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Space Administration

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Lyndon B. Johnson Space Center
Houston, Texas

SPACE SHUTTLE PROGRAM
ORBITER PROJECT
COMPUTER PROGRAM DEVELOPMENT SPECIFICATION

VOLUME 1
BOOK 7

STS SYSTEM LEVEL REQUIREMENTS,
SOFTWARE

CONTRACT NAS9-14000

LEVEL A
SOFTWARE

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PAGE CHANGE NOTICE
FOR
COMPUTER PROGRAM DEVELOPMENT SPECIFICATION
VOLUME I, BOOK 7
STS SYSTEM LEVEL REQUIREMENTS SOFTWARE
PAGE CHANGE NOTICE NO. H-1

CHANGE INSTRUCTIONS

1. Retain this notice.
2. This PCN, in conjunction with any other prior numbered PCN's and the latest complete issue of the document, constitutes the current version of this specification.
3. Remove the following listed pages and replace with the same numbered attached pages.

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CHANGE RECORD

The following tabulation lists the paragraphs that have been changed as a result of approved change requests since the publication of Revision H of this document dated August 31, 1982.

<u>PARAGRAPH</u>	<u>CHANGE REQUEST</u>
4.6.2.4.3	39295 (REL 20)
4.6.2.4.5	39610
4.6.2.4.6	39834
4.6.3.1.7	39864
4.6.3.1.12	39524B 39661 (REL 20) 39670C 39820
4.6.3.3.3	39866D (POST 20 REL)
4.6.3.3.4	39866F (POST 20 REL) 39691 39867 (POST 20 REL)
4.6.3.3.5	39295 (REL 20)
4.6.4.3.1	39868 (POST 20 REL)
4.6.4.3.6	39835
4.6.4.5.1	39517
4.6.4.5.2	39517
4.6.6.2.3	39693
4.6.6.2.4	39281
5.3.2.2.1	39296
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5.3.3.7.1	39868 (POST 20 REL)
5.3.3.7.4	39868 (POST 20 REL)
5.3.3.7.5	39868 (POST 20 REL)

5.3.5.6.1	39294B
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5.3.5.7.4	39296
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5.8.1	39779B
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5.9.4.3	39717
5.9.4.7	59271A (POST 22)
5.9.4.8	39765A (POST 20 REL)
6.4	39087A
6.5.2	39295 (REL 20) 39266A 39401A 39533
6.6.1	39716C
6.6.2	39266A 39491 (REL 20)
6.7.1	39774 39524B 39539A 39621A 39670C
6.9	39524B 39866D (POST 20)

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39517
39524B
39539A
39544A
39610
36921A
39583E
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39670C
39691
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BASELINE RECORD

The following tabulation lists approved Change Requests (CR's) for future software implementation and are not incorporated into the main body of this document. Release 20 CR's are incorporated into appendix A and post-Release 20 CR's are incorporated into appendix B.

REL 20

39295
39491
39961
39779B

POST 20 REL

39765A
39866D
39867
39868

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```

XXXX/XXX/XXX   GPC MEMORY   XX X DDD/HH:MM:SS
                                DDD/HH:MM:SS
MEM/BUS CONFIG  READ/WRITE XXX
1 CONFIG XX(XX)  DATA 20X  BIT SET 22X  SEQ ID 24
2 GPC X X X X X  CODE 21X  EIT RST 23X  WRITE 25
                26 ENG UNITS XXXX  HEX 27X
STRING 1 7 X    ADD ID  DESIRED  ACTUAL
          2 8 X  28 XXXXX  29 XXXX  ±XXXXXXXXXXXXX
          3 9 X  30 XXXXX  31 XXXX  ±XXXXXXXXXXXXX
          4 10 X 32 XXXXX  33 XXXX  ±XXXXXXXXXXXXX
        PL 1/2 11 X 34 XXXXX  35 XXXX  ±XXXXXXXXXXXXX
          36 XXXXX  37 XXXX  ±XXXXXXXXXXXXX
          38 XXXXX  39 XXXX  ±XXXXXXXXXXXXX
        CRT 1 12 X
          2 13 X
          3 14 X
          4 15 X  MEMORY DUMP
                40 START ID  XXXXX
                41 NUMBER WDS XXXXXX
        LAUNCH 1 16 X  42 WD/FRAME  XXX
          2 17 X  DUMP 43
        MM 1 18 X
          2 19 X  44 DOWNLIST GPC X  STORE MC XX
                OPS 0 ENA 49X  45 CONFIG XX
                ERR LOG RESET 48  46 GPC X
                                STORE 47

