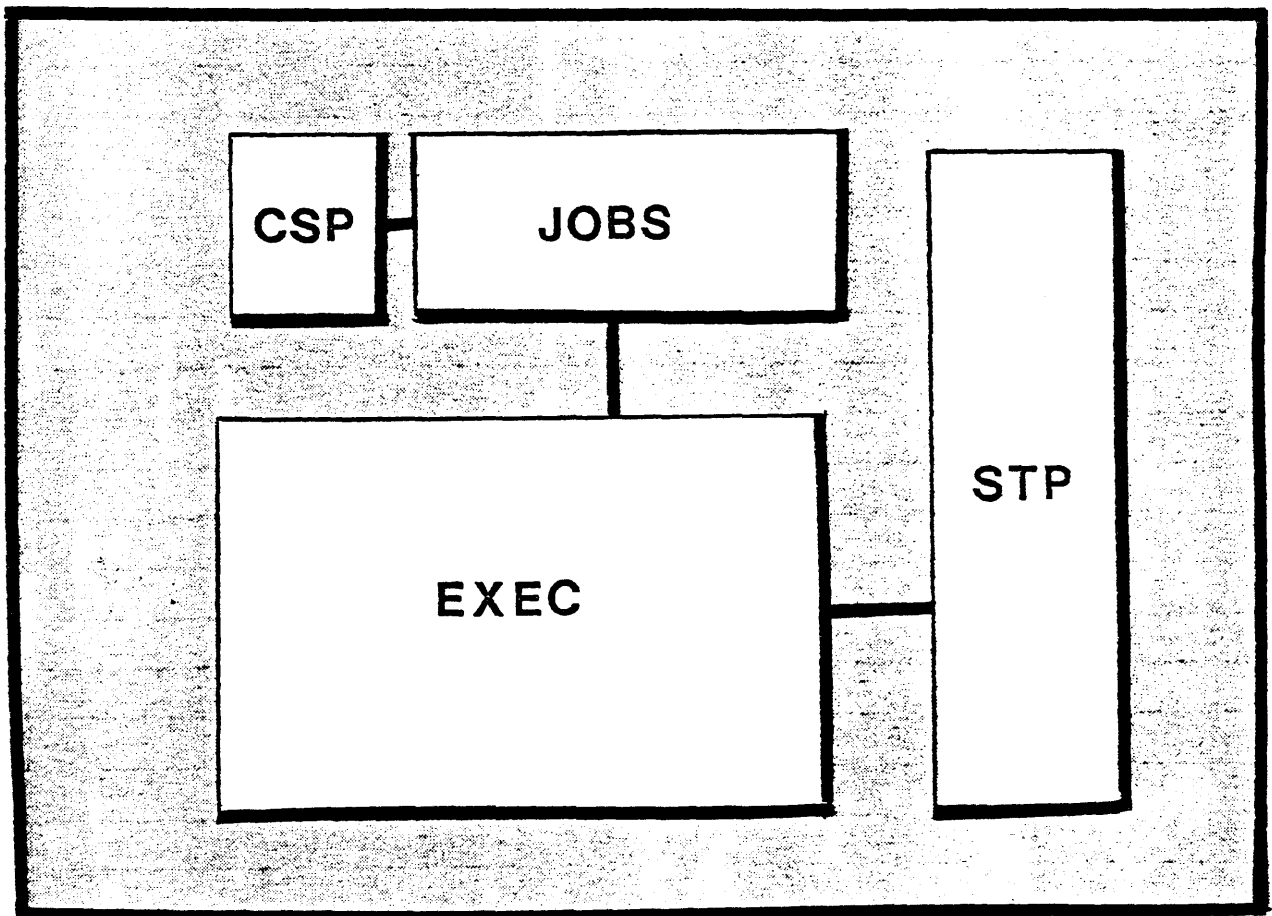
## COS SOFTWARE ELEMENTS

### ● RESIDENT SYSTEM PROGRAMS

EXECUTIVE (EXEC)

SYSTEM TASK PROCESSOR (STP)

CONTROL STATEMENT PROCESSOR (CSP) - OPTIONAL



### ● NON-RESIDENT PROGRAMS

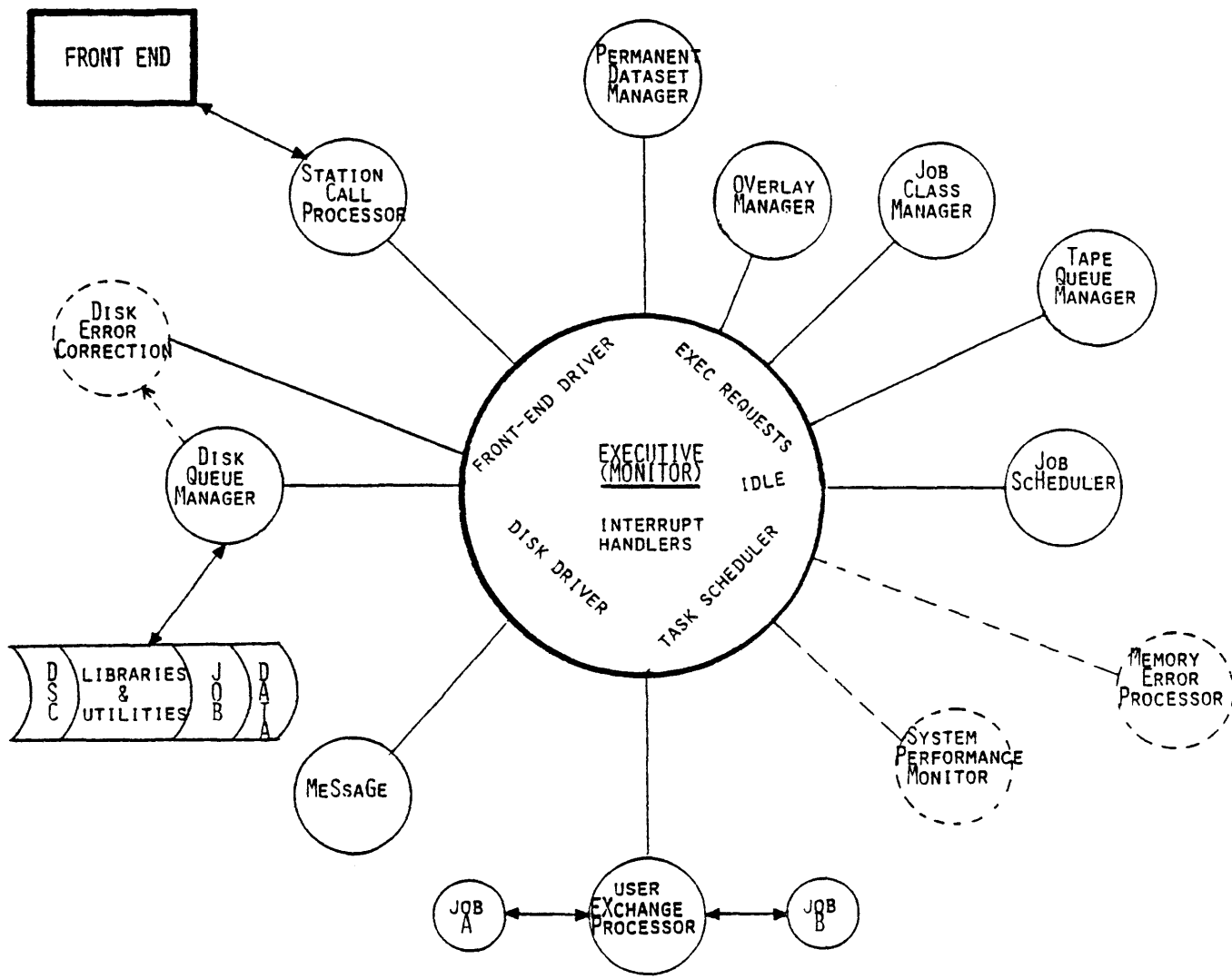
LIBRARIES

SYSTEM UTILITIES

USER APPLICATIONS

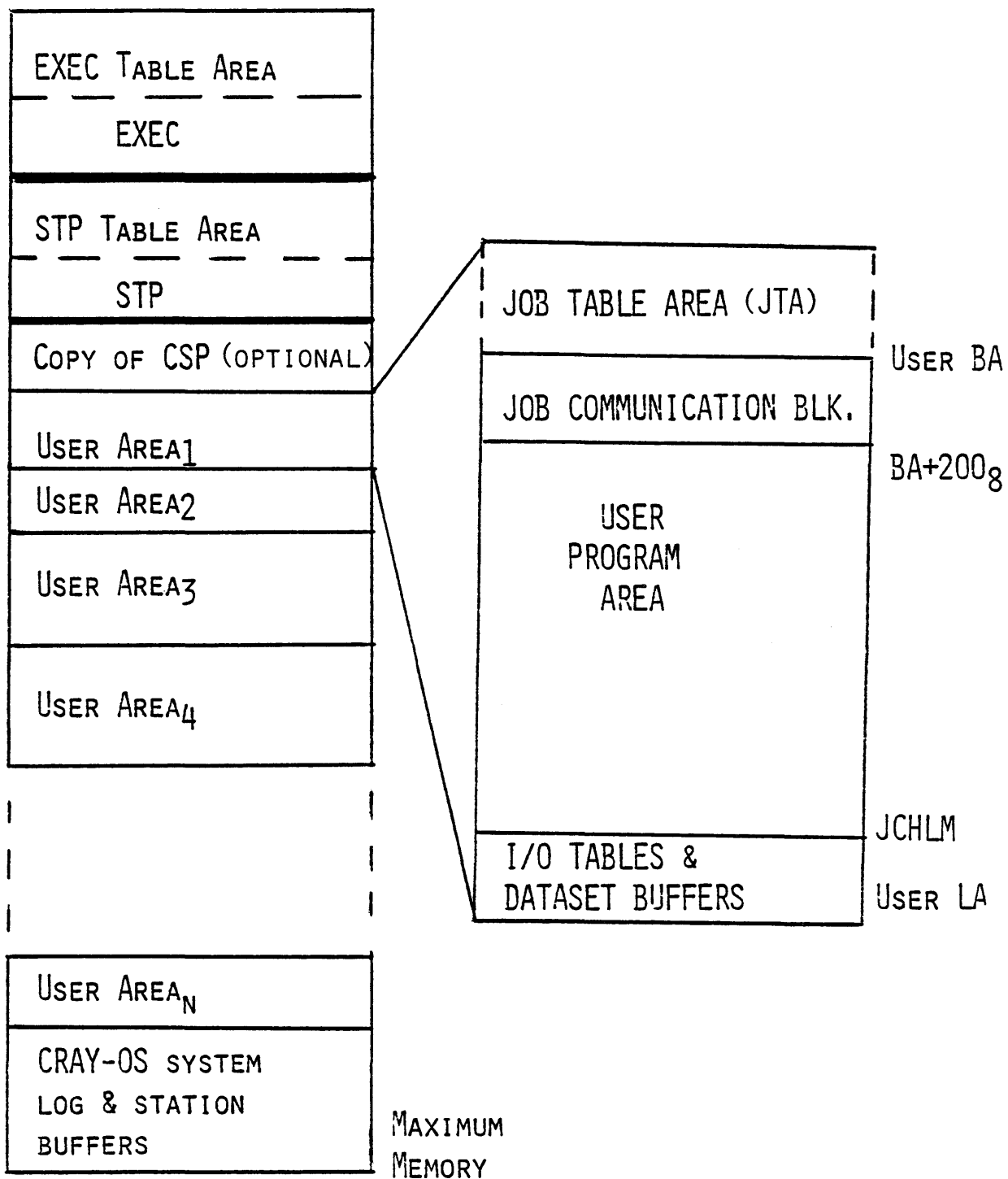








# SYSTEM MEMORY ASSIGNMENTS



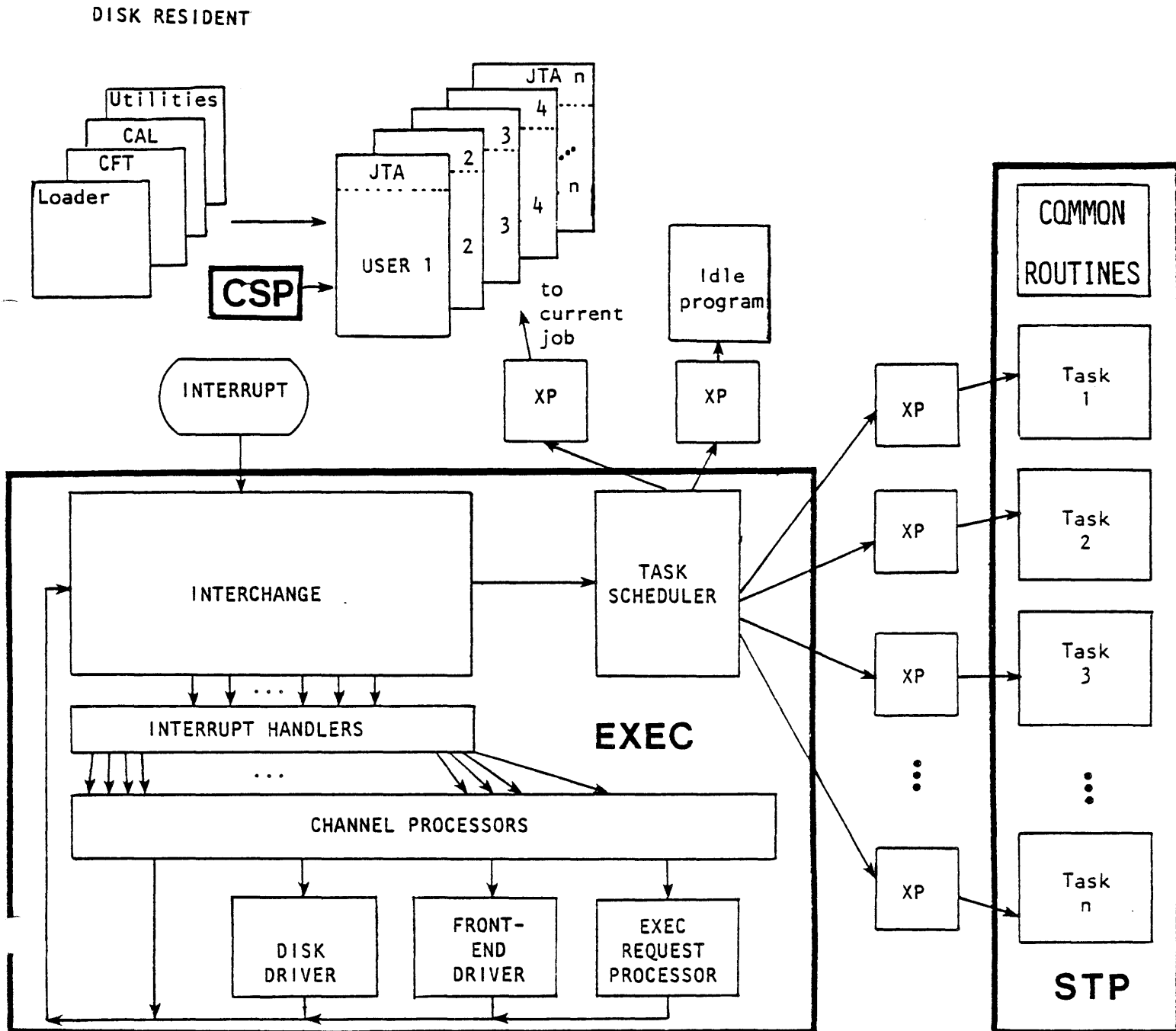


SYSTEM EXECUTIVE



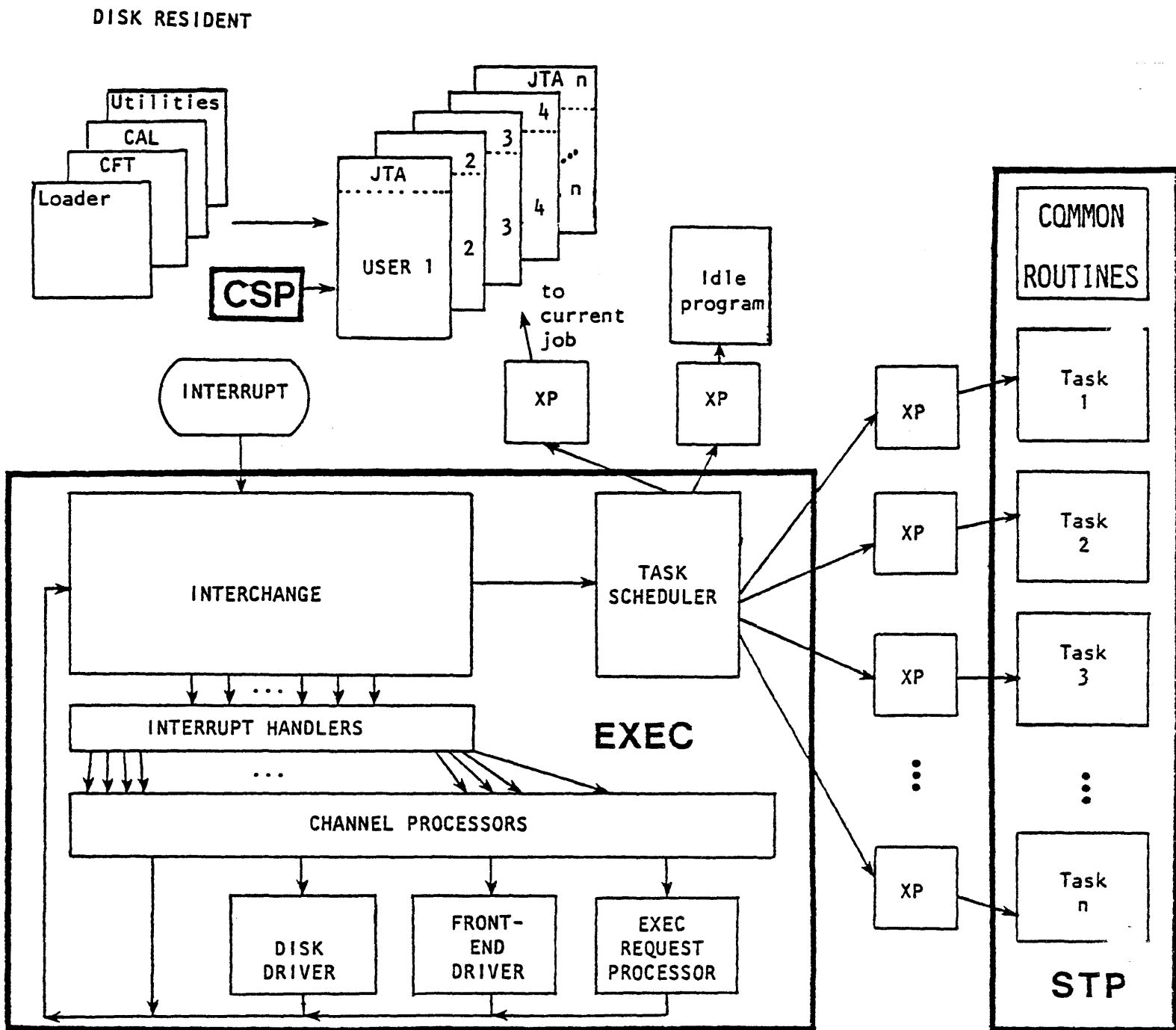
# SYSTEM EXECUTIVE PROGRAM (EXEC)

- CONTROL CENTER FOR COS
- EXECUTES IN MONITOR MODE
- CAN ACCESS ALL OF MEMORY (BA=0, LA=I@MEM)



# SYSTEM EXECUTIVE PROGRAM (EXEC)

- CONTROL CENTER FOR COS
- EXECUTES IN MONITOR MODE
- CAN ACCESS ALL OF MEMORY





## FUNCTIONS OF EXEC

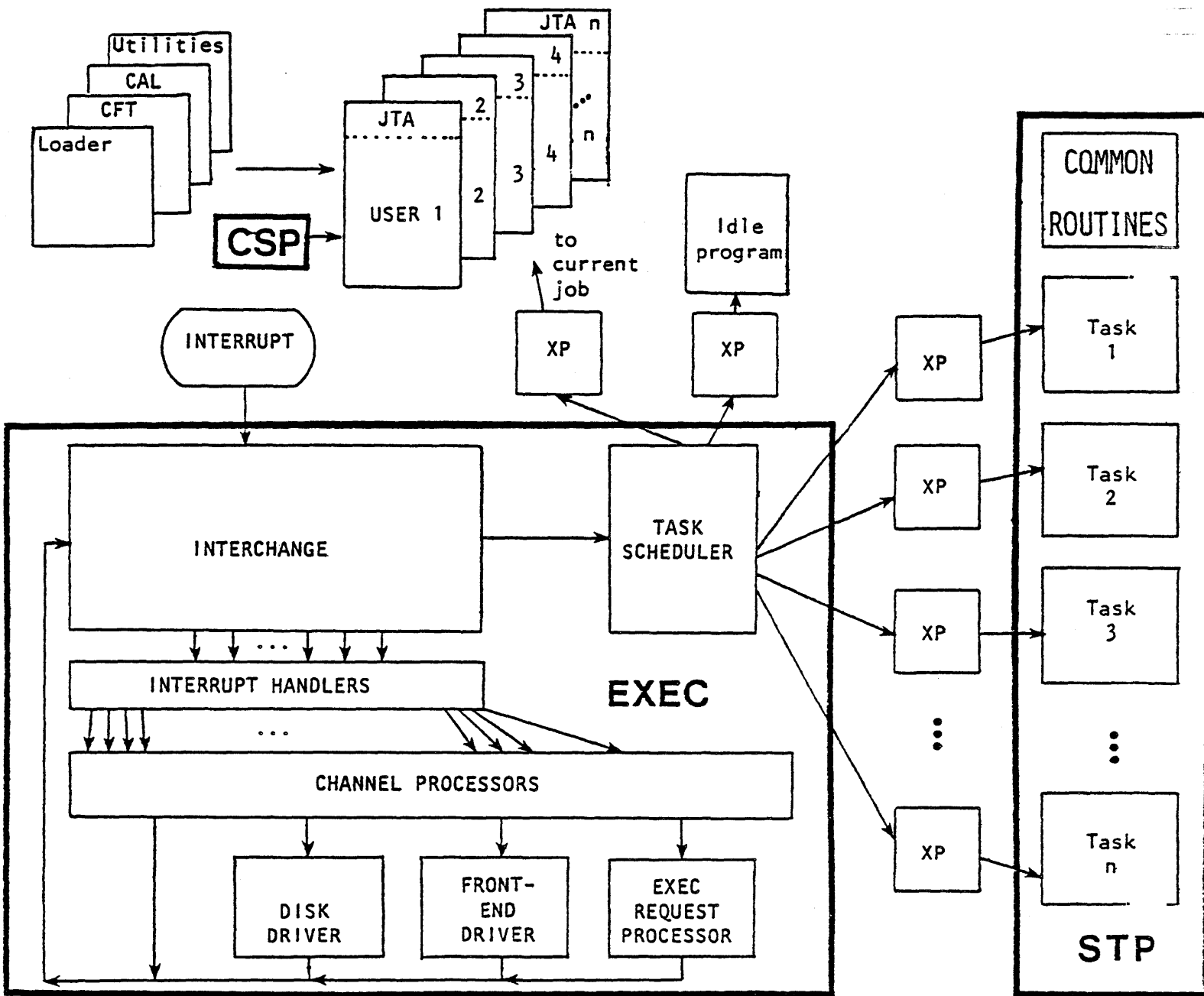
- INTERCHANGE ANALYSIS
- INTERRUPT HANDLERS
- CHANNEL MANAGEMENT
- TASK SCHEDULER
- EXECUTIVE REQUEST PROCESSOR
- DISK DRIVER
- FRONT-END DRIVER

# SYSTEM EXECUTIVE PROGRAM (EXEC)

- CONTROL CENTER FOR COS
- EXECUTES IN MONITOR MODE
- CAN ACCESS ALL OF MEMORY

*Non Interruptible*

DISK RESIDENT



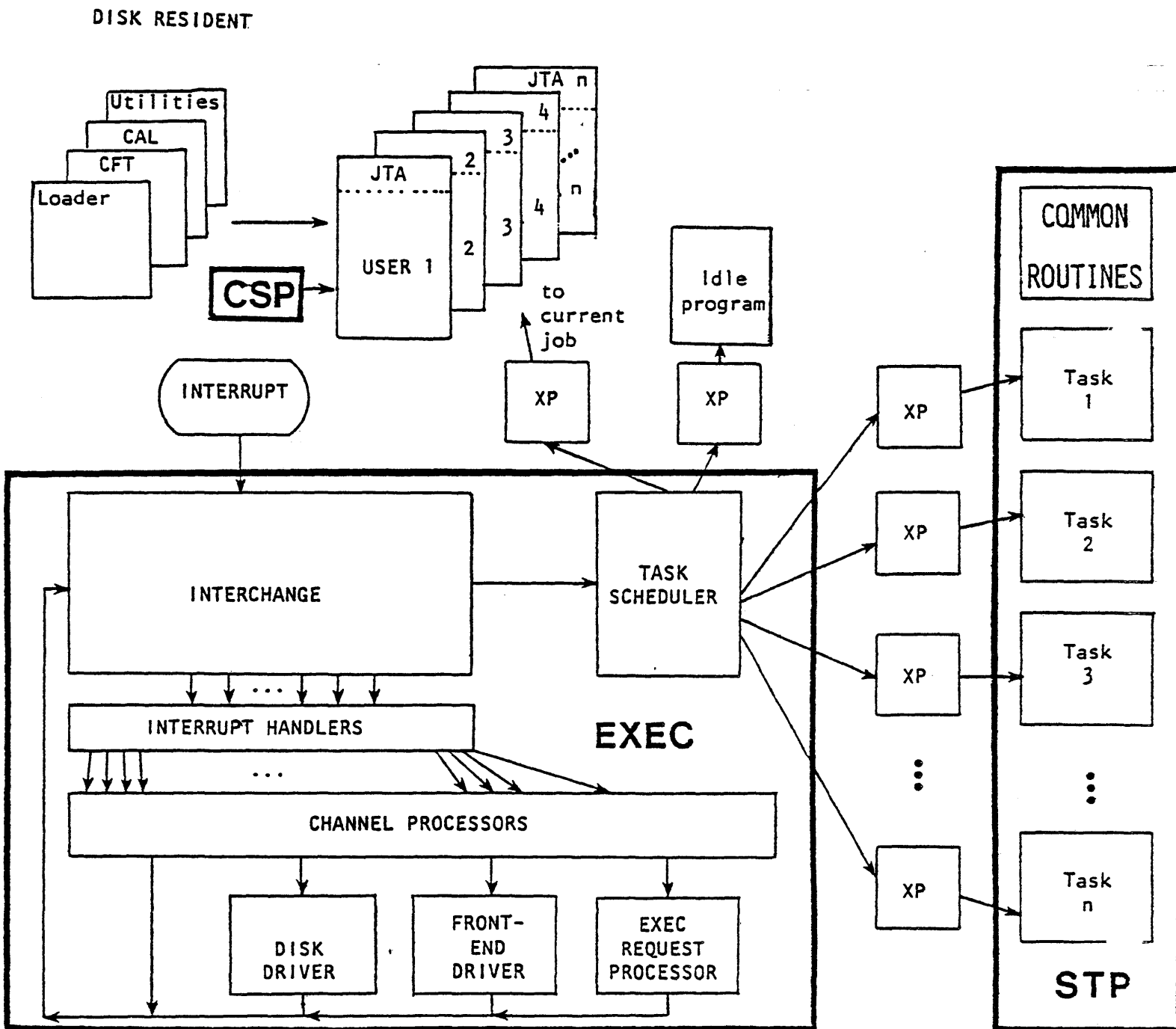
## INTERCHANGE

- SAVES CURRENT RTC
- UPDATES ACCRUED CPU TIME
- CALLS I/O HANDLER IF I/O INTERRUPT
- SENSES FOR LOST HARDWARE INTERRUPTS OF PREVIOUS DISK I/O INSTRUCTIONS
- CALLS INTERRUPT HANDLERS FOR:

CONSOLE I/O interrupt  
REAL TIME CLOCK  
ERROR EXIT  
NORMAL EXIT  
MEMORY ERROR EXIT  
m.u. external clock  
floating point err  
Prog range err  
Operand range err

# SYSTEM EXECUTIVE PROGRAM (EXEC)

- CONTROL CENTER FOR COS
- EXECUTES IN MONITOR MODE
- CAN ACCESS ALL OF MEMORY



## INTERRUPT HANDLERS

- EXECUTE ONE OF THE FOLLOWING INTERRUPT HANDLERS:

.IOI I/O INTERRUPT HANDLER

CII CONSOLE INTERRUPT HANDLER

RTI REAL-TIME INTERRUPT HANDLER

NEI NORMAL EXIT INTERRUPT HANDLER

EEI  ERROR EXIT INTERRUPT HANDLER

MEI  MEMORY ERROR INTERRUPT HANDLER

*Not  
Used*

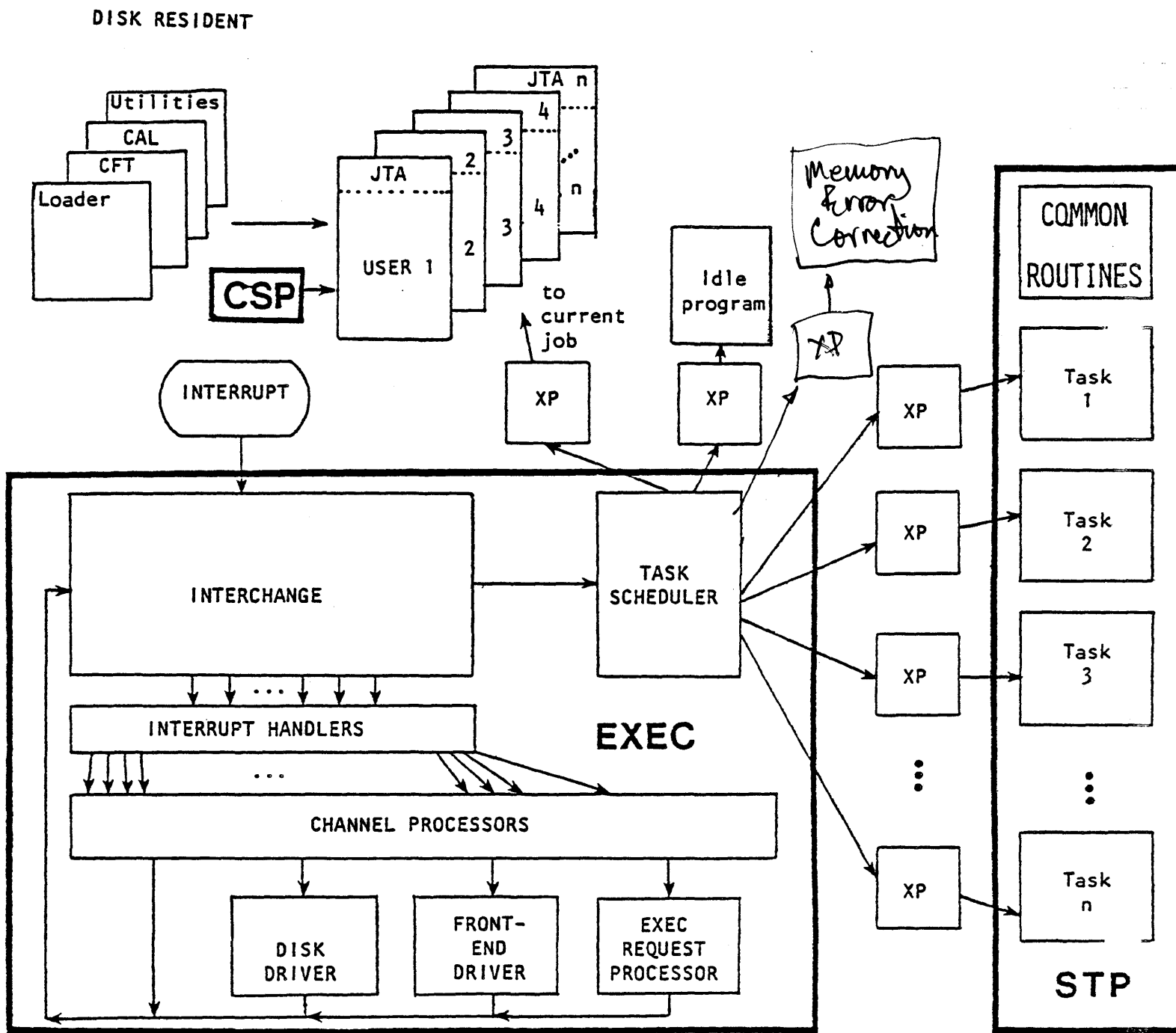
*PII*

*Programmable Clock Int. Hand.*

- CLEAR THE INTERRUPT FLAG IN THE EXCHANGE PACKAGE OF THE INTERRUPTED PROGRAM
- DETERMINE THE CHANNEL ON WHICH THE INTERRUPT OCCURED
- BRANCH TO THE APPROPRIATE CHANNEL PROCESSOR

# SYSTEM EXECUTIVE PROGRAM (EXEC)

- CONTROL CENTER FOR COS
- EXECUTES IN MONITOR MODE
- CAN ACCESS ALL OF MEMORY



## CHANNEL PROCESSORS

- CHANNEL PAIRS ARE ASSIGNED NUMBERS AS FOLLOWS:

0	CONSOLE	<i>Interrupt for</i>	
1	<del>MCU CLOCK</del>	<i>Deadstart Signal</i>	
2	] - 12 I/O CHANNELS		
4			
6			
.			
.			
.			
24			
26		NORMAL EXIT PSEUDO CHANNEL	
28		ERROR EXIT PSEUDO CHANNEL	
30		PROGRAMMABLE CLOCK PSEUDO CHANNEL	
32		MEMORY ERROR PSEUDO CHANNEL	<i>→ Not Used</i>

*Processor*

---

*0 - CEP  
14 - Interrupt  
2-24 RJ  
(Unused channels)  
26 - NE  
(Create what rom  
task => For register  
error of task level)  
28 - FE  
(All errors)  
32 - ME  
(Not used)  
30 - PCI  
(loop back)  
Not Used*

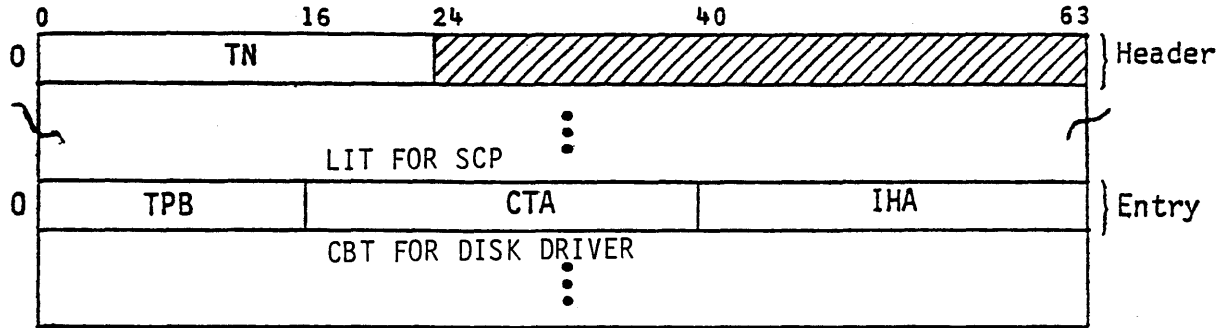
- CHANNEL PROCESSOR TABLE (CHT) HAS ENTRIES FOR BOTH THE INPUT AND OUTPUT SIDES OF EACH CHANNEL
- CHT POINTS TO THE INTERRUPT PROCESSOR
- CHT POINTS TO A PARAMETER AREA FOR EACH CHANNEL PROCESSOR
- CHT POINTS TO CONTROL TABLE ADDRESS





CHANNEL TABLE - CHT

The Channel Table resides in EXEC memory and contains information for use by the interrupt handlers. There is one entry for each channel, physical or pseudo.



HEADER

Field	Word	Bits	Description
CHTN	0	0-23	Table name; "CHT" in ASCII

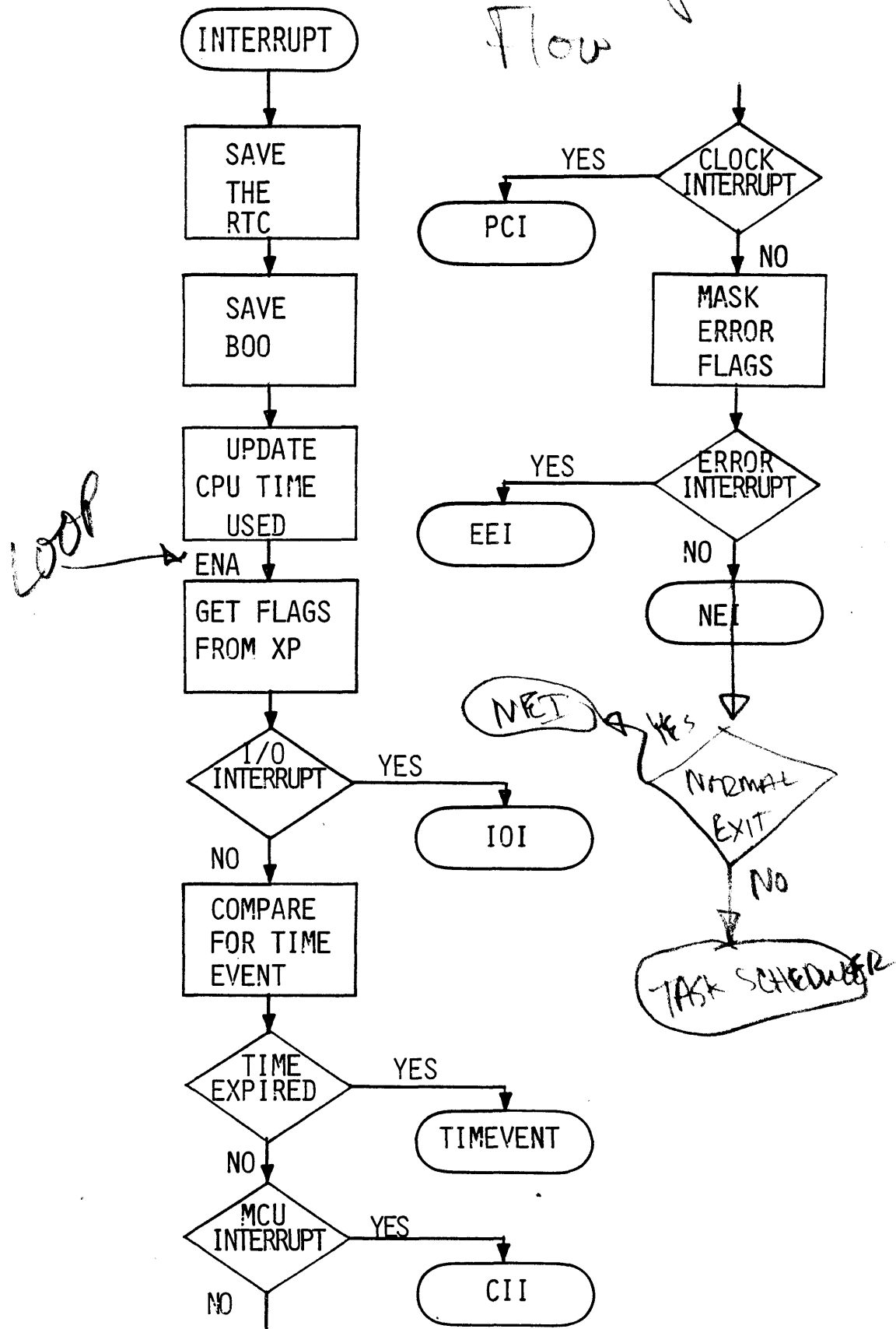
ENTRY

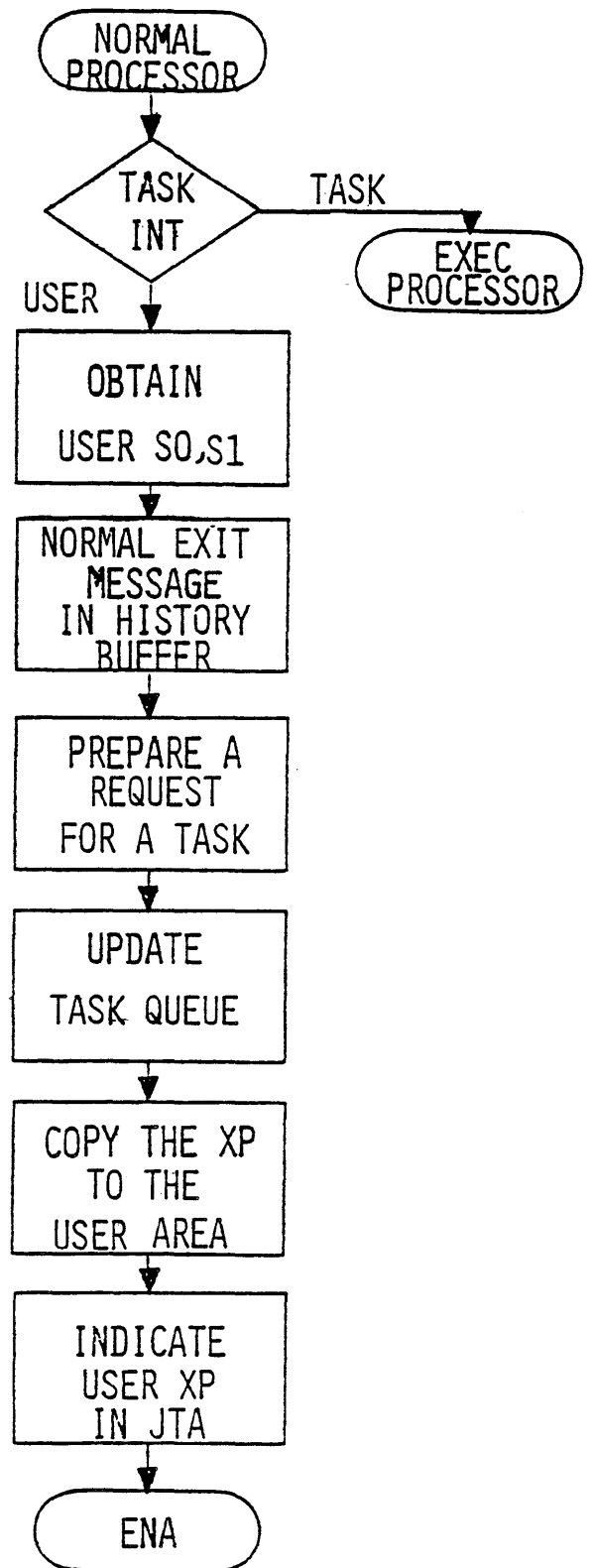
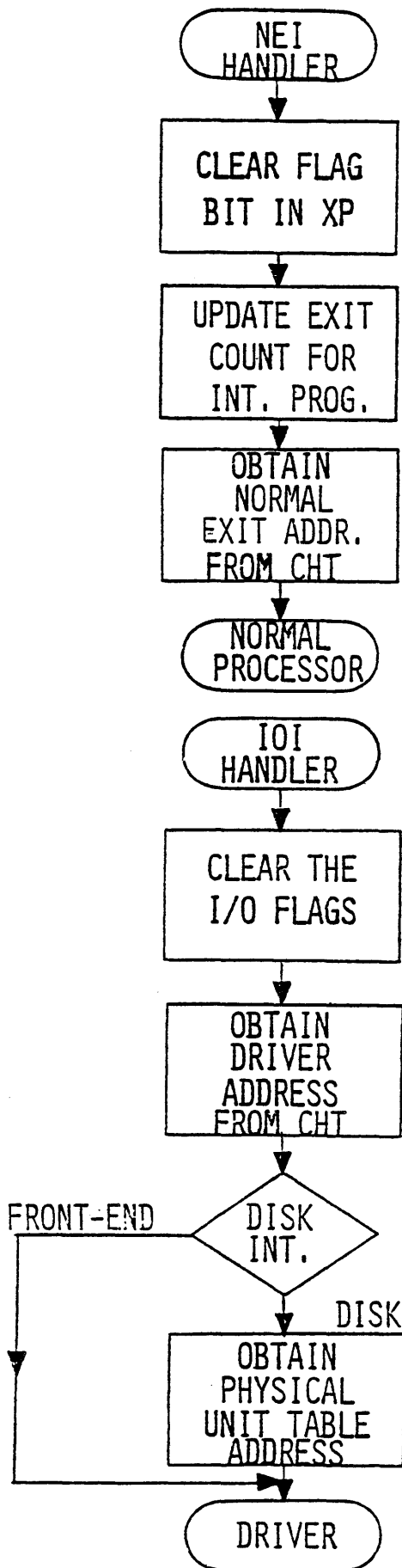
Field	Word	Bits	Description
CHTPB	0	0-15	Address of task parameter word
CHCTA	0	16-39	Control table address
CHIHA	0	40-63	Interrupt handler address

CHANNEL PROCESSOR TABLE

00000000	00161500007143200075661	0000000000230300064451	0000000000000000000000	00161500007143200074370	CHT
00000001	00161500007143200075661	00000000002323000657324	00000000002323000657324	0000000000233300072623	
00000002	00000000002333000657324	00000000002343000657324	00000000002343000657324	00000000002353000687211	
00000003	00000000002353000657324	00000000002363000701131	00000000002363000657324	00000000002373000657324	
00000004	00000000002373000657324	00000000002383000657324	00000000002383000657324	00161500007157000074370	
00000005	00161500007157000075661	00161500007172000074370	00161500007172000075661	00161500007206400074370	
00000006	00161500007206400075661	0016150000722200074370	0016150000722200075661	0000000000245300064044	
00000007	0000000000000000000000	0000000000246300064453	0000000000000000000000	0000000000247300065135	
00000008	0000000000000000000000	0000000000250300065215	0000000000000000000000		

# Interchange Flow







## TASK REQUESTS

- THE EXECUTIVE REQUEST PROCESSOR IS INITIATED BY THE NORMAL EXIT CHANNEL PROCESSOR.
- THE REQUEST IS PASSED TO EXEC IN REGISTERS S6 AND S7
- EXECUTIVE REQUESTS ARE:

CREATE A TASK

READY A TASK

SELF SUSPEND TASK

ASSIGN CHANNEL

STATION I/O REQUEST

DISK BLOCK I/O REQUEST

READY TASK AND SUSPEND SELF

GET TIME AND DATE

CONNECT USER JOB TO CPU

DISCONNECT USER JOB FROM CPU

POST A MESSAGE IN HISTORY BUFFER

SET MEMORY SIZE

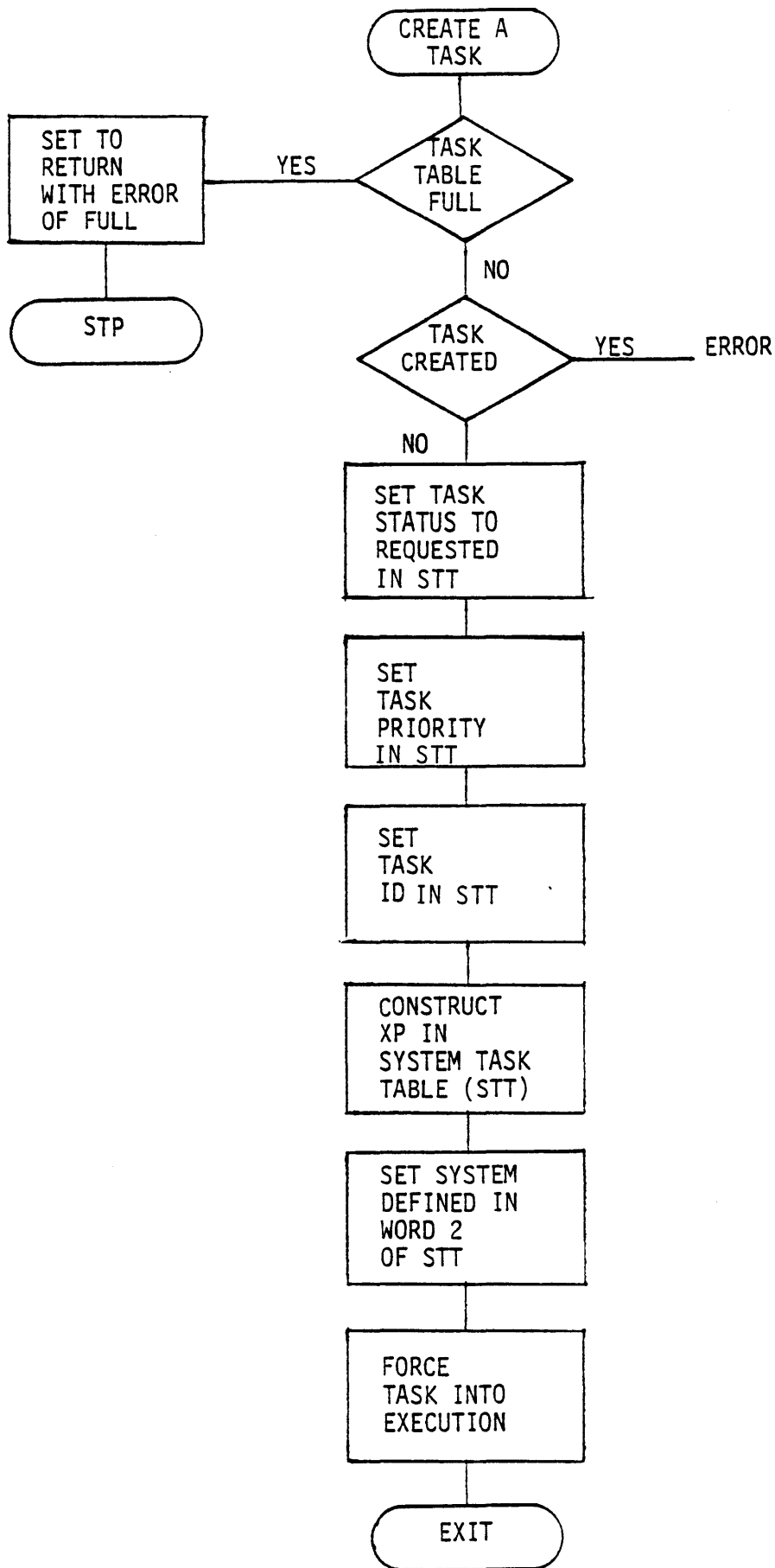
START/STOP OPERATING SYSTEM

DISPLAY MEMORY/EXCHANGE PACKAGE

ENTER MEMORY/EXCHANGE PACKAGE

SET/CLEAR SYSTEM BREAKPOINT





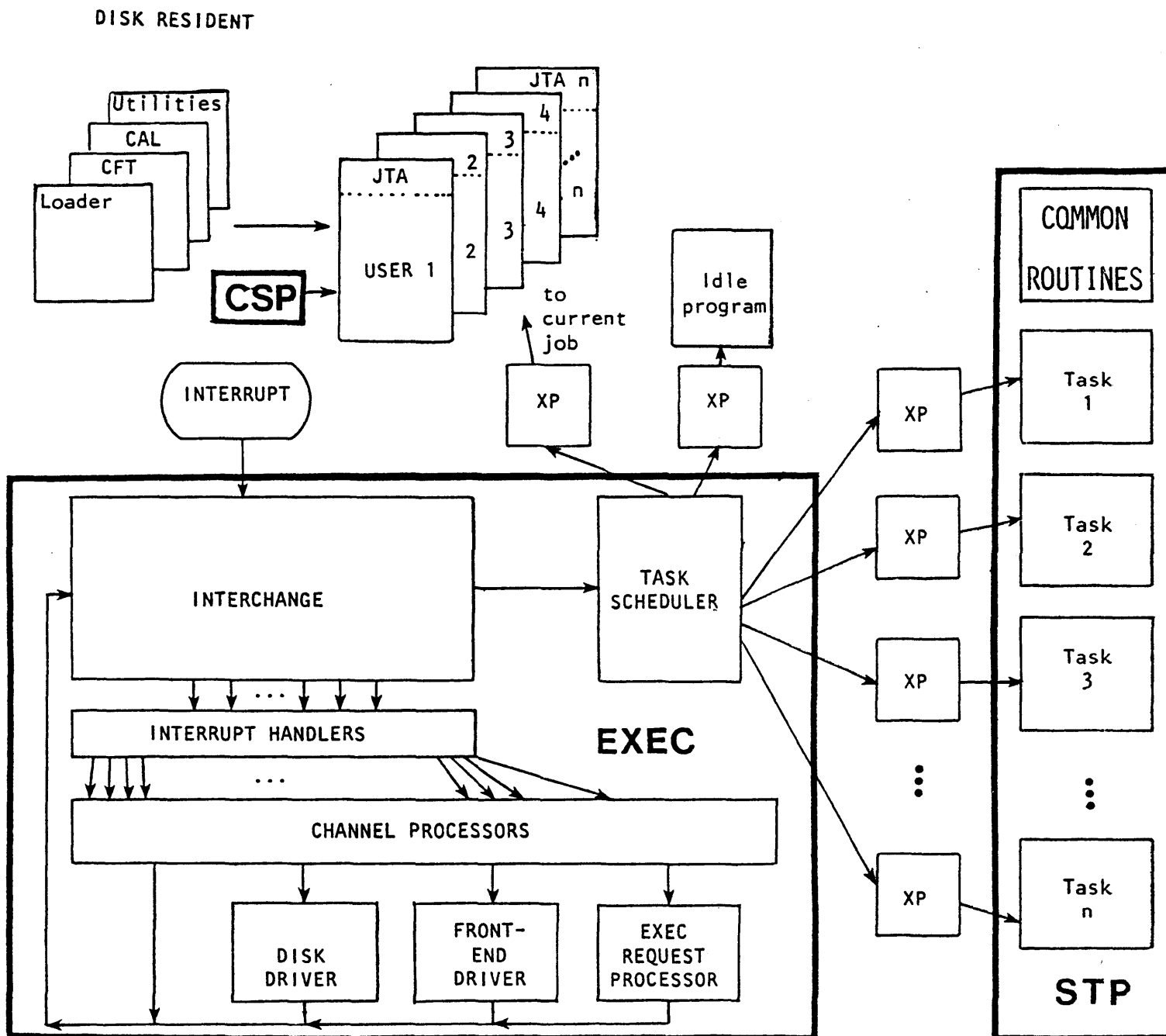
	0	16	40	48	56	63
S6				status	priority	task ID
S7				P-register for new task		01





# SYSTEM EXECUTIVE PROGRAM (EXEC)

- CONTROL CENTER FOR COS
- EXECUTES IN MONITOR MODE
- CAN ACCESS ALL OF MEMORY





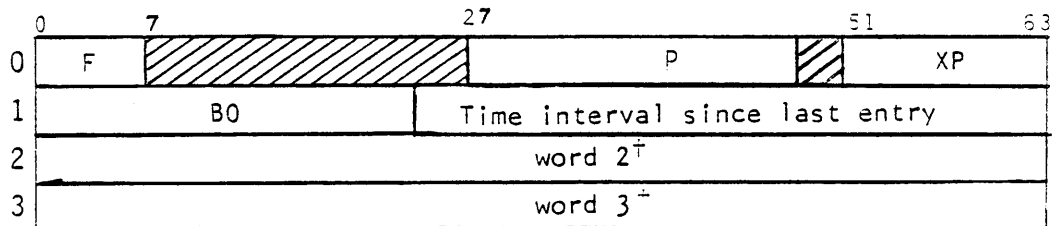
# EXEC HISTORY TRACE

- CIRCULAR BUFFER BEGINS AT LOCATION DBE
- LOCATION DBEP POINTS TO NEXT BUFFER ADDRESS
- EACH TRACE MESSAGE 4 WORDS IN LENGTH
- CIRCULAR BUFFER HOLDS THE 1024 MOST CURRENT MESSAGES.
- FUNCTIONS MAY BE COLLECTIVELY ENABLED/DISABLED THROUGH SETTING OF LOCATION DBUGM AND ITS ASSOCIATED FUNCTION TABLE.
- SETTING LOCATION DBUGM NONZERO ENABLES ALL FUNCTIONS
- SETTING DBUGM+FUNCTION NUMBER ENABLES THE FUNCTION

```

*
*      HISTORY BUFFER FUNCTION FLAGS
*
04051423000000000000000001 DBUGM   CON      'ALL'L+1    UNIVERSAL ENABLE FLAG
04451722200000000000000000 CON      'IOI'L     I/O INTERRUPT
05251621200000000000000000 CON      'UNE'L     USER NORMAL EXIT
05151621200000000000000000 CON      'SNE'L     STP NORMAL EXIT
04251621200000000000000000 CON      'ENE'L     EXEC NORMAL EXIT
05112422200000000000000000 CON      'RTI'L     REAL TIME INTERRUPT
05412020600000000000000000 CON      'XPC'L     COPY USER XP TO JTA
04650325200000000000000000 CON      'MCU'L     MCU COMMAND
05150322045000000000000000 CON      'SCHJ'L    SCHEDULE USER JOB
04211123651000000000000000 CON      'DIOR'L    DISK DRIVER REQUEST
04452423251400000000000000 CON      'ITMS'L    INTER-TASK MESSAGE
04250522200000000000000000 CON      'EEI'L     ERROR EXIT
                                17      BSSZ      DBUGM+DBUGN-W.*
00000000000000000000000000 XCHGBP  CON      0          XCHG PACKAGE TRACE CURRENT POSITION
00000000000000000000000000 DBFP    CON      0          DEBUG BUFFER CURRENT POSITION

```



Field	Word	Bits	Description
F	0	0-6	Function number
P	0	27-50	Program register of interrupted exchange package
XP	0	51-63	Exchange package address



2.23

FUNCTION	P-REG	SAVED B0	XP	INTERVAL	WORDS 2 AND 3			
011	DQM	0001660A	0000001B	01500	00000000000472	0114400002027100070220	04000000000000000000	@
011	DQM	0001660A	0000001B	01500	00000000000276	0000010011110000145000	0000000000256000002557	@
001	I/O	0001660A	0377760A	01500	000000000003050	0000050000230300067053	00000000000000041777777	+
001	I/O	0001660A	0377760A	01500	000000000000673	0000050000230300067173	00000000000000041777777	
001	I/O	0001660A	0377760A	01500	000000000000501	0000040000230300067212	00000000000000041777777	
001	I/O	0001660A	0377760A	01500	000000000002340	0000050000230300067656	01000000000000041777777	
001	I/O	0001660A	0377760A	01500	000000000000714	0000050000230300066274	01000000000000041777777	
001	I/O	0001660A	0377760A	01500	000000000000612	0000040000230300066325	01000000000000041777777	
001	I/O	0001660A	0377760A	01500	000000000000774	0000050000230300067755	01000000000000041001177	
001	I/O	0001660A	0377760A	01500	000000000001122	0000050000230300070167	01000000000000041001177	
010	SCP	0001660A	0000000A	01500	000000000000777	0000000000000000000000	0013001265000777771500	+P @
004	ENE	0001660A	0001461C	01500	000000000000364	0000000000000000000000	0013001265000777771500	+P @
001	I/O	0001660C	0377760A	01500	000000000003235	0000040000230300070220	01000000000000041001177	
011	DQM	0001660C	0000001B	01500	00000000000472	0114400002027100070220	0400000000000000000000	@
011	DQM	0001660C	0000001B	01500	00000000000276	0000010011110000145000	0000000000256000002557	@
001	I/O	0001660C	0377760A	01500	000000000003050	0000050000230300067053	00000000000000041777777	+
001	I/O	0001660C	0377760A	01500	000000000000673	0000050000230300067173	00000000000000041777777	
001	I/O	0001660C	0377760A	01500	000000000000501	0000040000230300067212	00000000000000041777777	
001	I/O	0001660C	0377760A	01500	000000000002340	0000050000230300067656	01000000000000041777777	
001	I/O	0001660C	0377760A	01500	000000000000714	0000050000230300066274	01000000000000041777777	
001	I/O	0001660C	0377760A	01500	000000000000612	0000040000230300066325	01000000000000041777777	
001	I/O	0001660C	0377760A	01500	000000000000774	0000050000230300067755	01000000000000041001177	
001	I/O	0001660C	0377760A	01500	000000000001122	0000050000230300070167	01000000000000041001177	
010	SCP	0001660C	0000000A	01500	000000000000777	0000000000000000000000	0013001265000777771500	+P @
004	ENE	0001660C	0001461C	01500	000000000000364	0000000000000000000000	0013001265000777771500	+P @
001	I/O	0001652C	0377760A	01500	000000000003270	0000040000230300070220	01000000000000041001177	
011	DQM	0001652C	0000001B	01500	00000000000472	0114400002027100070220	0400000000000000000000	@
011	DQM	0001652C	0000001B	01500	00000000000276	0000010011110000145000	0000000000256000002557	@
001	I/O	0001652C	0377760A	01500	000000000003050	0000050000230300067053	00000000000000041777777	+
001	I/O	0001652C	0377760A	01500	000000000000673	0000050000230300067173	00000000000000041777777	
001	I/O	0001652C	0377760A	01500	000000000000501	0000040000230300067212	00000000000000041777777	
005	RTI	0001652C	0000000C	01500	000000000002025	1000000000000000000000	0013001265000777771500	+P @
004	ENE	0101636D	0101676A	02060	000000000001345	00000000000000000001650	0013001265000777771500	+P @
005	RTI	0050606B	0102432B	02060	000000000006456	00000000000000000001650	0013001265000777771500	+P @
003	SNE	0050606B	0102432B	02060	000000000000753	0000000202020200000714	0000000000000001212020	
012	ITM	0050606B	0102432B	02060	000000000000250	1000000003030700033333	0000000000000000036610	@ 6 =



FUNCTION	P-REG	SAVED B0	XP	INTERVAL	WORDS 2 AND 3			
004	ENE	0050606D	0102432B	02060	00000000000623	00000000000000001650	0013001265000777771500	+P @
005	RTI	0050647D	0102432B	02060	00000000001554	00000000000000001650	0013001265000777771500	+P @
003	SNE	0050647D	0102432B	02060	00000000000753	00000000000000000005	00000000000000000002	
004	ENE	0050650B	0102432B	02060	00000000001632	00000000000000001650	0013001265000777771500	+P @
005	RTI	0050606B	0102512D	02060	00000000004210	00000000000000001650	0013001265000777771500	+P @
003	SNE	0050606B	0102512D	02060	00000000000753	0000000202020200000704	000000000000001212020	
012	ITM	0050606B	0102512D	02060	00000000000250	1000000001050000104075	00000000000000000000	@ =
004	ENE	0050606D	0102512D	02060	00000000000623	00000000000000001650	0013001265000777771500	+P @
005	RTI	0051004A	0102165C	02060	00000000003561	00000000000000001650	0013001265000777771500	+P @
003	SNE	0051004A	0102165C	02060	00000000000753	0400030000000000000000	000000000000001212020 @	
012	ITM	0051004A	0102165C	02060	00000000000250	00000000000000000007	0007347520054000064424 @	
004	ENE	0051004C	0102165C	02060	00000000000623	00000000000000001650	0013001265000777771500	+P @
005	RTI	0051005C	0102165C	02060	00000000000733	00000000000000001650	0013001265000777771500	+P @
003	SNE	0051005C	0102165C	02060	00000000000753	00000000000000000005	00000000000000000002	
004	ENE	0051006A	0102165C	02060	00000000001630	00000000000000001650	0013001265000777771500	+P @
005	RTI	0103051A	0101676A	02060	00000000003430	00000000000000001650	0013001265000777771500	+P @
003	SNE	0103051A	0101676A	02060	00000000000753	0000000030107400045310	0000000005426200002011	< J X
011	DQM	0103051A	2646214A	02060	00000000000756	0000020207040000323200	0000000005426200002011	X
001	I/O	0103051C	0377760A	02060	00000000001715	0000050000230300067656	0100000000000040777777	
001	I/O	0103051C	0377760A	02060	00000000000714	0000005000230300066274	0100000000000040777777	
004	ENE	0103051C	0101676A	02060	00000000001012	00000000000000001650	0013001265000777771500	+P @
001	I/O	0103051C	0377760A	02060	00000000000707	0000040000230300066325	0100000000000040777777	
001	I/O	0103051C	0377760A	02060	00000000000774	0000050000230300067755	0100000000000040020777	!
001	I/O	0103051C	0377760A	02060	00000000001156	0000050000230300070337	0100000000000040020777	!
005	RTI	0103051C	0377760A	02060	00000000000640	000000000000000001650	0013001265000777771500	+P @
004	ENE	0103051C	0101676A	02060	00000000000747	00000000000000001650	0013001265000777771500	+P @
005	RTI	0101636B	0101676A	02060	00000000001120	00000000000000001650	0013001265000777771500	+P @
003	SNE	0101636B	0101676A	02060	00000000001010	00000000000000000005	00000000000000000003	
004	ENE	0074442D	0074450B	02100	00000000001414	00000000000000001657	0013001265000777771500	+P @
001	I/O	0050437C	0377760A	02100	000000000006010	0000040000230300070370	0100000000000040020777	!
005	RTI	0050437C	0377760A	02100	00000000000753	000000000000000001657	0013001265000777771500	+P @
004	ENE	0050437C	0050335B	02100	00000000000747	000000000000000001657	0013001265000777771500	+P @
005	RTI	0050412A	0075103B	02100	00000000004246	000000000000000001657	0013001265000777771500	+P @
013	ERR	0050412A	0075103B	02100	00000000000670	0515242500000000000000	00000200000000000000 STT	

2.25





## DISK DRIVER (R011)

- DOES THE PHYSICAL I/O ON DISKS
- REQUESTS TO R011 QUEUED VIA THE REQUEST TABLE (RQT)
- UPDATES THE DATASET PARAMETER TABLE (DSP)
- EXAMINES THE DISK RESERVATION TABLE (DRT)  
FOR USEABLE DISK SPACE
- PERFORMS SERVO OFFSET AND DATA STROBE FUNCTIONS  
FOR ERROR RECOVERY



## COMMON SUBROUTINES



## SYSTEM TASK PROCESSOR

● DEFINITION - CONSISTS OF TABLES, COMMON SUBROUTINES, TASKS,  
AND I/O ROUTINES.

● COMMON SUBROUTINES  
RE-ENTRANT ROUTINES  
USED BY TASKS

● TASKS  
PERFORMS A SPECIFIC OPERATION  
CAN BE CALLED BY OTHER TASKS  
HAVE THEIR OWN XP'S  
HAVE THEIR OWN ID NUMBERS (0-35<sub>g</sub>).  
HAVE THEIR OWN PRIORITIES (0-377<sub>g</sub>).  
BA AND LA THE SAME FOR ALL TASKS (BA=B@STP,  
LA=I@MEM)  
COMMUNICATE WITH EXEC, EACH OTHER AND WITH  
USER JOBS.

● TABLES  
USED BY STP AND EXEC



## STP COMMON ROUTINES

● USED BY TASKS TO PERFORM:

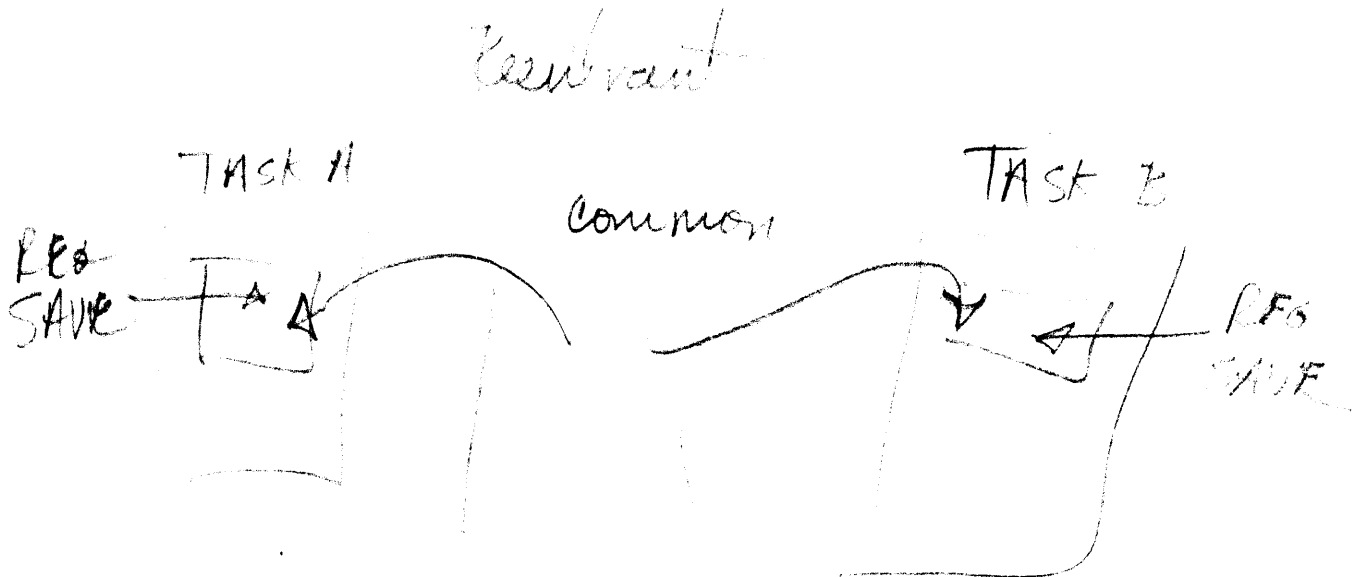
TASK LOGICAL INPUT/OUTPUT (TIO)

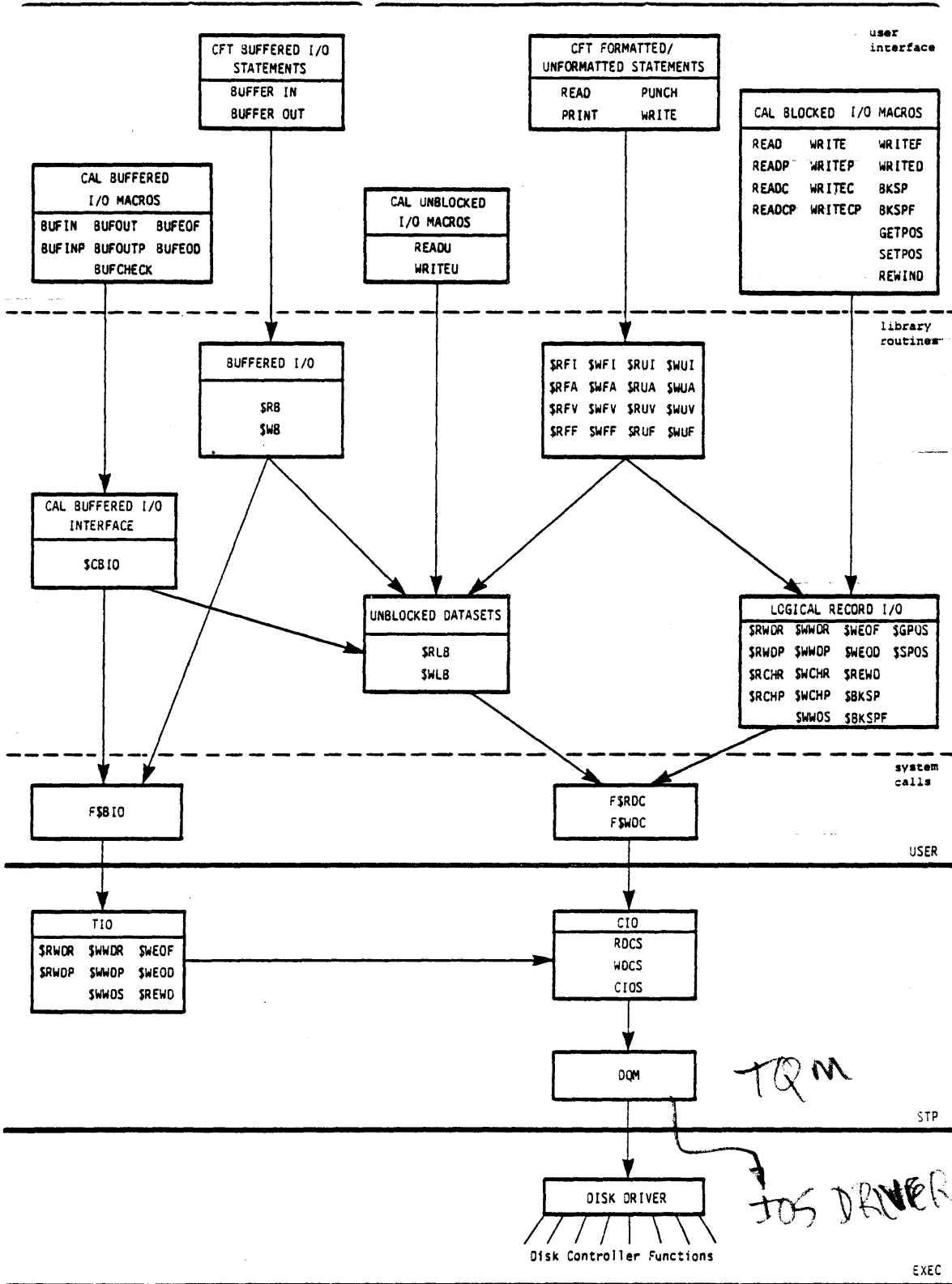
CIRCULAR INPUT/OUTPUT (CIO)

MEMORY MANAGEMENT

ITEM CHAINING/UNCHAINING

TASK TO TASK COMMUNICATION





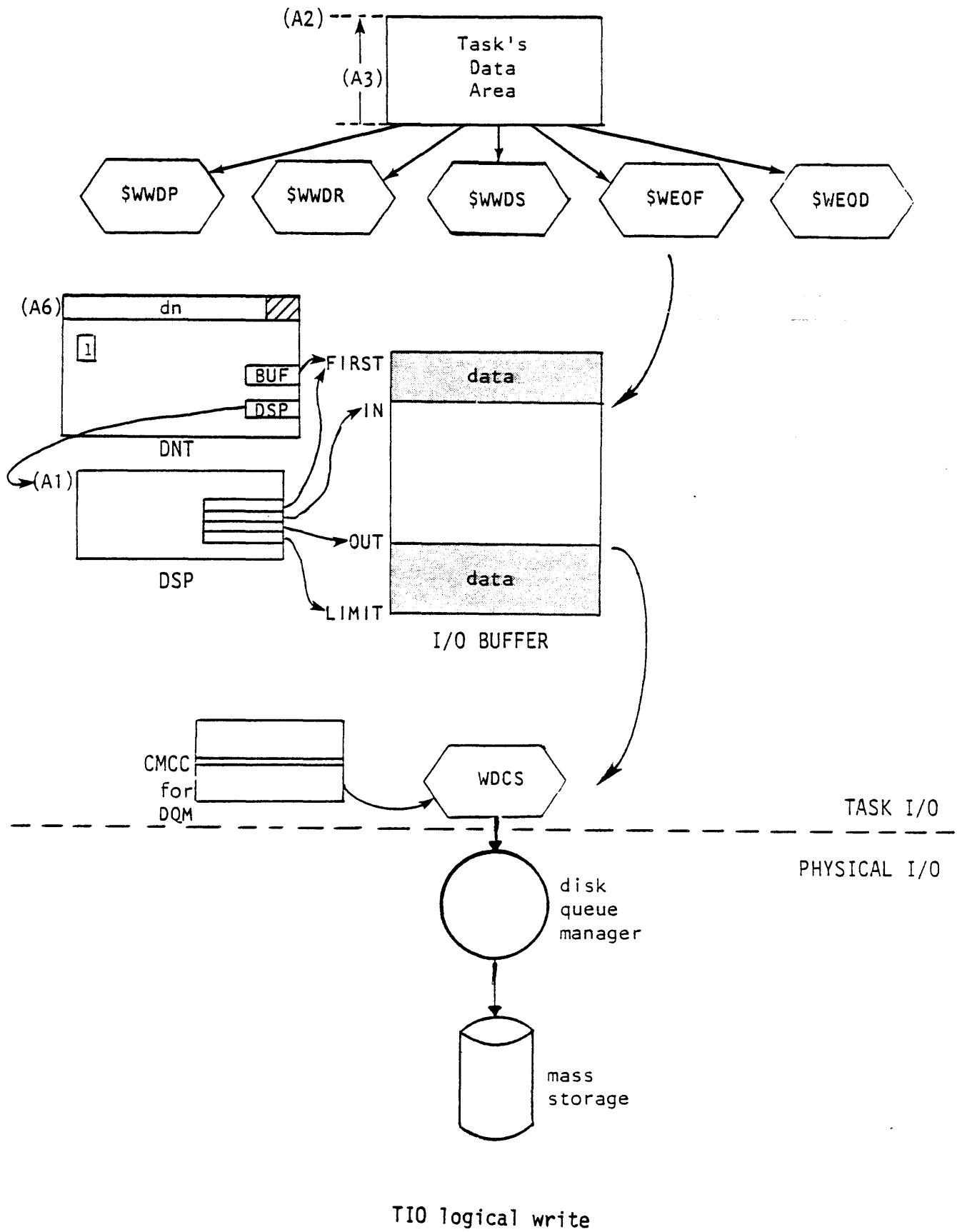
Overview of COS I/O



## TASK LOGICAL I/O (TIO)

- ALLOWS A SYSTEM PROGRAMMER TO DO LOGICAL I/O AT THE TASK LEVEL.
- TIO ROUTINES ARE:
  - \$RWDP/\$RWDR-READ WORDS PARTIAL/FULL RECORD
  - \$WWDP/\$WWDR-WRITE WORDS PARTIAL/FULL RECORD
  - \$WEOF-WRITE END OF FILE
  - \$WEOD-WRITE END OF DATA
  - \$REWD-REWIND A DATASET
  - \$WWDs-WRITE WORDS--UNUSED BIT COUNT
- TASKS CALL TIO BY PLACING REQUIRED PARAMETERS IN 'A' REGISTERS AND EXECUTING A RETURN JUMP TO THE ROUTINE.
- 1 TIO ROUTINE (\$WWDP/\$WWDR) WILL BE EXAMINED HERE. REFER TO SMO040 FOR REMAINDER OF TIO ROUTINES.

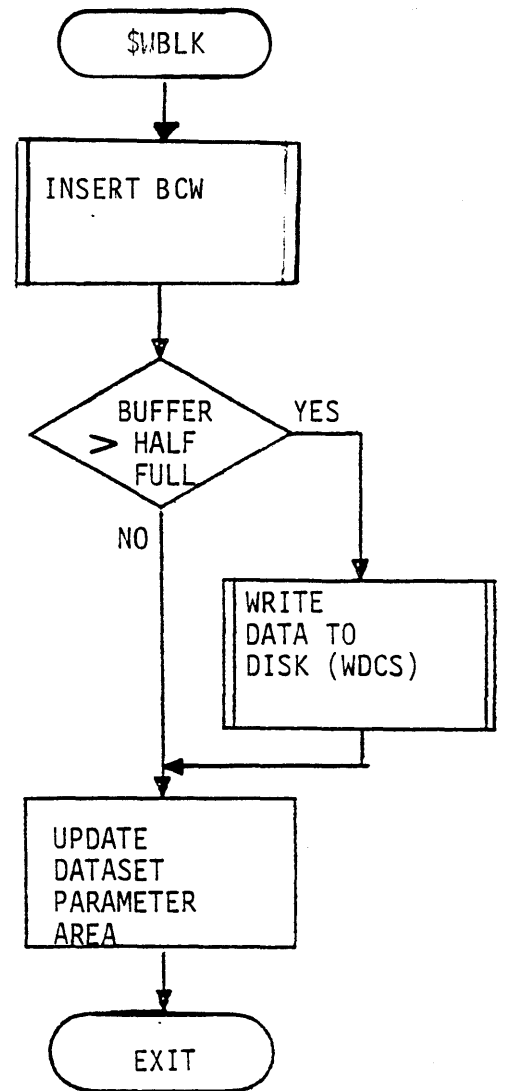
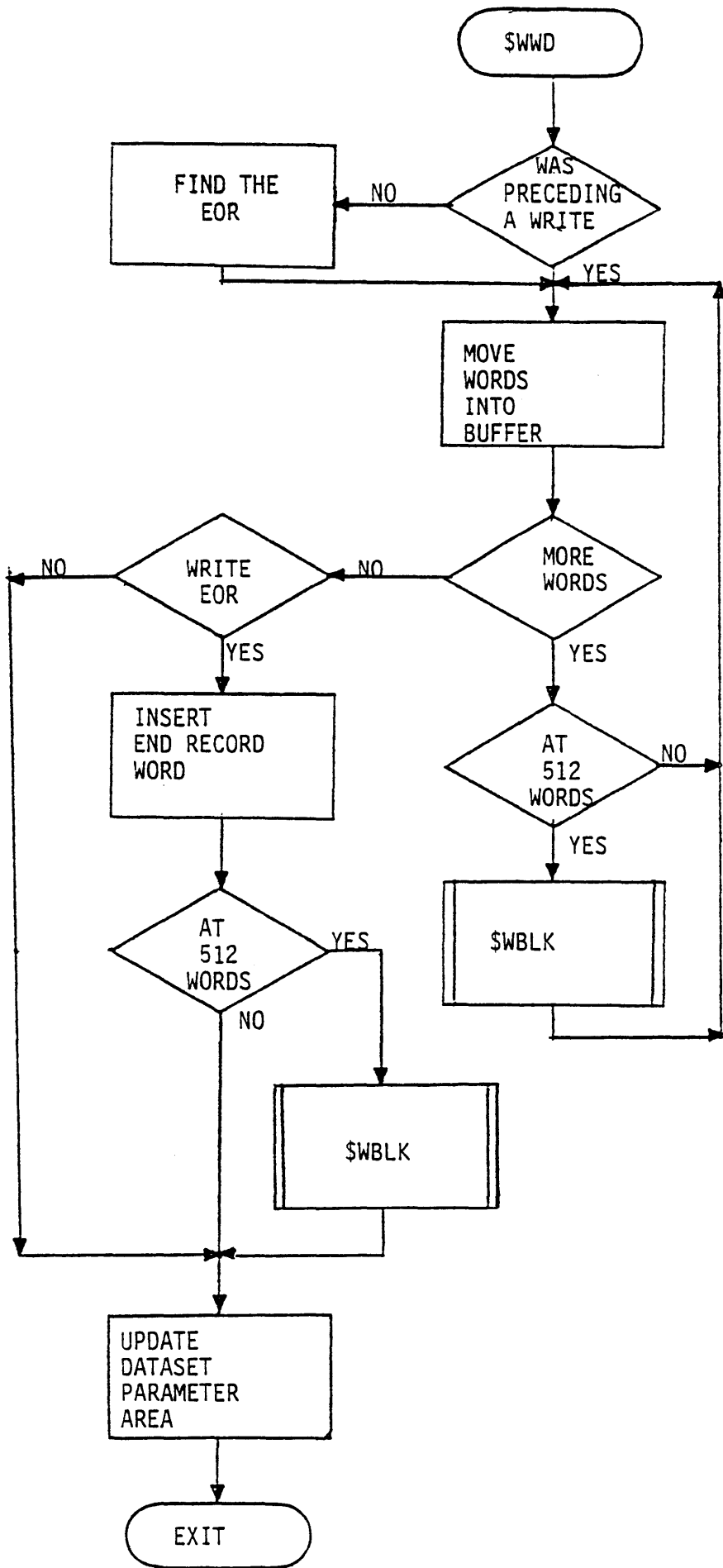




④ \$WWDP/\$WWR WRITES THE NUMBER OF WORDS SPECIFIED INTO THE I/O BUFFER. \$WWD IS CALLED VIA A RETURN JUMP WITH THE CALLER PROVIDING THE FOLLOWING:

ENTRY CONDITIONS: (A1) Address of DSP  
(A2) FWA of task's data area  
(A3) Word count  
If count is 0, no data is transferred  
(A6) Address of DNT  
(A7) Address of JXT  
(=0 if not job related)

RETURN CONDITIONS: (A0) Status  
<0 TIO error  
=0 Logical I/O complete



```

*      WRITE WORDS                                     S.16418
*      ENTRY:                                          S.16419
*      A1 @FCB                                         S.16420
*      A2 FWA                                          S.16421
*      A3 COUNT                                        S.16422
*      A6 DNT ADDRESS                                  S.16423
*      A7 JXT ADDRESS, =0 IF NOT JOB RELATED          S.16424
*      EXIT:                                           S.16425
*      A1 @FCB                                         S.16426
*      A2 FWA                                          S.16427
*      A3 COUNT                                        S.16428
*      A6 DNT ADDRESS                                  S.16429
*      A7 JXT ADDRESS                                  S.16430
*      MODIFIES:                                       S.16431
*      A0,4,5    S0,1,2,3,4,5,6,7                    S.16432
*      DPTM WORDS IN DSP                               S.16433
*      WRITE WORDS, PARTIAL MODE                       S.16434
$WWDP      =      *                                   S.16435
           S6      0                                   S.16436
           J      WW01                                S.16437
*      WRITE WORDS, RECORD MODE                       S.16438
$WWDR      =      *                                   S.16439
           S6      >1                                 S.16440
WW01      =      *                                   S.16441
           S1      A6      DNT ADDRESS                S.16442
           S2      A7      JXT ADDRESS                S.16443
           S1      S1<D'24                            S.16444
           S1      S1!S2                               S.16445
           W@DPTM+5,A1 S1                              S.16446
WW02      =      *                                   S.16447
           A7      B0                                   S.16448
           S1      A7      B.ZA                       S.16449
           S2      A2      B.ZB                       S.16450
           S1      S1<D'24                            S.16451
           S1      S1!S2                               S.16452
           W@DPTM+2,A1 S1                              S.16453
           R      TDSP      CALCULATE A7 = DSP BASE   S.16454
           S4      S,A1      PW                       S.16455
           S3      2,A1      IN                       S.16456
           A0      S4                                   S.16458
           S2      <30                                  S.16459
           JAN     WW03      NOT FIRST WRITE          S.16460
           S4      S3!S4&S2      SET POWA            S.16461
           S2      <1                                   S.16462
           A4      S3                                   S.16463
           S3      S3+S2      IN + 1                  S.16464
           S2      164                                       S.16465
           S2      S2<71                                       S.16466
           A4      A4+A7                                       S.16467
           0,A4     A0      CLEAR FIRST BCW           S.16468
           A4      A4-A7                                       S.16469
           S4      S2!S4      INSERT RFW BITS        S.16470
WW03      =      *                                   S.16471
           S0      S4<4                                       S.16472
           S2      >4                                       S.16473
           JSM     WW04      PRECEDING WRITE          S.16474
           R      W@30      PROCESS WRITE AFTER READ S.16475
           JAN     W@22      ERROR                    S.16476

```

	R	TDSP	CALCULATE A7 = DSP BASE ADDRESS	S.16477
WW04	=	*		S.16478
	S1	1,A1	FIRST	0001.102
	S0	S4		S.16479
	S4	S6!S4&S2	CLEAR RFD BITS	S.16480
	S2	0		S.16481
	JSP	WW05	NOT BOR	S.16482
	S0	S0<2		S.16483
	S2	<17		S.16484
	JSP	WW05	NOT BOF	S.16485
	S0	S0<1		S.16486
	S2	<43		S.16487
	JSM	WW09	WRITE AFTER EOD	S.16488
WW05	=	*		S.16489
	S2	S2<30		S.16490
	A3	A2+A3	LWA + 1	S.16491
	S4	#S2&S4	CONDITIONAL CLEAR BFI, BRI	S.16492
	S1	S1-S3	F - I	S.16493
	S2	<11		S.16494
	A4	S3	I	S.16495
	S1	S2&S1		S.16496
	S1	S3+S1		S.16497
	A5	S1	NOVA	S.16498
	W@DPTM,A1	S4	T.ZA	S.16499
WW10	=	*		S.16500
	S7	W@DPBIO,A1		S.16501
	S6	A1		S.16502
	A1	A2-A3		S.16503
	A6	A4-A5		S.16504
	S1	A1		S.16505
	A0	A1-A6		S.16506
	S2	<8		S.16507
	A1	S6		S.16508
	JAP	WW11	COUNT FIRST	S.16509
WW11	S1	A6		S.16510
	=	*		S.16511
	S0	S1		S.16512
	S2	#S1&S7		S.16513
	A6	S2		S.16514
	A6	A6+1	FIRST SEGMENT LENGTH	S.16515
	A7	A4+A7		S.16516
	JSZ	WW15	ZERO LENGTH	S.16517
	S0	S7		S.16518
	ERRIF	S@DPBIO,NE,0		S.16519
	JSM	WWVMV	USE VECTOR MOVE IF BUFFERED I/O	S.16520
	S0	0,A2		S.16521
WW14	=	*		S.16522
	A6	A6-1		S.16523
	A2	A2+1		S.16524
	A0	A6-1	DONE?	S.16525
	A7	A7+1		S.16526
	A4	A4+1		S.16527
	-1,A7	S0		S.16528
	S0	0,A2		S.16529
	JAP	WW14	NO	S.16530
	A6	D'64	MOVE IN 64 WORD CHUNKS	S.16531
WW15	=	*		S.16532
	A0	A4-A5		S.16533
	JAM	WW16	NOT AT BCW	S.16534
	A7	A7-A4		S.16535
	R	\$WBLK	PROCESS BCW	S.16536
	JAN	WW22	ERROR	S.16537
	J	WW10		S.16538

	A0	A2-A3		S. 16540
	S0	0, A2		S. 16541
	JAM	WW14	NOT AT EOC	S. 16542
	A7	A7-A4		S. 16543
	S0	W@DPTM, A1	T. ZA	S. 16544
*	END OF COUNT			S. 16545
	S4	W@DPTM, A1	PW (T. ZA)	S. 16546
	JSP	WW21	PARTIAL MODE	S. 16547
*	RECORD MODE			S. 16548
	S1	W@DPTM, A1	T. ZA	S. 16549
	S2	<43		S. 16550
	S1	S1>17		S. 16551
	S2	S2<11		S. 16552
	A6	S4	@ PCW	S. 16553
	S1	S2&S1	BFI, BRI	S. 16554
	S2	>4		S. 16555
	S1	S4!S1&S2	INSERT MODE BITS	S. 16556
	A7	A7+A4		S. 16557
	0, A7	S1	STORE RCW	S. 16558
	A7	A7-A4		S. 16559
	A7	A7+A6		S. 16560
	S6	0, A7	PCW	S. 16561
	A2	A6+1		S. 16562
	S1	A4		S. 16563
	A2	A4-A2	FWI	S. 16564
	S2	<30		S. 16565
	S4	S1!S4&S2	UPDATE PCWA	S. 16566
	A4	A4+1		S. 16567
	S1	A2		S. 16568
	A0	A4-A5		S. 16569
	S6	S6!S1	INSERT FWI	S. 16570
	0, A7	S6		S. 16571
	A7	A7-A6		S. 16572
	JAM	WW21	NOT AT BCW	S. 16573
	R	WB01	WRITE BLOCK	S. 16574
	JAN	WW22	ERROR	S. 16575
*	PARTIAL MODE			S. 16576
WW21	=	*		S. 16577
	S1	A4		S. 16578
	S, A1	S4	UPDATE PW	S. 16579
	S2	<30		S. 16580
	S3	S1!S3&S2	INSERT NWA	S. 16581
	S2	<60		S. 16582
	S3	S2&S3	CLEAR BP	S. 16583
	Z, A1	S3	UPDATE IN	S. 16584
	A2	W@DPTM+2, A1	B. ZB	S. 16585
	A3	A3-A2	COUNT	S. 16586
	A0	0	COMPLETE FLAG	S. 16587
	J	WW22		S002. 1447
WW39	=	*		S. 16592
	S1	W@DPERR, A1		S. 16593
	S3	>1		S. 16594
	S3	S3>S@DPERR	WRITE PAST EOD	S. 16595
	S1	S1!S3	SET ERROR FLAG	S. 16596
	W@DPERR, A1	S1		S. 16597
WW22	=	*		S002. 1448
	S1	W@DPTM+2, A1		S002. 1449
	S1	S1>D'24		S002. 1450
*				S. 16598
*	S1	43/24/B0		S. 16599
*	A1	DSP ADDRESS		S. 16600
*				S. 16601
WW99	=	*		S. 16602
	A7	S1		S. 16603
	B0	A7		S. 16604
	S1	W@DPTM+5, A1		S. 16605
	A7	S1	JXT ADDRESS	S. 16606
	S1	S1>D'24		S. 16607
	A6	S1	DNT ADDRESS	S. 16608
	J	B0		S. 16609



```

*      WJVMV      VECTOR MOVE FOR WRITE RECORD      S.16611
*
*      A2      SOURCE ADDRESS      S.16612
*      A1      OUT      S.16613
*      A7      DESTINATION ADDRESS      S.16614
*      A6      SHORT VECTOR LENGTH (NOT ZERO)      S.16615
*      S1      NEGATIVE NUMBER OF WORDS TO BE MOVED      S.16616
WJVMV  S2      A3      SAVE A3      S.16617
      A0      BIOV0SV      V0 SAVE AREA FOR BUFFERED I/O      S.16618
      A3      ZS0      D'64      S.16619
      VL      A3      S.16620
      ,A0,1    V0      SAVE V0      S.16622
      A3      S1      S.16623
      A3      -A3      S.16624
      A4      A4+A3      INCREMENT OUT      S.16625
      S.16626
WJVMV1 A0      A2      SOURCE ADDRESS      S.16627
      VL      A6      S.16628
      V0      ,A0,1    S.16629
      A0      A7      DESTINATION ADDRESS      S.16630
      A3      A3-A6      WORDS LEFT TO MOVE      S.16631
      A2      A2+A6      S.16632
      A7      A7+A6      S.16633
      A6      ZS0      D'64      S.16634
      ,A0,1    V0      S.16635
      A0      -A3      S.16636
      JAM      WJVMV1    LOOP UNTIL ALL WORDS MOVED      S.16637
      S.16638
      VL      A5      S.16639
      A0      BIOV0SV      S.16640
      V0      ,A0,1    RESTORE V0      S.16641
      A3      S2      RESTORE A3      S.16642
      J      WJ15      S.16643
      S.16644
      S.16645
      S.16646
**
* NAME      TDSP      S.16647
*      CALCULATE DSP POINTER BASE      S.16648
*      = 0 IF JXT ADDRESS =0      S.16649
*      = JTA ADDRESS IF DNJTF =1      S.16650
*      = USER BA IF DNJTF =0      S.16651
*      S.16652
* ENTRY     TDSP:      S003.737
*      A1      DSP ADDRESS      S003.738
*      S.16649
*      TDSP1:      S003.739
*      S7      16/0,24/DNT ADDRESS,24/JXT ADDRESS      S003.740
*      S.16650
*      S003.741
*      S003.742
* EXIT      A1      DSP ADDRESS (TDSP ENTRY ONLY)      S003.743
*      A7      BASE OF DSP POINTERS      S.16656
*      S.16657
*      REGISTERS MODIFIED -      S.16658
*      A0,A7 S0,S7      S.16659
*      S.16660
*      S.16661
TDSP      S7      W@DPTM+5,A1      S.16662
TDSP1     =      *      ENTRY W/ S7 = JXT ADDRESS      S.16663
      A0      S7      JXT ADDRESS      S.16664
      A7      0      S.16665
      JAZ      TDSP9      NOT JOB RELATED      S.16666
      A7      S7      JXT ADDRESS      S.16667
      A7      W@JXJTA,A7    JTA ADDRESS      S.16668
      S7      S7>D'24      S.16669
      TDSPA,0    A6      SAVE A6      S.16670
      A6      S7      DNT ADDRESS      S.16671
      S0      W@DNJTF,A6      S.16672
      S0      S0<S@DNJTF      S.16673
      A6      L@JTA      S.16674
      JSM      TDSP3      IN JTA      S.16675
      A7      A5+A7      USER BA      S.16676
      TDSP3     A6      TDSPA,0      S.16677
      TDSP9     J      B0      RETURN      S.16678
      TDSPA     0      S.16679

```



## CIRCULAR I/O

- PERFORMS PHYSICAL I/O ON A DATASET  
ACCESSIBLE TO TASKS THROUGH TIO AND DIRECT CALLS.

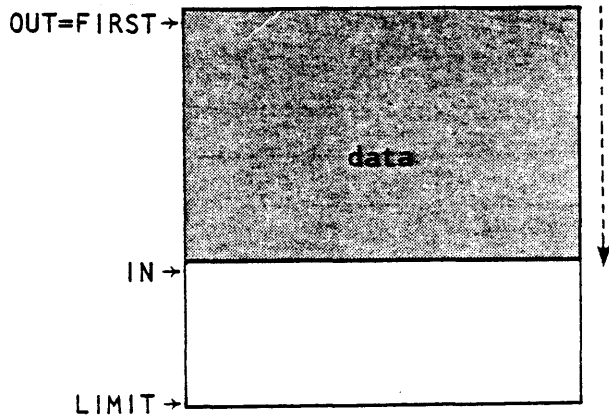
CIO ROUTINES ARE:

RDCS-READ CIRCULAR REQUEST

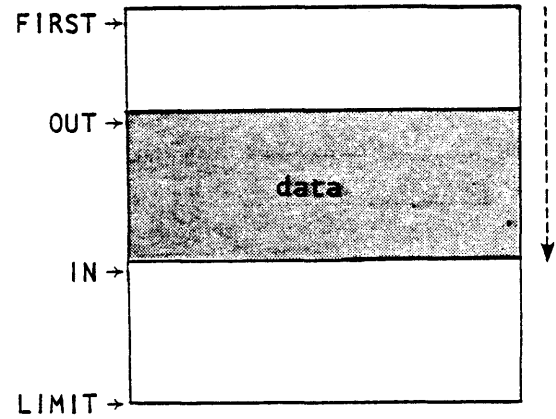
WDCS-WRITE CIRCULAR REQUEST

- TASKS CALL CIO BY PLACING REQUIRED PARAMETERS IN 'A' REGISTERS AND EXECUTING A RETURN JUMP TO THE ROUTINE.
- CIO READS/WITES 512 WORD BLOCKS. THE CALLER HAS THE RESPONSIBILITY OF MAINTAINING THE BUFFER IN/OUT POINTER IN THE DSP. AS SHOWN IN THE PREVIOUS \$WWD FLOW DIAGRAM.
- THE CALLER SENSES COMPLETION OF PHYSICAL I/O BY CALLING GETREPLY. IF A REPLY IS FOUND THE CALLER SHOULD CALL ROUTINE REPCIO WITH S1 AND S2 INTACT FROM GETREPLY.