                                MESSAGE LINE
                                SCRATCH PAD LINE

```

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NOTE: This figure is for clarification only and does not constitute the required formatting.

Figure 5-14.- GPC memory display.

5.9.3.1.2 Control inputs: Control parameters shall be entered by item number. Implied item numbers shall be used whenever practical to minimize the number of inputs. In addition to the mode control input described above, the following parameters are defined for display control:

- A. ADD ID (Memory location) - A five-digit hexadecimal number identifying the memory location being addressed. For quantities stored in full words (i.e., 32 bits), the identified location is the starting or most significant part of the word.
- B. SCALING AND CONVERSION - Two controls are provided to allow the crew to select the display format for the read option. The two options are Engineering Units (item 26) and Hex (item 27). The options for Engineering Units (EU's) are single precision floating point (32 bit) or single precision fixed point (16 bit). The first digit identifies fixed or floating point. The second and third digits select the desired unit conversion.

Digit A

- 1 - 16 bit/fixed
- 2 - 32 bit/floating

Digits BB

- 00 - units in memory (no conversion)
- 01 - NM from feet
- 02 - NM from K feet
- 03 - feet from NM
- 04 - K feet from NM
- 05 - feet/sec² from Gs
- 06 - deg/sec from M rad/sec
- 07 - deg from arc sec
- 08 - feet/sec² from micro G
- 09 - deg from rad
- 10 - KFT from feet

- C. WRITE (Execute load) - An item entry (item 25) to initiate transfer of data, code, BIT SET or BIT RESET to memory (refer to paragraph 5.9.3.1.4)
- D. SEQ ID (Sequential read) - An item entry (item 24) to initiate a sequential read (refer to paragraph 5.9.3.1.5)
- E. R/W TARGET MAJ FUNC - The MF selected shall be identified by the MAJ FUNC switch at the inputting CRT and shall be displayed on the format. The identified MF is the destination for memory write inputs. When inputting to a MF

string via ITEMS 7 through 10 (refer to paragraphs 4.6.4.3.6 and 4.6.2.2.5). The bus assignments may be modified by inputting the desired GPC for each bus via ITEMS 11 through 19. If the input GPC is not valid (0-5), then an appropriate error message shall be generated.

5.9.3.2.1 Display initialization: MC selection should be initialized to zero the first time the display (SPEC) is called and thereafter reflect crew inputs.

5.9.3.3 Memory dump.-

- A. main memory Dump. Two items shall exist to define the main memory data to be dumped via the downlist in allowed MC's (see table 6-3). For main memory dumps, the absolute main memory address in hexadecimal of the start of the dump is entered in the start item and the number of sequential 16-bit words of main memory to be dumped is entered via the number of words item. The data for these two items shall be displayed upon entry. The entire main memory may be requested for dumping with execution of these two items and WDS/FRAME. If the addition of the starting address and the number of words totals beyond the GPC address limit, an error message shall be generated and the input rejected.
- B. One item (DUMP) shall exist to select the dump. Upon entry of this item, the dump shall start, the starting address shall be shown incrementing, and the number of words shall decrement. At dump completion the start in address and number of words items shall blank. If no data has been entered for the start item and the number of words item and the words per frame item and this item is entered, an error message shall be generated and the input rejected. Attempts to initiate dump main memory via downlist item execute in non-allowed MC's shall result in rejection of the input with an error message.
- C. One item shall exist to define the number of 16-bit words in the downlist frame to be used for header and main or MM data. Entry of this item shall vary the length of the data content of the downlist frame so that a subset of the total downlist frame can be used for the 64 KBPS downlink frame. The item entry shall be in decimal. Refer to table 5-1 of CPDS SS-P-0002-140, Downlist/Uplink Software Requirements for the frame lengths of each downlist format in the 128 and 64 KBPS downlink formats.

5.9.3.4 GPC freeze-dry load.- Controls shall be provided (items 45 through 47) for loading a MC into a GPC without initiating execution of the associated application OPS. This capability is called freeze-dry load. This capability shall require that the

user input the desired MC number and the desired target GPC I.D., followed by a load execute (STORE) command. Associated processing as well as legality checking shall be as specified in paragraph 4.6.2.2.3 F.

The MC resident in the GPC driving this display shall be permanently displayed and verification of a successful freeze dry load shall be the resident MC changing to equal the input target MC. The MC variable shall be blanked if no valid MC is resident (i.e., memory overlay has started but has not completed) in the driving GPC.

5.9.4 DPS Utility Display

This display is the format always associated with SPEC 0-01. The DPS Utility Display provides crew controls to (1) Assign an MF to MMU's (MMU1 and MMU2); (2) provide the status (ready or busy) for each MMU; (3) select the memory source and bus for GPC reconfiguration; (4) enable checkpoint data retrieval from MM; (5) select primary or secondary ports for strings 1 through 4 and the PL MDM's; (6) select the variable parameters for use in the downlist format; (7) selection of automatic enabling and inhibiting of uplink or manual enabling or inhibiting of uplink (see figure 5-15).

5.9.4.1 MMU assign.-- Controls shall be provided (ITEMS 1 through 8) for assignment of an MF (and hence, GPC's in which that MF is resident) or a GPC OPS 0-00 (MC=0) GPC to MMU's (MMU1 or MMU2).

Only one MMU may be assigned to a MF. The system will be initialized with the GNC, PL, SM MF's, and CPS 0-00 assigned to MMU1. Indicators shall be provided to show the various assignments (refer to paragraph 4.6.2.3.5). Assignments carry forward across OPS transitions until manually changed.

5.9.4.2 MMU status.-- An indication of the status (ready or busy) of the latest MMU-ready discrete for each MMU will be displayed.

5.9.4.3 MMU source/bus.-- Item input (items 9, 10, and 11) are controls to select the memory source (i.e., MMU or another GPC) and data path for non-IPL memory reconfigurations. Three controls are required as follows:

- A. Any available GPC using either available MMU bus as the path (item 9). If the desired load is not in a GPC, the logic shall default to use the MMU.

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- B. The available MMU (MMU1 or MMU2) using its data bus (item 10). When this control is executed, the appropriate MF/QPS overlay shall be retrieved and loaded into the assigned GPC, regardless of its current contents (i.e., the load is forced).
- C. Any available GPC using LDB as the path (item 11). If the desired load is not in a GPC, the logic shall not attempt any further action, leaving the current QPS in execution.

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XXXX/XXX/XXX	DPS UTILITY	XX X	DDD/HH:MM:SS
MMU ASSIGN			DDD/HH:MM:SS
1 2	PORT ASSIGN		
GNC 1X 2X	PRI SEC	UL CNTL	
SM 3X 4X	STRING 1 15X 16X	AUTC 35X	
PL 5X 6X	2 17X 18X	ENA 36X	
OPS 0 7X 8X	3 19X 20X	INH 37X	