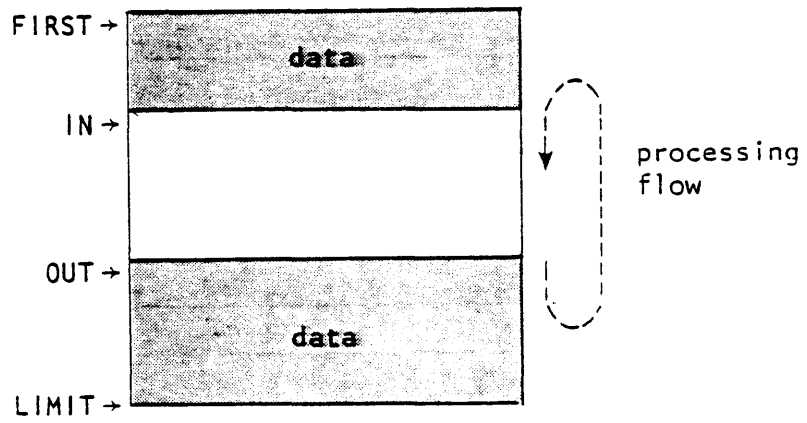




A. Filling the buffer



B. Emptying the buffer



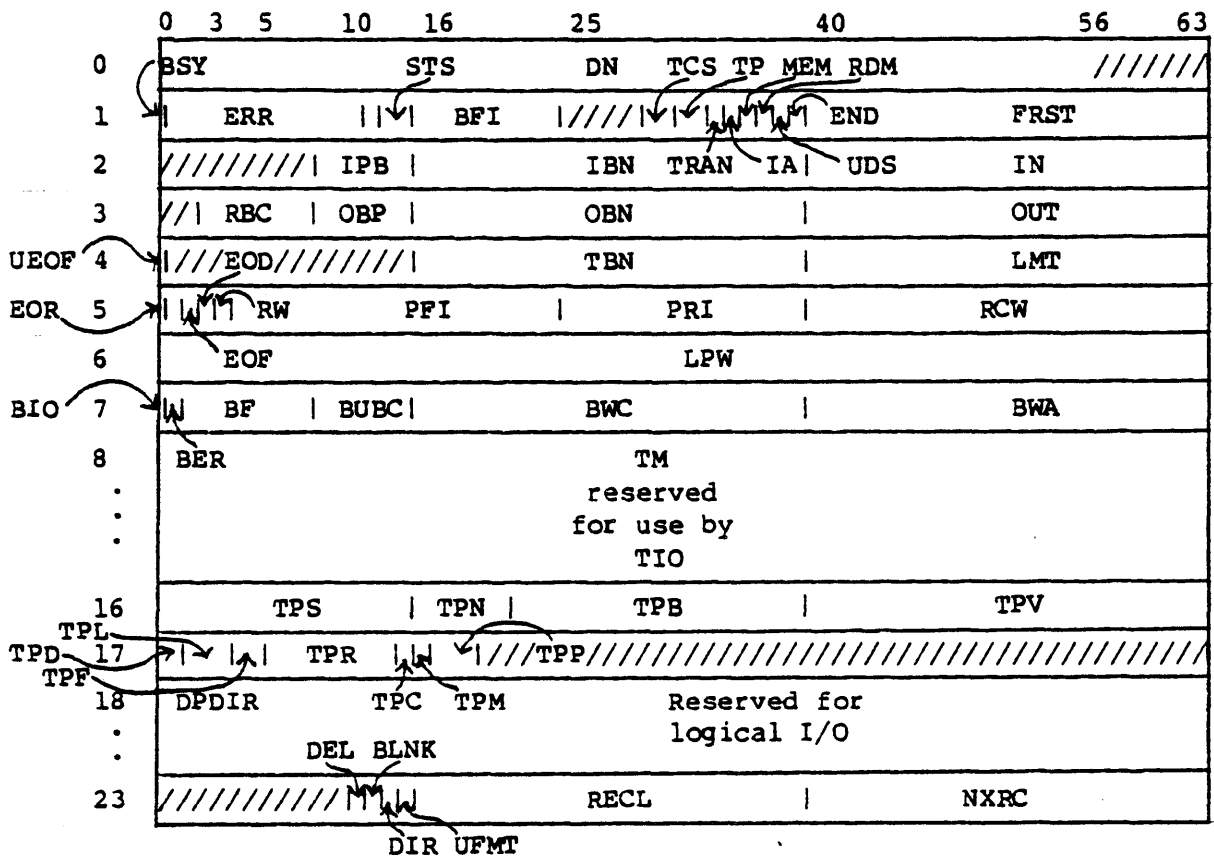
C. Concurrently filling and emptying the buffer

Physical I/O



DATASET PARAMETER AREA - DSP

Logical I/O requires the presence of a DSP for the dataset in the user's field. Refer to publication SR-0011 for details of DSP use.



TAPE I/O

Dataset Parameter Area (DSP)





## MEMORY MANAGEMENT

- PROVIDES TEMPORARY MEMORY AREAS FOR TASKS (AREAS IN STP)
- MEMORY AREAS ARE OF VARIABLE-SIZE
- MEMORY POOLS ARE USED

MEMORY MANAGEMENT ROUTINES ARE:

MEMAL-ALLOCATES A TASK MEMORY AREA

MEMDE-DEALLOCATES A TASK MEMORY AREA

● MEMAL ALLOCATES A VARIABLE-SIZE MEMORY AREA TO A TASK. MEMAL IS CALLED VIA A RETURN JUMP WITH THE CALLER PROVIDING:

INPUT REGISTERS: (A6) = Number of memory pool from which to allocate  
(A7) = Number of words desired

OUTPUT REGISTERS: (A6) = Status:  
0 Good status  
1 Invalid memory pool number  
2 Invalid number of words requested  
3 Memory not available  
(A7) = Address of first usable word of memory to be allocated

```

EJECT
*****
**
*
*NAME      MEMAL
*
*PURPOSE   MEMAL WILL ALLOCATE A VARIABLE SIZE AREA OF MEMORY FROM A
*          MEMORY POOL.
*
*ENTRY     A6 = NUMBER OF THE MEMORY POOL TO ALLOCATE FROM
*          A7 = NUMBER OF WORDS REQUIRED
*
*EXIT      A6 = STATUS
*          0 = GOOD RETURN
*          1 = INVALID POOL NUMBER
*          2 = INVALID NUMBER OF WORDS REQUESTED
*          3 = MEMORY NOT AVAILABE
*          A7 = ADDRESS OF FIRST USEABLE WORD ALLOCATED—MEANINGFUL
*          ONLY IF A6 = 0
*
*****
MISTAKE1 = 1
MISTAKE2 = 2
MISTAKE3 = 3
MEMAL = *
      A5      POOLTBL      BASE ADDRESS OF POOL TABLE
      GET,S5  S6&S7,PTMAX,A5 MAX POOL NUMBER
      A4      S5
      A0      A4-A6
      JAM     MEMER1      JUMP IF POOL NUMBER GREATER THAN MAX
      A5      A5+A6      ADDRESS OF POOL WORD
      S0      0,A5
      JSZ    MEMER1
      A0      A7
      JAZ    MEMER2      JUMP IF ZERO WORDS REQUESTED
*
*          THE TOTAL SIZE TO BE ALLOCATED IS THE REQUESTED SIZE PLUS
*          THE SIZE OF THE HEADER AND TRAILER
*
      A4      MPHT
      A7      A7+A4      TOTAL SIZE REQUIRED
*
*          VERIFY THAT THE REQUESTED SIZE IS NOT LARGER THAN THE POOL
*
      GET,S1  S6&S7,PTSIZE,A5
      A4      S1
      A0      A4-A7
      JAM     MEMER2
*
      GET,S1  S6&S7,PTBASE,A5
      A4      S1      BASE ADDRESS OF MEMORY POOL
*
*          LOCK OUT INTERRUPTS UNTIL THE SPACE HAS BEEN ALLOCATED
*
      S1      1
      STPLK,A0 S1
MEMAL10 = *
      GET,S1  S6&S7,MPID,A4  VALIDATE THE HEADER WORD
      S2      IDWRD,A6
      S0      S1-S2
      ERRSN
      GET,S0  S6&S7,MPST,A4
      JSN     MEMAL50      JUMP IF AREA IN USE
      GET,S1  S6&S7,MPSIZE,A4 SIZE OF AVAILABLE AREA
      A1      S1
      A0      A1-A7
      JAN     MEMAL30      REQUEST SIZE UNEQUAL TO AVAILABLE

```

A0255.933  
A0255.934  
A0255.935  
A0255.936  
A0255.937  
A0255.938  
A0255.939  
A0255.940  
A0255.941  
A0255.942  
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A0255.991  
A0255.992  
A0255.993  
A0255.994  
A0255.995  
A0255.996  
A0255.997  
A0255.998  
A0255.999

```

^
*
*
*
*
AT THIS POINT THE SIZE OF THE REQUEST IS EQUAL TO THE
AVAILABLE AREA
S1      1
PUT,S1  S6&S7,MPST,A4  SET IN USE INDICATOR
A2      A4+A1
A2      A2-1            ADDRESS OF TRAILER WORD
PUT,S1  S6&S7,MPST,A2

*
*
*
RELEASE INTERRUPT LOCKOUT

S1      0
UNLOCK
A7      A4+1            RETURN ADDRESS FIRST USABLE WORD

*
*
*
CLEAR THE MEMORY ALLOCATED WITHOUT DESTROYING THE HEADER
AND TRAILER

A6      A7
=      *
0,A6    S1
A6      A6+1
A0      A6-A2
JAN     MEMAL20

*
*
*
RETURN TO REQUESTOR WITH GOOD STATUS

A6      0
J       B00

*
*
*
HERE AN AVAILABLE MEMORY AREA HAS BEEN LOCATED.  IT IS UNEQUAL
IN SIZE TO THE REQUEST
MEMAL30 = *
JAM     MEMAL50      AVAILABLE IS LESS THAN REQUEST

*
*
*
REPLACE THE EXISTING HEADER WORD AND CREATE A NEW TRAILER

A2      A4+A7
A2      A2-1            TRAILER ADDRESS
S1      0
0,A2    S1            CLEAR OUT ANY GARBAGE
S1      A7
PUT,S1  S6&S7,MPST,A4
PUT,S1  S6&S7,MPST,A2  SIZE OF ALLOCATED AREA
S1      1
PUT,S1  S6&S7,MPST,A4
PUT,S1  S6&S7,MPST,A2  IN USE INDICATOR
S2      IDWRD,A6
PUT,S2  S6&S7,MPID,A4
PUT,S2  S6&S7,MPID,A2  POOL ID

*
*
*
CREATE A NEW HEADER AND TRAILER FOR THAT SPACE WHICH IS
STILL AVAILBLE.

A2      A2+1            ADDRESS OF NEW HEADER
A1      A1-A7          SIZE OF NEW AREA
A6      A2+A1
A6      A6-1            ADDRESS OF NEW TRAILER
S6      0
0,A2    S6            CLEAR NEW HEADER
S1      A1
PUT,S1  S6&S7,MPST,A2
PUT,S1  S6&S7,MPST,A6
S1      0
PUT,S1  S6&S7,MPST,A2
PUT,S1  S6&S7,MPST,A6
PUT,S2  S6&S7,MPID,A2
PUT,S2  S6&S7,MPID,A6
UNLOCK

```

*			A0255.1071
*		CLEAR THE ALLOCATED AREA	A0255.1072
*			A0255.1073
	A2	A2-1	A0255.1074
	A7	A4+1	A0255.1075
	A4	A4+1	A0255.1076
MEMAL40	=	*	A0255.1077
	0, A4	S1	A0255.1078
	A4	A4+1	A0255.1079
	A0	A2-A4	A0255.1080
	JAN	MEMAL40	A0255.1081
	A6	0	A0255.1082
	J	B00	A0255.1083
		RETURN GOOD STATUS	A0255.1084
MEMAL50	=	*	A0255.1085
	GET, S1	S6&S7, MPSIZE, A4	A0255.1086
		SIZE OF CURRENT AREA	A0255.1087
	A2	S1	A0255.1088
	A4	A4+A2	A0255.1089
		ADDRESS NEXT HEADER WORD	A0255.1090
	GET, S1	S6&S7, PTBASE, A5	A0255.1091
		POOL BASE ADDRESS	A0255.1092
	GET, S2	S6&S7, PTSIZE, A5	A0255.1093
		POOL SIZE	A0255.1094
	S1	S1+S2	A0255.1095
		END ADDRESS OF POOL	A0255.1096
	A1	S1	A0255.1097
	A0	A1-A4	A0255.1098
	JAN	MEMAL10	A0255.1099
		JUMP IN ENTRIE POOL NOT YET SEARCHED	A0255.1100
*			A0255.1101
*		THE MEMORY POOL DOES NOT CONTAIN ENOUGH AVAILABLE CONSECUTIVE	A0255.1102
*		SPACE TO FILL THE REQUEST	A0255.1103
*			A0255.1104
	UNLOCK		A0255.1105
		RELEASE INTERRUPT LOCK-OUT	C0763.1
	A6	MISTAKE3	A0255.1093
	J	B00	A0255.1099
MEMER1:	=	*	A0255.1100
	A6	MISTAKE1	A0255.1101
	J	B00	A0255.1102
MEMER2	=	*	A0255.1103
	A6	MISTAKE2	A0255.1104
	J	B00	A0255.1105

● MEMDE RETURNS (DEALLOCATES) MEMORY TO THE MEMORY POOL FOR REALLOCATION. MEMDE IS CALLED VIA A RETURN JUMP WITH THE CALLER PROVIDING:

INPUT REGISTERS: (A6) = Memory pool number  
(A7) = Address of first usable word of memory to be deallocated

OUTPUT REGISTERS: (A6) = Status:  
0 Good return  
1 Invalid address  
2 Area not currently allocated  
3 Invalid pool number  
(A7) = Address of memory released; meaningful only if status is 0.

```

EJECT
*****
**
*
*NAME      MEMDE
*
*PURPOSE  MEMDE RETURNS MEMORY TO THE POOL COMBINING IT WITH AVAILABLE
*          ADJACENT AREAS TO HELP PREVENT FRAGMENTATION
*
*
*ENTRY    A6 = POOL NUMBER MEMORY SHOULD BE RETURNED TO
*          A7 = ADDRESS OF THE MEMORY TO BE RELEASED
*
*EXIT     A6 = STATUS
*          0 = GOOD RETURN
*          1 = INVALID HEADER WORD
*          2 = AREA NOT CURRENTLY ALLOCATED
*          3 = INVALID POOL NUMBER
*          A7 = ADDRESS OF AREA RELEASED--MEANINGFUL ONLY IF GOOD STATUS
*
**
*****
DEERR1    =      1
DEERR2    =      2
DEERR3    =      3
MEMDE     =      *
A1        A7-1
GET, S1   S6&S7, MPID, A1
S2        IDWRD, A6
S0        S2-S1
JSN       DEER1          JUMP IF INVALID HEADER WORD
GET, S0   S6&S7, MPST, A1
JSZ       DEER2          JUMP IF PREVIOUSLY RELEASED
A5        POOLTBL        BASE ADDRESS OF POOL TABLE
GET, S1   S5&S6, PTMAX, A5 MAX VALID POOL NUMBER
S2        A6
S0        S1-S2
JSM       DEER3          JUMP IF INVALID POOL
A5        A5+A6          ADDRESS OF POOL WORD
S0        0, A5
JSZ       DEER3          JUMP IF INVALID POOL
GET, S1   S6&S7, PTBASE, A5
GET, S2   S6&S7, PTSIZE, A5 POOL SIZE
S2        S2+S1          END ADDRESS OF POOL
S3        A1             ADDRESS OF AREA TO RELEASE
S0        S3-S1
JSM       DEER3          JUMP IF ADDRESS OUTSIDE POOL RANGE
S0        S2-S3
JSM       DEER3          JUMP IF ADDRESS OUTSIDE POOL RANGE
*
*          THE VALIDATION IS COMPLETE.  NOW ACTUALLY RELEASE THE SPACE
*
S6        1
STPLK, A0 S6             LOCK OUT INTERRUPTS
GET, S4   S6&S7, MPSIZE, A1 SIZE OF AREA
S5        S3+S4
A2        S5
A2        A2-1          TRAILER ADDRESS
S6        0
PUT, S6   S0&S7, MPST, A1 MARK IT AVAILABLE
PUT, S6   S0&S7, MPST, A2
S0        S5-S2
JSP       MEMDE10       JUMP IF LAST AREA IN POOL
A4        S5             ADDRESS OF NEXT HEADER
GET, S0   S6&S7, MPST, A4
JSN       MEMDE10       JUMP IF NEXT AREA NOT AVIALABLE

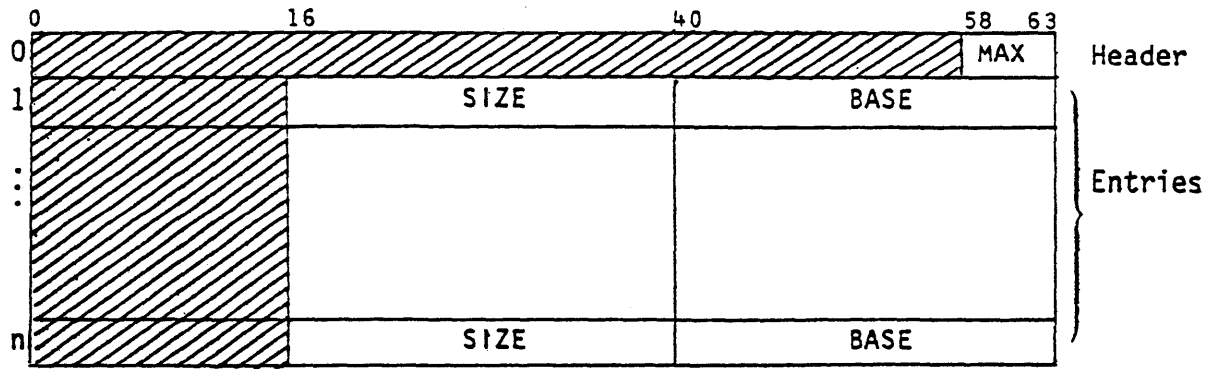
```

* * * *	THE FOLLOWING MEMORY AREA IS AVAILABLE. COMBINE THE TWO INTO ONE LARGE AREA	A0255.1171 A0255.1172 A0255.1173 A0255. 4 A0255.1175 A0255.1176 A0255.1177 A0255.1178 A0255.1179 A0255.1180 A0255.1181 A0255.1182 A0255.1183 A0255.1184 A0255.1185 A0255.1186 A0255.1187 A0255.1188 A0255.1189 A0255.1190 A0255.1191 A0255.1192 A0255.1193 A0255.1194 A0255.1195 A0255.1196 A0255.1197 A0255.1198 A0255.1199 A0255.1200 C0983.31 A0255. 2 A0255.1203 A0255.1204 A0255.1205 A0255.1206 A0255.1207 A0255.1208 A0255.1209 A0255.1210 A0255.1211
	GET, S5      S6&S7, MPST, A4      SIZE OF FOLLOWING AREA	
	S4            S5+S4                      COMBINED SIZE	
	A5            S4	
	A2            A1+A5	
	A2            A2-1                      TRAILER ADDRESS	
MEMDE10	=            *	
	S0            S1-S3	
	JSZ          MEMDE20                  JUMP IF AREA IS FIRST IN POOL	
	A4            A1-1                      ADDRESS OF PRECEDING TRAILER	
	GET, S0      S6&S7, MPST, A4	
	JSN          MEMDE20                  JUMP IF PRECEDING AREA IN USE	
* * * *	THE PRECEDING AREA IS AVAILABLE. COMBINE THE TWO INTO ONE LARGE AREA	
	GET, S5      S6&S7, MPST, A4      SIZE OF PRECEDING AREA	
	S4            S4+S5                      COMBINED SIZE	
	A4            S5	
	A1            A1-A4                      BASE ADDRESS OF LARGEST AREA	
* * * *	CREATE NEW HEADER AND TRAILER WORDS	
MEMDE20	=            *	
	PUT, S4      S6&S7, MPST, A1	
	PUT, S4      S6&S7, MPST, A2	
	A6            0                          GOOD STATUS	
	UNLOCK	
	J            B00	
DEER1	=            *	
	A6            DEERR1	
	J            B00	
DEER2	=            *	
	A6            DEERR2	
	J            B00	
DEER3	=            *	
	A6            DEERR3	
	J            B00	



POOL TABLE - POOLTBL

The Pool Table is an STP-resident table used for memory pool management.



Pool Table

HEADER

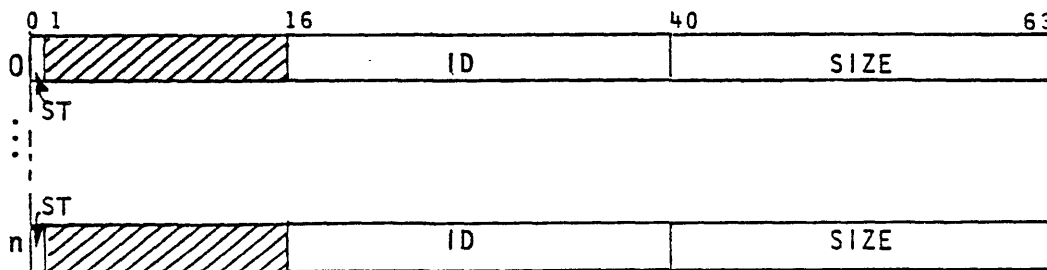
<u>Field</u>	<u>Word</u>	<u>Bits</u>	<u>Description</u>
PTMAX	0	58-63	Maximum valid memory pool number in system

ENTRY

<u>Field</u>	<u>Word</u>	<u>Bits</u>	<u>Description</u>
PTSIZE	0	16-39	Size of the memory pool
PTBASE	0	40-63	Base address of the memory pool

MEMORY POOL - POOLI...n

Memory pool areas are surrounded by header and trailer words that control the allocation and deallocation of the areas.



Memory Pool

<u>Field</u>	<u>Word</u>	<u>Bits</u>	<u>Description</u>
MPST	0,n,etc.	0	Status of the memory area: 0 Available 1 In use
MPID	0,n,etc.	16-39	Memory pool identification: 01010101 Pool 1 0x0x0x0x Pool x
MPSIZE	0,n,etc.	40-63	Size of the memory pool



## ITEM CHAINING/UNCHAINING

- PROVIDES MEANS FOR TASKS TO LINK DATA
- AMOUNT OF DATA TO LINK IS DEFINED BY THE TASKS
- MAY BE USED TO LINK REGISTER DATA OR POOL DATA
- DATA IS CONSIDERED AN ITEM



- CHAIN/CHAINF PLACE AN ITEM ON A CHAIN. CHAIN WILL PLACE AN ITEM ON THE END WHEREAS CHAINF WILL PLACE AN ITEM ON THE FRONT OF A CHAIN. CHAIN/CHAINF ARE CALLED VIA A RETURN JUMP WITH THE CALLER PROVIDING THE FOLLOWING:

INPUT REGISTERS: (A6) = Address of chain control word  
(A7) = Address of the item to be chained

OUTPUT REGISTERS: (A6) = Unchanged from input  
(A7) = Unchanged from input

```

EJECT
*****
**
*
*NAME      CHAIN
*
*PURPOSE   CHAIN WILL ADD AN ITEM TO AN EXISTING QUEUE.  ITEMS ARE
*           ALWAYS ADDED AT THE END OF THE QUEUE.
*
*ENTRY     A6 = ADDRESS OF CHAIN CONTROL WORD
*           A7 = ADDRESS OF THE ITEM TO ADD TO THE CHAIN
*
*EXIT      A6 = UNCHANGED
*           A7 = UNCHANGED
**
*****
CHAIN      =          *
           S1         0
           PUT,S1     S6&S7,CIFL,A7
           PUT,S1     S6&S7,CIBL,A7  JUST TO BE SAFE
           S1         A6
           PUT,S1     S6&S7,CICC,A7  SAVE CHAIN CONTROL ADDRESS
           GET,S1     S6&S7,CCTAIL,A6
           S2         A7
           PUT,S2     S6&S7,CCTAIL,A6  NEW TAIL ADDRESS
           PUT,S1     S6&S7,CIBL,A7  BACKWAR LINK = OLD TAIL
           S0         S1
           JSN        CHAIN10
*
*           THE CHAIN WAS EMPTY.  THIS IS THE ONLY ITEM ON QUEUE
*
           PUT,S2     S6&S7,CCHEAD,A6  HEAD = TAIL
           J          CHAIN20
CHAIN10    =          *
           A5         S1
           PUT,S2     S6&S7,CIFL,A5  FORWARD LINK OLD TAIL = NEW TAIL
CHAIN20    =          *
           J          B00

```

A0255.1212  
A0255.1213  
A0255.1214  
A0255.1215  
A0255.1216  
A0255.1217  
A0255.1218  
A0255.1219  
A0255.1220  
A0255.1221  
A0255.1222  
A0255.1223  
A0255.1224  
A0255.1225  
A0255.1226  
A0255.1227  
A0255.1228  
A0255.1229  
A0255.1230  
A0255.1231  
A0255.1232  
A0255.1233  
A0255.1234  
A0255.1235  
A0255.1236  
A0255.1237  
A0255.1238  
A0255.1239  
A0255.1240  
A0255.1241  
A0255.1242  
A0255.1243  
A0255.1244  
A0255.1245  
A0255.1246  
A0255.1247  
A0255.1248  
A0255.1249  
A0255.1250

```

*****
**
**NAME      CHAINF
**
**PURPOSE CHAINF WILL ADD AN ITEM TO THE FRONT OF AN EXISTING QUEUE.
**
**          ENTRY      A6 = ADDRESS OF CHAIN CONTROL WORD
**                      A7 = ADDRESS OF THE ITEM TO BE ADDED
**
**EXIT
**          A6 = UNCHANGED
**          A7 = UNCHANGED
**
**REGISTERS MODIFIED - S0,S1,S2,S6,S7,A6
**
*****
CHAINF      =      *
            S1      1
            STPLK,0  S1          LOCK OUT INTERRUPTS
            GET,S2   S6&S7,CCHEAD,A6
            S0      S2
            S1      A7
            JSZ     CHAINF1
            SPUT,S1 S6&S7,CCHEAD,A6
            A5      S2
            PUT,S1  S6&S7,CIBL,A5
            J       CHAINF2
CHAINF1    =      *
            GET,S1  S6&S7,CCHEAD
            SET,S1  S6&S7,CCTAIL
            W@CCHEAD,A6 S6
CHAINF2    =      *
            S1      A6
            PUT,S1  S6&S7,CICC,A7  CHAIN CONTROL POINTER
            S6      W@CIFL,A7
            GET,S2  S6&S7,CIFL
            S1      0
            SET,S1  S6&S7,CIBL
            W@CIFL,A7 S6
            UNLOCK
            J       B0
            ERRIF  W@CIFL,NE,W@CIBL
            ERRIF  W@CCHEAD,NE,W@CCTAIL

```

B0492.124  
 B0492.125  
 B0492.126  
 B0492.127  
 B0492.128  
 B0492.129  
 B0492.130  
 B0492.131  
 B0492.132  
 B0492.133  
 B0492.134  
 B0492.135  
 B0492.136  
 B0492.137  
 B0492.138  
 B0492.139  
 B0492.140  
 B0492.141  
 B0492.142  
 B0492.143  
 B0492.144  
 B0492.145  
 B0492.146  
 B0492.147  
 B0492.148  
 B0492.149  
 B0492.150  
 B0492.151  
 B0492.152  
 B0492.153  
 B0492.154  
 B0492.155  
 B0492.156  
 B0492.157  
 B0492.158  
 B0492.159  
 B0492.160  
 B0492.161  
 B0492.162  
 C0983.32  
 B0492.164  
 B0492.165  
 B0492.166





- UNCHAIN REMOVES AN ITEM FROM ANYWHERE ON THE CHAIN. THE CALLER MUST UPDATE THE COUNT OF THE NUMBER OF ITEMS REMAINING ON THE CHAIN. UNCHAIN IS CALLED VIA A RETURN JUMP WITH THE CALLER PROVIDING THE FOLLOWING:

INPUT REGISTER: (A7) = Address of item to be unchained

OUTPUT REGISTER: (A7) = Unchanged from input



```

EJECT
*****
**
*
*NAME      UNCHAIN
*
*PURPOSE   UNCHAIN WILL REMOVE AN ITEM FROM AN EXISTING QUEUE. THE ITEM
*           TO BE REMOVED MAY OCCUPY ANY POSITION IN THE CHAIN.
*
*          A7 = ADDRESS OF ITEM TO BE REMOVED
*
*EXIT      A0 = STATUS
*           0 = GOOD RETURN
*           1 = ITEM IS NOT ON A CHAIN
*          A7 = ADDRESS OF ITEM REMOVED
*
**
*****
UNCHER1 = 1
UNCHAIN = *
GET,S1   S6&S7,CICC,A7  CHAIN CONTROL WORD ADDRESS
S0       S1
A6       S1
A0       UNCHER1
JSZ      UNCH50          JUMP IF ITEM NOT ON A CHAIN
S1       1
STP_LK,A0 S1            LOCK OUT INTERRUPTS
GET,S1   S6&S7,CCHEAD,A6 HEAD OF CHAIN
S2       A7             ADDRESS OF ITEM TO REMOVE
GET,S3   S6&S7,CIFL,A7  FORWARD LINK OF ITEM
GET,S4   S6&S7,CIBL,A7  BACKWARD LINK OF ITEM
S0       S1-S2
JSN      UNCH10         JUMP IF ITEM NOT HEAD OF CHAIN
PUT,S3   S6&S7,CCHEAD,A6 ITEM FOWARD LINK = NEW HEAD
UNCH10  = *
GET,S1   S6&S7,CCTAIL,A6 TAIL OF CHIAN
S0       S1-S2
JSN      UNCH20         JUMP IF ITEM NOT TAIL OF CHIAN
PUT,S4   S6&S7,CCTAIL,A6 ITEM BACKWARD LINK = NEW TAIL
UNCH20  = *
S0       S3
JSZ      UNCH30         JUMP IF FOWAD LINK IS ZERO
A2       S3
PUT,S4   S6&S7,CIBL,A2  NEW BACKWARD LINK FOR FOLLOWING ITEM
UNCH30  = *
S0       S4
JSZ      UNCH40         JUMP IF BACKWARD LINK IS ZERO
A2       S4
PUT,S3   S6&S7,CIFL,A2  NEW FORWARD LINK FOR PRECEEDING ITEM
UNCH40  = *
UNLOCK
PUT,S1   S6&S7,CICC,A7  CLEAR CHAIN CONTROL
A0       0              GOOD STATUS
UNCH50  = *
J        B00

```

A0255.1251  
A0255.1252  
A0255.1253  
A0255.1254  
A0255.1255  
A0255.1256  
A0255.1257  
A0255.1258  
A0255.1259  
A0255.1260  
A0255.1261  
A0255.1262  
A0255.1263  
A0255.1264  
A0255.1265  
A0255.1266  
A0255.1267  
A0255.1268  
A0255.1269  
A0255.1270  
A0255.1271  
A0255.1272  
A0255.1273  
A0255.1274  
A0255.1275  
A0255.1276  
A0255.1277  
A0255.1278  
A0255.1279  
A0255.1280  
A0255.1281  
A0255.1282  
A0255.1283  
A0255.1284  
A0255.1285  
A0255.1286  
A0255.1287  
A0255.1288  
A0255.1289  
A0255.1290  
A0255.1291  
A0255.1292  
A0255.1293  
A0255.1294  
A0255.1295  
A0255.1296  
A0255.1297  
A0255.1298  
A0255.1299  
A0255.1300  
C0983.33  
A0255.1303  
C0983.34  
A0255.1305  
A0255.1306



## CHAIN CONTROL - CC

Intertask communication requires chain control words in the format defined.

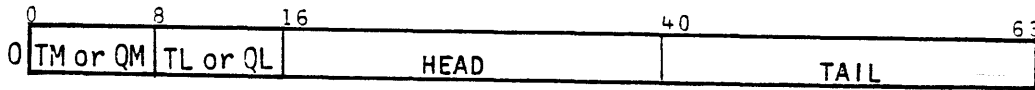
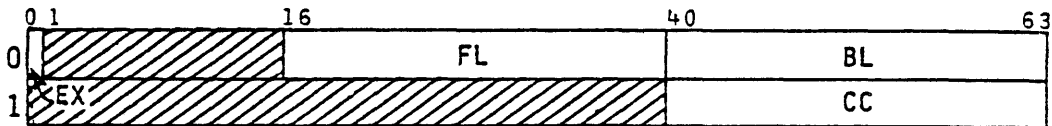


Figure 1.CC-1. Chain Control Word

<u>Field</u>	<u>Word</u>	<u>Bits</u>	<u>Description</u>
CCTM	0	0-7	Maximum number of items to be queued to a particular task
CCQM	0	0-7	Maximum number of items to be queued from one task to another
CCTL	0	8-15	Number of items queued to a particular task
CCQL	0	8-15	Number of items to be queued from one task to another
CCHEAD	0	16-39	Address of first item on the chain
CCTAIL	0	40-63	Address of last item on the chain

## CHAIN ITEM - CI

Any item queued using the STP common routines CHAIN and UNCHAIN must reserve the first two words of the item to be used by the common routines.



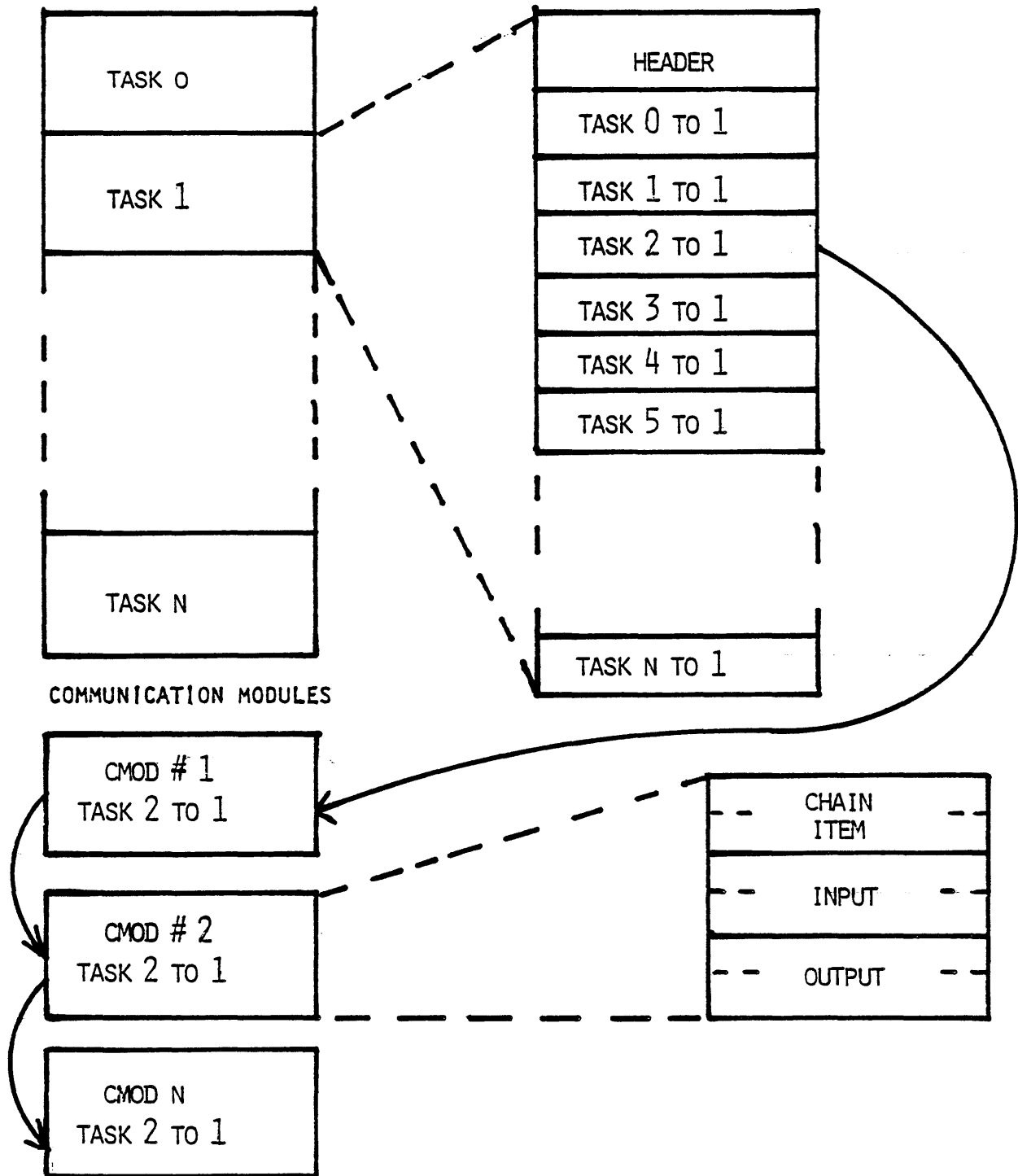
Chain Item

<u>Field</u>	<u>Word</u>	<u>Bits</u>	<u>Description</u>
CIEX	0	0	This bit, if set, indicates that the item is in execution.
CIFL	0	16-39	Forward link; address of next item on the chain
CIBL	0	40-63	Backward link; address of the preceding item on the chain
CICC	1	40-63	Address of the chain control word for this item

## TASK TO TASK COMMUNICATION

- THERE ARE 2 AREAS FOR INTERTASK COMMUNICATION
  1. COMMUNICATION MODULE CHAIN CONTROL (CMCC).
    - CONTIGUOUS AREA
    - ENTRY FOR EACH POSSIBLE TASK COMBINATION
    - ARRANGED IN TASK NUMBER SEQUENCE
    - POINT TO THE COMMUNICATION MODULES (CMOD's)
  2. COMMUNICATION MODULE (CMOD)
    - ALLOCATED AS NEEDED FROM A POOL
    - ALL TASK REQUESTS ARE THROUGH A CMOD.
    - ALL TASK REPLIES ARE THROUGH A CMOD.
      - 2 WORDS FOR SYSTEM CONTROL
      - 2 WORDS AS TASK INPUT REGISTERS
      - 2 WORDS AS TASK OUTPUT REGISTERS
- TASKS PLACE REQUESTS IN THE INPUT WORDS OF A CMOD.
- TASKS RECEIVE REPLIES IN THE OUTPUT WORDS OF THEIR CMOD
- FORMAT OF A REQUEST IS DEFINED BY THE CALLED TASK

COMMUNICATION MODULE CHAIN CONTROL







- A TASKS CALLS EXEC TO ACTIVATE ANOTHER TASK.
- THE TASK SCHEDULER IN EXEC EXAMINES THE SYSTEM TASK TABLE TO DETERMINE THE HIGHEST PRIORITY TASK READY TO EXECUTE.
- THE RE-ENTRANT ROUTINES:
  - PUTREQ
  - GETREQ
  - PUTREPLY
  - GETREPLY
  - TSKREQ

ARE USED FOR INTERTASK COMMUNICATION.

- THE REQUEST FOR INTERTASK COMMUNICATION IS PASSED IN REGISTERS S1 AND S2.

- PUTREQ PLACES THE REQUEST IN THE INPUT REGISTERS OF A CMOD AND LINKS THE CMOD TO THE APPROPRIATE CMCC. PUTREQ IS CALLED VIA A RETURN JUMP WITH THE CALLER PROVIDING THE FOLLOWING:

INPUT REGISTERS:     (A1) = "Throw-away" indicator. If (A1) is positive, control is not returned to caller until request is queued. If (A1) is negative, control returns with no action taken if the request cannot be queued without suspending the caller.

                      (A2) = Requested task's ID

                      (S1) = INPUT+0     } request

                      (S2) = INPUT+1     }

OUTPUT REGISTERS:   None

```

EJECT
*****
**
*
*NAME      PUTREQ
*
*PURPOSE  PUTREQ QUEUES A REQUEST FOR PROCESSING TO ANOTHER TASK.
*          ONCE THE REQUEST HAS BEEN CHAINED PUTREQ RETURNS TO THE
*          THE ORIGINATOR
*
*ENTRY    A1 = THROW AWAY INDICATOR
*          A1 = NEGATIVE THROW AWAY REQUEST INSTEAD OF SUSP
*          A1 = POSITIVE SUSPEND UNTIL REQUEST QUEUED
*          A2 = DESTINATION TASK ID
*          S1 = INPUT+0
*          S2 = INPUT+1
*
*EXIT
*
**
*****
PUTREQ    =      *
          A6      LE@SAVER
          A7      CTID,A0
          A6      ASXA7
          A7      SAVER
          A6      A6+A7          ADDRESS OF SAVE AREA FOR ORIGIN TASK
          SAVEA1,A6 A1
          SAVEA2,A6 A2
          SAVEA3,A6 A3
          SAVEA4,A6 A4
          SAVEA5,A6 A5
          SAVES0,A6 S0
          SAVES1,A6 S1
          SAVES2,A6 S2
          SAVES3,A6 S3
          SAVES4,A6 S4
          SAVES5,A6 S5
          SAVES6,A6 S6
          SAVES7,A6 S7
          A7      B00
          SAVERT,A6 A7
          S6      0
          SAVEA6,A6 S6
          SAVEA7,A6 S6
          A3      A6
          S0      S1
          ERRSZ          ERROR IF INPUT&1 = 0
PUTREQ10 =      *
          A6      CNPOOL          MEMORY POOL NUMBER
          A7      CMSIZE          CMOD SIZE
          R      MEMAL          ALLOCATE A CMOD
          A5      SAVERT,A3      RESTORE B00 FOR TRACE ENTRIES
          B00     A5
          A0      A6
          JAZ     PUTREQ20       JUMP IF GOOD STATUS RETURNED
          A7      MISTAKE3
          A0      A6-A7
          ERRAN

```

A0255.379  
A0255.380  
A0255.381  
A0255.382  
A0255.383  
A0255.384  
A0255.385  
A0255.386  
A0255.387  
A0255.388  
A0255.389  
A0255.390  
A0255.391  
A0255.392  
A0255.393  
A0255.394  
A0255.395  
A0255.396  
A0255.397  
A0255.398  
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A0255.402  
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A0255.424  
B0492.7  
B0492.8  
A0255.425  
A0255.426  
A0255.427  
A0255.428  
A0255.429  
A0255.430  
A0255.431  
A0255.432  
A0255.433  
A0255.434  
A0255.435

*			A0255.436
*	MEMAL	RETURNED A THREE STATUS--THERE IS NO MEMORY AVAILABLE.	A0255.437
*		SUSPEND AND TRY AGAIN LATER	A0255.438
*			A0255.439
	A0	SAVEA1,A3	A0255.440
	JAM	PUTREQS0	A0255.441
	S7	SUSP	A0255.442
	EX		A0255.443
	R	ERRP00	A0255.444
	J	PUTREQ10	A0255.445
PUTREQ20	=	*	A0255.446
	S1	SAVE31,A3	A0255.447
	S2	SAVE32,A3	A0255.448
	CMIN0,A7	S1	A0255.449
	CMIN1,A7	S2	A0255.450
	POST	12,S1,S2	A0255.451
		PUT THE MESSAGE IN THE CMOO	A0255.452
*			A0255.453
*		CALCULATE ADDRESS OF CHAIN CONTROL HEADER	A0255.454
*		CHAIN CONTROL HEADER = DESTINATION TASK ID * LENGTH OF CHAIN	A0255.455
*		CONTROL ENTRY + CHAIN CONTROL BASE	A0255.456
*			A0255.457
	A6	SAVEA2,A3	A0255.458
	A5	LE@CMCC	A0255.459
	A5	ASKA6	A0255.460
	A6	CMCC	A0255.461
	A5	A5+A6	A0255.462
		CHAIN CONTROL HEADER ADDRESS	A0255.463
*			A0255.464
*		CALCULATE THE CHAIN CONTROL WORD ADDRESS	A0255.465
*		CHAIN CONTROL = CHAIN CONTROL HEADER + LENGTH OF HEADER +	A0255.466
*		CURRENT TASK ID	A0255.467
*			A0255.468
	A6	LH@CMCC	A0255.469
	A6	A6+A5	A0255.470
	A4	CTID,A0	A0255.471
	A6	A6+A4	A0255.472
PUTREQ21	=	*	A0255.473
	A1	1	A0255.474
	STPLK,A0	A1	A0255.475
	GET,S1	S6&S7,CCTL,A5	A0255.476
	GET,S2	S6&S7,CCTM,A5	A0255.477
	S0	S2	A0255.478
	ERRSZ		A0255.479
	S0	S1-S2	A0255.480
	JSZ	PUTREQ22	A0255.481
	S4	1	A0255.482
	S1	S4+S1	A0255.483
	GET,S2	S6&S7,CCQL,A6	A0255.484
	GET,S3	S6&S7,CCQM,A6	A0255.485
	S0	S3	A0255.486
	ERRSZ		A0255.487
	S0	S2-S3	A0255.488
	JSZ	PUTREQ22	A0255.489
	S2	S2+S4	A0255.490
*		UPDATE THE QUEUE COUNTS	A0255.491
	PUT,S1	S6&S7,CCTL,A5	A0255.492
	PUT,S2	S6&S7,CCQL,A6	A0255.493
	J	PUTREQ25	A0255.494
*			A0255.495
*		THE QUEUE IS AT ITS MAX. EITHER SUSPEND OR THROW THE REQUEST	A0255.496
*		AWAY	A0255.497
*			A0255.498
PUTREQ22	=	*	A0255.499
	A1	0	A0255.500
	STPLK,A0	A1	A0255.501
	A0	SAVEA1,A3	A0255.502
	JAM	PUTREQ23	A0255.503
	S7	SUSP	A0255.504
	EX		A0255.505
	R	ERRP00	A0255.506
	J	PUTREQ21	A0255.507
		RELEASE INTERRUPT LOCKOUT	
		JUMP TO THOW THE REQUEST AWAY	

```

* * * * *
* * * * *      THROW THE REQUEST AWAY
* * * * *
PUTREQ23 = *
A6          *   CPOOL
R           *   MEME
A5          *   SAVERT,A3
B00        *   PUTREQ50
J           *
PUTREQ50 = *
R           *   CHAIN
A5          *   SAVERT,A3
B00        *
A1          *   0
STPLK,A0   *   A1
PUTREQ40 = *
S6          *   SAVEA2,A3
S7          *   RTSK
EX         *
R           *   ERROR0

* * * * *      RESTORE THE REGISTERS AND EXIT
* * * * *
PUTREQ50 = *
A6          *   A3
A0          *   SAVEA0,A6
A1          *   SAVEA1,A6
A2          *   SAVEA2,A6
A3          *   SAVEA3,A6
A4          *   SAVEA4,A6
A5          *   SAVEA5,A6
S0         *   SAVE50,A6
S1         *   SAVE51,A6
S2         *   SAVE52,A6
S3         *   SAVE53,A6
S4         *   SAVE54,A6
S5         *   SAVE55,A6
S6         *   SAVE56,A6
S7         *   SAVE57,A6
A7         *   SAVERT,A6
B00        *   A7
A6         *   SAVEA7,A6
A5         *   SAVEA6,A6
J          *   B20

A0255 506
A0255 507
A0255 508
A0255 509
A0255 510
A0255 511
A0255 512
A0255 513
A0255 514
A0255 515
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A0255 547
A0255 548
A0255 549

```

- GETREQ SEARCHES FOR AN ACTIVE REQUEST FOR THE CALLER. GETREQ IS CALLED VIA A RETURN JUMP AND REPLIES WITH THE FOLLOWING:

INPUT REGISTERS:     None

OUTPUT REGISTERS:   (A0) = "Found" indicator. If (A0) = 0, no outstanding requests exist. If (A0) ≠ 0, a request is being returned.

(A2) = ID of task that generated the request.

(S1) = INPUT+0        }  
(S2) = INPUT+1       } request

```

EJECT
*****
**
*
*NAME      GETREQ
*
*PURPOSE  GETREQ SEARCHES FOR AN OUTSTANDING REQUEST TO THE TASK.
*          THE HIGHEST PRIORITY REQUEST WILL BE RETURNED TO THE
*          ORIGINATING TASK. PRIORITY CORRESPONDS TO TASK ID
*
*ENTRY
*EXIT     A0 = FIND/NO FIND INDICATOR
*          0 = NO FIND
*          1 = FIND
*          A2 = TASK ID OF THE REQUEST LOCATED
*          S1 = INPUT+0
*          S2 = INPUT+1
*
**
*****
GETREQ    =      *
          A6      LE@SAVER
          A7      CTID,A0
          A6      A$KA7
          A7      SAVER
          A6      A$+A7          ADDRESS OF SAVE AREA FOR ORIGIN TASK
*
*          SAVE THOSE REGISTERS NOT ALREADY DESTROYED
*
          SAVEA1,A6 A1
          SAVEA2,A6 A2
          SAVEA3,A6 A3
          SAVEA4,A6 A4
          SAVEA5,A6 A5
          SAVES0,A6 S0
          SAVES1,A6 S1
          SAVES2,A6 S2
          SAVES3,A6 S3
          SAVES4,A6 S4
          SAVES5,A6 S5
          SAVES6,A6 S6
          SAVES7,A6 S7
          A7      B00
          SAVERT,A6 A7
          S6      0
          SAVEA6,A6 S6
          SAVEA7,A6 S6
          SAVEA0,A6 S6          ASSUME NO FIND WILL OCCUR
          A3      A6
*
*
*          CALCULATE THE ADDRESS OF CHAIN CONTROL HEADER
*          CHAIN CONTROL HEADER = CURRENT TASK ID * CHAIN CONTROL LENGTH
*          OF ENTRY + BASE OF CHAIN CONTROL
*
          A1      CTID,A0
          A2      LE@CMCC
          A1      A1*KA2
          A2      CMCC
          A1      A1+A2          CHAIN CONTROL HEADER ADDRESS
          GET,S0  S6&S7,OCTL,A1
          JEZ     GETREQ00      JUMP IF THERE IS NOTHING ON QUEUE

```

A0255.550  
A0255.551  
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A0255.609  
A0255.610  
A0255.611

```

*
* SEARCH EACH CHAIN CONTROL WORD FOR AN OUTSTANDING REQUEST
*
A2      LH@CMCC
A1      A1+A2
A2      0          WILL CONTAIN TASK ID OF FIND ON EXIT
A4      MAXTN
GETREQ10 =      *
GET, S0  S6&S7, CQCL, A1
JSN     GETREQ20  JUMP IF ITEMS ON CHAIN
GETREQ15 =      *
A1      A1+1      THIS CHAIN IS EMPTY GO TO THE NEXT
A2      A2+1
A0      A4-A2
JAN     GETREQ10  JUMP IF ALL CHAINS NOT EXAMINED
J       GETREQ30  THERE ARE NO REQUESTS FOR THE TASK
*
* A CHAIN WITH ITEMS HAS BEEN LOCATED
*
GETREQ20 =      *
GET, S1  S6&S7, CHEAD, A1
GET, S2  S6&S7, COTAIL, A1
GETREQ22 =      *
A5      S1          CMOD ADDRESS
GET, S0  S6&S7, CIEX, A5
JSZ     GETREQ25  JUMP IF REQUEST IS NOT IN EXECUTION
*
* THE TASK IS EXECUTING THIS ITEM
*
S0      S1-S2
JSZ     GETREQ15  JUMP IF ALL ITEMS IN EXECUTION
GET, S1  S6&S7, CIFL, A5  ADDRESS OF NEXT CMOD
J       GETREQ22
*
* A REQUEST TO PROCESS HAS BEEN LOCATED
*
GETREQ25 =      *
SAVEA2, A3 A2          SAVE TASK ID OF REQUEST
S1      1
SAVEA0, A3 S1          SET FIND INDICATOR
PUT, S1  S6&S7, CIEX, A5  SET EXECUTE INDICATOR
S1      CMIN0, A5
S2      CMIN1, A5
S0      S1
EPRSZ          ERROR IF INPUT&1 = 0
SAVE S1, A3 S1
SAVE S2, A3 S2
*
* RESTORE REGISTERS AND EXIT.
*
GETREQ30 =      *
A6      A3
A0      SAVEA0, A6
A1      SAVEA1, A6
A2      SAVEA2, A6
A3      SAVEA3, A6
A4      SAVEA4, A6
A5      SAVEA5, A6
S0      SAVE S0, A6
S1      SAVE S1, A6
S2      SAVE S2, A6
S3      SAVE S3, A6
S4      SAVE S4, A6
S5      SAVE S5, A6
S6      SAVE S6, A6
S7      SAVE S7, A6
A7      SAVERT, A6
B00     A7
A7      SAVEA7, A6
A6      SAVEA6, A6
J       B00

```

```

A0255. 612
A0255. 613
A0255. 614
A0255. 615
A0255. 616
A0255. 617
A0255. 618
A0255. 619
A0255. 620
A0255. 621
A0255. 622
A0255. 623
A0255. 624
A0255. 625
A0255. 626
A0255. 627
A0255. 628
A0255. 629
A0255. 630
A0255. 631
A0255. 632
A0255. 633
A0255. 634
A0255. 635
A0255. 636
A0255. 637
A0255. 638
A0255. 639
A0255. 640
A0255. 641
A0255. 642
A0255. 643
A0255. 644
A0255. 645
A0255. 646
A0255. 647
A0255. 648
A0255. 649
A0255. 650
A0255. 651
A0255. 652
A0255. 653
A0255. 654
B0492. 9
B0492. 10
A0255. 655
A0255. 656
A0255. 657
A0255. 658
A0255. 659
A0255. 660
A0255. 661
A0255. 662
A0255. 663
A0255. 664
A0255. 665
A0255. 666
A0255. 667
A0255. 668
A0255. 669
A0255. 670
A0255. 671
A0255. 672
A0255. 673
A0255. 674
A0255. 675
A0255. 676
A0255. 677
A0255. 678
A0255. 679
A0255. 680

```



- PUTREPLY PLACES A REPLY IN THE APPROPRIATE CMOD WHEN A TASK COMPLETES PROCESSING. PUTREPLY IS CALLED VIA A RETURN JUMP WITH THE CALLER PROVIDING THE FOLLOWING:

INPUT REGISTERS: (A2) = ID of task to receive the reply.

(S1) = OUTPUT+0 } Reply  
(S2) = OUTPUT+1 }

OUTPUT REGISTERS: None

```

EJECT
*****
*
*
* NAME PUTREPLY
*
* PURPOSE PUTREPLY SAVES OUTPUT IN THE APPROPRIATE CMOD WHEN A TASK
* COMPLETES PROCESSING
*
* ENTRY A2 = ID OF THE TASK TO RECEIVE THE REPLY
* S1 = OUTPUT+0
* S2 = OUTPUT+1
*
* EXIT
*
**
*****
PUTREPLY = *
A6 LE@SAVER
A7 CTID,A0 ORIGINATING TASK ID
A6 ASXA7
A7 SAVER
A6 AS+A7 ADDRESS OF SAVE AREA FOR ORIGIN TASK
*
* SAVE THE REGISTERS CLEARING THOSE ALREADY DESTROYED.
*
SAVEA0,A6 A0
SAVEA1,A6 A1
SAVEA2,A6 A2
SAVEA3,A6 A3
SAVEA4,A6 A4
SAVEA5,A6 A5
SAVE$0,A6 $0
SAVE$1,A6 $1
SAVE$2,A6 $2
SAVE$3,A6 $3
SAVE$4,A6 $4
SAVE$5,A6 $5
SAVE$6,A6 $6
SAVE$7,A6 $7
A7 B00
SAVERT,A6 A7
$6 0
SAVEA7,A6 $6
SAVEA6,A6 $6
A3 A6
$0 $2
ERRSZ ERROR IF 2ND WORD OF REPLY IS ZERO
*
* CALCULATE CHAIN CONTROL HEADER AND CHAIN CONTROL WORD ADR
* CHAIN CONTROL HEADER = BASE OF CMOD CHAIN CONTROL + (LENGTH
* OF AN ENTRY * CURRENT TASK ID)
* CHAIN CONTROL WORD = CHAIN CONTROL HEADER + LENGTH OF HEADER
* + RECEIVING TASK ID
*
A1 CTID,A0
A6 LE@CMCC
A6 ASXA1
A1 CMCC
A6 AS+A1 CHAIN CONTROL HEADER
A7 LH@CMCC
A7 A7+A6
A7 A2+A7 CHAIN CONTROL WORD
GET,$0 $6&$7,CCQL,A7
ERRSZ
GET,$5 $6&$7,CCHEAD,A7
GET,$4 $6&$7,CCTAIL,A7

```

```

PUTREP10 = *
A6 S5 CMOD ADDRESS
S0 CMOU1,A5
JSZ PUTREP20 JUMP IF CMOD HAS NO REPLY

*
* A REPLY EXISTS IN THIS CMOD. GO TO THE NEXT CMOD IF THERE IS
* ONE
*
S0 S4-S5
ERRSZ
GET,S5 SB&S7,CIFL,A5 NEXT CMOD ADDRESS
J PUTREP10

*
* AT THIS POINT WE HAVE FOUND A CMOD FOR THE REPLY
*
PUTREP20 = *
A1 1
STPLK,A0 A1 SET INTERRUPT LOCK-OUT
CMOUT0,A5 S1
CMOUT1,A5 S2

*
* DECREMENT THE NUMBER OF ITEMS ON QUEUE
*
GET,S1 SB&S7,COOL,A7
S4 1
S1 S1-S4
PUT,S1 SB&S7,COOL,A7
GET,S1 SB&S7,CCTL,A6
S1 S1-S4
PUT,S1 SB&S7,COOL,A6
A1 0
STPLK,A0 A1

*
* READY THE RECEIVING TASK
*
S1 CMOU0,A5
POST 12,S1,S2
S6 A2
S7 RTSK
EX R
R ERROR0

*
* RESTORE THE REGISTERS AND EXIT
*
A6 A3
A0 SAVEA0,A6
A1 SAVEA1,A6
A2 SAVEA2,A6
A3 SAVEA3,A6
A4 SAVEA4,A6
A5 SAVEA5,A6
S0 SAVE$0,A6
S1 SAVE$1,A6
S2 SAVE$2,A6
S3 SAVE$3,A6
S4 SAVE$4,A6
S5 SAVE$5,A6
S6 SAVE$6,A6
S7 SAVE$7,A6
A7 SAVERT,A6
B00 A7
A7 SAVEA7,A6
A6 SAVEA6,A6
J B00

```

```

A0255.746
A0255.747
A0255.748
A0255.749
A0255.750
A0255.751
A0255.752
A0255.753
A0255.754
A0255.755
A0255.756
A0255.757
A0255.758
A0255.759
A0255.760
A0255.761
A0255.762
A0255.763
A0255.764
A0255.765
A0255.766
A0255.767
A0255.768
A0255.769
A0255.770
A0255.771
A0255.772
A0255.773
A0255.774
A0255.775
A0255.776
A0255.777
A0255.778
A0255.779
A0255.780
A0255.781
A0255.782
A0255.783
A0255.784
A0255.785
A0255.786
A0255.787
A0255.788
A0255.789
A0255.790
A0255.791
A0255.792
A0255.793
A0255.794
A0255.795
A0255.796
A0255.797
A0255.798
A0255.799
A0255.800
A0255.801
A0255.802
A0255.803
A0255.804
A0255.805
A0255.806
A0255.807
A0255.808
A0255.809

```

- GETREPLY SEARCHES FOR A REPLY TO THE CALLING TASK. GETREPLY ALSO RELEASES THE APPROPRIATE CMOD WHEN A REPLY IS FOUND. GETREPLY IS CALLED VIA A RETURN JUMP AND REPLIES WITH THE FOLLOWING:

INPUT REGISTERS:     None

OUTPUT REGISTERS:   (A0) = Find indicator. If (A0) = 0, no reply was located; if (A0) ≠ 0, a reply is being returned to the caller.  
                      (A2) = ID of replying task  
                      (S1) = OUTPUT+0    } Reply  
                      (S2) = OUTPUT+1   }

```

EJECT
*****
**
*
*NAME      GETREPLY
*
*PURPOSE   GETREPLY LOCATES AND RETURNS THE HIGHEST PRIORITY REPLY TO
*           A TASK.  THE PRIORITY STRUCTURE CORRESPONDS TO THE TASK ID
*
*ENTRY
*
*EXIT      A0 = FIND, NO FIND INDICATOR
*           0 = NO FIND
*           1 = FIND
*
*           A2 = ID OF TASK WHERE REPLY FOUND
*           S1 = OUTPUT+0
*           S2 = OUTPUT+1
*
**
*****
GETREPLY =
    A6      LE@SAVER
    A7      CTID, A0
    A3      A6+A7
    A7      SAVER
    A6      A6+A7                ADDRESS OF SAVE AREA FOR ORIGIN TASK
*
*           SAVE THE REGISTERS CLEARING THOSE ALREADY DESTROYED
*
    SAVEA1, A6 A1
    SAVEA2, A6 A2
    SAVEA3, A6 A3
    SAVEA4, A6 A4
    SAVEA5, A6 A5
    SAVES0, A6 S0
    SAVES1, A6 S1
    SAVES2, A6 S2
    SAVES3, A6 S3
    SAVES4, A6 S4
    SAVES5, A6 S5
    SAVES6, A6 S6
    SAVES7, A6 S7
    A7      B00
    SAVERT, A6 A7
    S6      0
    SAVEA7, A6 S6
    SAVEA0, A6 S6                ASSUME NO FIND WILL OCCUR
    SAVEA6, A6 S6
    A3      A6
*
*           CALCULATE CHAIN CONTROL ADDRESS
*           CHAIN CONTROL = CURRENT TASK ID + CHAIN CONTROL BASE + LENGTH
*                           OF CHAIN CONTROL HEADER
*
    A6      CMCC
    A1      CTID, A0
    A6      A6+A1
    A5      LH@CMCC
    A6      A6+A5
    A2      0
    A4      MAXTN
    A5      LE@CMCC

```

A0255. 310  
A0755. 311  
A0255. 312  
A0255. 313  
A0255. 314  
A0255. 315  
A0255. 316  
A0255. 317  
A0255. 318  
A0255. 319  
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A0255. 363  
A0255. 364  
A0255. 365  
A0255. 366  
A0255. 367  
A0255. 368  
A0255. 369  
A0255. 370  
A0255. 371

GETREP10 =	*		A0255.872
GET, S1	SS&S7, CCHEAD, A6		A0255.873
S0	S1		A0255.874
JSZ	GETREP20		A0255.875
A7	S1	ADDRESS OF THE CMOD	A0255.876
S0	CMOUT1, A7		A0255.
JSN	GETREP30	JUMP IF A REPLY EXISTS	A0255.878
*			A0255.879
*	THERE IS NO REPLY FROM THIS TASK. UPDATE TO NEXT TASK		A0255.880
*			A0255.881
GETREP20 =	*		A0255.882
A6	A6+A5	NEXT CHAIN CONTROL	A0255.883
A2	A2+1	NEXT TASK ID	A0255.884
A0	A4-A2		A0255.885
JAN	GETREP10	JUMP IF ALL CHAINS NOT EXAMINED	A0255.886
*			A0255.887
*	AT THIS POINT THE SEARCH IS COMPLETE WITH NO REPLY FOUND		A0255.888
*			A0255.889
J	GETREP40		A0255.890
GETREP30 =	*		A0255.891
SAVEA2, A3	A2	SAVE TASK ID OF FIND	A0255.892
A0	1		A0255.893
SAVEA0, A3	A0		A0255.894
S1	CMOUT0, A7		A0255.895
S2	CMOUT1, A7		A0255.896
SAVES1, A3	S1		A0255.897
SAVES2, A3	S2	MOVE THE REPLY OUT OF THE CMOD	A0255.898
R	UNCHAIN	REMOVE IT FROM THE CHAIN	A0255.899
A5	SAVERT, A3	RESTORE B00 FOR TRACE ENTRIES	A0255.900
B00	A5		A0255.901
ERRAN			A0255.902
A6	CMP00L	DEALLOCATE THE MEMORY	A0255.903
R	MEMDE		A0255.904
A5	SAVERT, A3	RESTORE B00 FOR TRACE ENTRIES	A0255.905
B00	A5		A0255.
A0	A6		A0255.907
ERRAN			A0255.908
*			A0255.909
*	RESTORE THE REGISTERS AND EXIT		A0255.910
*			A0255.911
GETREP40 =	*		A0255.912
A6	A3		A0255.913
A0	SAVEA0, A6		A0255.914
A1	SAVEA1, A6		A0255.915
A2	SAVEA2, A6		A0255.916
A3	SAVEA3, A6		A0255.917
A4	SAVEA4, A6		A0255.918
A5	SAVEA5, A6		A0255.919
S0	SAVES0, A6		A0255.920
S1	SAVES1, A6		A0255.921
S2	SAVES2, A6		A0255.922
S3	SAVES3, A6		A0255.923
S4	SAVES4, A6		A0255.924
S5	SAVES5, A6		A0255.925
S6	SAVES6, A6		A0255.926
S7	SAVES7, A6		A0255.927
A7	SAVERT, A6		A0255.928
B00	A7		A0255.929
A7	SAVEA7, A6		A0255.930
A6	SAVEA6, A6		A0255.931
J	B00		A0255.932

- TSKREQ QUEUES A REQUEST TO ANOTHER TASK.
- TSKREQ IS CALLED VIA A RETURN JUMP WITH THE CALLER PROVIDING THE FOLLOWING:

INPUT REGISTERS:      (A2) = ID OF REQUESTED TASK  
                          (S1) = INPUT+0      } REQUEST  
                          (S2) = INPUT+1      }

OUTPUT REGISTERS:    (S1) = OUTPUT+0      } REPLY  
                          (S2) = OUTPUT+1      }

- ONCE THE REQUEST HAS BEEN PROCESSED, THE CALLER MAY EXAMINE ITS S1,S2 REGISTERS FOR A REPLY. CONVENTIONALLY, S1=ZERO WHEN THERE IS NO ERROR, OTHERWISE S1=ERR CODE. S2=THE CALLING TASKS INPUT+0 REGISTER (S1) INFORMATION.

```

EJECT
*****
**
**NAME      TSKREQ
**
**PURPOSE  TSKREQ QUEUES A REQUEST FOR PROCESSING TO ANOTHER TASK. THE
**          ORIGINATING TASK IS SUSPENDED UNTIL THE DESTINATION TASK HAS
**          COMPLETED PROCESSING.
**
**ENTRY    A2 = DESTINATION TASK ID
**          S1 = INPUT+0
**          S2 = INPUT+1
**
**EXIT     S1 = OUTPUT+0
**          S2 = OUTPUT+1
**
**
*****
TSKREQ     =          *
           A3         LE@SAVER
           A4         CTID,A0
           A3         A3*A4
           A4         SAVER
           A3         A3+A4          ADDRESS OF SAVE AREA FOR ORIGIN TASK
**
**          SAVE THE REGISTERS AND CLEAR OUT THOSE THAT HAVE ALREADY
**          BEEN DESTROYED
**
           SAVEA0,A3 A0
           SAVEA1,A3 A1
           SAVEA2,A3 A2
           SAVEA5,A3 A5
           SAVEA6,A3 A6
           SAVEA7,A3 A7
           SAVES0,A3 S0
           SAVES1,A3 S1
           SAVES2,A3 S2
           SAVES3,A3 S3
           SAVES4,A3 S4
           SAVES5,A3 S5
           SAVES6,A3 S6
           SAVES7,A3 S7
           S6         0
           SAVEA3,A3 S6
           SAVEA4,A3 S6
           A4         B00
           SAVERT,A3 A4          SAVE THE RETURN ADDRESS
           S0         S1
           ERRSZ     B0492.5          ERROR IF INPUT&1 = 0
TSKREQ10  =          *
           A6         CMPPOOL      MEMORY POOL NUMBER
           A7         CMSIZE      NUMBER OF WORD REQUIRED
           R         MEMAL      ALLOCATE A CMOD
           A5         SAVERT,A3   RESTORE B00 FOR TRACE ENTRIES
           B00       A5
**
**          CHECK STATUS RETURNED FROM MEMAL
**
           A0         A6
           JAZ       TSKREQ20     JUMP IF GOOD RETURN
           A7         3
           A0         A5-A7
           ERRAN

```



* * * *	AT THIS POINT THERE IS NO MEMORY AVAILABLE. SUSPEND AND TRY AGAIN LATER	A0255.251 A0255.252 A0255.253 A0255.254 A0255.255 A0255.256 A0255.257 A0255.258 A0255.259
	S7 SUSP	
	EX	
	R ERROR0	
	J TSKREQ10	A0255.260 A0255.261 A0255.262 A0255.263 A0255.264 A0255.265 A0255.266 A0255.267 A0255.268
* * * *	A CMOD HAS BEEN ALLOCATED PUT THE INPUT MESSAGE IN THE CMOD	A0255.269 A0255.270 A0255.271 A0255.272
	TSKREQ20 = *	
	S1 SAVES1,A3	A0255.273
	S2 SAVES2,A3	A0255.274
	CMIN0,A7 S1	A0255.275
	CMIN1,A7 S2	A0255.276
	POST 12,S1,S2	A0255.277 A0255.278
* * * * *	CALCULATE THE ADDRESS OF THE CHAIN CONTROL HEADER CHAIN CONTROL HEADER = DESTINATION TASK ID * LENGTH OF CHAIN CONTROL ENTRY + BASE OF CHAIN CONTROL	A0255.279 A0255.280 A0255.281 A0255.282
	A5 SAVEA2,A3	A0255.283
	A4 LE@CMCC	A0255.284
	A5 A4*A5	A0255.285
	A4 CMCC	A0255.286
	A5 A4+A5 CHAIN CONTROL HEADER ADDRESS	A0255.287 A0255.288
* * * *	CALCULATE CHAIN CONTROL WORD ADDRESS CHAIN CONTROL WORD = CHAIN CONTROL HEADER + LENGTH OF CHAIN CONTROL HEADER + CURRENT TASK ID	A0255.289 A0255.290 A0255.291 A0255.292
	A6 LH@CMCC	A0255.293
	A6 A6+A5	A0255.294
	A4 CTID,A0	A0255.295
	A6 A6+A4 CHAIN CONTROL WORD ADDRESS	A0255.296 A0255.297 A0255.298 A0255.299
	TSKREQ30 = *	A0255.300 A0255.301 A0255.302 A0255.303
	A1 1	A0255.304
	STPLK,A0 A1 LOCK OUT INTERRUPTS	A0255.305 A0255.306 A0255.307 A0255.308 A0255.309 A0255.310
	GET,S1 S6&S7,CCTL,A5	
	GET,S2 S6&S7,CCTM,A5	
	S0 S2	
	ERRSZ ERROR IF QUEUE MAX IS ZERO	
	S0 S1-S2	
	JSZ TSKREQ70 JUMP IF QUEUE AT LIMIT	
	S4 1	
	S1 S1+S4	
	GET,S2 S6&S7,CCQL,A6	
	GET,S3 S6&S7,CCQM,A6	
	S0 S3	
	ERRSZ	
	S0 S2-S3	
	JSZ TSKREQ70 JUMP IF QUEUE AT LIMIT	
	S2 S2+S4	
	PUT,S1 S6&S7,CCTL,A5 UPDATE QUEUE COUNTS	
	PUT,S2 S6&S7,CCQL,A6	
	R CHAIN	
	A5 SAVERT,A3 RESTORE B00 FOR TRACE ENTRIES	
	B00 A5	
	A1 0	
	STPLK,A0 A1 ENABLE INTERRUPTS	

```

*
* THE REQUEST HAS BEEN QUEUED TO THE DESTINATION TASK READY THE
* TASK AND SUSPEND UNTIL A REPLY IS RECEIVED
*
TSKREQ40 = *
S6 SAVEA2,A3
S7 RTSS
EX
R ERROR0
TSKREQ50 = *
S1 CMOUT0,A7
S2 CMOUT1,A7
S0 S2
JSN TSKREQ60
*
* THE DESTINATION TASK DID NOT REACTIVATE ME
*
S7 SUSP
EX
R ERROR0
J TSKREQ50
TSKREQ60 = *
SAVES1,A3 S1
SAVES2,A3 S2
POST 12,S1,S2
R UNCHAIN UNCHAIN THE CMOD
AS SAVERT,A3 RESTORE B00 FOR TRACE ENTRIES
B00 AS
ERRAN
A6 CMPPOOL RELEASE THE CMOD MEMORY
R MEMDE
AS SAVERT,A3 RESTORE B00 FOR TRACE ENTRIES
B00 AS
A0 AS STATUS CHECK
ERRAN
*
* RESTORE THE REGISTERS AND EXIT
*
A0 SAVEA0,A3
A1 SAVEA1,A3
A2 SAVEA2,A3
A5 SAVEA5,A3
A6 SAVEA6,A3
A7 SAVEA7,A3
S0 SAVES0,A3
S1 SAVES1,A3
S2 SAVES2,A3
S3 SAVES3,A3
S4 SAVES4,A3
S5 SAVES5,A3
S6 SAVES6,A3
S7 SAVES7,A3
A4 SAVERT,A3
B00 A4
A4 SAVEA4,A3
A3 SAVEA3,A3
J B00
TSKREQ70 = *
*
* THE QUEUE FOR THE DESTINATION TASK IS AT ITS LIMIT THE
* REQUESTOR WILL HAVE TO WAIT.
*
A1 0
STPLK,A0 A1 RELEASE INTERRUPT LOCKOUT
S7 SUSP
EX
R ERROR0
J TSKREQ30

```

```

A0255.311
A0255.312
A0255.313
A0255.314
A0255.315
A0255.316
A0255.317
A0255.318
A0255.319
A0255.320
A0255.321
A0255.322
A0255.323
A0255.324
A0255.325
A0255.326
A0255.327
A0255.328
A0255.329
A0255.330
A0255.331
A0255.332
A0255.333
A0255.334
A0255.335
A0255.336
A0255.337
A0255.338
A0255.339
A0255.340
A0255.341
A0255.342
A0255.343
A0255.344
A0255.345
A0255.346
A0255.347
A0255.348
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A0255.350
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A0255.358
A0255.359
A0255.360
A0255.361
A0255.362
A0255.363
A0255.364
A0255.365
A0255.366
A0255.367
A0255.368
A0255.369
A0255.370
A0255.371
A0255.372
A0255.373
A0255.374
A0255.375
A0255.376
A0255.377
A0255.378

```

## USER TO STP CALLS

- 0 ADVANCE JOB
- 0 ABORT JOB
- 0 GET CURRENT DATE
- 0 GET CURRENT TIME
- 0 ENTER LOGFILE MESSAGE
- 0 DATASET RECALL
- 0 TERMINATE JOB
- 0 SET SENSE SWITCH
- 0 OPEN DATASET
- 0 REQUEST MEMORY
- 0 CLOSE DATASET
- 0 CREATE DNT
- 0 SET EXCHANGE PACKAGE MODE
- 0 GET NEXT CONTROL STATEMENT
- 0 LOAD BINARY DATASET
- 0 RETURN DATASET
- 0 PERMANENT DATASET MANAGEMENT REQUEST
- 0 READ DISC CIRCULAR
- 0 WRITE DISC CIRCULAR
- 0 GET SYSTEM REVISION NUMBERS
- 0 DISPOSE DATASET
- 0 GET CURRENT JULIAN DATE
- 0 RETURN ACCUMULATED CPU TIME
- 0 RETURN ACCOUNTING INFORMATION
- 0 SET P REGISTER & SUSPEND USER
- 0 CLEAR SENSE SWITCH
- 0 TEST SENSE SWITCH
- 0 DELAY JOB

● A USER COMMUNICATES WITH STP THROUGH MACRO CALLS.



STARTUP (Z)



## TASK PROCESSORS

● CURRENT TASKS ARE:

CRAY-OS STARTUP

STATION CALL PROCESSOR

DISK QUEUE MANAGER

PERMANENT DATASET MANAGER

JOB CLASS MANAGER

JOB SCHEDULER

EXCHANGE PACKAGE PROCESSOR

MESSAGE PROCESSOR

MEMORY ERROR PROCESSOR

DISK ERROR CORRECTION

SYSTEM PERFORMANCE MONITOR

OVERLAY MANAGER

TAPE QUEUE MANAGER





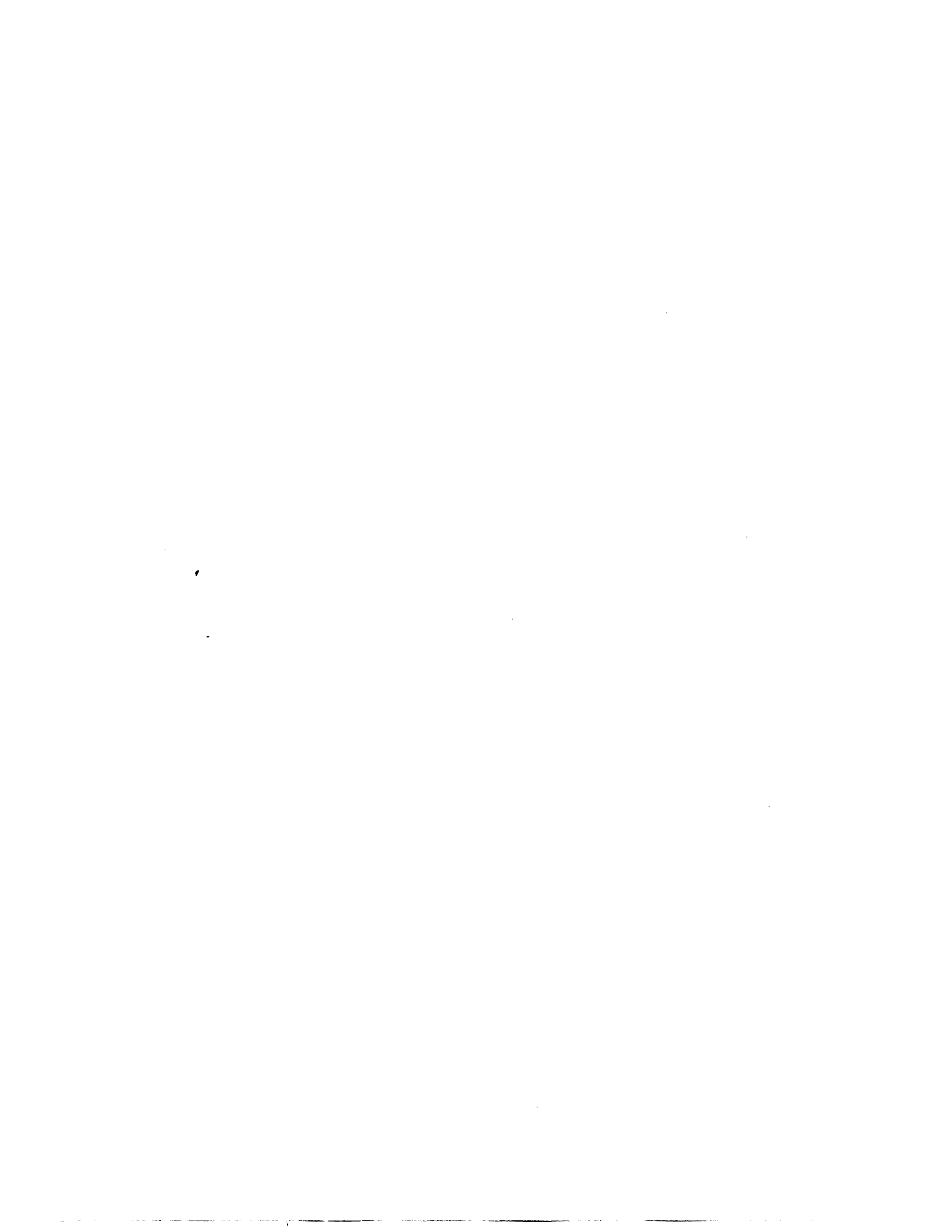
## CRAY-OS STARTUP

- LOADS CRAY-OS OPERATING SYSTEM (COS) INTO MEMORY.
- BEGINS EXECUTION OF THE OPERATING SYSTEM.
- GENERATES OR RECOVERS SYSTEM TABLES.
- THREE METHODS OF STARTUP.

INSTALL-INITIATION OF COS THE FIRST TIME

DEADSTART-CONTINUATION OF COS FOLLOWING A NORMAL  
SYSTEM SHUTDOWN

RESTART-CONTINUATION OF COS FOLLOWING A SYSTEM  
INTERRUPTION.



## INSTALL

- LOADS THE CRAY-1 OPERATING SYSTEM (COS) INTO CRAY-1 MEMORY.
- CRAY-1 MASS STORAGE IS INITIALIZED FOR THE VERY FIRST TIME.

A DEVICE LABEL (DVL) IS WRITTEN ON EACH DISK UNIT.

SPACE IS ZEROED AND RESERVED ON THE MASTER DEVICE SUFFICIENT TO HOLD CRAY-1 MEMORY SIZE.

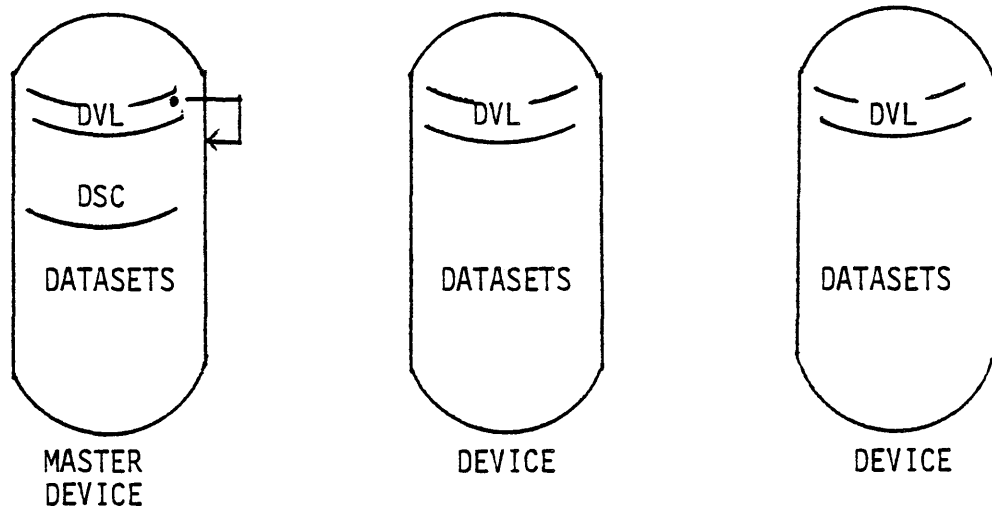
A ROLL JOB INDEX DATASET IS INITIALIZED (\$ROLL).

- SYSTEM TABLES ARE INITIALIZED FOR THE VERY FIRST TIME.

REFLECT HOW MUCH USEABLE DISK SPACE IS AVAILABLE (DRT).

CREATES A DISK DATASET CATALOG (DSC) AND WRITES THE DSC TO THE MASTER DEVICE.

MAKES ENTRIES IN THE DSC FOR \$ROLL



Mass Storage Organization



## SYSTEM DIRECTORY INITIALIZATION

- THE SYSTEM DIRECTORY (SDR) MUST BE INITIALIZED AFTER ANY INSTALL (AUTOMATIC IN DEADSTART AND RESTART).
- INITIALIZATION OCCURS THROUGH SUBMISSION OF A HIGH PRIORITY JOB.
- THE JOB'S PRIORITY SHOULD ENABLE IT TO EXECUTE BEFORE ANY OTHER JOB IN THE INPUT QUEUE.
- ONCE A DATASET NAME IS ENTERED IN THE SDR IT IS ACCESSABLE TO OTHER JOBS.
- AN 'ACCESS' CONTROL STATEMENT WITH PARAMETER 'ENTER' IS SPECIFIED FOR EACH DATASET BEING ENTERED IN THE SDR.

### SAMPLE JOB:

```
JOB,JN=SYSDIR,T=2,M=20,P=15.      ACCESS,ENTER,DN=PDSLOAD.
*.      ACCESS,ENTER,DN=SKIPD.
*.  SDR initialization job      ACCESS,ENTER,DN=SKIPF.
*.      ACCESS,ENTER,DN=SKIPR.
ACCESS,ENTER,DN=AUDIT.      ACCESS,ENTER,DN=UNB.
ACCESS,ENTER,DN=BUILD.      ACCESS,ENTER,DN=UPDATE.
ACCESS,ENTER,DN=CAL.      ACCESS,ENTER,DN=WRITEDS.
ACCESS,ENTER,DN=CFT.      (EOF)
ACCESS,ENTER,DN=COMPARE.
ACCESS,ENTER,DN=COPYD.
ACCESS,ENTER,DN=COPYF.
ACCESS,ENTER,DN=COPYR.
ACCESS,ENTER,DN=DSDUMP.
ACCESS,ENTER,DN=DUMP.
ACCESS,ENTER,DN=EXTRACT.
ACCESS,ENTER,DN=FDUMP.
ACCESS,ENTER,DN=LDR.
ACCESS,ENTER,DN=PDSDUMP.
```



## DEADSTART

- CONTINUES THE CRAY-1 OPERATING SYSTEM (COS) FOLLOWING A NORMAL SYSTEM SHUTDOWN.
- DELETES DSC ENTRIES FOR INPUT AND OUTPUT DATASETS. (SDT)
- PRESERVES DSC ENTRIES FOR PERMANENT DATASETS.
- PRESERVES DISK SPACE OCCUPIED BY THE SYSTEM DUMP.
- COPIES SYSTEM DUMP TO ANOTHER AREA IF USED AND MAKES IT A PERMANENT DATASET.
- REBUILDS THE SYSTEM DIRECTORY FROM DISK IF DESIRED.





## RESTART

- CONTINUES THE CRAY-1 OPERATING SYSTEM (COS) FOLLOWING AN ABNORMAL SYSTEM INTERRUPTION.
- PRESERVES DSC ENTRIES FOR INPUT AND OUTPUT DATASETS.
- PRESERVES DSC ENTRIES FOR PERMANENT DATASETS.
- PRESERVES DISK SPACE OCCUPIED BY THE SYSTEM DUMP.
- COPIES SYSTEM DUMP TO ANOTHER AREA IF USED AND MAKES IT A PERMANENT DATASET.
- PRESERVES ROLLED JOBS AND ASSOCIATED DATASETS IF REQUIRED.
- REBUILDS THE SYSTEM DIRECTORY FROM DISK IF DESIRED.



## RECOVERY OF THE SYSTEM DIRECTORY DURING A RESTART

- AN ACCESS OF THE \$SDR PERMANENT DATASET IS REQUESTED.
- IF \$SDR DOES NOT EXIST THEN THE SYSTEM CREATES \$SDR AS A PERMANENT DATASET.
- IF \$SDR EXISTS A DATSET NAME TABLE (DNT) IS CREATED AND THE DATASET IS ACCESSED.
- IF THE \*SDR COMMAND IS IN THE RESTART PARAMETER FILE THE PREVIOUS \$SDR DATASET IS NOT RECOVERED AND A NEW EDITION OF \$SDR IS CREATED AS A PERMANENT DATASET.
- ONCE INITIALIZATION OF THE \$SDR DATASET IS COMPLETE, ADDITIONAL ENTRIES MAY BE ADDED TO THE SYSTEM DIRECTORY AND THE \$SDR DATASET.



## RECOVERY OF ROLLED JOBS DURING A RESTART

- A VALIDATION OF THE ROLLED JOB INDEX TABLE ENTRY FOR A JOB ENSURES THE JOB IS NOT MARKED IRRECOVERABLE AND THE JOB RESIDES ON AN AVAILABLE DEVICE.
- THE JOBS JOB TABLE AREA (JTA) IS READ INTO MEMORY AND THE JOBS DATS ARE VERIFIED AS ARE ALL DATS WITHIN THE SYSTEM.
- IF A JOB'S DAT IS INVALID AND THE JOB IS RERUNNABLE THE SYSTEM CLEARS THE INDEX ENTRY AND THE JOB REMAINS ON THE INPUT QUEUE IN THE SYSTEM DATASET TABLE (SDT).
- IF ALL DATS FOR A JOB ARE VALID THE SYSTEM SETS THE DEVICE RESERVATION TABLE (DRT) ENTRIES FOR THE DATS.



## DATASET ALLOCATION TABLE (DAT) VERIFICATION

A DATASET ALLOCATION TABLE (DAT) MUST RESIDE ENTIRELY IN THE SYSTEM FOR SYSTEM DATASETS, AND WITHIN A JOBS JOB TABLE AREA (JTA) FOR A JOB.

THE DAT MUST POINT TO THE CORRECT JOB EXECUTION TABLE (JXT) ENTRY FOR A JOB (LOCAL) DATASET.

THE DEVICES USED BY THE DATASETS MUST BE AVAILABLE.

FOR A DAT THE LOGICAL TRACK ADDRESSES MUST NOT HAVE THE CORRESPONDING BIT SET IN THE DEVICE RESERVATION TABLE (DRT).

WHEN THE LAST LOGICAL TRACK ADDRESS IS VERIFIED AGAINST THE DRT BIT THE REMAINING ADDRESS COUNT MUST BE ZERO.

DAT VERIFICATION OCCURS IN TWO PASSES

FIRST PASS SCANS FOR ERRORS AS ABOVE  
SECOND PASS SETS THE DRT BITS

PERMANENT DATASETS ARE FURTHER VERIFIED AGAINST THE DISK RESIDENT DATASET CATALOG (DSC) AND EACH DATASET DAT IS COMPARED AGAINST THE DISK COPY.





STATION CALL PROCESSOR (SCP)



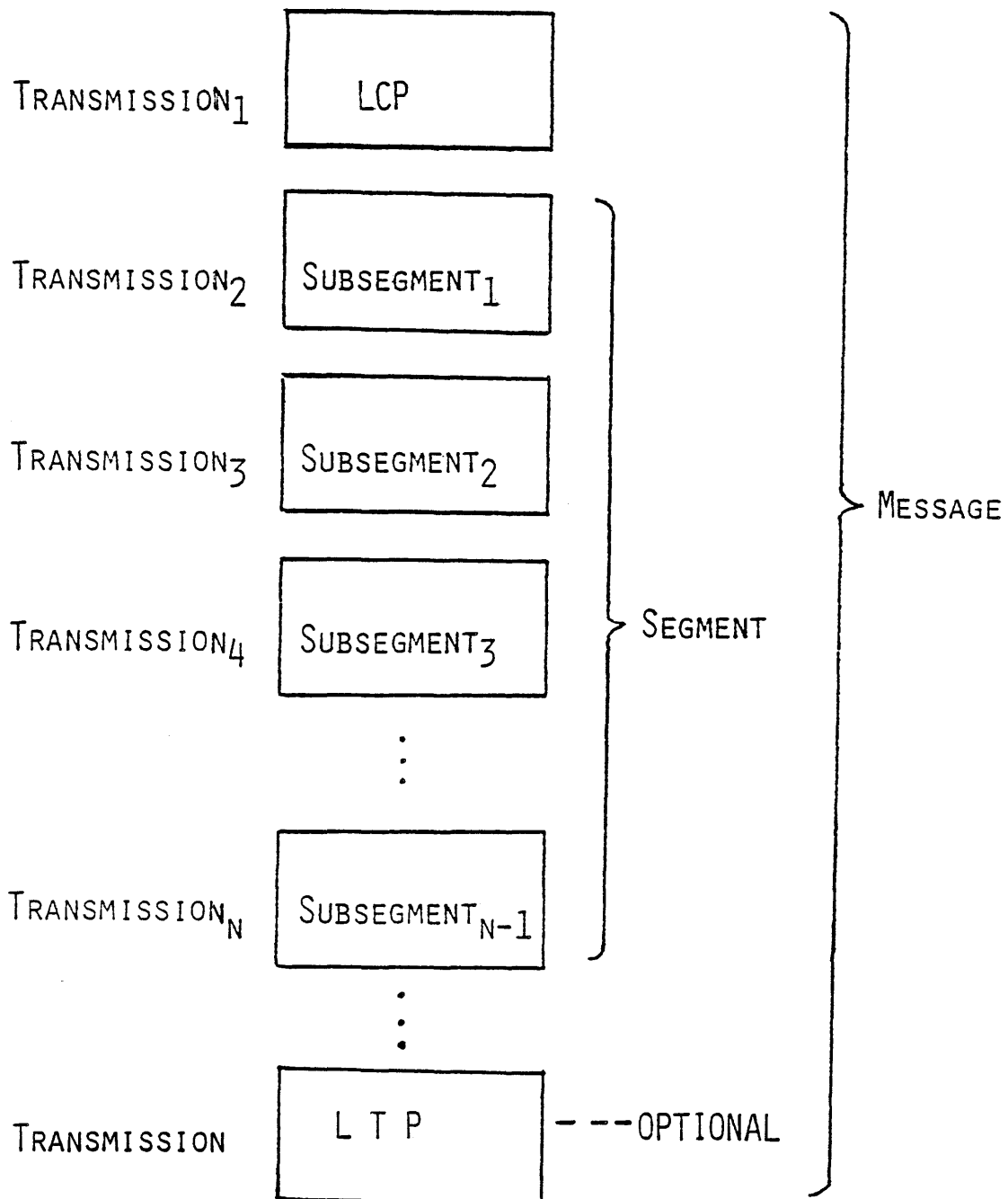
STATION CALL PROCESSOR (SCP)

- PROVIDES COMMUNICATIONS WITH FRONT-END SYSTEMS.
- MANAGES I/O TRANSMISSION POOLS CREATED AT STARTUP.
- PROVIDES FOR OPERATOR GUIDANCE.
- CHANNEL DISCIPLINE IS TWO WAY ALTERNATE.
- INDEPENDENT OF FRONT-END TYPE.
- MULTIPLEXES STREAMS (8 INPUT AND 8 OUTPUT).



# GENERAL INTERFACE PROTOCOL

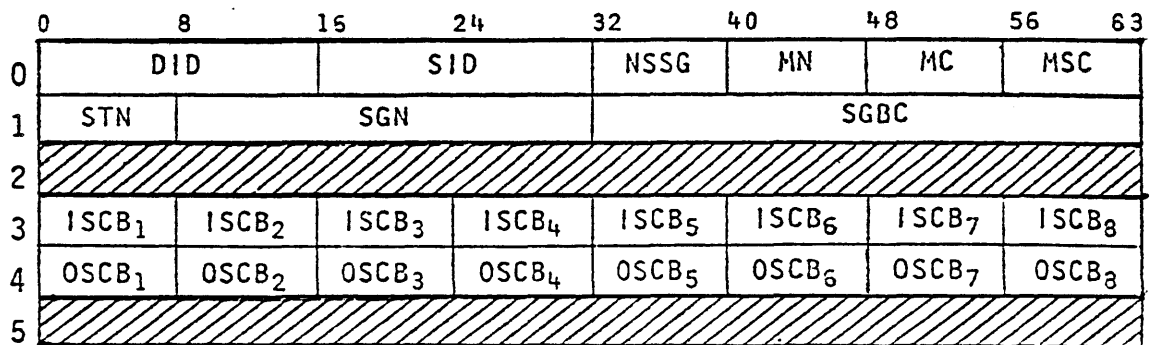
- EACH MESSAGE IS HEADED BY A LINK CONTROL PACKAGE
- SUBSEGMENT SIZE VARIES WITH FRONT-END





## LINK CONTROL PACKAGE

- EACH LCP CONSISTS OF SIX 64-BIT WORDS
- LCP CONTAINS:
  - . SOURCE MAINFRAME ID (SID)
  - . DESTINATION MAINFRAME ID (DID)
  - . NO. OF SUBSEGMENTS (NSSG)
  - . MESSAGE NUMBER (MN)
  - . MESSAGE CODE (MC)
  - . MESSAGE SUB CODE (MSC)
  - . STREAM NO. (STN)
  - . SEGMENT NUMBER (SGN)
  - . SEGMENT LENGTH (SGBC)
  - . STREAM CONTROL BYTES (ISCB, OSCB)







Message codes

Code	Function	Sender		Segment	Stream Required
		Front-end	CRAY-1		
001	Logon	x		x	
002	Relog	x <sup>††</sup>			
003	Logoff	x			
004	Start		x	x	
005	Restart		x		
006	Dataset header	x	x	x	x
007	Dataset segment	x	x	x	x
011	Control	x	x		
012	Message error	x	x		
013	Dataset transfer request	x <sup>††</sup>	x	x	
014	Dataset transfer reply	x	x	x	
015	Enter logfile request	x <sup>††</sup>		x	
016	Enter logfile reply		x	x	
020	Logfile information request	x <sup>††</sup>		x	
021	Job status request	x <sup>††</sup>		x	
022	System status request	x <sup>††</sup>		x	
023	Dataset status request	x <sup>††</sup>		x	
024	Link status request	x <sup>††</sup>		x	
025	Mass storage status request	x <sup>††</sup>		x	
026	Operator function request	x <sup>††</sup>		x	
027	Debug function request	x <sup>††</sup>		x	
030	Logfile information reply		x	x	
031	Job status reply		x	x	
032	System status reply		x	x	
033	Dataset status reply		x	x	
034	Link status reply		x	x	
035	Mass storage status reply		x	x	
036	Operator function reply		x	x	
037	Debug function reply		x	x	
040	Diagnostic echo request	x <sup>††</sup>	x	x	
041	Diagnostic echo reply	x <sup>††</sup>	x	x	

<sup>††</sup> Optional; front end not required to send

## STREAM CONTROL BYTES

- 8 INPUT AND 8 OUTPUT STREAMS
- ALTHOUGH EACH MESSAGE IS ASSIGNED TO ONLY ONE STREAM, THE LCP MUST CARRY STREAM CONTROL BYTES FOR ALL 16 STREAMS.