	4 21X 22X		
MMU STATUS	PL 1/2 23X 24X		
1 XXX			
2 XXX			
	VARIABLE PARAM ID LIST		
MMU SOURCE/EUS	25 XXXX		
GPC/MMU 9X	26 XXXX		
MMU/MMU 10X	27 XXXX		
GPC/LDB 11X	28 XXXX		
	29 XXXX		
CKPT RETRV ENA 12X	30 XXXX		
	31 XXXX		
RTC	32 XXXX		
13 XXXX XXXX	33 XXXX		
CMD 14	34 XXXX		
	MESSAGE LINE		
	SCRATCH PAD LINE		

NOTE: This figure is for clarification only and does not constitute the required formatting.

Figure 5-15.- DPS utility display.

TABLE 6-8.- GPC MEMORY DISPLAY INPUTS (Continued)

M/S ID NO.	MNEMON	NOMENCLATURE	SOURCE	T Y P E	UNITS	I L D
V93X	A	ERROR LOG RESET INITIATE	UI	D		
V93J4071C	A20928	GPC 2 SEL/DES FOR SELECTED MC	UI	I		
V93J4080C	A20929	GPC 3 SEL/DES FOR SELECTED MC	UI	I		
V93J4082C	A20930	GPC 4 SEL/DES FOR SELECTED MC	UI	I		
V93J4086C	A20931	GPC 5 SEL/DES FOR SELECTED MC	UI	I		
V93J4084C	A20932	STRING 1/GPC ASSIGN FOR SEL MC	UI	I		
V93J4085C	A20933	STRING 2/GPC ASSIGN FOR SEL MC	UI	I		
V93J4088C	A20934	STRING 3/GPC ASSIGN FOR SEL MC	UI	I		
V93J4089C	A20935	STRING 4/GPC ASSIGN FOR SEL MC	UI	I		
V93J4005C	A21734	PL 1&2/GPC ASSIGN FOR SEL MC	UI	I		
V93J4006C	A21735	CRT 1/GPC ASSIGN FOR SEL MC	UI	I		
V93J4007C	A21736	CRT 2/GPC ASSIGN FOR SEL MC	UI	I		
V93J4008C	A21737	CRT 3/GPC ASSIGN FOR SEL MC	UI	I		
V93J4009C	A21738	CRT 4/GPC ASSIGN FOR SEL MC	UI	I		
V93J4015C	A21739	LDB 1/GPC ASSIGN FOR SEL MC	UI	I		
V93J4016C	A21740	LDB 2/GPC ASSIGN FOR SEL MC	UI	I		
V93J4017C	A21741	MM 1/GPC ASSIGN FOR SEL MC	UI	I		
V93J4018C	A21742	MM 2/GPC ASSIGN FOR SEL MC	UI	I		
V93U4612C	A20613	START ADDRESS MEMORY DUMP INPUT	UI	HX		

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TABLE 6-8.- GPC MEMORY DISPLAY INPUTS (Concluded)

M/S ID NO.	MNEMON	NOMENCLATURE	SOURCE	T Y P E	UNITS	I L D
V93Q4644C	A20614	WDS/FRAME IN MEMORY DUMP INFUT	UI	I		
V93X4618X	A20629	GPC MEMORY DUMP EXEC	UI	D		
V93Q4610C	A21498	NUMBER WDS IN MEMORY DUMP INPUT	UI	I		

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TABLE 6-9.- GPC MEMORY DISPLAY OUTPUTS (Concluded)

M/S ID NC.	MNEMON	NOMENCLATURE	FUNCTION	DESTINATION		T	UNITS
V91J1691C	A21747	CRT 4/GPC ASSIGNED FOR MC	UI	X	I		
V91J1693C	A21748	LDB 1/GPC ASSIGNED FOR MC	UI	X	I		
V91J1695C	A21749	LDB 2/GPC ASSIGNED FOR MC	UI	X	I		
V91J1697C	A21750	MM 1/GPC ASSIGNED FOR MC	UI	X	I		
V91J1700C	A21751	MM 2/GPC ASSIGNED FOR MC	UI	X	I		
V93U4612C	A21050	START ADDRESS MEMORY DUMP INPUT	UI	X	HX		
V93U4644C	A21051	NUMBER WDS IN MEMORY DUMP INPUT	UI	X	I		
V93Q4644C	A20614	WDS/FRAME IN MEMORY DUMP INPUT	UI	X	I		
V91J1694C	A12493	MC NO. FOR FROZEN OVERLAY	UI	X	I		
V91J1696C	A12494	GPC NO. FOR FROZEN OVERLAY	UI	X	I		
V91J1702C	A12495	GPC - SELF RESIDENT MC NO.	UI	X	I		

TABLE 6-10.- DPS UTILITY DISPLAY INPUTS

M/S ID NO.	MEMON	NOMENCLATURE	SOURCE	T Y P E	UNITS	I D
V93X5501X	A20960	STRING 1/MDM PORT ASSIGN	UI	D		
V93X5509X	A20961	STRING 2/MDM PORT ASSIGN	UI	D		
V93X5514X	A20962	STRING 3/MDM PORT ASSIGN	UI	D		
V93X5519X	A20963	STRING 4/MDM PORT ASSIGN	UI	D		
V93X5528X	A20964	PL BUSES/MDM PORT ASSIGN	UI	D		
V93J4371C	A20276	MEMORY SOURCE SELECT	UI	I		
V93X4040X	A20938	GNC MMU ASSIGN	UI	D		
V93X4042X	A20939	SM MMU ASSIGN	UI	D		
V93X4050X	A20940	PL MMU ASSIGN	UI	D		
V93X4055X	A20941	OPS 0 MMU ASSIGN	UI	D		
V93X4095X	A21480	CHECKPT RETRIEVE ENA/INH	UI	D		
V93U4632C	A20660	ADDRESS OF VAR PARAMETER 1	UI	HX		
V93U4634C	A20604	ADDRESS OF VAR PARAMETER 2	UI	HX		
V93U4636C	A20605	ADDRESS OF VAR PARAMETER 3	UI	HX		
V93U4638C	A20606	ADDRESS OF VAR PARAMETER 4	UI	HX		
V93U4640C	A20607	ADDRESS OF VAR PARAMETER 5	UI	HX		
V93U4660C	A20608	ADDRESS OF VAR PARAMETER 6	UI	HX		
V93U4662C	A20609	ADDRESS OF VAR PARAMETER 7	UI	HX		
V93U4664C	A20610	ADDRESS OF VAR PARAMETER 8	UI	HX		
V93U4666C	A20611	ADDRESS OF VAR PARAMETER 9	UI	HX		

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