Octal Code	Mnemonic	Request/Response	Sender	Receiver
00	IDL	Idle	x	x
01	RTS	Request to send	x	
02	PTR	Preparing to receive		x
03	SND	Sending	x	
04	RCV	Receiving		x
05	SUS	Suspend		x
06	END	End dataset	x	
07	SVG	Saving dataset		x
10	SVD	Dataset saved		x
11	PPN	Postpone	x	x
12	CAN	Cancel	x	x
13	MCL	Master clear	x	x

RECEIVER SCB RESPONSE

	IDL	PTR	RCV	SUS	SVG	SVD	PPN	CAN
SENDER SCB SENT	IDL	N						
	RTS		N	C	C		A	
	SND			N	N		A	A
	END					N	C	A
	PPN	C						
	CAN	C						

N = Normal receiver SCB response

C = Normal receiver SCB response which requires change in sender SCB

A = Abnormal receiver SCB response

SENDER SCB RESPONSE

	IDL	RTS	SND	END	PPN	CAN	
RECEIVER SCB SENT	IDL	N	C				
	PTR		N				
	RCV			N	C	A	A
	SUS			N	C	A	A
	SVG				N		
	SVD	C					
	PPN	C					
	CAN	C					

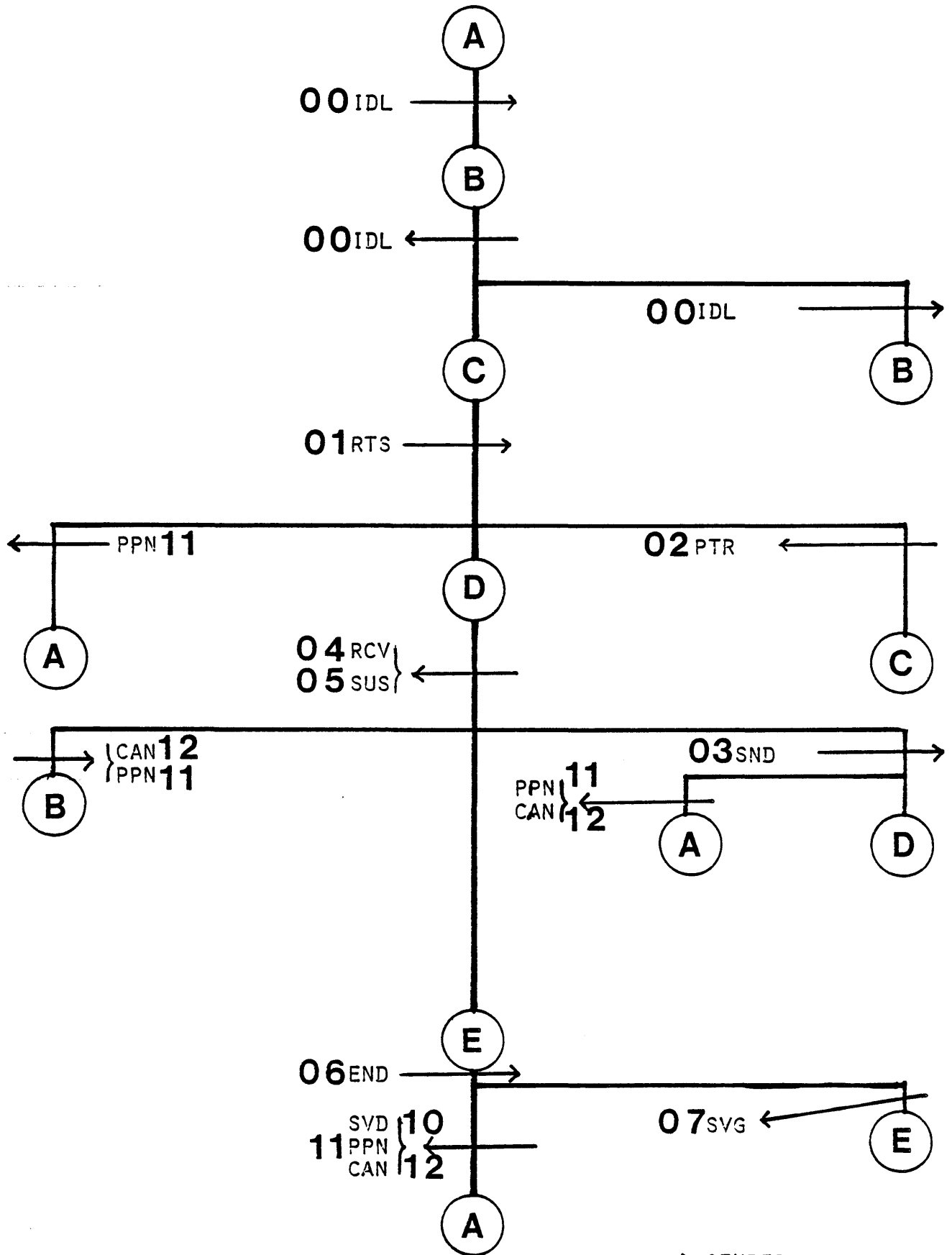
N = Normal sender SCB response

C = Normal sender SCB response which requires change in receiver SCB

A = Abnormal sender SCB response

## BASIC STREAM FLOW

- FRONT-END IS LOGGED ON
- COMMUNICATIONS IN AN IDLE STATE
- FRONT-END SENDS RTS(01) TO THE CRAY-1
- CRAY-1 SENDS RCV (04) TO THE FRONT END.
- FRONT-END SENDS SND (03) TO THE CRAY-1 ALONG WITH THE JOB DATASET
- CRAY-1 SENDS RCV (04) TO THE FRONT-END WHILE DECODING THE MESSAGE AND SAVING THE JOB DATASET
- FRONT-END SENDS END (06) TO THE CRAY-1 UNTIL CRAY-1 HAS SAVED THE DATASET.
- CRAY-1 SENDS SVD (10) TO THE FRONT-END ONCE DATASET HAS BEEN SAVED.
- FRONT-END AND CRAY-1 THEN KEEP COMMUNICATIONS OPEN BY ALTERNATELY SENDING AND RECEIVING IDL(00).



**13**

NOTE: A MCL SCB IS A LEGAL REQUEST OR RESPONSE AT ANY TIME. THE ONLY LEGAL REPLY TO MCL IS IDL.

STREAM CONTROL BYTE FLOW



## SCP JOB STREAM FLOW

- EXAMINES THE DATASET HEADER MESSAGE AND DETERMINES THE DATASET IS A JOB DATASET.
- BUILDS DISK BUFFERS FROM STATION BUFFERS AND WHEN BUFFERS ARE FULL HAS THEM WRITTEN TO DISK.
- 'CRACKS' THE JOB CARD ASSIGNING DEFAULTS WHEN APPROPRIATE.
- MAKES APPROPRIATE ENTRIES IN THE JOB QUEUE (SYSTEM DATASET TABLE (SDT) ), SUCH AS:

DATASET NAME

JOB NAME AND PRIORITY

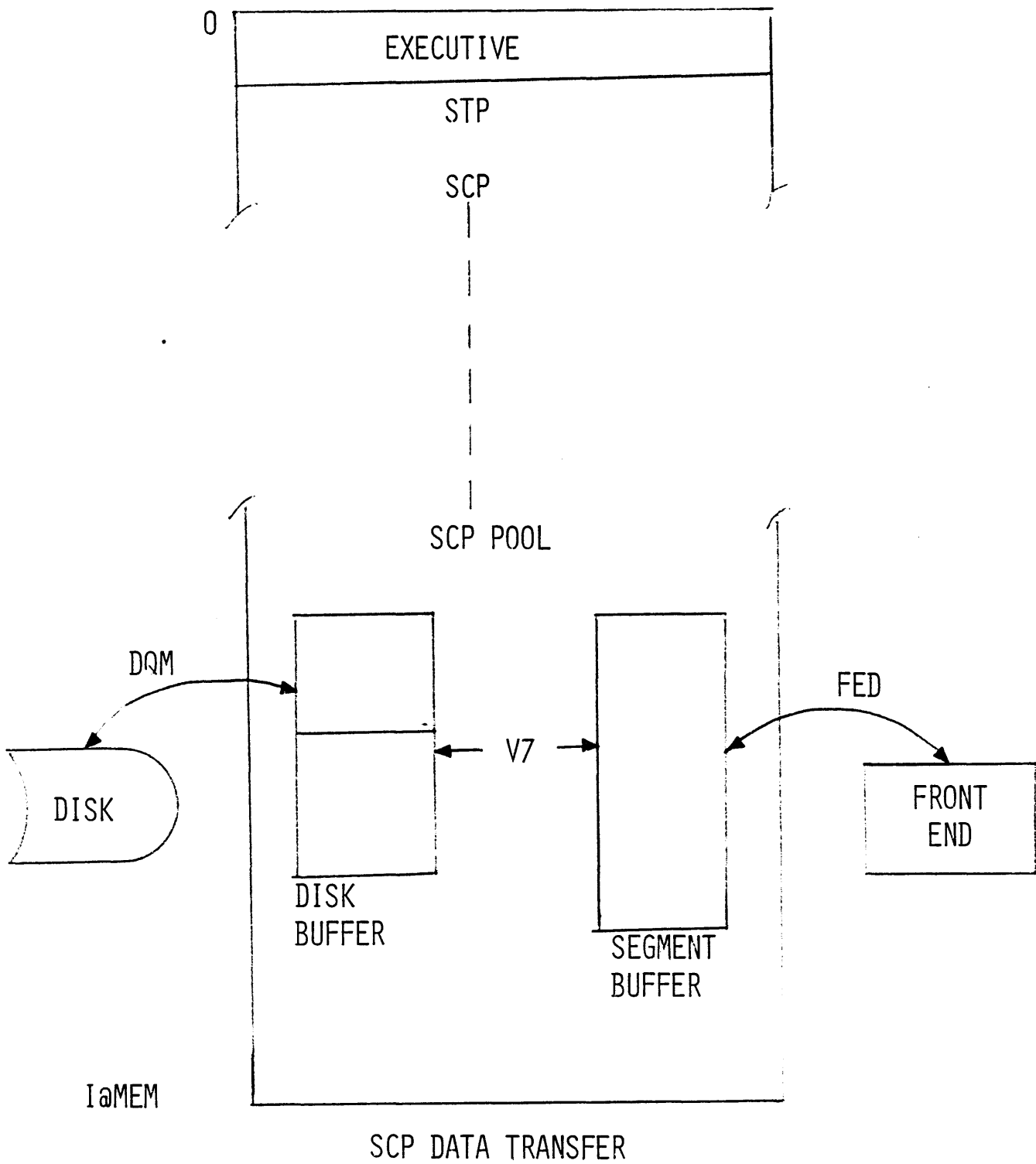
SOURCE AND DESTINATION ID

DISPOSITION CODE SET TO JOB DATASET (IN)

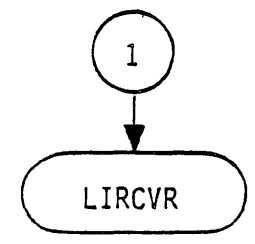
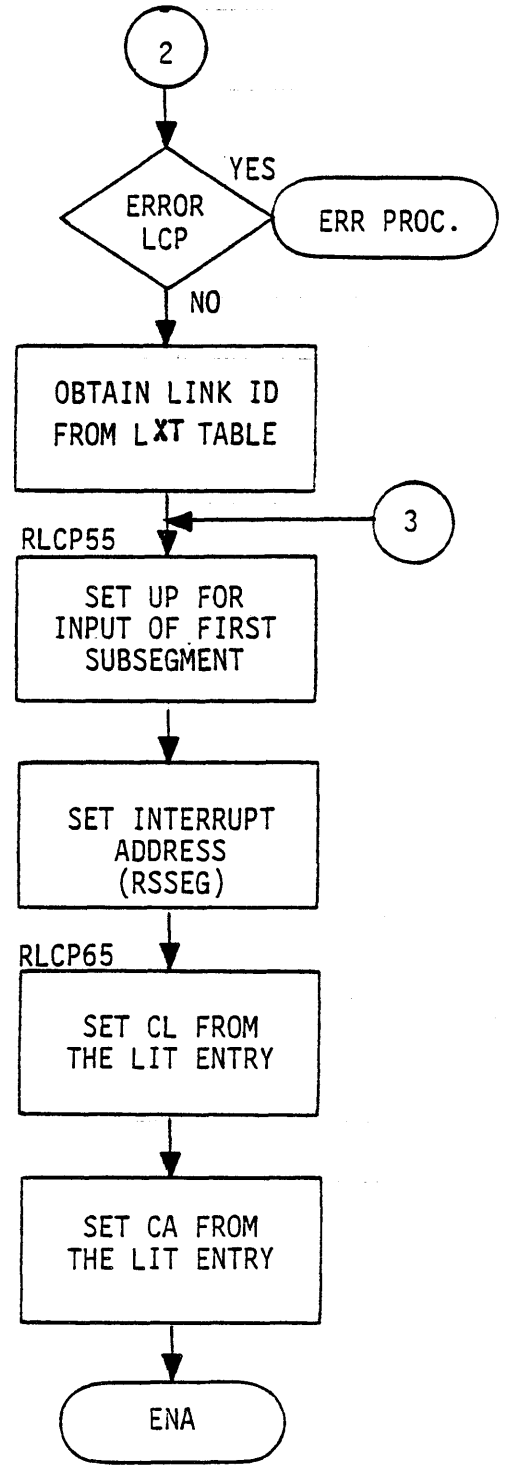
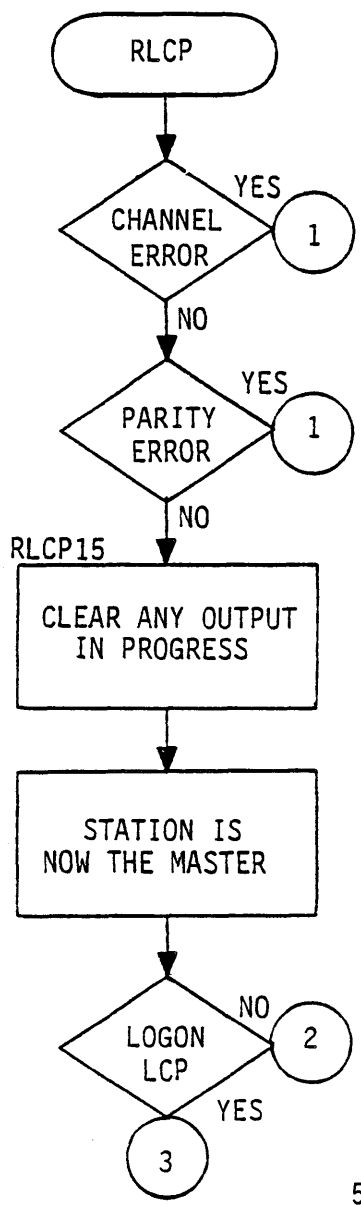
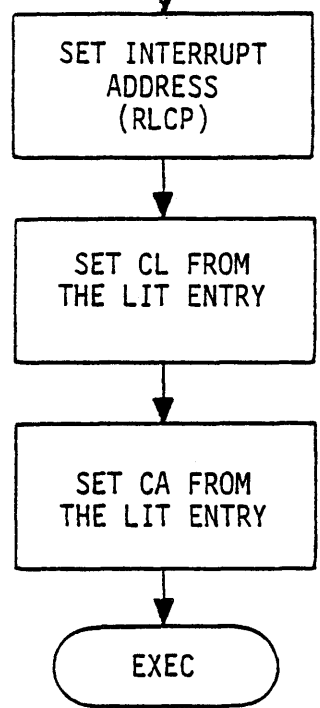
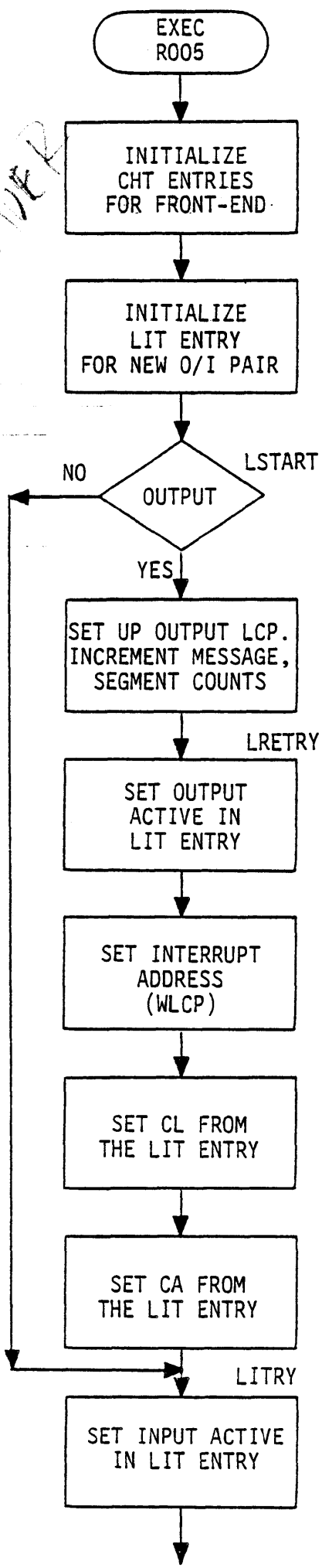
- HAS THE DATASET MADE PERMANENT FOR THE LIFE OF THE JOB. (DSC)

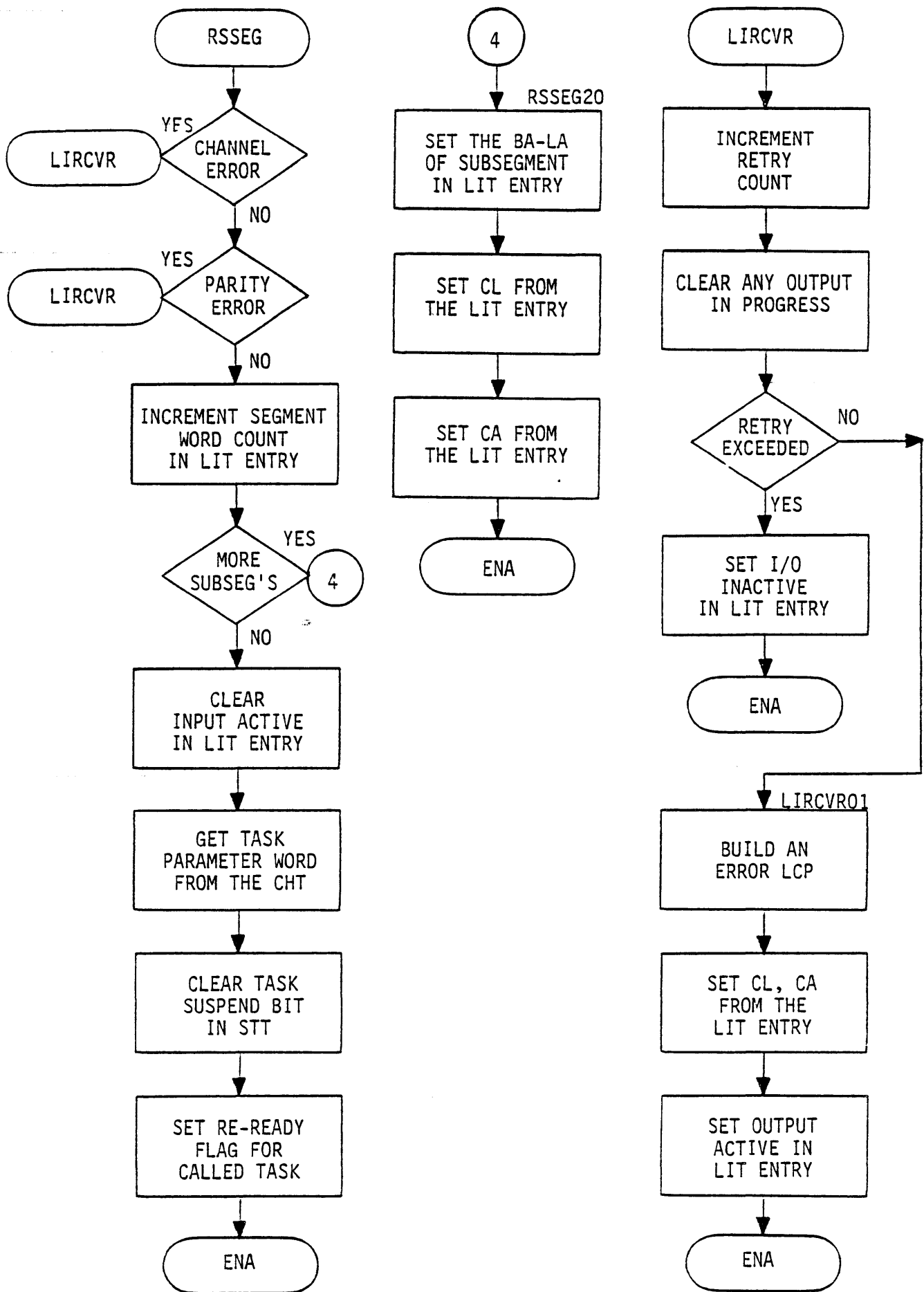






FE  
LAYER







DISK QUEUE MANAGER (DQM)

## DQM REQUESTS

- PRE ALLOCATE SPACE
- DATA TRANSFER
- DE ALLOCATE SPACE

## MODES

- STATIC
- DYNAMIC

SIZE IN TRACKS

ONLY SIZE IS TRACK

---

## DEVICE ALLOCATION

BY LOGICAL DEVICE NAME

PER ASSIGNMENT TABLE

32000, 110000

DISK QUEUE MANAGER (DQM)

- MANAGES ALLOCATION/DEALLOCATION OF MASS STORAGE (DISKS)
- MANAGES MASS STORAGE REQUEST QUEUES
- MANAGES MASS STORAGE CHANNELS, CONTROLLERS AND DISK UNITS.
- MAXIMUM OF 11 DISK CONTROLLERS (44 DSU'S)
- UPDATES THE DEVICE RESERVATION TABLE (DRT) FOR EACH DSU.
- CALLED BY EXEC (UPON TRANSFER OF AN I/O SEGMENT) OR BY ANOTHER TASK (FOR DISK REQUEST).

CALLER BY - (DQM) (DQM)

- RQ

- DQM (DQM)

- SW

- DQM (DQM)

- DQM

ICP

CALLER BY - (DQM) (DQM)

- RQ

- DQM (DISK REQUEST)

DATASET ALLOCATION TABLE - DAT

A DAT exists for each dataset in the system. A DAT defines where a dataset logically resides on mass storage, i.e., on which logical device or devices, and what portions of each device.

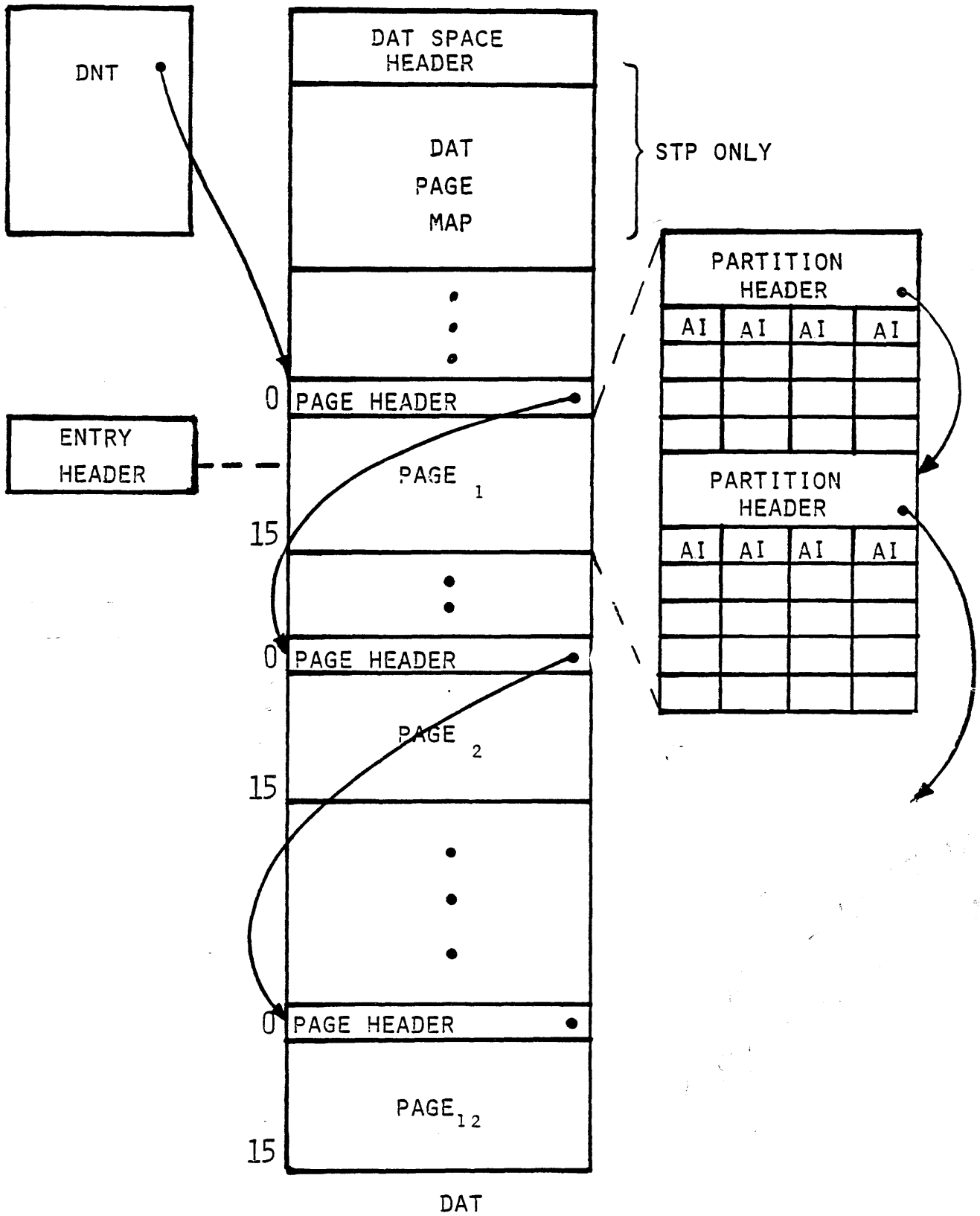
The DAT page and entry header contains general dataset information.

The DAT partition header contains general information concerning a particular partition of the DAT. A partition represents a portion of a single logical device. Each allocation index (AI) in a partition is a bit number in the respective Device Reservation Table (DRT).

The DAT is composed of as many 16-word DAT pages as necessary to represent the mass storage occupied by the dataset. Additional DAT pages continue from the point at which the last DAT left off.

- 1 DAT / DRIVE      100 MAR 1 10 10 0 = 1 10 10  
EQT    1 entry / unit    ptr to tail  
DAT    1 entry / unit  
         200 100 0 @ tail  
         200 100 0 @ head + 1







	0	16	24	28	32	40	48	63	STP	
	0	TN		WCT		PA			DAT Space Header	
	1	MAP								
		⋮								
DAT Page	0	PN				JORD	DAT			DAT Page Header
	1	DSC			AS		PDS			
	2	CA				DSZ				DAT Entry Header
	3	LDV								
	4			BPB		NPA		NAI		DAT Partition Header
	5	AI	AI	AI	AI	AI	AI	AI		
	6	AI	AI	AI	AI	AI	AI	AI	DAT Partition	
	7	AI	AI	AI	AI	AI	AI	AI		
	8	LDV								
	9			BPB		NPA		NAI		DAT Partition Header
	10	AI	AI	AI	AI	AI	AI	AI		
	11	AI	AI	AI	AI	AI	AI	AI	DAT Partition	
	12	AI	AI	AI	AI	AI	AI	AI		
	13	AI	AI	AI	AI	AI	AI	AI		
	14	AI	AI	AI	AI	AI	AI	AI		
15	AI	AI	AI	AI	AI	AI	AI			
0	PN				JORD	DAT				DAT Page Header
1	AI	AI	AI	AI	AI	AI	AI			
		⋮								
	15	AI	AI	AI	AI	AI	AI	AI		

Dataset Allocation Table (DAT)

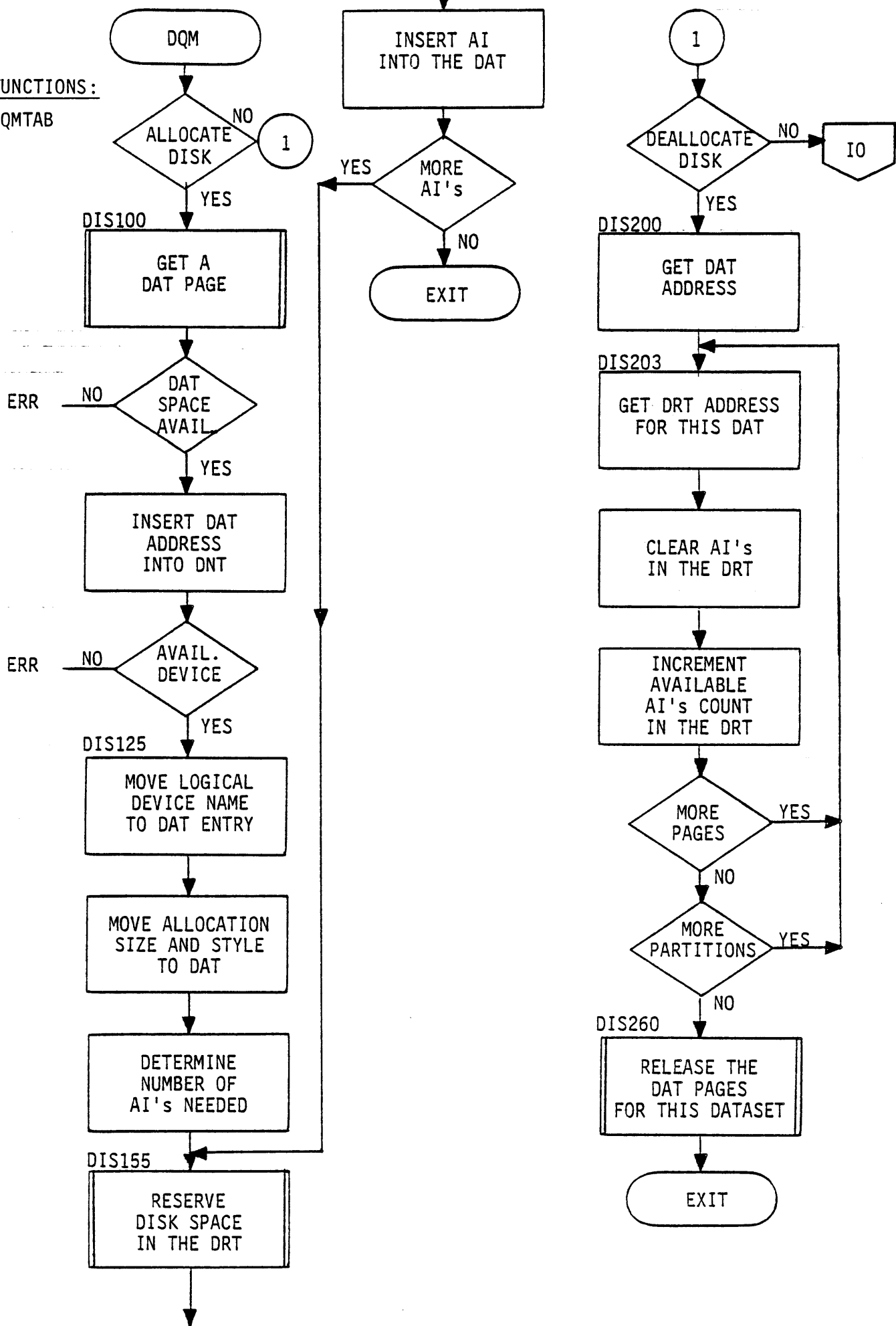


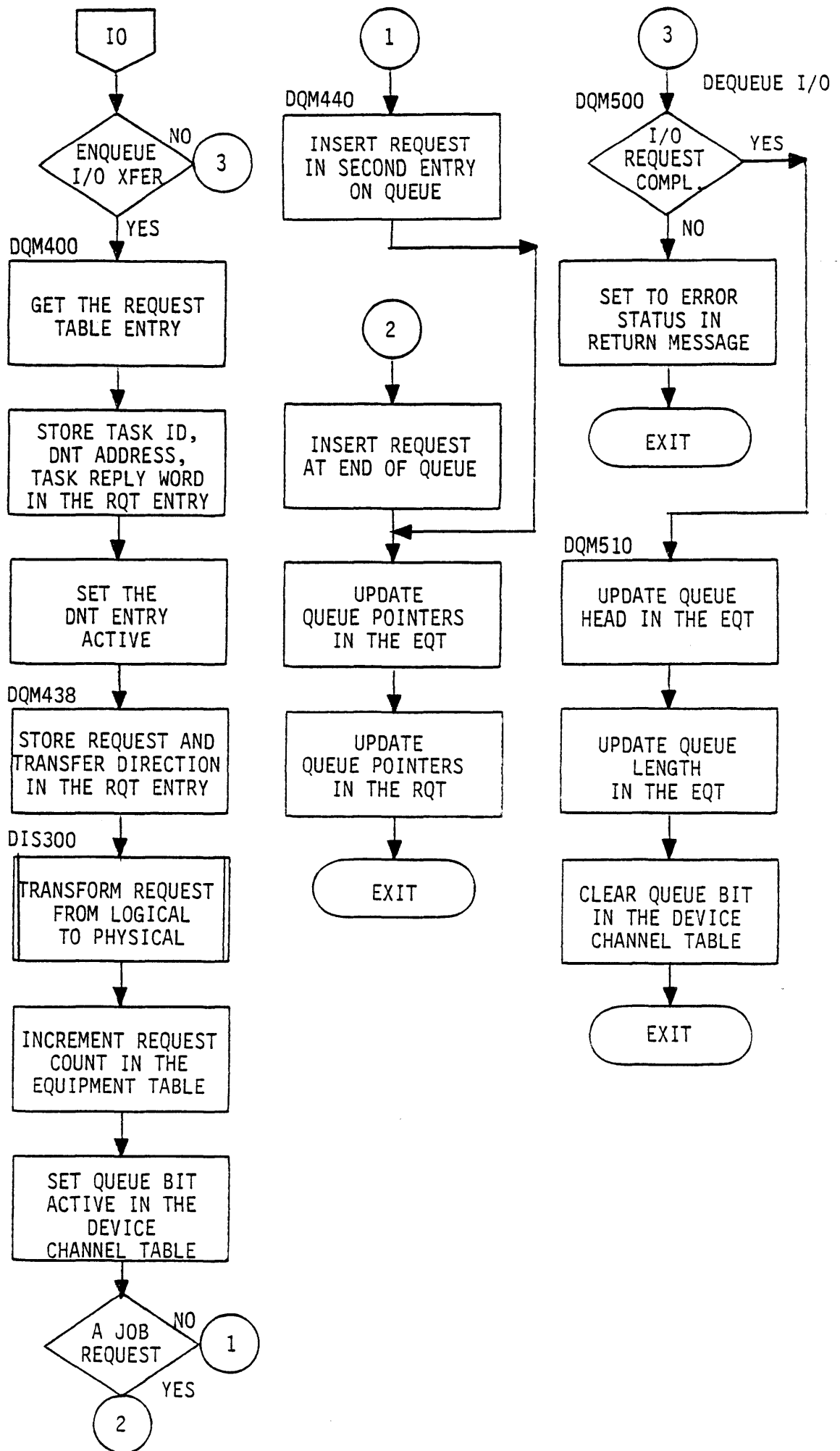
127

DATASET ALLOCATION TABLE AREA

0020372	042101250000000000412	1777773777774000000000				DAT		
0020374	0000000000000000000000	0000000000000000000000	0000000000000000000000					
0020400	0004000000000000000000	0000000000000100000000	0000001620000001223000	0421041323047113231060			9	& DD-19-20
0020404	00000000001100000000045	0000020000140001000005	0000060000340002000011	0000120000600003200016		%		
0020410	0000170001000004200022	0000230001200005200026	0000270001400006200032	0000330001600007200036		!	" # \$ % & '	
0020414	0000370002000010200042	0000430002200011200046	0000470000000000000000	0000000000000000000000				
0020420	0004000000000000020440	0000000000000100000000	0000000000000004026000	0421041323047113231060		!		, DD-19-20
0020424	00000000001100000000163	0000500002440012400053	0000540002640013400057	0000600003040014400063		( ) * + , - . / 0 1 2 3		
0020430	0000640003240015400067	0000700003440016400073	0000740003640017400077	0001000004040020400103		4 5 6 7 8 9 : ; < = > ? @ A B C		
0020434	0001040004240021400107	0001100004440022400113	0001140004640023400117	0001200005040024400123		D E F G H I J K L M N O P Q R S		
0020440	0010000000000000020460	0001240005240025400127	0001300005440026400133	0001340005640027400137		! 0 T U V W X Y Z [ \ ] ^ _		
0020444	0001400006040030400143	0001440006240031400147	0001500006440032400153	0001540006640033400157				
0020450	0001600007040034400163	0001640007240035400167	0001700007440036400173	0001740007640037400177				
0020454	0002000010040040400203	0002040010240041400207	0002100010440042400213	0002140010640043400217				
0020460	0014000000000000000000	0002200011040044400223	0002240011240045400227	0002300011440046400000				
67	464	0000000000000000000000	0000000000000000000000	0000000000000000000000				
	470	0000000000000000000000	0000000000000000000000	0000000000000000000000				
	474	0000000000000000000000	0000000000000000000000	0000000000000000000000				
0020500	0004000000000000000000	0000013340000100000000	00000005200000000001000	0421041323047113231060				DD-19-20
0020504	00000000001100000000001	0000010000000000000000	0000000000000000000000	0000000000000000000000				
0020510	0000000000000000000000	0000000000000000000000	0000000000000000000000	0000000000000000000000				
0020514	0000000000000000000000	0000000000000000000000	0000000000000000000000	0000000000000000000000				
0020520	0004000000000000020540	0000021604000100000000	00000043000000003720000	0421041323047113231060		!	8@	DD-19-20
0020524	00000000001100000000160	0023010114100470202352	0024040145000624603171	0031730151540702203416				P S
0020530	0034210161100704603424	0034250161400713203456	0034700163501012004102	0041640207241035604334		- . 8 : ( B		
0020534	0043760222341174605002	0050060243341216005071	0064240321541507006437	0064430322201511206446		'	7 8 9	# \$ % &
0020540	0010000000000000020560	0064470322401512206453	0064540322641513406457	0064600323041514406463		!	' ( ) + , - . / 0 1 2 3	
0020544	0064640323241515406477	0065020324141521006505	0065060327341741407607	0076100370441742407613		4 5 6 7 B C D E F		
0020550	0076140370641743407617	0076200371101744607624	0076250371341746007631	0076320371541747007635				
0020554	0076360371741750007641	0076420372141751007645	0076460372341752007651	0076520372541753007655				
0020560	0014000000000000000000	0076560372741754007661	0076620373141755007666	0000000000000000000000				
		LOCATIONS 00020564 THROUGH 00020573 CONTAIN	0000000000000000000000					
0020574	0000000000000000000000	0000000000000000000000	0000000000000000000000	0000000000000000000000				
0020600	0004000000000000000000	0000001064000100000000	00000005200000000001000	0421041323047113231463		@		DD-19-33
0020604	00000000001100000000001	0012010000000000000000	0000000000000000000000	0000000000000000000000				

FUNCTIONS:  
DQMTAB









PERMANENT DATASET MANAGER (PDM)

at least  
save  
~~at least~~

5

15

## PERMANENT DATASET MANAGER (PDM)

- PROVIDES FOR CREATING, ACCESSING, DELETING, MAINTAINING, AND AUDITING PERMANENT DATASETS.
- PERMANENT DATASETS MAY EXIST FOR USERS OR THE SYSTEM.
- USER PERMANENT DATASETS ARE CREATED UPON REQUEST BY A USER JOB. (SAVE)
- SYSTEM PERMANENT DATASETS ARE CREATED FOR SPOOLED INPUT AND OUTPUT DATASETS.
- A SYSTEM PERMANENT DATASET IS CREATED FOR JOB DATASETS ARRIVING FROM A FRONT-END. (SDT)
- A PERMANENT JOB DATASET IS DELETED UPON COMPLETION OF THE JOB.

Y-RE-70

-EXT  
-SCP  
-MSF

Y-OUTP-70

Y-  
-SDT  
-MSF

DSE - contains DATS

50 words/page

ECW  
Req header  
SAS header

Entry DATS  
63 words

USES HASH into

see AR011

7/page

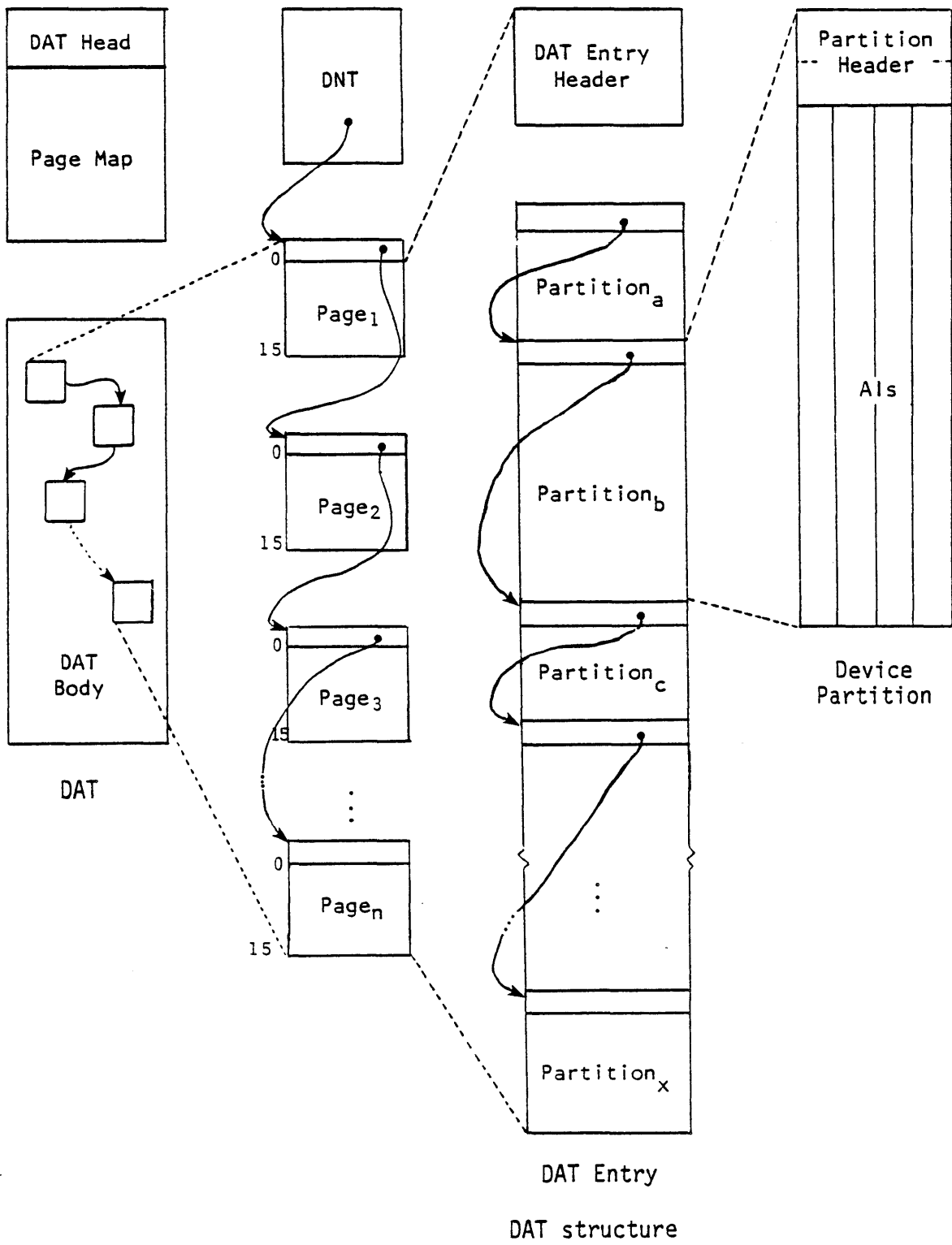
No tree structure

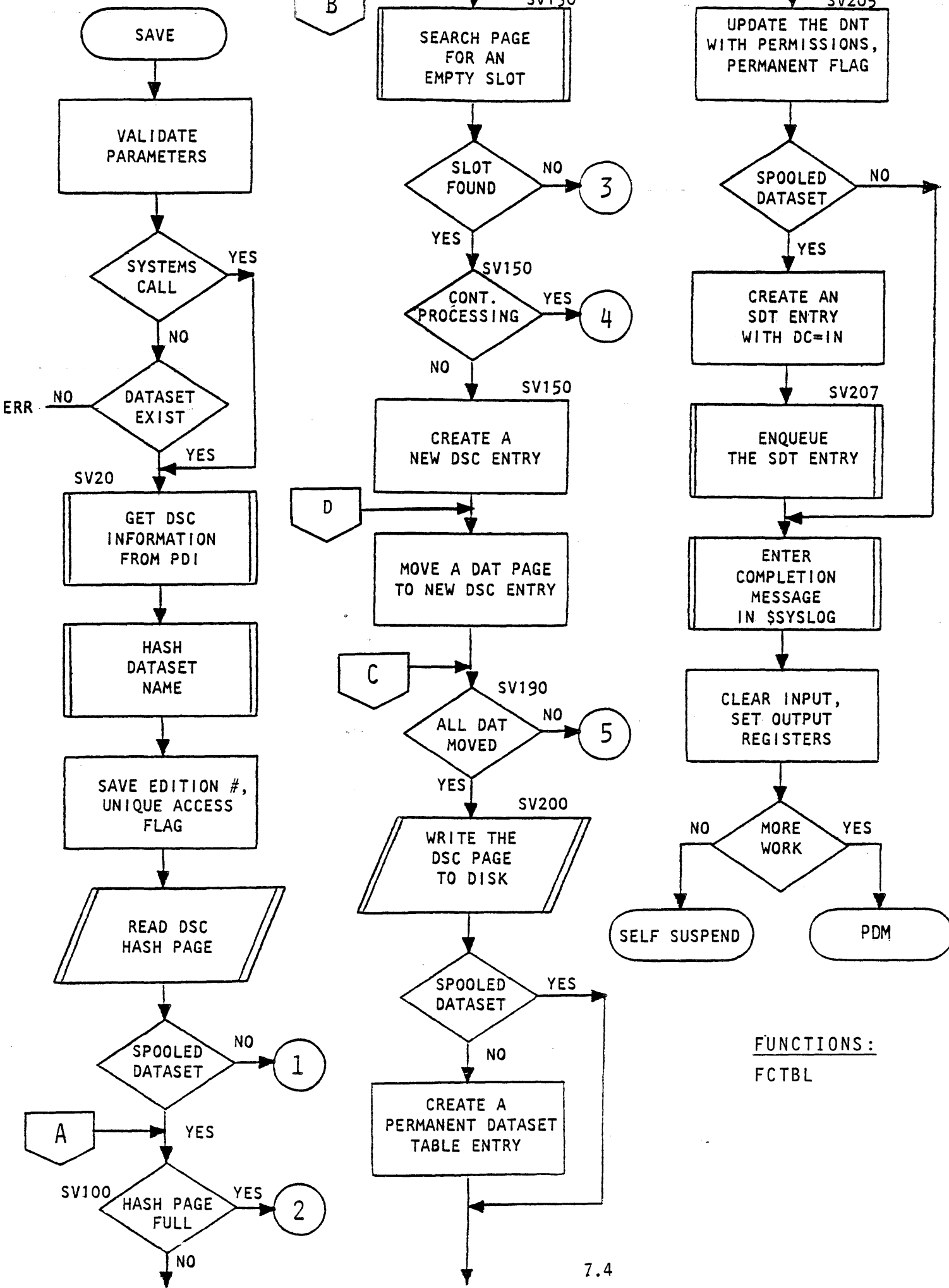
Media Data level contains

DSE -> DATS => Max DSE 18M words

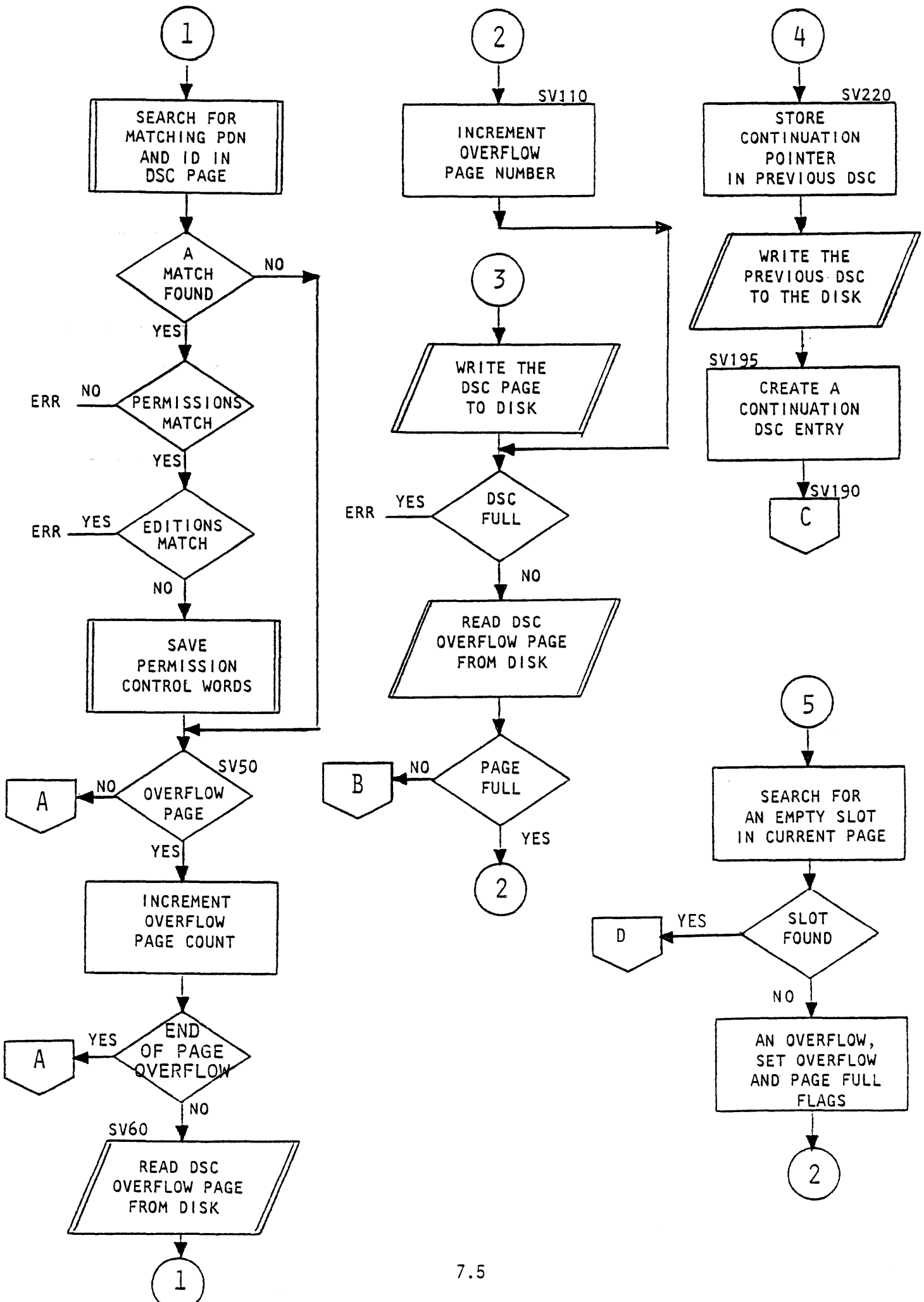
SYSTEM DIRECTORY - SAR (NEW STRUCT)

PBT PDS PDD -> NEW REQUESTOR



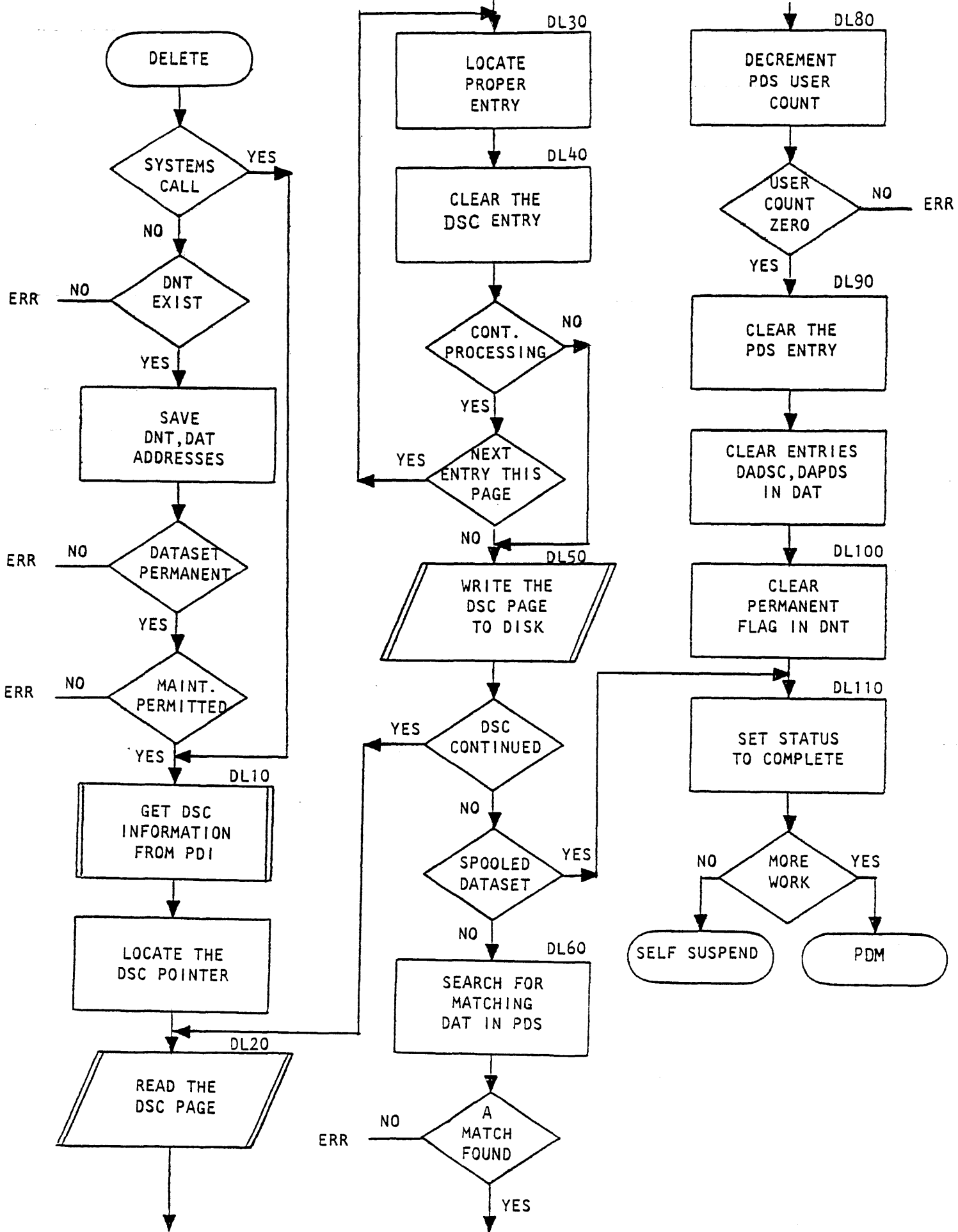


FUNCTIONS:  
FCTBL











JOB SCHEDULER (JSH)



## JOB SCHEDULER (JSH)

- INITIATES JOB SCHEDULING
- MANAGES USER AREA MEMORY RESOURCES. (JTA-LA)
- MANAGES USER JOB SWAPPING.
- MANAGES ROLL-IN AND ROLL-OUT OF USER JOBS.
- INITIATED THROUGH CALLS BY OTHER TASKS.



## JOB SCHEDULING

- JSH SELECTS JOBS FROM THE SYSTEM DATASET TABLE (DC=IN).
- JOBS ARE ENTERED ON THE JOB EXECUTION TABLE (JXT) BY CLASS, PRIORITY AND TIME OF SUBMISSION.
- A PRIORITY OF 0-15 MAY BE SPECIFIED ON THE JOB CARD.
- THERE CAN BE UP TO 63 ENTRIES ON THE JXT.
- JOBS ON THE JXT CONTEND FOR MEMORY BASED ON PRIORITY AND JOB SIZE. (EXCLUDING PRIORITY 0 JOBS).
- ONCE A WAITING JOB BECOMES THE HIGHEST MEMORY PRIORITY IT IS MOVED FROM THE DISK TO MEMORY.





## USER JOB SWAPPING

- ONCE IN MEMORY A JOB MUST CONTEND WITH OTHER JOBS IN MEMORY FOR CPU TIME.
- CPU PRIORITY FALLS WHEN A JOB IS CONNECTED TO THE CPU.
- CPU PRIORITIES ARE RECOMPUTED AFTER EACH SCHEDULING INTERVAL.
- CPU PRIORITY IS GIVEN TO JOBS THAT ARE STREAMING (DOING I/O).
- THE ALGORITHM FOR COMPUTING CPU PRIORITY IS ADJUSTABLE.



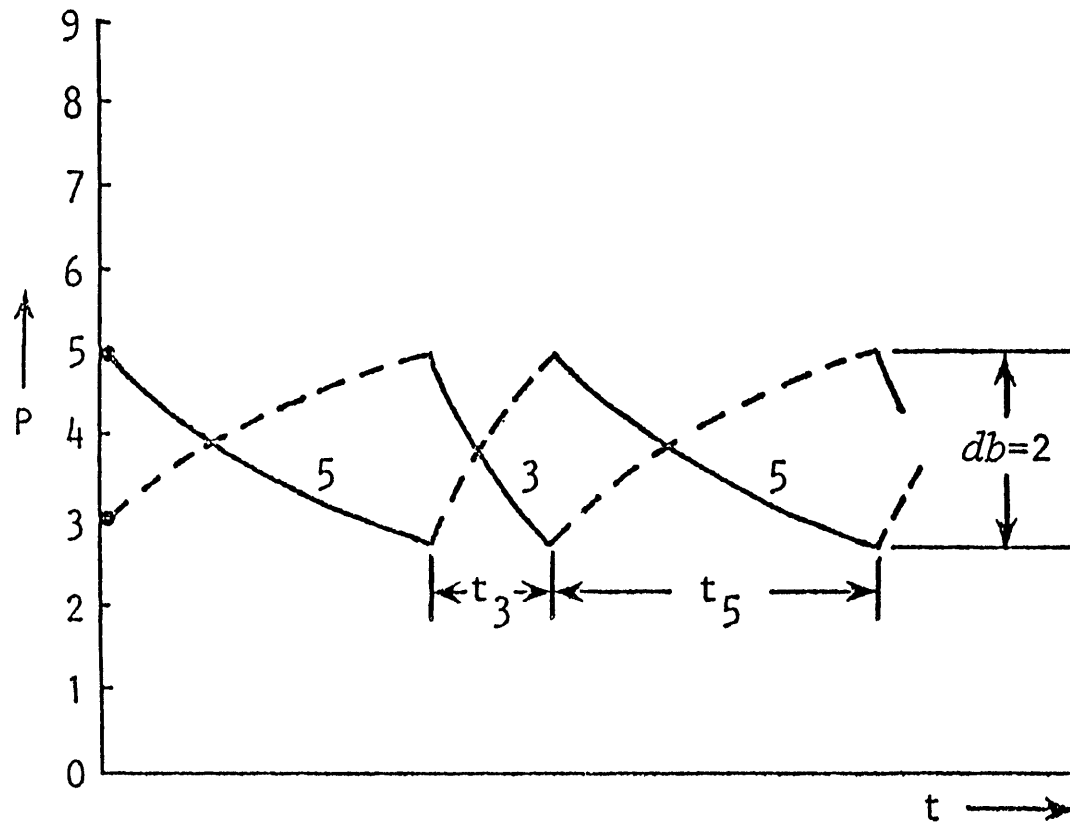
## ROLL-OUT AND ROLL-IN OF JOBS

- MEMORY PRIORITY RISES WHILE A JOB IS WAITING FOR MEMORY
- MEMORY PRIORITY FALLS WHEN A JOB IS IN MEMORY AND EXECUTING
- HIGHER PRIORITY JOBS MAY PRE-EMPT MEMORY FROM LOWER PRIORITY JOBS, THEN:

THE LOWER PRIORITY JOB IS WRITTEN TO DISK (ROLLED-OUT).  
HIGHER PRIORITY JOB USES THE VACATED MEMORY.  
MEMORY MAY HAVE TO BE 'COMPACTED' SO HIGH PRIORITY  
JOB HAS A CONTIGUOUS AREA.

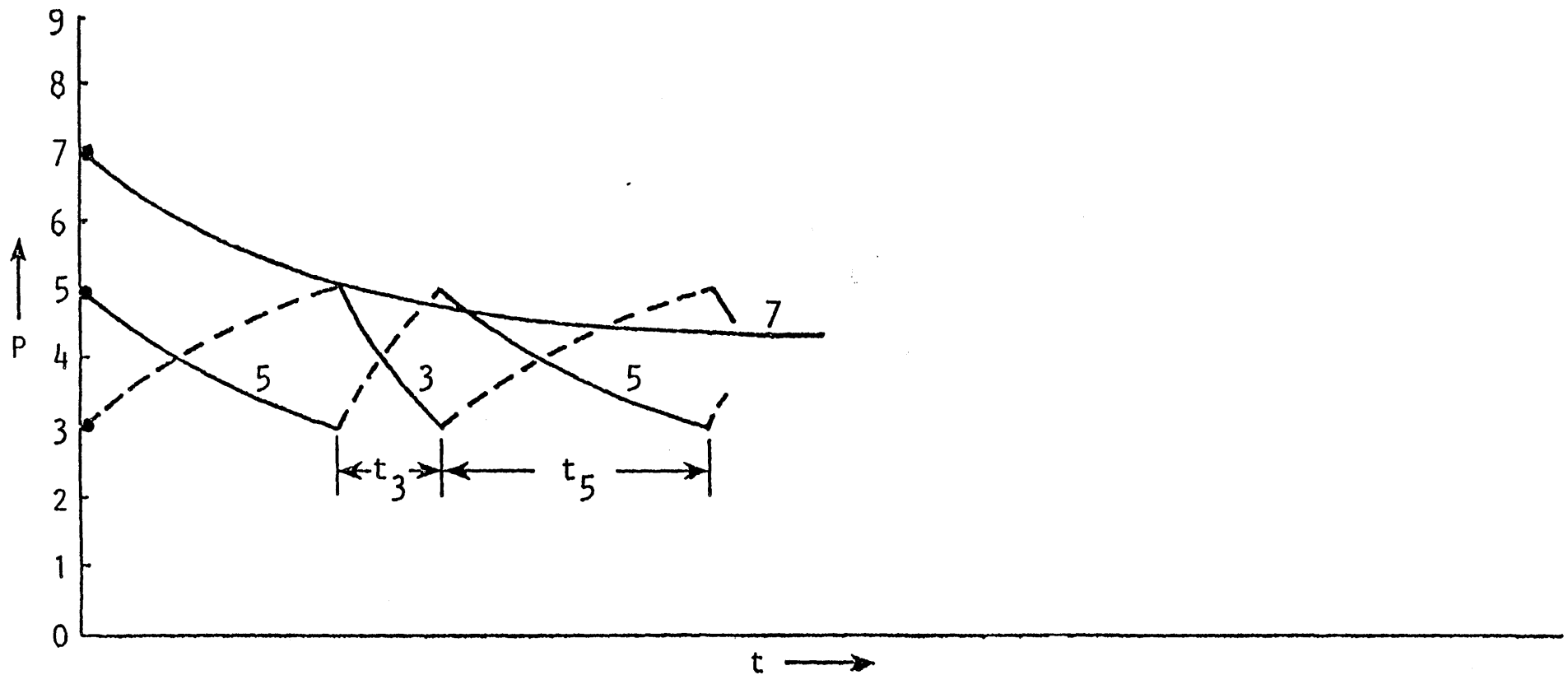
- ROLLED-OUT JOBS PRIORITY IS RISING SO EVENTUALLY IT WILL BE WRITTEN BACK TO MEMORY (ROLLED-IN).
- THE ALGORITHM FOR COMPUTING MEMORY PRIORITY IS ADJUSTABLE.
- ROLLED JOBS MAY BE CONTINUED OR RERUN AFTER A RESTART





Note: In all the examples, jobs are swapped when the difference between their priorities equals or exceeds  $db$ .

Showing two jobs which are too large to share memory. Their initial priorities (from the job cards) are 3 and 5. Note that the higher-priority job runs first and consistently enjoys a longer stay in memory, because its priority has asymptotes at  $P=2$  and 8 (as opposed to 0 and 6 for the other job.)



Showing three jobs, only two of which can share memory at any one time. Except for the presence of the priority-7 job, this graph is identical to figure 3.8-2. The priority-7 job can never be forced out of memory because its priority never will be even as much as one unit below  $P=5$ , which is the maximum attainable by either of the other two jobs. (If its initial priority were 6 instead of 7, it still would never be forced out by the other two jobs.)

```

SUBTITLE 'JOB SCHEDULER (ROLLJOB)'
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
**
*
*          SUBROUTINE ROLLJOB
*
* PURPOSE:
* TO MAKE A REQUEST OF THE DISK QUEUE MANAGER, EITHER TO COPY
* A JOB OUT ONTO ITS ROLLOUT DATASET OR TO READ THE JOB'S IMAGE
* BACK INTO MEMORY.
*
* ENTRY:
* A4 = JXT-ENTRY ADDRESS.
* A5 = JTA ADDRESS.
* DNP (PROCESSING DIRECTION IN THE ROLLFILE'S DNT) IS ALREADY
* SET -- TO 0 IF ROLLING IN, OR TO 1 IF ROLLING OUT.
*
* EXIT:
* I/O IS IN PROGRESS.
*
* REGISTERS:
* (A0-A2), (A6-A7), (S0-S2), (S6-S7) ARE DESTROYED
**
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
ROLLJOB = *
A7      W@JXDNT,A4
A6      W@JXCJS,A4
S1      A5          SET UP THE DNT:
PUT,S1  S6&S7,INBUF,A7  BUFFER ADDRESS = JTA ADDRESS,
S2      A6          NUMBER OF BLOCKS = JOB SIZE/S12.
S2      S2>D'9
PUT,S2  S6&S7,DNNBK,A7
S1      A4          SUBMIT THE I/O REQUEST:
S1      S1<D'40      LEFT-ADJUST THE JXT ADDRESS.
S2      A7
S1      S1!S2       INSERT THE DNT ADDRESS.
A1      JSHID,0
A2      DQMID,0
S2      TRANSFER
J       PUTREQ      LET PUTREQ RETURN TO THE CALLER.

```





## USER AREA MANAGEMENT

- PROVIDES FOR ROLL-IN, ROLL-OUT RESOURCES
- PROVIDES FOR INITIAL JOB ENTRY TO MEMORY
- PROVIDES DYNAMIC ALLOCATION OF MEMORY TO USER JOBS
- PROVIDES DYNAMIC DEALLOCATION OF MEMORY TO USER JOBS
- USES A TABLE (MST) FOR DETERMINING USEABLE MEMORY SPACE
- USES A 'FIRST-FIT' METHOD FOR GAINING MORE MEMORY
- 'FIRST-FIT' METHOD:
  - ALLOCATES MEMORY (BY BLOCK) BEGINNING AT LOW END OF MEMORY
  - MOVES JOBS (IF REQUIRED) BEGINNING AT HIGH END OF MEMORY
  - ENCOURAGES LARGE BLOCKS OF FREE MEMORY AT THE HIGH END OF MEMORY

```

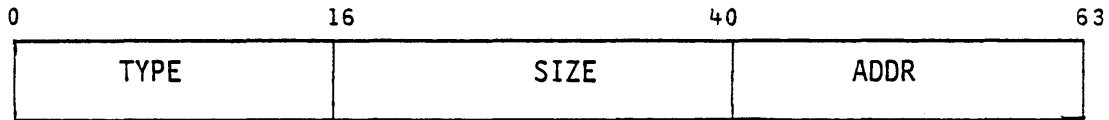
SUBTITLE 'JOB SCHEDULER (LIB@INIT)'
*****
*
*          -----
*          SUBROUTINE LIB@INIT
*          -----
*
* PURPOSE:
*         TO FIND THE MST ENTRY FOR AN ALLOCATED SEGMENT WHOSE ADDRESS
*         IS KNOWN, OR TO FIND THE MST ENTRY FOR THE FIRST ALLOCATED
*         SEGMENT ABOVE A GIVEN ADDRESS.
*
* ENTRY:
*         A3 = ADDRESS OF AN ALLOCATED SEGMENT WHICH IS TO BE FREED,
*             OR ANY VALUE LESS THAN THAT ADDRESS AS LONG AS IT IS
*             GREATER THAN THE ADDRESS OF ANY LOWER ALLOCATED SEGMENT.
*
* EXIT:
*         S0 = 0 IF NO ALLOCATED SEGMENT EXISTS WITH AN ADDRESS
*             THAT IS EQUAL TO OR GREATER THAN (A3).
*         A2 = (IF S0 IS NONZERO) THE OFFSET OF THE DESIRED MST ENTRY.
*         S2 = (IF S0 IS NONZERO) THE MST ENTRY ITSELF.
*
* REGISTERS:
*         (A0-A2), (S0-S2) ARE DESTROYED.
**
*****

LIB@INIT =      *
              A2      -1          LET A2=0 TO FETCH THE FIRST MST ENTRY.
LIB1         =      *
              A2      A2+1        ADVANCE THE MST OFFSET.
              S2      B@MST,A2    FETCH AN MST ENTRY.
              S0      S2
              JSZ     LIB2        RETURN S0=0 IF NO MSADDR IS >= A3.
              S0      S2>D'64-N@MSTYPE
              A1      S2          A1 = MSADDR.
              A0      A1-A3       COMPARE MSADDR TO THE CALLER'S ADDRESS.
              JSZ     LIB1        RELOOP IF THIS SEGMENT ISN'T ALLOCATED.
              JAM     LIB1        LOOP UNTIL THE DESIRED SEGMENT IS FOUND.
LIB2         =      *
              J       B0          RETURN.

```

## MEMORY SEGMENT TABLE - MST

The MST in STP memory contains a one-word entry for each segment of memory that has been allocated by the Job Scheduler plus additional entries that describe free segments. MST entries are stored in ascending order according to the beginning address of the segment (MSADDR). Any free space between two allocated segments is consolidated into a single entry. The last entry in the table is always followed by a zero word. To provide for the case where every allocated segment is surrounded by a free segment, the MST must have twice as many words in it as the maximum number of allocated segments, plus two more.



Memory Segment Table (MST) entry

<u>Field</u>	<u>Word</u>	<u>Bits</u>	<u>Description</u>
MSTYPE	0	0-15	Contains 0 if the segment is free; otherwise, it contains the JXT ordinal of the job to which the segment is allocated.
MSSIZE	0	16-39	Number of words in the segment. This is always a multiple of 1000 <sub>8</sub> .
MSADDR	0	40-63	STP-relative address of the first word in the segment. This is always a multiple of 1000 <sub>8</sub> .

### MEMORY SEGMENT ALLOCATION TABLE

```

0040753 0000010014500000116000
0040754 0000020014500000263000 0000000121000000430000 000000000000000000000000 000000000000000000000000
          LOCATIONS 00040750 THROUGH 00041053 CONTAIN 000000000000000000000000
0041054 000000000000000000000000
  
```

SUBTITLE 'JOB SCHEDULER (MOVEMEM)'

```

*****
**
*
*           -----
*           SUBROUTINE MOVEMEM
*           -----
*
* PURPOSE:
*         TO MOVE A BLOCK OF WORDS IN MEMORY.
*
* ENTRY:
*         A3 = ADDRESS OF THE DESTINATION AREA.
*         A5 = ADDRESS OF THE FIRST WORD TO BE MOVED.
*         A6 = NUMBER OF WORDS IN THE DESTINATION AREA.
*         A7 = NUMBER OF WORDS TO BE MOVED.
*
* EXIT:
*         THE NUMBER OF WORDS GIVEN BY MIN (A6,A7) IS MOVED FROM (A5)
*         TO (A3).  A2 AND S2 ARE SET UP FOR A SUBSEQUENT 'ERASEMEM'
*         CALL (WHICH WILL HAVE NO EFFECT IF S2 <= 0).
*
* REGISTERS:
*         (V0), (B10-B11), (A0-A2), (S0-S3) ARE DESTROYED.
*         (T10,T11) ARE DESTROYED WHILE THE POST CALL IS PRESENT.
*
* METHOD:
*         IF A3=A5, NO MOVING IS DONE, BUT A2 AND S2 ARE SET FOR
*         ERASEMEM ANYWAY.  IF A3<A5, MOVING COMMENCES WITH THE
*         LOWER ADDRESSES.  IF A3>A5, IT BEGINS AT THE HIGHER ONES.
*         64 ELEMENTS ARE MOVED AT A TIME, UNLESS THE STORE WOULD
*         OVERFLOW THE DESTINATION AREA --- IN WHICH CASE A FINAL
*         PASS IS MADE WITH A REDUCED VL.
**
*****

```

```

MOVEMEM = *
          B10  A3
          B11  A5
          A0   A6-A7      TOTAL MOVE LENGTH (IN S3) = MIN. (A6,A7).
          A1   A3-A7
          S3   A7
          JAP  MVM1
          S3   A6
MVM1     = *
          S2   A1          SET UP S2 AND A2 FOR A SUBSEQUENT CALL TO
          A2   A3+A7      ERASEMEM (WILL BE A NO-OP IF S2<=0)

          A0   A3-A5      COMPARE THE TWO GIVEN ADDRESSES.
          S1   <6
          A1   ZS0        INITIAL VECTOR LENGTH = 64.
          S0   #S1&S3
          JAZ  MVM9        DO NOTHING IF A3=A5.
          JSM  MVM9        DO NOTHING IF S3<0.

          T10  S2          BUILD ARGUMENTS FOR A POST CALL.
          T11  S7
          S1   A5          FROM-ADDRESS
          S1   S1<D'24
          S2   A3          TO-ADDRESS
          S2   S2<D'24
          S7   A7          FROM-LENGTH
          S1   S1<S7
          S7   A6          TO-LENGTH
          S2   S2<S7
          S7   MVM9        IDENTIFIER
          S7   S7<D'43
          S1   S7<S1
          POST S2,S1,S2    POST THE MOVE ARGUMENTS
          S2   T10        AND RESTORE REGISTERS.
          S7   T11

```

S.20481  
S.20482  
S.20483  
S.20484  
S.20485  
S.20486  
S.20487  
S.20488  
S002.1969  
S.20490  
S.20491  
S.20492  
S.20493  
S.20494  
S.20495  
S.20496  
S.20497  
S.20498  
S.20499  
S.20500  
S.20501  
S.20502  
S002.1970  
S002.1971  
S.20504  
S.20505  
S.20506  
S.20507  
S.20508  
S.20509  
S.20510  
S.20511  
S.20512  
S.20513  
S.20514  
S.20515  
S002.1972  
S002.1973  
S.20516  
S.20517  
S.20518  
S.20519  
S.20520  
S.20521  
S.20522  
S.20523  
S.20524  
S.20525  
S.20526  
S.20527  
S.20528  
S002.1974  
S002.1975  
S002.1976  
S002.1977  
S002.1978  
S002.1979  
S002.1980  
S002.1981  
S002.1982  
S002.1983  
S002.1984  
S002.1985  
S002.1986  
S002.1987  
S002.1988  
S002.1989  
S002.1990  
S002.1991  
S002.1992

	JSZ	MVM4	DO ONLY THE FINAL PASS IF S3<64.	S002.1303
	JAP	MVM6	MOVE FROM THE TOP DOWN IF A3>A5.	S.20531
MVM2	=	*		S.20532
	VL	A1	SET VL TO 64 (OR, ON FINAL PASS, TO RESIDUE).	S.20533
	S1	A1		S.20534
MVM3	=	*		S.20535
	A0	A5	SET ADDRESS FOR VECTOR LOAD.	S.20536
	S3	S3-S1	S3 = WORDS STILL TO BE MOVED AT LOOP'S END.	S.20537
	A5	A5+A1	ADVANCE VECTOR-LOAD POINTER.	S.20538
	V0	,A0,1	LOAD.	S.20539
	A0	A3	SET ADDRESS FOR VECTOR STORE.	S.20540
	S0	S3-S1	S0 WILL BE NEGATIVE WHEN S3<64 (OR, ON FINAL	S.20541
	A3	A3+A1	PASS, WHEN S3=0).	S.20542
	,A0,1	V0	STORE.	S.20543
	JSP	MVM3	RELOOP WHILE S3 >= 64.	S.20544
				S.20545
MVM4	=	*		S.20546
	S0	S3	0 <= S3 < 64: WE ARE DONE IF S3=0.	S.20547
	A1	S3		S.20548
	JSN	MVM2	IF S3>0, GO BACK TO MAKE A FINAL PASS.	S.20549
				S.20550
	J	MVM8	ELSE RETURN.	S.20551
				S.20552
*				S.20553
			HERE IF MOVING FROM THE TOP DOWN INSTEAD OF FROM THE BOTTOM UP.	S002.1304
				S.20554
MVM6	=	*		S.20555
	A1	S3	START A5 AND A3 AT THEIR HIGHEST VALUES.	S.20556
	A5	A5+A1		S.20557
	A3	A3+A1		S.20558
	A1	ZS0	RESTORE A1=64.	S.20559
MVM7	=	*		S.20560
	VL	A1	SET VL TO 64 (OR, ON FINAL PASS, TO RESIDUE).	S.20561
	S1	A1		S.20562
MVM8	=	*		S.20563
	A0	A5-A1	SET ADDRESS FOR VECTOR LOAD.	S.20564
	S3	S3-S1	S3 = WORDS STILL TO BE MOVED AT LOOP'S END.	S.20565
	A5	A5-A1	BACK UP VECTOR-LOAD POINTER.	S.20566
	V0	,A0,1	LOAD.	S.20567
	A0	A3-A1	SET ADDRESS FOR VECTOR STORE.	S.20568
	S0	S3-S1	S0 WILL BE NEGATIVE WHEN S3<64 (OR, ON FINAL	S.20569
	A3	A3-A1	PASS, WHEN S3=0).	S.20570
	,A0,1	V0	STORE.	S.20571
	JSP	MVM8	RELOOP WHILE S3 >= 64.	S.20572
				S.20573
	S0	S3	0 <= S3 < 64: WE ARE DONE IF S3=0.	S.20574
	A1	S3		S.20575
	JSN	MVM7	IF S3>0, GO BACK TO MAKE A FINAL PASS.	S.20576
				S.20577
MVM9	=	*		S.20578
	A3	B10		S.20579
	A5	B11		S.20580
	J	B0	RETURN.	S.20581
				S.20582
				S002.1305
				S002.1306
				S002.1307
				S.20584



## JOB SCHEDULER JOB FLOW

- JOB DATASET ENTERS THE SYSTEM
- STATION CALL PROCESSOR (SCP) HAS THE JOB SAVED ON DISK
- SCP HAS AN ENTRY MADE IN THE SYSTEM DATASET TABLE (SDT), AND DATASET CATALOG (DSC)
- JOB IS PLACED IN JOB EXECUTION TABLE (JXT) ACCORDING TO CLASS/PRIORITY AND TIME OF SUBMISSION
- ONCE ON THE JXT THE JOB CONTENDS FOR MEMORY
- JOB MEMORY IS ERASED WHEN JOB INITIATED (I@ERASE)
- JOB IN MEMORY CONTENDS FOR CPU TIME
- JOB IN MEMORY MAY BE ROLLED OUT
- WHEN A JOB COMPLETES, ITS OUTPUT DATASETS ARE PLACED IN THE OUTPUT QUEUE IN SDT AND MADE PERMANENT
- WHEN FRONT-END ACKNOWLEDGES RECEIPT OF A DATASET THE DATASET CATALOG ENTRY IS REMOVED





## Calling Sequence

JSH can be invoked from any other task by calling either TSKREQ or PUTREQ with the following instruction sequence:

Location	Result	Operand
	A1	calling task's ID
	A2	JSHID,0
	S1	function code (already shifted)
	S2	job's offset in JXT
	S1	S1!S2
	S2	address if any
	S2	S2<D'16
	S1	S1!S2
	S2	auxiliary information if any
	S2	S2<D'40
	S1	S1!S2
	R	TSKREQ or PUTREQ

Input register format:

	00	24	48	53	63
INPUT+0	AUX		ADDR		JXO
INPUT+1	unused				

**AUX** Auxiliary information; unused by JSH. (Any value the caller places in INPUT+0 is returned verbatim in OUTPUT+1.)

**ADDR** Word address relative to the beginning of STP of an additional word or list of words if needed to fully specify the call.

**FC** Function code; use equated labels of the form J\$XXXX, selected from table

**JXO** JXT offset for the job in question.

Output register format:

	00	24	48	53	63
OUTPUT+0	STATUS				
OUTPUT+1	AUX		ADDR		JXO

**STATUS** Status of requested function.

0 Requested function completely accomplished.

≠0 Error or system is unable to fulfill request completely.



PARTIAL JOB SCHEDULER FUNCTIONS

FUNCTIONS:  
JSREQTAB

Function Code	Input Parameters	Function
	—no input required—	Fill up JXT with jobs from SDT.
J\$ABORT	JXO, CODE	Abort a job.
J\$DELETE	JXO	Release all space allocated to a job.
J\$RERUN	JXO	Same as J\$DELETE but reinitiate a job.
J\$ALLOC	JXO, ADDR	Allocate or release memory for a job.
J\$IOSUSP	JXO	Suspend a job until an I/O request is done.
J\$IODONE	JXO	Resume an I/O suspended job.
J\$DELAY	JXO, ADDR	Suspend a job for a given time.
J\$DELAYK	JXO, ADDR	Same as J\$DELAY but keep the job in memory.
J\$AWAIT	JXO, ADDR	Suspend a job until a given event occurs.
J\$SUSP	JXO	Suspend a job momentarily; system initiated.
J\$SUSPK	JXO	Same as J\$SUSP but keep the job in memory.
J\$REMK	JXO	Lift the "keep in memory" restriction.
J\$RESUME	JXO	End momentary suspension.
J\$STOP	JXO	Suspend a job indefinitely; operator action.
J\$STPALL	JXO	Suspend all jobs indefinitely; operator action.
J\$START	JXO	End an indefinite suspension for a job; operator action.
J\$STRALL	JXO	End an indefinite suspension for all jobs; operator action.
J\$CLEAR	JXO	Force the end of a job's suspension.
J\$INDEX	JXO	Mark the job irrecoverable.
J\$SHTDWN	JXO	Idle down job activity in preparation for a system interruption.
J\$RCVR	JXO	Lift the suspension from jobs suspended by a J\$SHTDWN or system interruption.



## JOB STATUS AND STATE CHANGES

The status field

The 23-bit status field (JXSTAT) in each job's JXT entry is described in table 3.8-2. The bits labeled Q, R, X, I, U, L, S, O, and M are mutually exclusive. Generally, whichever one of them is set determines the job's state. The other bits modify the job's state.

If all of bits 3 through 22 are zero, the job is said to be waiting to be connected to the CPU (state W).

Table 3.8-2. Status bit assignments

Bit position in JXSTAT	Bit name	Corresponding job state	Interpretation (when bit is set)
0	K	<i>S</i>	Keep this job in memory; don't roll it out.
1	A	<i>any</i>	Abort pending; reason given in JXEPC.
2	H	<i>O</i>	Holding operator or shutdown suspension until RN is set.
3	O	<i>O</i>	Suspended (indefinitely) by operator.
4	S	<i>S</i>	Suspended (momentarily) by system.
5	T	<i>S</i>	Suspended until a given time elapses.
6	E	<i>S</i>	Suspended until a given event occurs.
7	M	<i>M</i>	Memory allocation is pending.
8	Q	<i>Q</i>	Queued up; waiting to be initiated.
9	R	<i>R</i>	Rolled out. The M bit may also be set.
10	X	<i>X</i>	Executing.
11	I	<i>I</i>	Dormant pending recall on I/O completion.
12	C	<i>any</i>	Rerun request in process.
13	D	<i>any</i>	Delete request in progress.
14	U	<i>U</i>	Unloading from memory to roll file.
15	L	<i>L</i>	Loading into a new memory area.
16	P	<i>U or L</i>	Unload or load initiation is pending.
17	Y	<i>M, Q or R</i>	Waiting for memory liberation.
18	Z	<i>M, Q or R</i>	Waiting for memory compaction.
19	B	<i>S</i>	Suspended (indefinitely) by recovery.
20	V	<i>I</i>	Waiting on INDEX write completion.
21	F	<i>I</i>	Waiting on rollfile write completion.
22	N	<i>M, Q or R</i>	Not in memory.

NOW ROLL  
NOW PUSH



## CPU SWAPPING

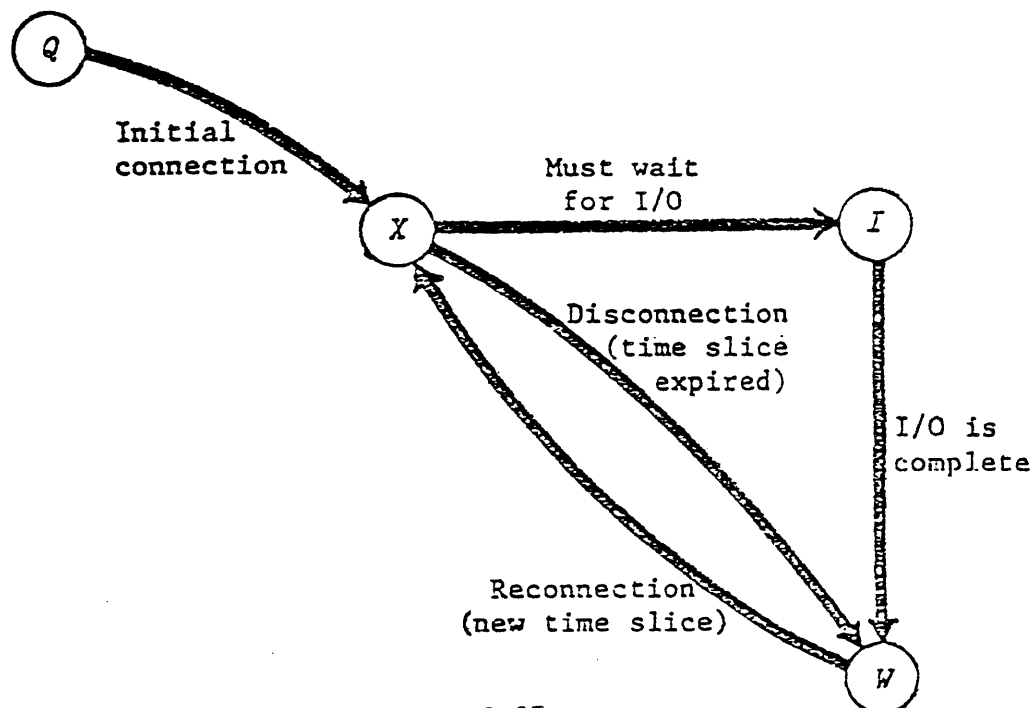
Q → X      A JOB IS QUEUED IN THE JOB EXECUTION TABLE (JXT) WAITING MEMORY. THE JOB IS BROUGHT INTO MEMORY AND BEGINS EXECUTION

X → I      THE JOB IS SUSPENDED PENDING COMPLETION OF I/O. THE CPU IS AVAILABLE FOR USE BY ANOTHER JOB.

I → W      THE I/O COMPLETES. THE JOB MAY WAIT FOR MORE CPU TIME.

W → X      JSH RECONNECTS THE WAITING JOB BECAUSE OF ITS HIGH PRIORITY

X → W      THE JOB'S TIME SLICE EXPIRES. THE CPU IS AVAILABLE FOR USE BY ANOTHER JOB.

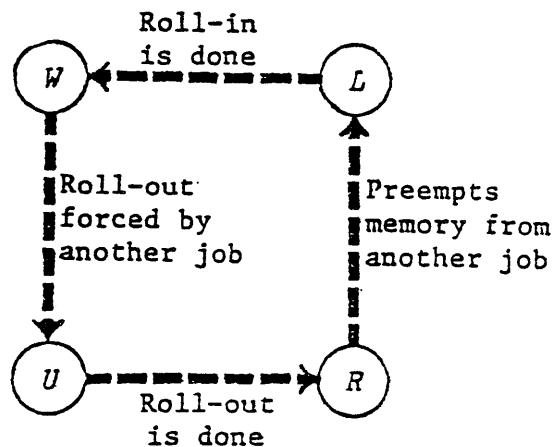






## MEMORY SWAPPING

- W → U I/O IS INITIATED FOR ROLL-OUT OF THE WAITING JOB.
- U → R THE JOB IS ROLLED-OUT. THE JOB'S MEMORY IS AVAILABLE.
- R → L I/O IS INITIATED FOR ROLL-IN OF THE JOB. MEMORY HAS BEEN ALLOCATED.
- L → W THE JOB IS ROLLED-IN. THE JOB MAY WAIT FOR CPU TIME.



## JOB SUSPENSION

X → M THE EXECUTING JOB MAKES A REQUEST FOR MORE MEMORY. IF REQUEST CANNOT BE SATISFIED THE JOB MAY BE ROLLED-OUT.

M → W THE ALLOCATION REQUEST WAS SATISFIED. THE JOB WAS NOT ROLLED OUT SO NOW MAY WAIT FOR CPU TIME

M → U I/O IS INITIATED FOR ROLL-OUT OF THE JOB REQUESTING MORE MEMORY

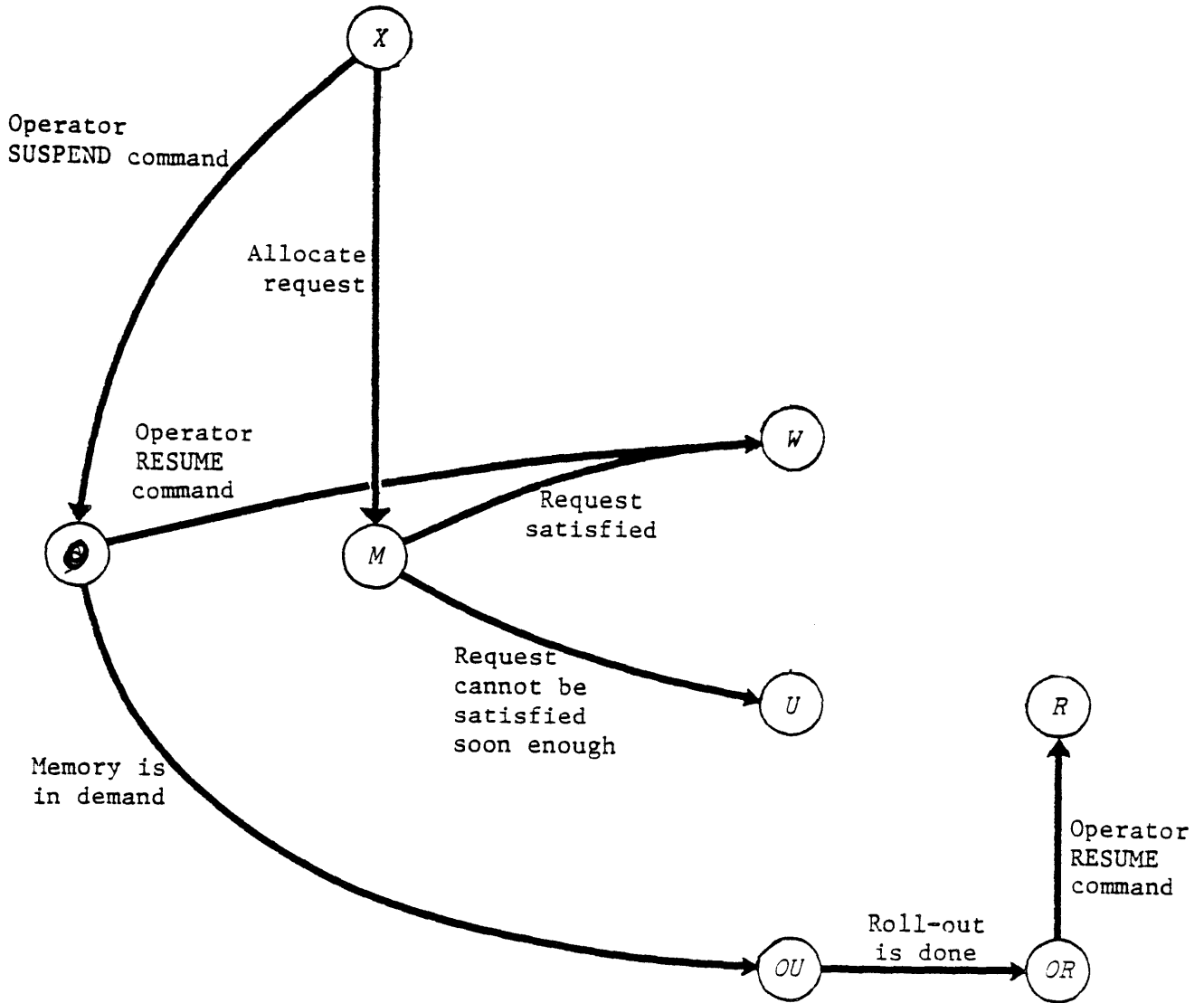
X → O X → S THE EXECUTING JOB REQUESTS SUSPENSION. JOB IS DISCONNECTED FROM CPU AND LIABLE TO BE ROLLED OUT.

O → OU S → SU I/O IS INITIATED FOR ROLL-OUT OF THE SUSPENDED JOB.

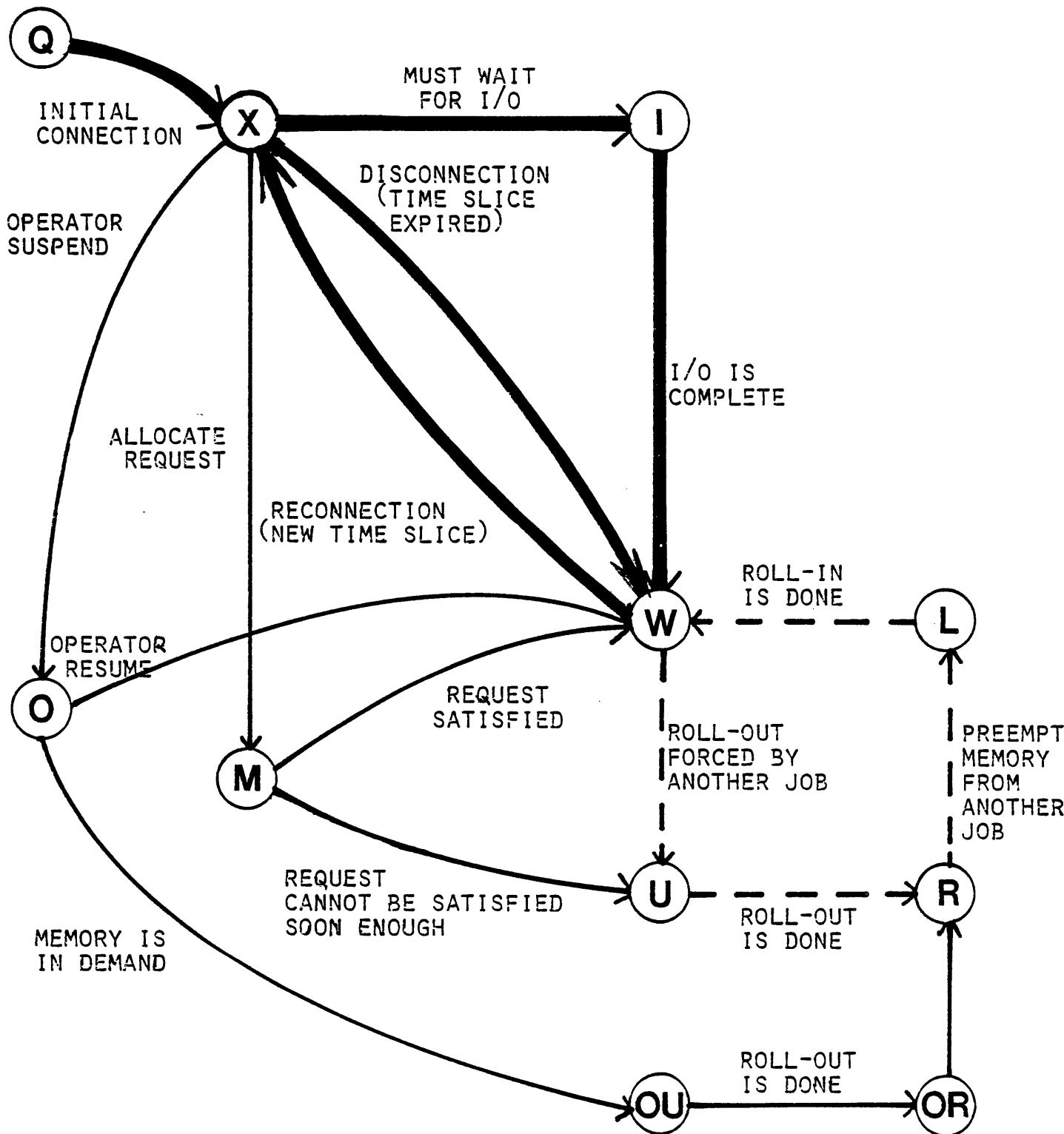
OU → OR SU → SR THE SUSPENDED JOB IS ROLLED-OUT. THE JOB'S MEMORY IS AVAILABLE.

OR → R SR → R THE SUSPENDED JOB IS REACTIVATED.

O → W S → W THE SUSPENDED JOB IN MEMORY IS REACTIVATED.









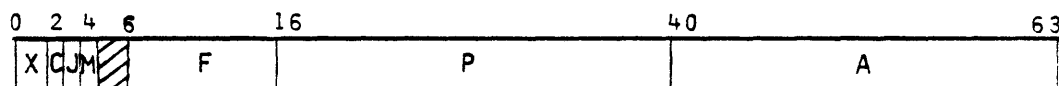
USER EXCHANGE PROCESSOR (EXP)





## USER EXCHANGE PROCESSOR (EXP)

- PROCESSES ALL USER NORMAL ACTION REQUESTS.
- PROCESSES ALL USER ERROR EXITS.
- PROCESSES JSH REQUESTS TO INITIATE OR ABORT A USER JOB.
- ALL REQUESTS MADE THROUGH THE EXCHANGE PROCESSOR REQUEST WORD (JTEP) IN A USER JTA. JTEP IS WORD 67<sub>8</sub>.



<u>Field</u>	<u>Bits</u>	<u>Description</u>
JTEPX	0-1	User exit 2 Normal exit 1 Error exit or execution error 0 Not user exit
JTEPC	2	Continuation flag
JTEPJ	3	Job Scheduler request flag
JTEPM	4	JTA expansion request flag
JTEPF	7-15	Exchange package flags
JTEPP	16-39	P register for errors
JTEPA	40-63	EXP Continuation address



## USER NORMAL EXIT

- USER ISSUES A SYSTEM ACTION REQUEST WHICH SETS S REGISTERS AND ISSUES AN EX INSTRUCTION

SO-DESIRED CALL TABLE OFFSET (FUNCTION CODE)

S1-CONVENTION -- AN ADDRESS OF A USER TABLE  
(OPTIONAL)

S2-FURTHER OPTIONAL ARGUMENT

- WHEN THE REQUEST IS COMPLETE THE USER'S SO-REGISTER IS SET

SO-ZERO IF REQUEST COMPLETED NORMALLY

SO-ERROR CODE QR JOB ABORTS

- EXP EXAMINES THE USERS JXT ENTRIES. A JXT ENTRY POINTS TO THE USERS JTA

- THE USERS JTA CONTAINS A COPY OF THE EXCHANGE PACKAGE

- EXP EXAMINES JTEP (WORD 67<sub>8</sub>) AND THE USERS SO REGISTER TO DETERMINE REQUEST



CALL	=	W.*		S.
	CON	0*X24+ADV	00 ADVANCE PROGRAM	1182
	CON	0*X24+ABT	01 ABORT JOB	1183
	CON	1*X24+DAT	02 GET DATE - MM/DD/YY	1184
	CON	1*X24+TIM	03 GET TIME - HH:MM:SS	1185
	CON	D'8*X24+MSG	04 PUT MESSAGE INTO USERS DAYFILE	1186
	CON	2*X24+RCL	05 SUSPEND IF I/O ACTIVE	1187
	CON	0*X24+TRM	06 TERMINATE JOB	1188
	CON	1*X24+SSW	07 SET SENSE SWITCHES	1189
	CON	2*X24+OPN	10 OPEN DATASET	1190
	CON	1*X24+MEM	11 MEMORY REQUEST	1191
	CON	1*X24+LBN	12 GET LAST BLOCK NUMBER	1192
	CON	2*X24+CLS	13 CLOSE DATASET	1193
	CON	D'8*X24+DNT	14 CREATE/SENSE DNT	1194
	CON	1*X24+MDE	15 SET MODE	1195
	CON	D'8*X24+GNS	16 GET NEXT CONTROL CARD	1196
	CON	0*X24+EXU	17 EXECUTE AN OBJECT CODE FILE	1197
	CON	D'8*X24+RLS	20 RELEASE DATASET	1198
	CON	0*X24+PDM	21 PERMANENT DATASET MANAGER REQUEST	1199
	CON	D'16*X24+RDC	22 READ DISK CIRCULAR	1200
	CON	D'16*X24+WDC	23 WRITE DISK CIRCULAR	1201
	CON	2*X24+GRN	24 GET SYSTEM REVISION LEVELS	1202
	CON	D'16*X24+DPS	25 DISPOSE DATASET	1203
	CON	1*X24+JDA	26 GET JULIAN DATE - YYDDD	1204
	CON	1*X24+JTI	27 ACCUMULATE JOB CPU TIME	1205
	CON	D'8*X24+ACT	30 GET ACCOUNTING INFORMATION FROM JTA	1206
	CON	0*X24+SFS	31 SET P AND SUSPEND USER	1207
	CON	1*X24+CSW	32 CLEAR SENSE SWITCH	1208
	CON	1*X24+TSW	33 TEST SENSE SWITCH	1209
	VWD	D'40/LE@DSP,D'24/BIO	034 BUFFERED I/O REQUEST	1210
	CON	1*X24+DLY	35 DELAY JOB X NUMBER OF MILLISECONDS	1211
	CON	0*X24+AQR	36 ACQUIRE DATASET FROM FRONT END	1212
	CON	0*X24+NRN	37 DISABLE NO-RERUN CHECK	1213
	CON	0*X24+RRN	40 OVERRIDE NOT-RERUNNABLE FLAG	1214
40	CALMAX	=	W.*-CALL-1	1215
41	CALMAX1	=	CALMAX+1	1216

EXCHANGE PROCESSOR CALL TABLE

00451175	000000000000000000313162	000000000000000000313632	00000000000000100321101
00451176	00000000000000100327712	00000000000000100327712	00000000000000200327327
00451177	00000000000000100327631	0000000000000020032763	00000000000000100325364
00451178	000000000000002003280401	00000000000000100321754	00000000000000100324314
00451179	0000000000000000323067	00000000000000100327437	0000000000000000326641
00451180	000000000000002000330120	00000000000000200324022	000000000000002000322540
00451181	00000000000000100324230	00000000000000100313106	0000000000000000327624
00451182	00000000000000100327725	000000000000002000317724	00000000000000100321730
00451183	0000000000000000325734	000000000000000000327544	

3  
1  
1

```

0136000 0411252465440000000000 000000000063551645625 0000000000023663324313 0000000000000073314630 BUSY      K
0136004 000000000000000000000055 0000000000000000000007 0000000000000000000000 0000000000000000000000
      LOCATIONS 00136010 THROUGH 00136017 CONTAIN 0000000000000000000000
0136020 000000000104100000212 0000000014500000000000 0000000030301600000000 0000001500000000000000  !
0136024 000000000000000000000000 0000000000000000000000 0000000000000000000000 000000000000000000213
0136030 000000000000000000000000 0000000000000000000000 0000000000000000000000 0000000000000000000000
0136034 000000000000000000000000 0000000000000000000000 0000000000000000000000 0000000000000000000001
0136040 177777777777777777777777 0000000000000000000000 0000000000000000000000 0000000000000000000000
      LOCATIONS 00136044 THROUGH 00136057 CONTAIN 0000000000000000000000
0136060 000000000000000000000000 0000000000000000000000 0000000000000000000000 000000000063551645625
0136064 000000000000000000000000 0425322255254201321403 00000000000000000324715 0000000000000000000000      EZJ
0136070 000000000000000000000000 0000000000000000000000 0000000000000000000000 0421072104340000036026      DGDG <
0136074 0475202125110125047522 0400615063140064344400 0400505667546174000000 0000040000000000000000 OPERATOR@1 3 @ 1
0136100 000000000000000000001020 00000000000000000000213 0000000000000000000000 0000000000000000000000
      LOCATIONS 00136104 THROUGH 00137317 CONTAIN 0000000000000000000000
0137320 022103246000000000000001 00000200000000000002000 0000000000000100002000 00000000000000000002010 $CS
0137324 0000000000000000000003000 10000000000000000002011 0000000000000000000000 0000400000000000000000
0137330 100000000000000000002007 0000000000000000000000 0000000033651400117660 0000000000000000000000      L
0137334 000000000000000000352545 0000000012240600036026 0020000000700500007017 1000000000000000000000      <
0137340 022114236434000000000001 00000100000000000003000 00000000000000000003152 00000000000000000003000 $LOG
0137344 000000000000000000004000 10400000000000000003151 0000000000000000000000 0000000000000000000000
0137350 10400000000000000003140 0000000000000000000000 0000000035636000000712 0000000000000000000000
0137354 000000000000000000000000 0000000012242400036026 0000000000000000000000 0000000000000000000000      <
0137360 046104244000000000000000 0100000000000000000200 0000000000001100000200 0000000000001000010450 LDR      e      (
0137364 00000000000000000011200 1000000100001000010450 0000000000000000000000 0000000000000000000000      (
0137370 0000000100001000010447 0000000000000000000000 0000000033630700125200 0000000000000000000000      '
0137374 000000000000000000352615 0000000011742000036026 0062000001515000017414 0221202044700000000000      <      $PBN
0137400 000000000000000000000000 0000000000000000000000 0000000000000000000000 0000000000000000000000
      LOCATIONS 00137404 THROUGH 00137417 CONTAIN 0000000000000000000000
0137420 046104244000000000000000 0000002464140100021140 00000400000000500132200 1000200000000000000000 LDR      SC ""
0137424 0000000035213400001360 0000000000000000000000 0000000100000001100004 00000000000000000000011
0137430 0000000001100000116100 0000000000000000000000 0000000000000000000000 0000000000000000000000      e
0137434 000000000000000000000000 0000000000000000000000 0000000000000000000000 0000000000000000000000
0137440 000000000000000000343413 00000000000000000116000 00000000000000000036026 000000000000000000333175      <
0137444 00000000000000000004520 00000000000000000122000 0000000000000000004000 0000000000000077777777      P
0137450 000000000000000000000000 0000000000000000000000 0007070260011751604001 0000000000000000000001      0
0137454 0000010000000000000000 0377777777777777700000 0000000000000000000000 000000000000000000333175      ?
0137460 000000000000000000000000 0000000000000000000000 0000000000000000000000 0000000000000000000000
      LOCATIONS 00137464 THROUGH 00137657 CONTAIN 0000000000000000000000
0137660 046104244270000000000000 0000000000000000000000 0000000000000000000000 0000000000000000000000 LDR..
      LOCATIONS 00137664 THROUGH 00137673 CONTAIN 0000000000000000000000
0137674 0000000001451600136000 0000030012200000121600 0000060000000000121564 0000000000000000000000      N

```

LOCATIONS 00137700 THROUGH 00137737 CONTAIN 00000000000000000000

0137740 0000000000000000340546 00000000000000000000 00000000000000000000 00000000000000000000
0137744 0000000000000000122520 00000000000000002426E0 00000000000000000000 00000000000000000000
0137750 0000000000000000000000 0000000000000000000000 00000000000000000000 00000000000000000000
0137754 0000000000000000130572 0000000000000000000000 0000000000000000000000 00000000000000000000

LOCATIONS 00137760 THROUGH 00137777 CONTAIN 00000000000000000000

0140000 0000000000000000000002 0451172042411223436502 0525232622612412200000 1020000000000000000001
0140004 0415062502700000000000 1040000000000000000001 0461042442700000000000 1040000000000000000001
0140010 0425302225205600000000 1030000000000000000001 0425302225205600000000 1030000000000000000000
0140014 1600000000000000000000 0154442222007510030000 1010000000000000000002 0200601403044010044440
0140020 0364401420000000000000 1050000000000000000002 0154442164752423620060 0300610000000000000000
0140024 1060000000000000000001 0154442124710400000000 1030000000000000000000 1600000000000000000000
0140030 1700000000000000000000 0000000000000000000000 0000000000000000000000 0000000000000000000000

P E
JOB(JN=BUSY,T)
CFT. LDR.
EXIT. EXIT.
#I = 0 001 I
= 1 #GOTO 001
#END

LOCATIONS 00140034 THROUGH 00140077 CONTAIN 00000000000000000000

0141000 00000000000000000000016 0200401002004010020040 0310611643046016431062 0200401002004010030056
0141004 0300601403004010020040 0415232402004010020040 0200401002004010020040 0415222025445514220040
1010 0515052444450123026461 0310401002004010020040 041522222005510046505 0471042365210110044105
1014 0415072205212313020115 0445162342704010020040 0300661363106113633471 1000000000000000000006
1020 0200401002004010020040 0310611643046016431062 0200401002004010030056 0300601403004010020040
1024 0415232402004010020040 0200401002004010020040 1000000000000000000016 0200401002004010020040
0141030 0310611643046016431062 0200401002004010030056 0300601403004010020040 0415232402004010020040
0141034 0200401002004010020040 0415222025445514220040 0475202125110125044516 0434402465452325042515
0141040 0200401002004010020040 0415172462006113430066 0200402025152321246502 0461311004210125042440
0141044 0300661363106013633471 1000000000000000000006 0200401002004010020040 0310611643046016431062
0141050 0200401002004010030056 0300601403004010020040 0415232402004010020040 0200401002004010020040
0141054 1000000000000000000006 0200401002004010020040 0310611643046016431062 0200401002004010030056
0141060 0300601403004010020040 0415232402004010020040 0200401002004010020040 1000000000000000000007
0141064 0200401002004010020040 0310611643046016431062 0200401002004010030056 0300601403004010020040
0141070 0415232402004010020040 0451172042411223436502 0525232622612412220040 1000000000000000000006
0141074 0200401002004010020040 0310611643046016431062 0200401002004010030056 0300601403104010020040
0141100 0415232402004010020040 0415062502704010020040 1000000000000000000013 0200401002004010020040
0141104 0310611643046016431062 0200401002004010030056 0300601403144010020040 0525232125104010020040
0141110 0431241403006410026440 0415062502012621251123 0445172342005510020040 0300661363106013633471
0141114 0201232064410521052514 0425221002004010020040 1000000000000000000012 0200401002004010020040
0141120 0310611643046016431062 0200401002004010030056 0300601423244010020040 0525232125104010020040
0141124 0431241403006110026440 0415172325011123042440 0521112324244017220040 0200401402706014030462
0141130 0201232124151723442123 1000000000000000000006 0200401002004010020040 0310611643046016431062
0141134 0200401002004010030056 0300601423244010020040 0415232402004010020040 0461042442704010020040
0141140 1000000000000000000010 0200401002004010020040 0310611643046016431062 0200401002004010030056
0141144 0300601443244010020040 0525232125104010020040 0461041403046010026440 0411052164451610042530
0141150 0425032525211123647040 1000000000000000000000 0000000000000000000000 0000000000000000000000

21:10:22 0.
0000 CSP CRAY-1
SERIAL-12 CRI - MENDOTA HE
IGHTS; MINN. 06/21/79
21:10:22 0.0000
CSP
21:10:22 0.0000 CSP
CRAY-1 OPERATING SYSTEM
COS 1.06 ASSEMBLY DATE 1
06/20/79 21:10:22
0.0000 CSP
21:10:22 0
0000 CSP
21:10:22 0.0000
CSP
JOB(JN=BUSY,T)
21:10:22 0.0002
CSP
CFT.
21:10:22 0.0003 USER
FT004 - CFT VERSION - 06/20/79
SCHEDULER
21:10:22 0.0015 USER
FT001 - COMPILE TIME = 0.0012
SECONDS 21:10:22
0.0015 CSP LDR.
21:10:22 0.
0025 USER LD010 - BEGIN EX
ECUTION

LOCATIONS 00141154 THROUGH 00141777 CONTAIN 00000000000000000000

97

0  
0  
0

0142000	00177400000000000007000	0000000000000000000000	0221042124112521600000	0000000000000000000000					\$DEBUG		
0142004	0000000000000000000000	0000000000000000000000	0000000000000000000000	0000000000000000000000							
0142010	0000000000000000000000	0000000000000000000000	0411252465440000000000	04411725247000000000001					BUSY	HOUN	
0142014	0300020040000000116000	0004160130000000145000	0212462231431100145000	0735670000000000036067	0				" I	<7	
0142020	00000000000057133222455	0000000000000000000055	0040000012200000004000	0000000000000000000000		%-	-				
0142024	0000000000000000000000	0000001411317731664600	0461041403046010026440	0411052164451610042530	0				LD010	-	BEGIN EX
0142030	0425032525211123647040	0000000000000000000000	0000000000000000000000	0000000000000000000000					ECUTION		
0142034	0000000000000000000000	0000000000000000000000	0000000000000000000000	0000000000000000000000							
0142040	0000000000000000000000	0000000000002763711340	0000000000000000000000	0425322255167321422126							EZJ F#V
0142044	0425322255254201230216	0425322255253643523024	0425322255167434626471	0377676123163236734000	EZJ 0	EZJ ^	EZJ	-9?	3		ROLL DNT
0142050	0000000000000000000000	0000000000000000000000	0000000000000000007000	0511172304604021047124							
0142054	0700002464140000021420	0000000000000000000000	000000000000000000145	0000000000000000000000		SC #					
LOCATIONS 00142060 THROUGH 00142073 CONTAIN 00000000000000000000											
0142074	0004000000000000000000	0000000000001000000000	0000000040000000145000	0421041323047113231463							DD-19-33
0142100	00000000001100000000006	0041050204301034204162	0041640207300000000000	0000000000000000000000				E F			
LOCATIONS 00142104 THROUGH 00142403 CONTAIN 00000000000000000000											
0142404	1000000707070700000016	00000000000000000004423	0221032460000000000001	0400002224700100020600					\$CS	@ IN	!
0142410	0000010000000000120000	1001600000000000000000	0100000035222400001320	0000000000000000000000							
0142414	0000000100000000100001	0000000000000000000000	0000000000000000000000	0000000000000000000000							!
0142420	0000000000000000000000	1000000707070700000016	1000000707070700000016	000000000440500004441							!
0142424	0221142304340000000001	020000240510017773321	0000000000000000000000	000160000000000000063		\$LOG	PR				!
0142430	0100000000000000000000	0000000000000000000000	0000000000000000000001	0000000000000000000000							!
0142434	0000000000000000000063	0000000000000000000000	0000000000000000000000	100000070707070000016			3				!
0142440	1000000707070700000016	0000000000442300004501	0221123400000000000000	0610002464140100020600					A#IN	SC	!
0142444	0000010000000000253000	1000200000000000000000	0000000000000000134640	0000000000000000000000			V				!
0142450	0000000100000000100004	0000000000000000000000	0000000000000000000000	0000000000000000000000							
0142454	0000000000000000000000	1000000707070700000016	1000000707070700000022	0004000000000100000000							
0142460	0000000000000100000000	0000000560000000000000	0421041323047113231463	0000000001100000000003							DD-19-33
0142464	0037030174240761600000	0000000000000000000000	0000000000000000000000	0000000000000000000000							
0142470	0000000000000000000000	0000000000000000000000	0000000000000000000000	0000000000000000000000							
0142474	0000000000000000000000	0000000000000000000000	0000000000000000000000	1000000707070700000022							
0142500	1000000707070700000016	0000000000444100004517	0221172525200000000000	0600002405100100000000				!	O#OUT	' PR	
0142504	0000000000000000000000	0001600000000000000000	0000000000000000000000	0000000000000000000000							
0142510	0000000000000000000004	0000000000000000000000	00000000000000000003720	0000000000000000000000							
0142514	0000000000000000000000	1000000707070700000016	1000000707070700000016	000000000450100004535							A I
0142520	0221022304200000000000	000000246414017773203	0000010000000000247000	0001600000000000000000		\$BLD	SC			N	
0142524	0000000000000000124660	0000000000000000000000	0000000200000000000004	0000000000000000000001							
0142530	0000000000000000116100	0000000000000000000000	0000000000000000000000	1000000707070700000016			0				
0142534	1000000707070700000016	0000000000451700000000	0221042124112521600000	070001246414017773225				0	\$DEBUG	SC	
0142540	0000010000000000243000	0001600000000000000000	0000000000000000124700	0000000000000000000000			F				
0142544	0000000100000000100004	0000000000000000000001	0000000000000000116100	0000000000000000000000						@	
0142550	0000000000000000000000	1000000707070700000016	1000000707070700000022	0004000000000100000000							



0142554 0000000000000100000000 0000000520000000001000 0421041323047113231463 0000000001100000000001  
0142560 003710000000000000000000 0000000000000000000000 0000000000000000000000 0000000000000000000000  
0142564 000000000000000000000000 0000000000000000000000 0000000000000000000000 0000000000000000000000  
0142570 000000000000000000000000 0000000000000000000000 0000000000000000000000 10000007070700000022  
0142574 1000000707070700000022 0004000000000100000000 0000000000000100000000 000000052000000001000  
0142580 0421041323047113231463 0000000001100000000001 0037110000000000000000 0000000000000000000000 DD-19-33  
LOCATIONS 00142604 THROUGH 00142613 CONTAIN 0000000000000000000000  
0142614 000000000000000000000000 10000007070700000022 00000007070700002162 0000000000000000000000  
LOCATIONS 00142620 THROUGH 00144773 CONTAIN 0000000000000000000000  
0144774 000000000000000000000000 0000000000000000000000 0000000000000000000000 00000007070700002162

DD-19-33

DD-19-33

\*\*\* DMEM.FWA=303000,L=7000.

```

0303000 0415222025151000000000 0000000000000000072535 0000000000000217262754 0000000000000006340325 CRASH
0303004 0000000000000000000004 00000000000000000003 00000000000000000000 00000000000000000000
LOCATIONS 00303010 THROUGH 00303017 CONTAIN 00000000000000000000
0303020 0000000000133300000000 0000000003120000000021 0000000004500160000001 000000150210000000000
0303024 0000000000000000000000 0000000000000000000657 0000000000000000000020 000000000000000000006
0303030 00000000000000000000017 000000000000000000020 000000000000000000000 000000000000000000000
0303034 0200000000000000000000 000000000000000000017 000000000000000000040 000000000000000000176
0303040 0002000000000000000000 000000000000000000000 000000000000000000000 000000000000000000000
LOCATIONS 00303044 THROUGH 00303057 CONTAIN 00000000000000000000
0303060 0000000000000000000000 000000000000000000000 000000000000000000000 000000000000000006657
0303064 0000000000000000000000 000000000000000000000 00000000000000000324715 00000000000000000343636
0303070 0000000000000000000000 000000000000000000001 000000000000000000001 0421072104340000036102
0303074 0475202125110125047522 0400375321405400000000 0400455051050044000000 000004000000000000000 OPERATOR@ , e% e
0303100 00000000000000000004561 000000000000000000200 0000000000000000001074 000000000000000000000
LOCATIONS 00303104 THROUGH 00303167 CONTAIN 00000000000000000000
0303170 0000000000000000000000 000000000000000000000 000000000000000000000 0000000000000000001616
0303174 0000000000000000000000 000000000000000000000 000000000000000000000 000000000000000000000
LOCATIONS 00303200 THROUGH 00303277 CONTAIN 00000000000000000000
9.10 300 0425162504252200000000 0124120644252200000000 0060122504252200000000 0000122504252200000000 ENTER ER TER TER
304 0135162504252200000000 0111162504252200000000 0041162504252200000000 0100372504252200000000 NTER NTER NTER TER
310 0000000000000000000000 000000000000000000000 000000000000000000000 000000000000000000000
LOCATIONS 00303314 THROUGH 00303377 CONTAIN 00000000000000000000
0303400 0421160000000000000000 0501042340000000000000 0445040000000000000000 0425040000000000000000 DN PDN ID ED
0303404 0510000000000000000000 0534000000000000000000 0464000000000000000000 0525210000000000000000 R W M UQ
0303410 0425162504252200000000 0060140160602502400000 0074140420000101447000 0114060360002200042400 ENTER N E
0303414 0114060421003524000000 0114060500603505600000 0114050364252324600000 0110020520012324600000 S ESS SS
0303420 0110240241042006600000 000000000000000000000 000000000000000000000 000000000000000000000
LOCATIONS 00303424 THROUGH 00303477 CONTAIN 00000000000000000000
0303500 1000000000000000000000 000000000000000000000 000000000000000000000 0300000000000000000000 0
0303504 0000000000000000000000 000000000000000000000 000000000000000000000 000000000000000000000
0303510 0000000000000000000000 030000000000000000000 000000000000000000000 000000000000000000000 0
LOCATIONS 00303514 THROUGH 00303577 CONTAIN 00000000000000000000
0303600 1000000000000000000000 100000000000000000000 100000000000000000000 100000000000000000000
0303604 100000000000000000000 100000000000000000000 100000000000000000000 000000000000000000001
0303610 000000000000000000001 100000000000000000000 000000000000000000001 000000000000000000000
LOCATIONS 00303614 THROUGH 00303677 CONTAIN 00000000000000000000
0303700 0000000000000000000650 0000000000000000000660 0000000000000000000662 0000000000000000001230
0303704 0000000000000000000673 0000000000000000000674 0000000000000000000675 0000000000000000001231
0303710 0000000000000000001232 0000000000000000000651 0000000000000000001642 000000000000000000000
LOCATIONS 00303714 THROUGH 00303777 CONTAIN 00000000000000000000
0304000 0000000000000000000657 0000000000000000000660 0000000000000000000662 0000000000000000001230
0304004 0000000000000000000673 0000000000000000000674 0000000000000000000675 0000000000000000001231

```

0304010 0000000000000000001232 0000000000000000000650 0000000000000000001642 0000000000000000000000  
 LOCATIONS 00304014 THROUGH 00304077 CONTAIN 000000000000000000000000

0304100 0000000000000000000657 0000000000000000000661 0000000000000000000662 0000000000000000001230  
 0304104 0000000000000000000673 0000000000000000000674 0000000000000000000675 0000000000000000001231  
 0304110 0000000000000000001232 0000000000000000000650 0000000000000000001642 0000000000000000000000  
 LOCATIONS 00304114 THROUGH 00304177 CONTAIN 000000000000000000000000

0304200 0405232464450723400000 0000000000000000000017 042116000000000000000000 0000000000000000000007 ASSIGN DN  
 0304204 0221112340000000000000 0000000000000000000017 040100000000000000000000 0000000000000000000007 \$IN A  
 0304210 0431241403240000000000 0000000000000000000017 046115000000000000000000 0000000000000000000007 FT05 LM  
 0304214 0300000000000000000000 00000000000000000000037 0000000000000000000000 0000000000000000000000 0

LOCATIONS 00304220 THROUGH 00304317 CONTAIN 000000000000000000000000

0304320 02210324600000000000001 000000000000000000002000 000000000000000000100002000 0000000000000000000002012 \$CS  
 0304324 00000000000000000003000 10000000000000000002013 000000000000000000000000 000020000000000000000000  
 0304330 10000000000000000002011 000000000000000000000000 0000000033651400264660 000000000000000000000000 L  
 0304334 00000000000000000352545 0000000026740600036102 0020000000700500007017 100000000000000000000000 <B

0304340 0221142364340000000001 00000100000000000003000 00000000000000000003130 00000000000000000003000 \$LOG X  
 0304344 00000000000000000004000 10400000000000000003127 000000000000000000000000 000000000000000000000000 W  
 0304350 10400000000000000003120 000000000000000000000000 0000000035636600000712 000000000000000000000000 P  
 0304354 0000000000000000000000 0000000026742400036102 000000000000000000000000 000000000000000000000000 <B

6 030 0415172405452200000000 1000000000000000000200 0000000000000000000200 1777777777777700000200 COPYR  
 1.1 031 00000000000000000004200 000000000000000000000000 000000000000000000000000 000000000000000000000000  
 370 0000000000000000000000 000000000000000000000000 0000000033602000007200 000000000000000000000000

0304374 00000000000000000352545 1777777777777777521200 0002000000720000007210 000000000000000000000000

LOCATIONS 00304400 THROUGH 00304437 CONTAIN 000000000000000000000000

0304440 0000000000000000000000 0000000000000000000263000 000000000000000000036102 000000000000000000272000 <B  
 0304444 00000000000000000004520 000000000000000000335713 0000000000000000000010 0000000000000000000005 P  
 0304450 0000000000000000000000 0415172405452200000000 0415172405452200000000 000000000000000000000000 COPYR COPYR  
 0304454 0000000000001400177700 1777777776000000000000 000000000000000000177700 0000000000001400177700  
 0304460 0000000000000000000000 0000000000000000000000 0000000000000000000000 0000000000000000000000

LOCATIONS 00304464 THROUGH 00304657 CONTAIN 000000000000000000000000

0304660 0415172405452213400000 0000000000000000000000 0000000000000000000000 0000000000000000000000 COPYR.  
 LOCATIONS 00304664 THROUGH 00304673 CONTAIN 000000000000000000000000

0304674 0000000000647500136000 0000020012600000125600 000004000000000125570 0000000000000000000000 =  
 LOCATIONS 00304700 THROUGH 00304737 CONTAIN 000000000000000000000000

0304740 00000000000000000334257 0000000000000000000000 0000000000000000000000 00000000000000000007643  
 0304744 00000000000000000267442 0000000000000000000000 0000000000000000000000 0000000000000000000000  
 LOCATIONS 00304750 THROUGH 00304777 CONTAIN 000000000000000000000000

0305000 0000000000000000000002 0451172042411223436503 0511012464405100000000 1030000000000000000003 JOB (JN=CRASH)  
 0305004 0405032064252324624104 0470752064752026251054 0425162504252212200000 1020000000000000000001 ACCESS (DN=COPYR, ENTER)  
 0305010 0415172405452213400000 1020000000000000000001 0425302225205600000000 1030000000000000000001 COPYR. EXIT.  
 0305014 0425302225205600000000 1030000000000000000000 1600000000000000000000 1700000000000000000000 EXIT.  
 0305020 0000000000000000000000 0000000000000000000000 0000000000000000000000 0000000000000000000000

3  
3  
3

DMEM FWA=0303000 LWA=0311777 LE=0000

DUMP ID = SYSDUMP

FDUMP 1.06

06/25/79

16:58:58

PAGE 130

DATE = 06/21/79

TIME = 21:13:41

LOCATIONS 00305024 THROUGH 00305777 CONTAIN 00000000000000000000

0306000	00000000000000000000000016	0200401002004010020040	0310611643046216431062	0200401002004010030056			21:12:22	0
0306004	0300601403004010020040	0415232402004010020040	0200401002004010020040	0415222025445514220040	0000	CSP		CRAY-1
0306010	0515052444450123026461	0310401002004010020040	041522222005510046505	0471042365210110044105		SERIAL-12		CRI - MENDOTA HE
0306014	0445072205212313020115	0445162342704010020040	0300661363106113633471	100000000000000000000006		IGHTS, MINN.		06/21/79
0306020	0200401002004010020040	0310611643046216431062	0200401002004010030056	0300601403004010020040			21:12:22	0.0000
0306024	0415232402004010020040	0200401002004010020040	100000000000000000000016	0200401002004010020040		CSP		
0306030	0310611643046216431062	0200401002004010030056	0300601403004010020040	0415232402004010020040	21:12:22		0.0000	CSP
0306034	0200401002004010020040	0415222025445514220040	0475202125110125044516	0434402465452325042515		CRAY-1 OPERATING SYSTEM		
0306040	0200401002004010020040	0415172462006113430066	0200402025152321246502	0461311004210125042440		COS 1.06 ASSEMBLY DATE		
0306044	0300661363106013633471	100000000000000000000006	0200401002004010020040	0310611643046216431062	06/20/79			21:12:22
0306050	0200401002004010030056	0300601403004010020040	0415232402004010020040	0200401002004010020040	0.0000	CSP		
0306054	100000000000000000000006	0200401002004010020040	0310611643046216431062	0200401002004010030056			21:12:22	0.
0306060	0300601403004010020040	0415232402004010020040	0200401002004010020040	100000000000000000000007	0000	CSP		
0306064	0200401002004010020040	0310611643046216431062	0200401002004010030056	0300601403004010020040			21:12:22	0.0000
0306070	0415232402004010020040	0451172042411223436503	0511012464405110020040	100000000000000000000010		CSP		JOB (JN=CRASH)
0306074	0200401002004010020040	0310611643046216431062	0200401002004010030056	0300601403104010020040			21:12:22	0.0002
0306100	0415232402004010020040	0405032064252324624104	0470752064752026251054	0425162504252212220040		CSP		ACCESS (DN=COPYR, EHTER)
0306104	1000000000000000000000013	0200401002004010020040	0310611643046216431062	0200401002004010030056			21:12:22	0.
0306110	0300601403144010020040	0501042322004010020040	0501041403006110026440	0405032064252324620040	0003	PDM		PD001 - ACCESS
0306114	0415172405452210020040	0200401002004010020040	0425041723006014031440	0415172325011421252105		COPYR		ED=0003 COMPLETE
0306120	100000000000000000000006	0200401002004010020040	0310611643046216431062	0200401002004010030056			21:12:22	0.
0306124	0300601403144010020040	0415232402004010020040	0415172405452213420040	100000000000000000000000	0003	CSP		COPYR.
0306130	000000000000000000000000	000000000000000000000000	000000000000000000000000	000000000000000000000000				

LOCATIONS 00306134 THROUGH 00306777 CONTAIN 00000000000000000000

0307000 001777000000000000007000 0000000000000000000000 000000000000000000000000 000000000000000000000000

LOCATIONS 00307004 THROUGH 00307403 CONTAIN 00000000000000000000

0307404	1000000707070700000016	0000000000000000004423	0221032460000000000001	0400002224700200021400				\$CS @ IN #
0307410	0000010000000000265000	1001600000000000000000	0100000035222400001320	0000000000000000000000				
0307414	0000000100000000100001	0000000000000000000000	0000000000000000000000	0000000000000000000000				
0307420	0000000000000000000000	1000000707070700000016	1000000707070700000016	000000000440500004441				!
0307424	0221142364340000000001	020000240510027773321	0000000000000000000000	0001600000000000000063	\$LOG	FR		3
0307430	0100000000000000000000	0000000000000000000000	0000000000000000000001	0000000000000000000000				
0307434	0000000000000000000063	0000000000000000000000	0000000000000000000000	1000000707070700000016		3		
0307440	1000000707070700000016	0000000000442300004501	0221112340000000000000	0610002464140200021400			A\$IN	SC #
0307444	000001000000000420000	1000200000000000000000	0000000000000000134640	0000000000000000000000				
0307450	000000010000000100004	0000000000000000000000	0000000000000000000000	0000000000000000000000				
0307454	0000000000000000000000	1000000707070700000016	1000000707070700000022	0004000000002000000000				
0307460	0000000000000100000000	0000000560000000000000	0421041323047113231463	0000000011000000000003				DD-19-33
0307464	003720017504076400000	0000000000000000000000	0000000000000000000000	0000000000000000000000				
0307470	0000000000000000000000	0000000000000000000000	0000000000000000000000	0000000000000000000000				
0307474	0000000000000000000000	0000000000000000000000	0000000000000000000000	1000000707070700000022				

```

0307500 1000000707070700000016 0000000000444100004517 0221172525200000000000 0600002405100200000000      ! 0#OUT ' PR
0307504 000000000000000000000000 000160000000000000000000 0000000000000000000000 0000000000000000000000
0307510 000000000000000000000004 0000000000000000000000 0000000000000000003720 0000000000000000000000
0307514 000000000000000000000000 100000707070700000016 100000707070700000016 0000000000450100000000      A
0307520 0415172405452200000000 100000246414017773243 0000020000000000272200 1000200000000000000000 COPYR SC
0307524 00400000000000000001360 0000000000000000000000 0000000100000000200004 0000000000000000000004
0307530 0000000000400000116100 0000000000000000000000 0000000000000000000000 100000707070700000016      e
0307534 1000000707070700000022 0004000000000200000000 0000007424000100035405 0000000520000000004000      @ ;
0307540 0421041323047113231463 0000000001100000000001 0020130000000000000000 0000000000000000000000 DD-19-33
      LOCATIONS 00307544 THROUGH 00307553 CONTAIN 0000000000000000000000
0307554 000000000000000000000000 100000707070700000022 000000707070700002222 0000000000000000000000
      LOCATIONS 00307560 THROUGH 00311773 CONTAIN 0000000000000000000000
0311774 0000000000000000000000 0000000000000000000000 0000000000000000000000 0000000707070700002222

```

9.13

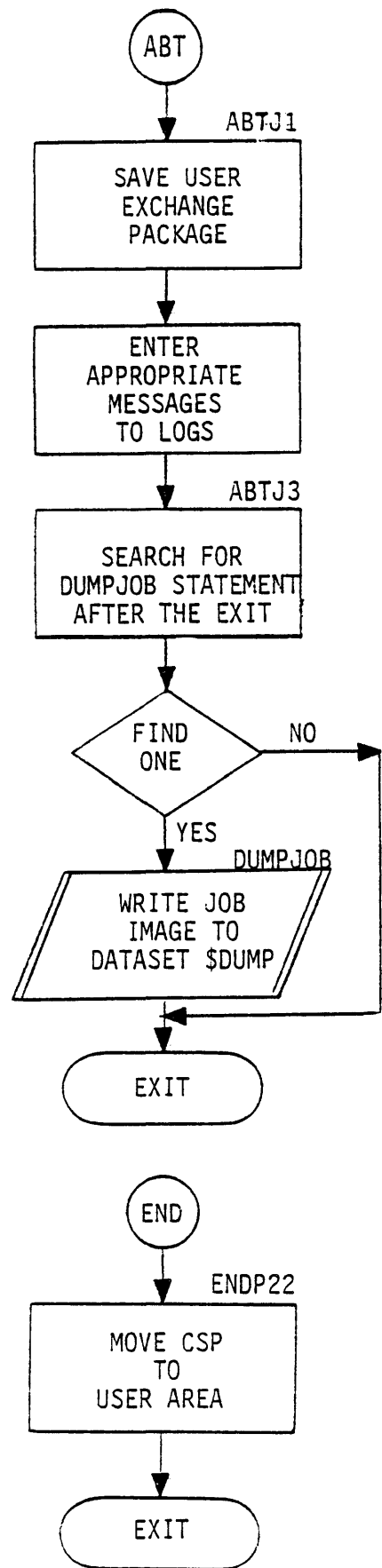
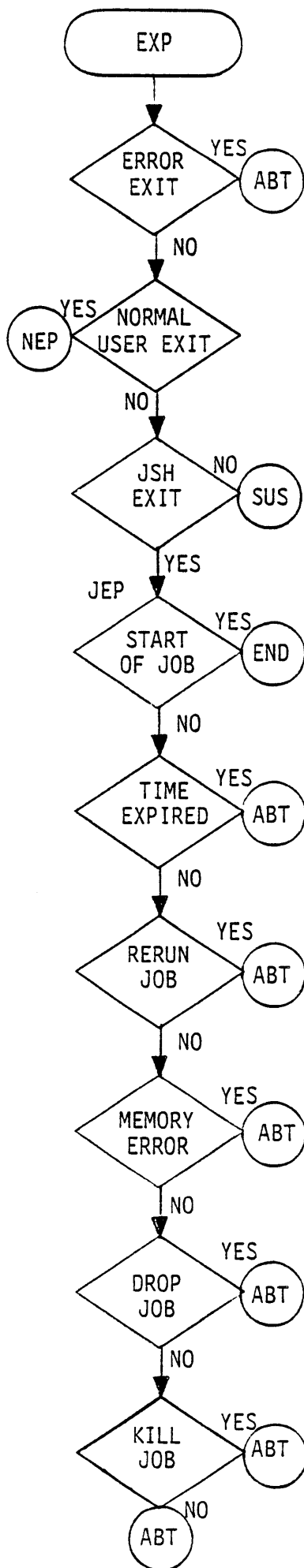
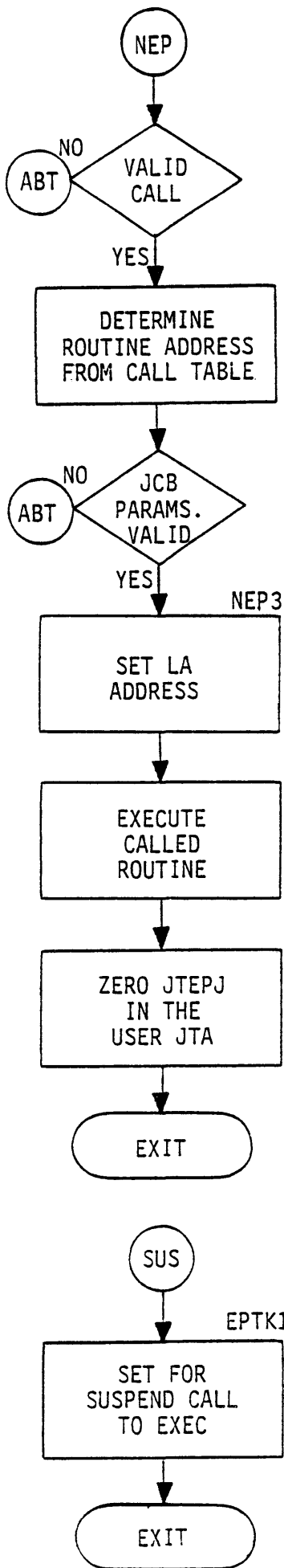


## USER ERROR EXIT

- A JOB EXECUTES AN ERROR EXIT (ERR) INSTRUCTION OR ENCOUNTERS A HARDWARE DETECTED ERROR
- EXP ISSUES APPROPRIATE ERROR MESSAGES
- EXP MAY INITIATE JOB ABORT OR REPRIEVE PROCESSING
- EXP MAY SEARCH THE REMAINING JOB CONTROL STATEMENTS FOR AN EXIT OR END-OF-FILE
- IF EXIT IS FOUND EXP EXAMINES THE NEXT STATEMENT
- IF THE NEXT STATEMENT IS 'DUMPJOB' A DATASET NAMED \$DUMP IS WRITTEN TO DISK IN BINARY
- \$DUMP IS A BINARY UNBLOCKED DATASET AND CONTAINS THE JTA AND ENTIRE USER FIELD (BA-LA) OF THE ABORTED JOB
- \$DUMP MAY THEN BE USED BY THE 'DUMP' CONTROL STATEMENT TO OUTPUT VARIOUS AREAS OF THE ABORTED PROGRAM
- IF REPRIEVE PROCESSING, EXP TRANSFERS CONTROL BACK TO THE USER JOB AT THE ADDRESS SPECIFIED IN THE REPRIEVE MACRO









MESSAGE PROCESSOR (MSG)



## MESSAGE PROCESSOR (MSG)

- WRITES MESSAGES IN THE SYSTEM AND USER LOG FILES.
- CAN BE CALLED BY OTHER TASKS AND USERS(THROUGH EXP).
- MSG USES TIO WHEN PERFORMING I/O.
- THE SYSTEM LOG CAN BE ANALYZED BY THE 'EXTRACT' PROGRAM.
- USERS CAN ENTER MESSAGES IN THE SYSTEM AND/OR USER LOG.

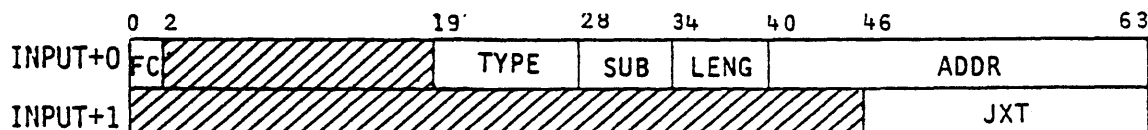


# SYSTEM LOG PROCESSING

- THE SYSTEM LOG IS A PERMANENT DATASET NAMED \$SYSTEMLOG
- THE SYSTEM LOG BUFFER AND DSP ARE ALLOCATED IN HIGH MEMORY.
- A TASK CALLS MSG THROUGH THE TSKREQ ROUTINE WITH THE FOLLOWING REGISTERS SET:

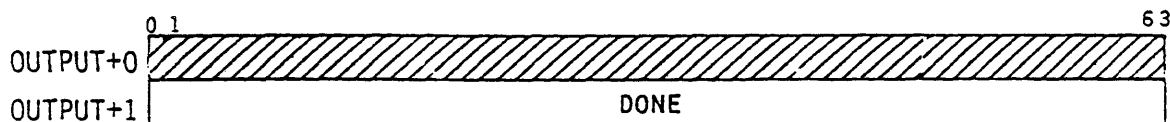
(A1) ID of task requesting message entry  
 (A2) MSGID,0  
 (S1) INPUT+0 } request  
 (S2) INPUT+1 }

Request format:



<u>Field</u>	<u>Word</u>	<u>Bits</u>	<u>Description</u>
FC	INPUT+0	0-1	Function code: 1 Write message in user's logfile only 2 Write message in SYSTEMLOG only 3 Write message in both user's logfile and in SYSTEMLOG
TYPE	INPUT+0	19-27	Major class of log record
SUB	INPUT+0	28-33	Subtype of log record
LENGTH	INPUT+0	34-39	Length in words of message. If length is 0, the message is a character string terminated by a zero byte in the low-order eight bits.
ADDR	INPUT+0	40-63	Starting address relative to STP of message to be written
JXT	INPUT+1	46-63	JXT address if message associated with job; otherwise 0

Reply format:



<u>Field</u>	<u>Word</u>	<u>Bits</u>	<u>Description</u>
DONE	OUTPUT+1	0-63	Characters 'MSG DONE' in ASCII





## USER LOG PROCESSING

- THE USER LOG (\$LOG) IS CREATED BY JSH FOR EACH USER JOB.
- THE USER LOG BUFFER IS IN THE JOB'S JTA.
- THE USER CALLS MSG VIA THE 'MESSAGE' MACRO:

### MESSAGE - ENTER MESSAGE IN LOGFILE

The printable ASCII message at the location specified in the macro call is entered in the job and system logfile. The message must be 1-80 characters terminated by a zero byte. A flag, *loc*, indicates the destination for the message.

Format:

Location	Result	Operand
	MESSAGE	<i>address, loc</i>

*address*      A symbol or an A, S, or T register that contains the address.

*loc*            Destination for message. May be any of the following:  
                 U    User logfile only  
                 S    System logfile only  
                 US   User and system logfiles; default, if *loc* is blank.



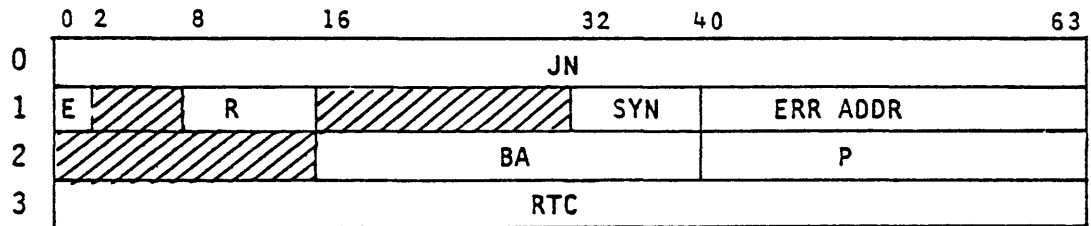
MEMORY ERROR PROCESSOR (MEP)

DISK ERROR CORRECTION (DEC)



## MEMORY ERROR PROCESSOR (MEP)

- PURPOSE IS TO RELAY MEMORY ERROR INFORMATION FROM EXEC TO MSG.
- MESSAGES FROM EXEC TO MSG ARE IN THE FORMAT:

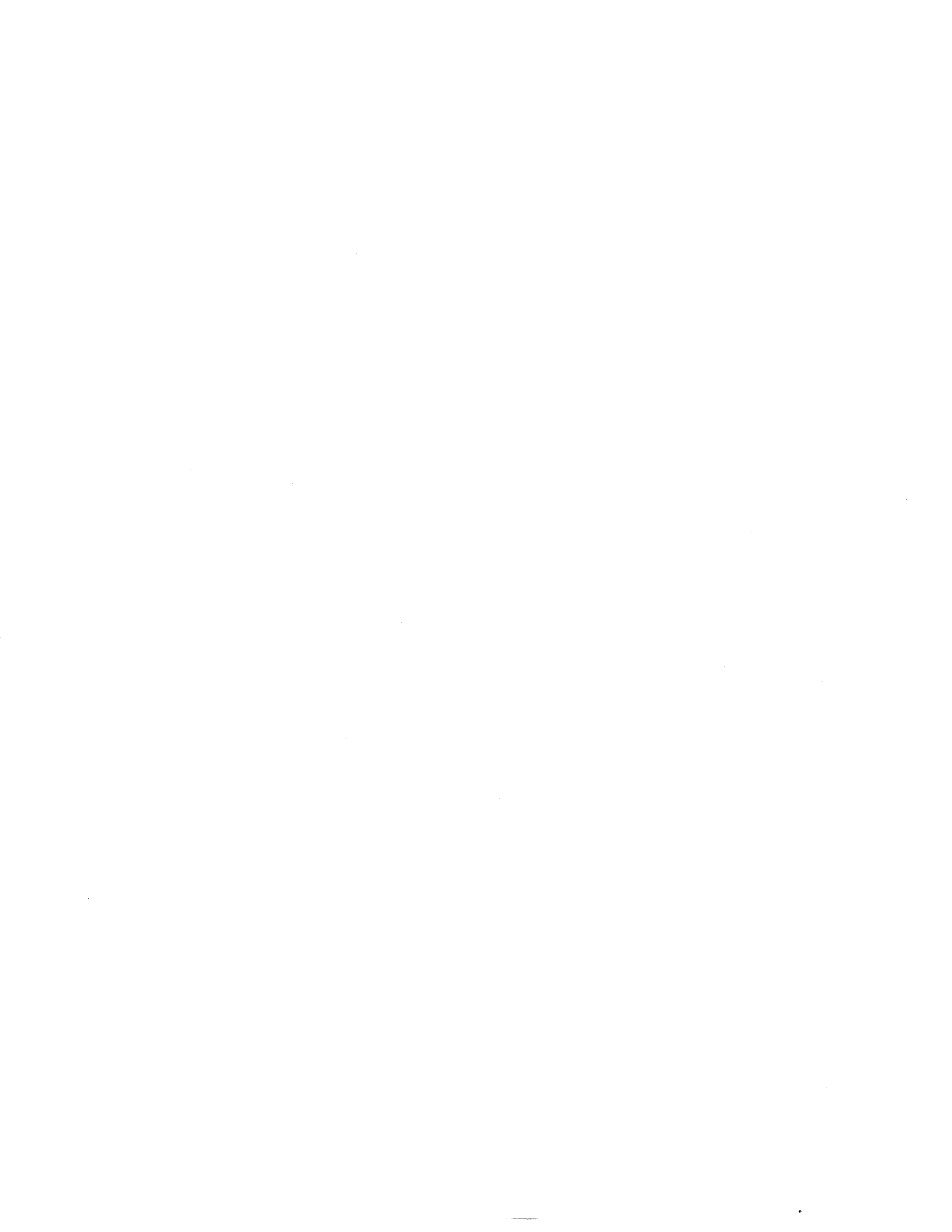


<u>Field</u>	<u>Word</u>	<u>Bits</u>	<u>Significance</u>
JN	0	0-63	Jobname or 'STP'
E	1	0,1	Error type (binary): 10 Uncorrectable memory error 01 Correctable memory error
R	1	8-15	Read mode: 0 Scalar 1 I/O 2 Vector 3 Fetch
SYN	1	32-39	Syndrome bits
ERR ADDR	1	40-63	Error address
BA	2	26-39	Base address
P	2	40-63	Program address
RTC	3	0-63	Real-time clock



## DISK ERROR CORRECTION (DEC)

- ATTEMPTS CORRECTION OF A DATA ERROR FROM DISK.
- USES CYCLIC REDUNDANCY CHECKWORDS (CRC) FOR ERROR CORRECTION.
- DQM SCHEDULES DEC IF NORMAL RECOVERY PROCEDURES ARE UNSUCCESSFUL.
- DQM PASSES THE EQT ADDRESS WHICH CONTAINS THE VALID CHECKWORDS.
- DEC PROCESSES ONE DISK ERROR AT A TIME.
- REFER TO MASS STORAGE SUBSYSTEM REFERENCE MANUAL 2240630 FOR THE CRC ALGORITHM.





SYSTEM PERFORMANCE MONITOR



## SYSTEM PERFORMANCE MONITOR

- MEASURES OVERALL SYSTEM PERFORMANCE
- INVOKED ON A TIME DELAY BASIS
- DELAY INTERVAL BETWEEN COLLECTIONS IS (I@SPMDLY)
- USES MESSAGE TASK TO WRITE SYSTEM TIMES TO THE SYSTEMLOG
- USES POOL 1 AS A BUFFER FOR THE SYSTEM TIMES
- MEASUREMENTS COLLECTED BY SPM INCLUDE

CPU UTILIZATION

NUMBER OF TASK READIES

NUMBER OF EXEC REQUESTS BY TASK

NUMBER OF EXEC REQUESTS BY TYPE

MEMORY UTILIZATION

CHANNEL INTERRUPT COUNT

DISK CHANNEL UTILIZATION

DISK UNIT UTILIZATION

LINK UTILIZATION

USER CALL USAGE

JOB SCHEDULER STATISTICS

JOB CLASS STATISTICS



```

11:12:02.9094 EXECUTIVE REQUESTS TIME INTERVAL = 60012.18 MILLISECONDS
NUMBER OF TASK 0 REQUESTS = 0
NUMBER OF TASK 1 REQUESTS = 313
NUMBER OF TASK 2 REQUESTS = 1370
NUMBER OF TASK 3 REQUESTS = 266
NUMBER OF TASK 4 REQUESTS = 0
NUMBER OF TASK 5 REQUESTS = 715
NUMBER OF TASK 6 REQUESTS = 576
NUMBER OF TASK 7 REQUESTS = 0
NUMBER OF TASK 8 REQUESTS = 21
NUMBER OF TASK 9 REQUESTS = 2239
NUMBER OF TASK 10 REQUESTS = 0

```

```

11:12:02.9096 TASK UTILIZATION TIME INTERVAL = 60012.18 MILLISECONDS
NUMBER OF TASK 0 READIES = 0
NUMBER OF TASK 1 READIES = 129
NUMBER OF TASK 2 READIES = 488
NUMBER OF TASK 3 READIES = 86
NUMBER OF TASK 4 READIES = 0
NUMBER OF TASK 5 READIES = 297
NUMBER OF TASK 6 READIES = 156
NUMBER OF TASK 7 READIES = 0
NUMBER OF TASK 8 READIES = 3
NUMBER OF TASK 9 READIES = 410
NUMBER OF TASK 10 READIES = 0

```

```

11:12:02.9099 CPU UTILIZATION TIME INTERVAL = 60012.18 MILLISECONDS
USER TIME = 60134.40 MSEC 100.20%
IDLE TIME = 0.00 MSEC 0.00%
BLOCKED TIME = 0.00 MSEC 0.00%
EXEC TIME = 151.90 MSEC 0.25%
TASK 0 TIME = 0.00 MSEC 0.00%
TASK 1 TIME = 16.42 MSEC 0.03%
TASK 2 TIME = 25.84 MSEC 0.04%
TASK 3 TIME = 4.39 MSEC 0.01%
TASK 4 TIME = 0.00 MSEC 0.00%
TASK 5 TIME = 14.25 MSEC 0.02%
TASK 6 TIME = 17.61 MSEC 0.03%
TASK 7 TIME = 0.00 MSEC 0.00%
TASK 8 TIME = 0.41 MSEC 0.00%
TASK 9 TIME = 48.38 MSEC 0.08%
TASK 10 TIME = 0.00 MSEC 0.00%
TIME NOT ACCOUNTED FOR = -402.02 MSEC -0.67%

```

----- END OF EXTRACT REPORT

43892 RECORDS READ FROM \$SYSLOG

49 RECORDS WRITTEN ON \$OUT

Listing of all subtypes of SPM records

```

11:12:02.9087 CHANNEL INTERRUPT COUNTS TIME INTERVAL = 60012.18 MILLISECONDS
CHANNEL 0 = 0 CHANNEL 17 = 0
CHANNEL 1 = 0 CHANNEL 18 = 0
CHANNEL 2 = 118 CHANNEL 19 = 0
CHANNEL 3 = 116 CHANNEL 20 = 0
CHANNEL 4 = 611 CHANNEL 21 = 0
CHANNEL 5 = 684 CHANNEL 22 = 0
CHANNEL 6 = 1819 CHANNEL 23 = 0
CHANNEL 7 = 1090 CHANNEL 24 = 0
CHANNEL 8 = 0 CHANNEL 25 = 0
CHANNEL 9 = 0 CHANNEL 26 = 5627
CHANNEL 10 = 0 CHANNEL 27 = 0
CHANNEL 11 = 0 CHANNEL 28 = 0
CHANNEL 12 = 0 CHANNEL 29 = 0
CHANNEL 13 = 0 CHANNEL 30 = 486
CHANNEL 14 = 0 CHANNEL 31 = 0
CHANNEL 15 = 0 CHANNEL 32 = 0
CHANNEL 16 = 0 CHANNEL 33 = 0

```

```

11:12:02.9090 EXEC CALL USAGE TIME INTERVAL = 60012.18 MILLISECONDS
NUMBER OF TYPE 0 CALLS = 0 NUMBER OF TYPE 17 CALLS = 0
NUMBER OF TYPE 1 CALLS = 0 NUMBER OF TYPE 18 CALLS = 0
NUMBER OF TYPE 2 CALLS = 905 NUMBER OF TYPE 19 CALLS = 0
NUMBER OF TYPE 3 CALLS = 1172 NUMBER OF TYPE 20 CALLS = 0
NUMBER OF TYPE 4 CALLS = 0 NUMBER OF TYPE 21 CALLS = 0
NUMBER OF TYPE 5 CALLS = 104 NUMBER OF TYPE 22 CALLS = 0
NUMBER OF TYPE 6 CALLS = 370 NUMBER OF TYPE 23 CALLS = 0
NUMBER OF TYPE 7 CALLS = 0 NUMBER OF TYPE 24 CALLS = 0
NUMBER OF TYPE 8 CALLS = 24 NUMBER OF TYPE 25 CALLS = 0
NUMBER OF TYPE 9 CALLS = 176 NUMBER OF TYPE 26 CALLS = 0
NUMBER OF TYPE 10 CALLS = 24 NUMBER OF TYPE 27 CALLS = 0
NUMBER OF TYPE 11 CALLS = 0 NUMBER OF TYPE 28 CALLS = 1
NUMBER OF TYPE 12 CALLS = 0 NUMBER OF TYPE 29 CALLS = 1
NUMBER OF TYPE 13 CALLS = 108 NUMBER OF TYPE 30 CALLS = 1
NUMBER OF TYPE 14 CALLS = 307 NUMBER OF TYPE 31 CALLS = 1
NUMBER OF TYPE 15 CALLS = 307 NUMBER OF TYPE 32 CALLS = 1
NUMBER OF TYPE 16 CALLS = 1997

```

```

11:12:02.9092 DISK CHANNEL UTILIZATION TIME INTERVAL = 60012.18 MILLISECONDS
CHANNEL 0 = 0.00 MSEC 0.00%
CHANNEL 1 = 0.00 MSEC 0.00%
CHANNEL 2 = 2559.79 MSEC 4.27%
CHANNEL 3 = 1426.73 MSEC 2.38%
CHANNEL 4 = 0.00 MSEC 0.00%
CHANNEL 5 = 0.00 MSEC 0.00%
CHANNEL 6 = 0.00 MSEC 0.00%
CHANNEL 7 = 0.00 MSEC 0.00%
CHANNEL 8 = 0.00 MSEC 0.00%
CHANNEL 9 = 0.00 MSEC 0.00%
CHANNEL 10 = 0.00 MSEC 0.00%
CHANNEL 11 = 0.00 MSEC 0.00%

```

Listing of all subtypes of SPM records (continued)

08:54:24.8568

MEMORY UTILIZATION

TIME INTERVAL = 300006.12 MILLISECONDS

EXECUTE MEMORY INTEGRAL = 0.10355550E+02 MWS 8.944 % UTILIZATION  
 I/O WAIT MEMORY INTEGRAL = 0.13730810E+02 MWS 11.950 % UTILIZATION  
 CPU WAIT MEMORY INTEGRAL = 0.28333448E+02 MWS 24.473 % UTILIZATION  
 AVAILABLE MEMORY INTEGRAL = 0.11577656E+03 MWS

08:54:24.8570

DISK UTILIZATION

TIME INTERVAL = 300006.12 MILLISECONDS

LDU	RATE	%SEEK	%TRANS	% TOTAL	# REQS	# ON-CYL	% FREE	% PERM	BLKS/REQ
DD-19-20	0.103957 MWS/S	38.34	29.50	67.84	5348	773	6.76	0.00	11.38
DD-19-30	0.064985 MWS/S	9.09	14.75	23.85	3476	290	12.26	0.00	10.95
DD-19-40	0.104673 MWS/S	11.78	27.04	38.82	3203	376	23.22	0.00	13.12
DD-19-50	0.000000 MWS/S	0.00	0.00	0.00	0	0	100.00	0.00	0.00
DD-29-21	0.032098 MWS/S	9.72	7.91	17.63	1533	266	56.03	0.00	12.22
DD-19-31	0.040775 MWS/S	9.40	11.62	21.03	2426	289	32.09	0.00	9.85
DD-19-41	0.007004 MWS/S	8.39	4.73	13.12	2183	713	20.15	0.00	1.88
DD-19-51	0.000000 MWS/S	0.00	0.00	0.00	0	0	100.00	0.00	0.00
DD-19-22	0.000000 MWS/S	0.00	0.00	0.00	0	0	100.00	0.00	0.00
DD-19-32	0.000000 MWS/S	0.00	0.00	0.00	0	0	100.00	0.00	0.00
DD-19-42	0.000000 MWS/S	0.00	0.00	0.00	0	0	100.00	0.00	0.00
DD-19-52	0.000000 MWS/S	0.00	0.00	0.00	0	0	100.00	0.00	0.00
DD-19-23	0.000000 MWS/S	0.00	0.00	0.00	0	0	100.00	0.00	0.00
DD-19-33	0.000000 MWS/S	0.00	0.00	0.00	0	0	100.00	0.00	0.00
DD-19-43	0.000000 MWS/S	0.00	0.00	0.00	0	0	100.00	0.00	0.00
DD-19-53	0.000000 MWS/S	0.00	0.00	0.00	0	0	100.00	0.00	0.00

0.053392 MWS/S

71.61 0.00

08:54:24.8577

LINK UTILIZATION

TIME INTERVAL = 300006.12 MILLISECONDS

LINK	TOTAL #	GROSS RATE	-OUTPUT DATA NET RATE--	--INPUT DATA NET RATE--
IDNT	MESSAGES	(MBITS/S)	WORDS SENT (MBITS/S)	WORDS RCVD (MBITS/S)
M6	152	0.001105	3299	0.000704
US	1372	0.014410	34197	0.007295
IC	2918	0.009560	4903	0.001046
EB	0	0.000000	0	0.000000
DG	796	0.003017	4496	0.000957
JB	63	0.000220	264	0.000056

Listing of all subtypes of SPM records (continued)

08:54:24.8591      USER CALL USAGE      TIME INTERVAL =    300006.12 MILLISECONDS

NUMBER OF TYPE 0 CALLS =	0	NUMBER OF TYPE 25 CALLS =	0
NUMBER OF TYPE 1 CALLS =	1	NUMBER OF TYPE 26 CALLS =	0
NUMBER OF TYPE 2 CALLS =	92	NUMBER OF TYPE 27 CALLS =	8
NUMBER OF TYPE 3 CALLS =	83	NUMBER OF TYPE 28 CALLS =	13832
NUMBER OF TYPE 4 CALLS =	691	NUMBER OF TYPE 29 CALLS =	0
NUMBER OF TYPE 5 CALLS =	2720	NUMBER OF TYPE 30 CALLS =	0
NUMBER OF TYPE 6 CALLS =	7	NUMBER OF TYPE 31 CALLS =	0
NUMBER OF TYPE 7 CALLS =	0	NUMBER OF TYPE 32 CALLS =	0
NUMBER OF TYPE 8 CALLS =	656	NUMBER OF TYPE 33 CALLS =	778
NUMBER OF TYPE 9 CALLS =	26	NUMBER OF TYPE 34 CALLS =	21
NUMBER OF TYPE 10 CALLS =	178	NUMBER OF TYPE 35 CALLS =	0
NUMBER OF TYPE 11 CALLS =	593	NUMBER OF TYPE 36 CALLS =	0
NUMBER OF TYPE 12 CALLS =	480	NUMBER OF TYPE 37 CALLS =	1
NUMBER OF TYPE 13 CALLS =	0	NUMBER OF TYPE 38 CALLS =	204
NUMBER OF TYPE 14 CALLS =	2099	NUMBER OF TYPE 39 CALLS =	9
NUMBER OF TYPE 15 CALLS =	0	NUMBER OF TYPE 40 CALLS =	0
NUMBER OF TYPE 16 CALLS =	38	NUMBER OF TYPE 41 CALLS =	0
NUMBER OF TYPE 17 CALLS =	46	NUMBER OF TYPE 42 CALLS =	88
NUMBER OF TYPE 18 CALLS =	2338	NUMBER OF TYPE 43 CALLS =	0
NUMBER OF TYPE 19 CALLS =	2105	NUMBER OF TYPE 44 CALLS =	0
NUMBER OF TYPE 20 CALLS =	825	NUMBER OF TYPE 45 CALLS =	312
NUMBER OF TYPE 21 CALLS =	3	NUMBER OF TYPE 46 CALLS =	203
NUMBER OF TYPE 22 CALLS =	2	NUMBER OF TYPE 47 CALLS =	0
NUMBER OF TYPE 23 CALLS =	118773	NUMBER OF TYPE 48 CALLS =	0
NUMBER OF TYPE 24 CALLS =	11		

08:49:24.8529      JOB CLASS STATISTICS      TIME INTERVAL =    300006.14 MILLISECONDS

CLASS NAME =		OPERATR
NUMBER OF ACTIVE JXTS =	0	
NUMBER OF JOBS WAITING FOR JXTS =	0	
NUMBER OF RESERVED JXTS =	1	
MAXIMUM NUMBER OF JXTS =	64	
STATUS =		ON

08:54:24.8586      JOB SCHEDULER STATISTICS      TIME INTERVAL =    300006.12 MILLISECONDS

NUMBER OF MEMORY COMPACTS =	6756
NUMBER OF ROLLS =	1268
NUMBER OF EXPANDS =	14
NUMBER OF REDUCES =	2
NUMBER OF INITIATES =	9
NUMBER OF TERMINATES =	6
NUMBER OF SCHEDULING INTERVALS =	60
NUMBER OF INDEX WRITES =	212
CLASS STRUCTURE NAME =	DAY
NUMBER OF JOBS IN SYSTEM =	38
NUMBER OF ACTIVE JXTS =	22
MAXIMUM # JXTS (LIMIT)	30
NUMBER OF AVAILABLE POOL JXTS =	3
NUMBER OF DEFINED CLASSES =	14
NUMBER OF CLASSES WAITING FOR JXTS =	65535

Listing of all subtypes of SPM records (continued)



OVERLAY MANAGER



## OVERLAY MANAGER (OVM)

- CONTROLS THE LOADING OF TASK OVERLAYS.
- EACH TASK USING OVM MUST RESERVE A MEMORY AREA SUFFICIENT TO HOLD ONE OR MORE DISK BLOCKS (512 WORDS) AS AN OVERLAY AREA.
- OVERLAYS MAY BE NESTED UP TO TEN DEEP, THAT IS OVERLAY X MAY CALL OVERLAY Y, ETC.
- AN OVERLAY MAY CALL ANOTHER OVERLAY WITH OR WITHOUT RETURN REQUESTED TO ITSELF.
- ONCE IN MEMORY AN OVERLAY MAY OR MAY NOT BE RELOADED FROM DISK DEPENDENT ON CHANGES IN INTERNAL CODING OR TABLES WITHIN THE OVERLAY.
- EACH CALLED OVERLAY OVERWRITES THE TASKS OVERLAY AREA WITH THE REQUESTED OVERLAY.



JOB CLASS MANAGER



## JOB CLASS MANAGER (JCM)

- VALIDATES JOB CLASS QUALIFICATIONS AND ASSIGNS A JOB TO A CLASS.

- LINKS JOB INPUT QUEUE ENTRIES IN THE SDT BY CLASS RANK, JOB PRIORITY, AND TIME SUBMITTED.

- OPTIONALLY REPLACES EACH JOB STATEMENT PRIORITY WITH THE CLASS RANK PRIORITY.

- ASSIGNS THE NUMBER OF AVAILABLE JOB EXECUTION TABLE (JXT) ENTRIES FOR EACH SPECIFIED JOB CLASS.

- ONCE A JOB HAS A JOB EXECUTION TABLE (JXT) ENTRY, ITS CLASS ASSIGNMENT DOES NOT CHANGE UNLESS THE JOB IS RERUN.

- A USER MAY LOWER A JOB CLASS THROUGH A PARAMETER IN THE JOB CONTROL STATEMENT.

- ENABLED/DISABLED THROUGH OPERATOR COMMANDS.





TAPE QUEUE MANAGER



TASK TO BE PROVIDED



CONTROL STATEMENT PROCESSOR (CSP)



## CONTROL STATEMENT PROCESSOR (CSP)

- BINARY COPY OF CSP RESIDES IN MEMORY IMMEDIATELY ABOVE STP OR OPTIONALLY ON DISK(S).
- WHEN A USER JOB IS SUBMITTED JSH CALLS EXP TO COPY CSP INTO THE USER FIELD (AT BA+200<sub>g</sub>).
- CSP EXECUTES IN THE USER FIELD AND IS SUBJECT TO USER JOB STATES.
- CSP SHARES THE USER TABLES SUCH AS THE JTA, JCB, DSP's, ETC.
- CSP 'CRACKS' USER CONTROL STATEMENTS.
- CSP ENTERS MESSAGES INTO THE LOGS THROUGH THE MESSAGE MACRO.





EXAMPLE

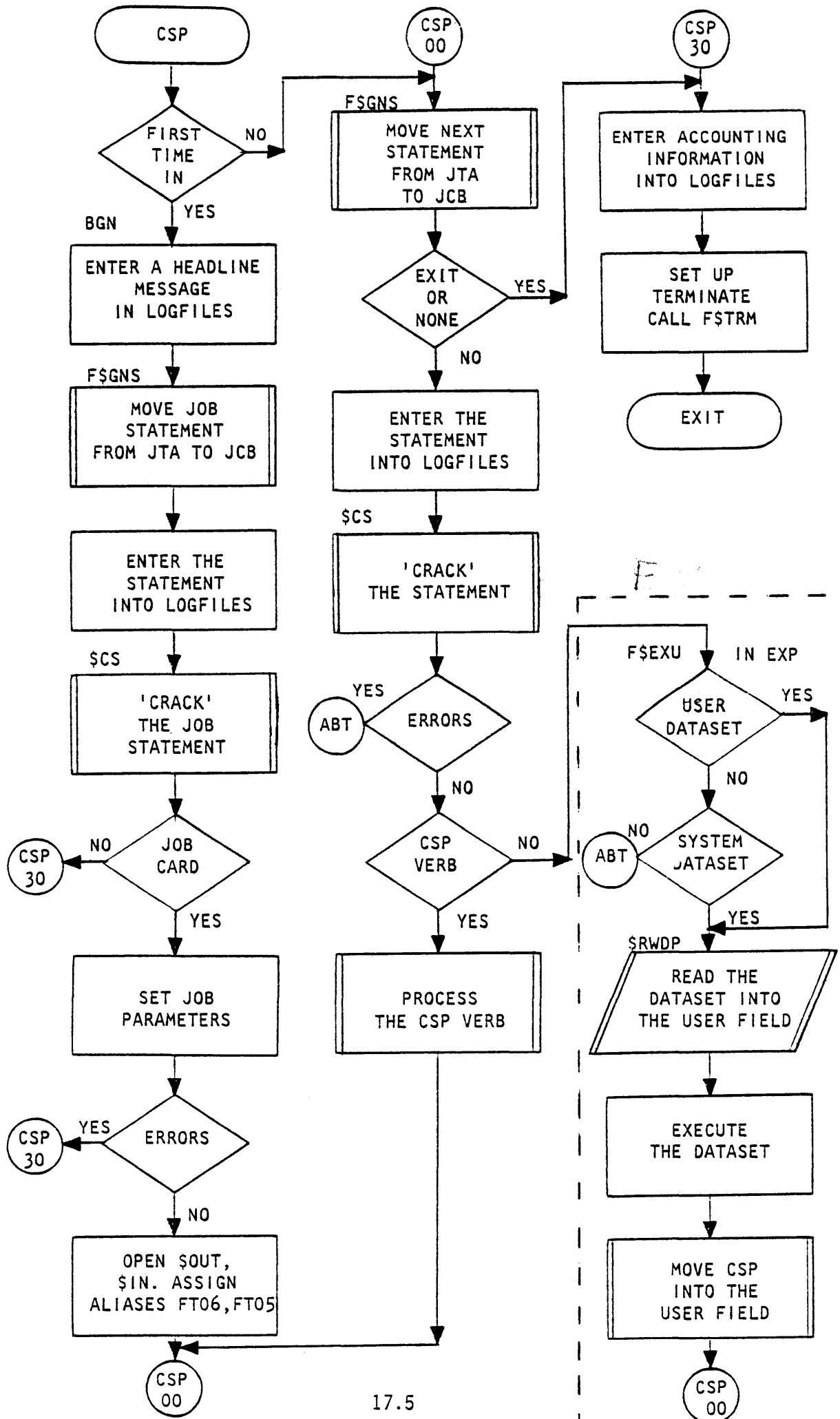
THE CONTROL STATEMENT

ASSIGN(DN=MYFILE,BS=25)

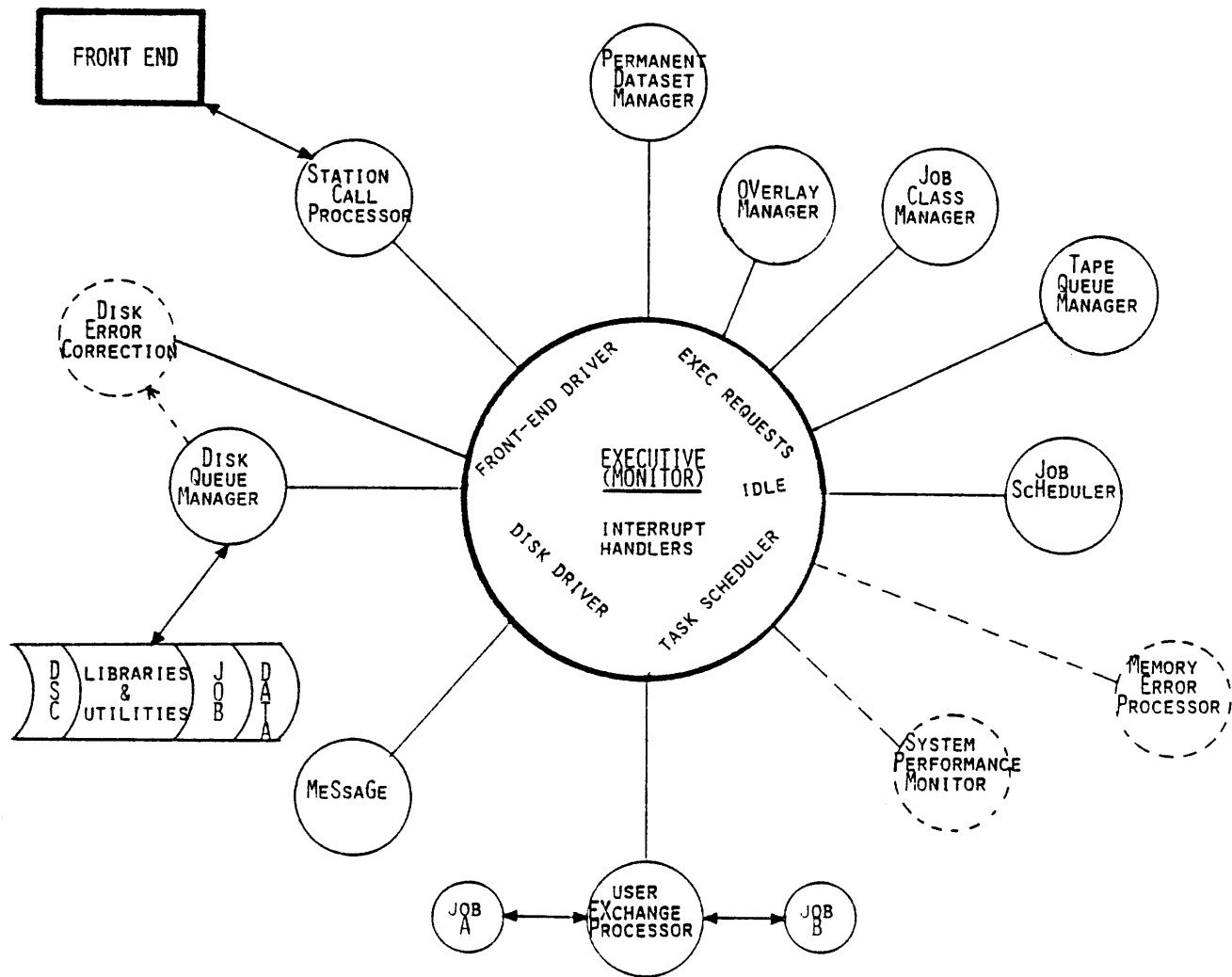
IS STORED IN THE JCB AS FOLLOWS:

0								
5	A	S	S	I	G	N	(	D
	N	=	M	Y	F	I	L	E
	,	B	S	=	2	5	)	0
	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0
	⋮							
15	0	0	0	0	0	0	0	0
16	A	S	S	I	G	N	0	0
	0	0	0	0	0	0	0	17 <sub>8</sub>
	D	N	0	0	0	0	0	0
	0	0	0	0	0	0	0	07
	M	Y	F	I	L	E	0	0
	0	0	0	0	0	0	0	17 <sub>8</sub>
	B	S	0	0	0	0	0	0
	0	0	0	0	0	0	0	07
	2	5	0	0	0	0	0	0
	0	0	0	0	0	0	0	37 <sub>8</sub>









JOB, JN=EXAMPLE, P=3.  
ACCESS, DN=TEMP, PDN=MASTERFILE, R=SECRET.  
ASSIGN, DN=TEMP, BS=12.  
COPYD, I=TEMP, O=COPY.  
DISPOSE, DN=COPY, SDN=BACKUP, DC=ST, MF=A.  
EXIT.  
EOF.

1. JOB IS STAGED FROM FRONT-END TO CRAY-1.
2. STATION CALL PROCESSOR (SCP) RECEIVES JOB AND PLACES IT IN THE SYSTEM DATASET TABLE (SDT) WHICH IS THE INPUT QUEUE FOR JOB SCHEDULER. SCP ALSO SAVES JOB IN THE DATASET CATALOG (DSC).
3. JOB SCHEDULER PICKS THE JOB FOR EXECUTION FROM SDT AND THEN MAKES AN ENTRY FOR THE JOB IN THE JOB EXECUTION TABLE AND ALLOCATES MEMORY.
4. JOB SCHEDULER CONNECTS THE JOB TO CPU.
5. CONTROL STATEMENT PROCESSOR (CSP) <sup>JOB CARD</sup> CRACKS THE ACCESS CARD, CALLS THE EXCHANGE PROCESSOR (EXP) TO VERIFY PERMISSIONS TO ACCESS MASTERFILE.
6. CSP CRACKS THE ASSIGN CARD, CALLS EXP TO OPEN TEMP, AND CHANGE THE BUFFER SIZE TO 12 INSTEAD OF 4 BLOCKS.

7. CSP CRACKS THE COPYD CARD, CALLS EXP TO LOAD PROGRAM COPYD FROM THE SYSTEM DIRECTORY.
8. COPYD EXECUTES, I/O BOUND, STREAMING DATA FROM TEMP TO COPY.
9. JOB SCHEDULER RECOGNIZES THAT JOB 'EXAMPLE' IS STREAMING AND CONNECTS EXAMPLE TO THE CPU WHENEVER A BLOCK IS AVAILABLE IN THE INPUT CIRCULAR BUFFER.
10. CSP CRACKS THE DISPOSE STATEMENT, CALLS EXP.
11. EXP WRITES AN ENTRY FOR BACKUP IN THE SDT OUTPUT QUEUE.
12. SCP STAGES BACKUP TO MAINFRAME A.
13. DEPENDING ON MAINFRAME A, SCP DELETES ENTRIES FOR BACKUP IN THE SDT AND DSC.
14. CSP CRACKS EXIT STATEMENT, CALLS EXP TO TERMINATE THE JOB.
15. EXP SEARCHES FOR \$OUT, COPIES \$LOG TO \$OUT (EXTENDING \$OUT), CHANGES \$OUT'S DATASET NAME TO JOBNAME.
16. JOB TERMINATION CHANGES ENTRIES IN THE DSC AND SDT OUTPUT QUEUE FOR DATASET EXAMPLE.
17. SCP STAGES EXAMPLE TO MAINFRAME A, ETC.
18. JOB TERMINATION RELEASES ALL LOCAL DATASETS, DELETES \$CS, AND TERMINATES JOB.





## SYSTEM INTERACTION



## JOB ENTRY

1. THE STATION CALL PROCESSOR (SCP) TASK EXAMINES A DATASET HEADER MESSAGE AND DETERMINES A JOB DATASET IS ENTERING THE SYSTEM.

SCP MOVES THE SEGMENT BUFFER TO THE DISK BUFFER EACH TIME THE SEGMENT BUFFER BECOMES FULL FROM INPUT OF THE SUBSEGMENTS.

SCP REQUESTS THE JOB DATASET DISK BUFFER BE WRITTEN TO DISK BY THE DISK QUEUE MANAGER (DQM) TASK.

2. THE DISK QUEUE MANAGER (DQM) TASK ALLOCATES DISK SPACE FOR THE JOB DATASET ON THE INITIAL CALL, AND HAS THE DISK BUFFER WRITTEN TO DISK VIA THE DISK DRIVER.
3. UPON REQUEST FROM THE STATION CALL PROCESSOR (SCP) TASK, THE JOB CLASS MANAGER (JCM) TASK DETERMINES WHICH JOB CLASS QUEUE ON THE SYSTEM DATASET TABLE (SDT) THE JOB SHOULD BE ENTERED IN.
4. UPON REQUEST FROM THE STATION CALL PROCESSOR (SCP) TASK, THE PERMANENT DATASET MANAGER (PDM) TASK CREATES A PERMANENT DATASET STRUCTURE FOR THE JOB AND SETS THE DISPOSITION CODE (DC) EQUAL TO ASCII CHARACTERS IN.
5. THE JOB SCHEDULER (JSH) TASK SELECTS THE HIGHEST PRIORITY JOB FROM THE INPUT QUEUE WHOSE JOB CLASS HAS A JOB EXECUTION TABLE (JXT) ENTRY AVAILABLE.

JSH CONSTRUCTS THE JOBS JXT ENTRY AND CHANGES THE SYSTEM DATASET TABLE (SDT) INPUT QUEUE ENTRY TO EXECUTE QUEUE AND SETS THE JOB STATE TO THE QUEUED (Q) STATE IN THE JXT.



## INITIAL JOB PREPARATION

1. THE JOB SCHEDULER (JSH) TASK SELECTS A JOB FROM THE JOB EXECUTING TABLE (JXT) THAT HAS BEEN GIVEN ITS INITIAL MEMORY ALLOCATION.
2. THE JOB SCHEDULER (JSH) ZEROES OUT THE JOB TABLE AREA (JTA) AND JOB COMMUNICATION BLOCK (JCB) OF THE JOB.
3. THE JOB SCHEDULER (JSH) INITIALIZES THE JOB COMMUNICATION BLOCK (JCB) POINTERS SUCH AS HLM, FL, DSP, ETC. AND SAVES THE POINTER TO THE JCB IN THE JOB TABLE AREA (JTA).
4. THE JOB SCHEDULER CREATES DATASET NAME TABLE (DNT) ENTRIES FOR \$CS, \$LOG, \$IN, AND \$OUT IN THE USERS JOB TABLE AREA (JTA).
5. THE JOB SCHEDULER INITIALIZES THE JOBS ROLLFILE DATASET NAME TABLE (DNT) ENTRY AT THE END OF THE JOB EXECUTION TABLE (JXT) ENTRY.
6. THE JOB SCHEDULER INITIALIZES THE ROLL JOB INDEX (RJI) TABLE ENTRY FOR THE JOB FOR POSSIBLE RECOVERY.
7. THE JOB SCHEDULER (JSH) SETS THE JOBS STATE TO WAITING (W) IN THE JXT THUS ALLOWING THE JOB TO CONTEND FOR THE CPU ALONG WITH OTHER ACTIVE JOBS IN THE JXT.



## JOB ROLLOUT

1. THE JOB SCHEDULER (JSH) TASK DETERMINES A NEED BY A JOB FOR USER MEMORY AND CREATES A REQUEST TO HAVE ANOTHER JOB IN MEMORY ROLLED-OUT.

JSH SEARCHES THE JOB EXECUTION TABLE (JXT) FOR A CANDIDATE FOR JOB ROLL-OUT.

JSH AFTER LOCATING A CANDIDATE MAY HAVE TO COMPACT MEMORY TO OBTAIN A LARGE ENOUGH FREE SEGMENT OF MEMORY.

JSH SETS THE PROPER JOB STATES OF THE WAITING JOB AND THE JOB ABOUT TO BE ROLLED-OUT.

2. THE DISK QUEUE MANAGER (DQM) TASK ALLOCATES DISK SPACE IF NEEDED, AND HAS THE MEMORY RESIDENT JOB AREA WRITTEN TO DISK VIA THE DISK DRIVER.
3. THE JOB SCHEDULER (JSH) TASK UPDATES THE MEMORY SEGMENT TABLE (MST).
4. THE JOB SCHEDULER (JSH) TASK LIFTS THE SUSPENSION ON THE JOB WAITING FOR MEMORY LIBERATION.





## ACCESS A PERMANENT DATASET

1. A JOB MAKES A REQUEST FOR PERMISSION TO USE A PERMANENT DATASET.
2. THE EXCHANGE PACKAGE PROCESSOR (EXP) TASK EXAMINES THE REQUEST FOR VALID PARAMETERS AND ISSUES A REQUEST TO THE PERMANENT DATASET MANAGER (PDM) TASK FOR ACCESS AND THE JOB SCHEDULER (JSH) TASK FOR JOB SUSPENSION.
3. THE PERMANENT DATASET MANAGER (PDM) TASK VALIDATES ACCESS TO THE SELECTED DATASET FOR THE USER JOB.

PDM MANAGES THE NECESSARY SYSTEM TABLES SO THAT THE USER HAS THE DESIRED PERMISSIONS GRANTED.

PDM CREATES A PERMANENT DATASET TABLE (PDS) ENTRY FOR THE ACTIVE DATASET.

PDM CREATES A DATASET NAME TABLE (DNT) ENTRY FOR THE USER AND INSURES THE DATASET ALLOCATION TABLE (DAT) FOR THE DATASET IS MADE RESIDENT IN THE REQUESTING JOB AREA THUS MAKING THE DATASET LOCAL FOR THAT JOB.

4. THE JOB SCHEDULER (JSH) TASK SETS THE JOBS STATUS BIT TO SUSPK (K) THUS DISALLOWING THE JOB FROM ROLL-OUT AND MEMORY MOVEMENT UNTIL THE JOBS DATASET ALLOCATION TABLE (DAT) ENTRY IS READ INTO THE USER AREA FROM THE DISK DATASET CATALOG (DSC).

JSH RESETS THE JOBS STATUS TO THE WAIT (W) STATE FOLLOWING COMPLETION OF GENERATION OF THE LOCAL DATASET BY THE PERMANENT DATASET MANAGER (PDM) TASK.



## DATASET ACQUISITION

1. A JOB MAKES A REQUEST TO ACQUIRE A PERMANENT DATASET.
2. THE EXCHANGE PACKAGE PROCESSOR (EXP) TASK EXAMINES THE REQUEST FOR VALID PARAMETERS AND ISSUES A REQUEST TO THE PERMANENT DATASET MANAGER (PDM) TASK TO SEARCH FOR AN EXISTANT PERMANENT DATASET.

IF THE DATASET ALREADY EXISTS IN THE SYSTEM, THE FLOW FOLLOWS ACCESS PROCESSING.

IF THE DATASET DOES NOT EXIST WITHIN THE SYSTEM EXP ISSUES A REQUEST TO THE JOB SCHEDULER (JSH) TASK TO SUSPEND THE JOB AND EXP ENQUEUES THE DATASET NAME AND PLACES IT ON THE REQUEST QUEUE IN THE SYSTEM DATASET TABLE (SDT).

3. THE PERMANENT DATASET MANAGER (PDM) TASK SEARCHES THE DATASET CATALOG (DSC) FOR AN EXISTANT DATASET AND IF SO TO VERIFY THE PERMISSION WORDS.

PDM MONITORS NECESSARY TABLES AND USER AREAS ENABLING THE DATASET TO BECOME LOCAL TO THE JOB THAT ISSUED THE ACQUIRE AS IN THE ACCESS FLOW.

4. IF THE JOB SCHEDULER (JSH) TASK WAS REQUESTED IT SUSPENDS THE JOB AWAITING THE DATASET TRANSFER FROM THE FRONT-END.
5. IF THE DATASET IS NOT CRAY RESIDENT THE STATION CALL PROCESSOR (SCP) TASK SELECTS THE REQUEST ENTRY FROM THE SYSTEM QUEUE AND COMMUNICATES WITH THE FRONT-END VIA THE FRONT-END DRIVER TO RETRIEVE THE NON-RESIDENT DATASET.

SCP THEN COMMUNICATES WITH THE JOB SCHEDULER (JSH), THE PERMANENT DATASET MANAGER (PDM) AND THE DISK QUEUE MANAGER (DQM) TO INSURE PROPER SAVING OF THE DATASET AND JOB ADVANCEMENT.



## LOCAL I/O

1. A JOB ISSUES A WRITE REQUEST THROUGH A SYSTEM MACRO CAUSING PHYSICAL I/O.
2. THE EXCHANGE PACKAGE PROCESSOR (EXP TASK EXAMINES THE REQUEST FOR VALID PARAMETERS AND FORWARDS THE REQUEST FOR I/O.
3. THE TASK I/O (TIO) ROUTINES TRANSFER DATA, INSERTING RCW's WHERE NEEDED, FROM THE JOB DATA AREA TO THE JOB DISK BUFFERS ON A WRITE.

TIO DETERMINES THE DISK BUFFERS ARE GREATER THAN HALF FULL AND PERFORMS CIRCULAR I/O (CIO).

CIRCULAR I/O (CIO) ISSUES A WRITE REQUEST OF THE DISK QUEUE MANAGER (DQM) TASK AND HAS THE JOB SUSPENDED, STATE I, BY THE JOB SCHEDULER (JSH).

4. THE DISK QUEUE MANAGER (DQM) TASK ALLOCATES DISK ON A WRITE IF NEEDED, AND PERFORMS THE I/O VIA THE DISK DRIVER.



## JOB MEMORY REQUEST

1. A JOB MAKES A REQUEST TO ALLOCATE/DEALLOCATE MEMORY THROUGH AN RFL CONTROL STATEMENT.
2. THE EXCHANGE PACKAGE PROCESSOR (EXP) EXAMINES THE USERS JOB COMMUNICATION BLOCK (JCB) FOR VALID PARAMETERS SUCH AS HLM, FL, ETC.

EXP REQUESTS THE JOB SCHEDULER (JSH) TASK FOR THE ACTUAL ALLOCATE/DEALLOCATE OF MEMORY.

3. THE JOB SCHEDULER (JSH) TASK UPON A DEALLOCATE REQUEST MUST UPDATE USER FIELDS SUCH AS LA, HLM, DSP POINTERS, ETC.

JSH RETURNS THE RELEASED MEMORY TO THE SYSTEM BY UPDATING THE MEMORY SEGMENT TABLE (MST) AND FILLING THE RETURNED MEMORY WITH THE CONTENTS OF I@ERASE SHIFTED LEFT 24 BITS.

4. THE JOB SCHEDULER (JSH) TASK UPON AN ALLOCATE REQUEST MUST SEARCH THE MEMORY SEGMENT TABLE (MST) FOR FREE MEMORY.
5. IF FREE MEMORY IS FOUND ADJACENT TO THE USER JOB THE MEMORY MAY BE GIVEN TO THE USER BY UPDATING VARIOUS USER FIELDS SUCH AS LA, HLM, ETC. AND UPDATING THE MEMORY SEGMENT TABLE (MST).
6. IF THE JOB SCHEDULER (JSH) TASK IN ITS SEARCH OF THE MEMORY SEGMENT TABLE (MST) CANNOT FIND MEMORY ADJACENT TO THE USER JOB, MEMORY COMPACTION OR ROLL-OUT MAY HAVE TO BE USED.

IF SUCH IS THE CASE THE REQUESTING JOB IS SET TO THE WAITING (W) STATE AND THE REQUESTING JOB ITSELF BECOMES SUBJECT TO ROLL-OUT.





## JOB TERMINATION

1. A JOB TERMINATES WITH AN EXIT CONTROL STATEMENT INTERPRETED BY THE CONTROL STATEMENT PROCESSOR (CSP).
2. CSP POSTS TERMINATION MESSAGES TO THE LOGFILES VIA THE MESSAGE (MSG) TASK.
3. THE EXCHANGE PACKAGE PROCESSOR (EXP) TASK COPIES THE JOBS \$LOG TO \$OUT.

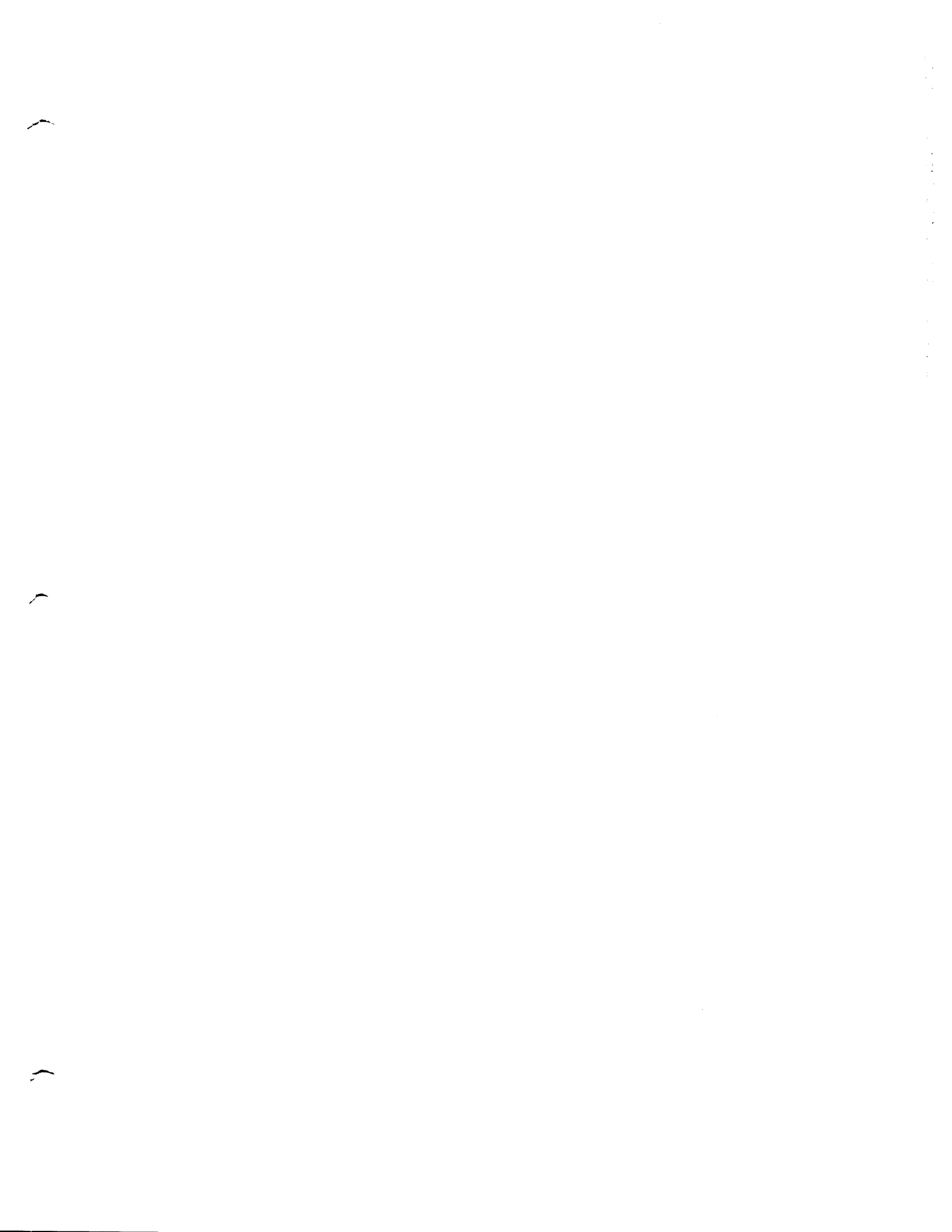
EXP CHANGES \$LOG TO SCRATCH AND RELEASES SCRATCH DATASETS AS WELL AS \$IN, \$CS.

4. THE PERMANENT DATASET MANAGER (PDM) CREATES A DATASET CATALOG ENTRY (DSC) FOR EACH JOB OUTPUT DATASET THUS MAKING THE DATASET PERMANENT.
5. EXP HAS CREATED ENTRIES FOR THE JOBS OUTPUT DATASETS IN THE SDT.
6. THE DISK QUEUE MANAGER (DQM) TASK ALLOCATES DISK FOR \$OUT IF NEEDED, AND HAS THE BUFFER WRITTEN TO DISK VIA THE DISK DRIVER.
7. THE JOB SCHEDULER (JSH) TASK TERMINATES THE JOB BY RELEASING THE EXECUTING QUEUE ENTRY IN THE JOB EXECUTION TABLE (JXT).

JSH RELEASES THE JOBS MEMORY AND RELEASES THE JOBS DATASET AND UPDATES THE MEMORY SEGMENT TABLE (MST).

8. THE STATION CALL PROCESSOR (SCP) TASK MANAGES SYSTEM MEMORY BUFFERS AND TRANSMITS THE JOBS OUTPUT DATASETS TO THE FRONT-END VIA THE FRONT-END DRIVER.
9. UPON RECEIPT OF EACH OUTPUT DATASET BY THE FRONT-END, THE STATION CALL PROCESSOR (SCP) REQUESTS THE PERMANENT DATASET MANAGER (PDM) TO DELETE THE DATASET CATALOG (DSC) ENTRY FOR THE DATASET AND DQM RELEASES THE DATASETS DISK SPACE.





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