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Memorandum

TO : Co-chairmen, G&C Implementation Sub-panel, MSC & MSFC
DATE : September 30, 1966

FROM : Chief, Guidance and Control Systems Analysis Branch, R-ASTR-NG
In reply refer to:
R-ASTR-NG-141-66
MBrooks/lw/876-8476

SUBJECT : Digital Command System (DCS) functions

1. This memorandum is prepared in response to action item 7-27-66-5 from the seventh meeting of the Guidance and Control Implementation Sub-panel.
2. A list of Digital Command System (DCS) routines which have been implemented on various vehicles is given below. Most of these will appear in every flight program; however, in some cases specific ones are not required. Generally, the DCS operation is inhibited during boost flight and will not recognize the DCS interrupt signal. However, abort and alternate sequence commands will be honored on some vehicles during powered flight.

a. Update Sequence Time Base: This routine provides the ground stations with the capability of altering the execution time of the sequences in time base four for up to ± 127 seconds. All functions which use time in time base four will be affected by this command. This includes switch selector functions and attitude maneuvers unless special efforts are taken to prevent this (as with maneuvers in AS-204 which are not functions of time in time base four). When a valid update command is received, the action taken depends upon whether the computer is operating in an "acquisition" or a "loss" period. These times are switch selector entries intended to correspond to physical station acquisition and loss. If the computer is in an acquisition period, the update will be saved until "loss" time occurs. Should the LVDC receive more than one update command during one acquisition, only the last one will be executed at loss time. If the LVDC receives a valid update command during loss time, the command will be executed immediately. In the event that the commanded increment would result in bypassing one or more switch selector functions, the LVDC will adjust the time base only to the beginning of that function.

b. Navigation Update: This routine provides the ground station with the capability to load six navigation parameters and an execution time in the LVDC. The LVDC stores the six navigation parameters and time in predetermined locations. The first active navigation update capability will be programmed in the AS-206 and AS-502 programs. Vehicles prior to these will have passive navigation updates. Instead of replacing the navigation parameters in the LVDC, the passive update stores the data where it may be dumped (sector dump) upon ground command.

Upon entry into this routine, the LVDC will telemeter the "Navigation Update" status code twice and return to the main orbital program prepared to receive 35 data commands or the "Terminate" command. Since only 6 information bits are transmitted in one data command, 5 transmissions are required to formulate one 26-bit LVDC word. Therefore, the LVDC must form a word after every 5th transmission until all seven words are formed. The seven LVDC words are stored in pre-determined locations. This routine is finished after the LVDC receives the 35th valid data command and forms the seventh LVDC word. The LVDC returns to the main orbital program after completion of this routine to execute an active update or continue unchanged with a passive update.

c. Generalized Switch Selector: This routine provides the capability of executing any S-IVB or IU switch selector function on command from the ground station. Upon entry into this routine, the LVDC will telemeter the "Switch Selector" status code twice and return to the main orbital program prepared to receive two data commands or a "Terminate" mode command. As soon as the LVDC verifies the second data command, it attempts to execute the requested switch selector function. The switch selector functions of the main orbital program take precedence; therefore, the LVDC must wait until there is adequate free time before beginning the switch selector subroutine. The main orbital program switch selector subroutine is used. The "Terminate" command will be accepted any time before the switch selector subroutine starts its sequence. This command cancels the commanded switch selector functions. The LVDC returns to the main orbital program once the switch selector subroutine has been executed or canceled.

d. Sector Dump: This routine provides the capability of commanding the LVDC to telemeter the entire contents of one LVDC memory sector, or a series of memory sectors within the same memory module. Upon entry into this routine, the LVDC will telemeter the "Sector Dump" status code twice and then return to the main orbital program to receive two data commands or a "Terminate" mode command. The LVDC will begin dumping the start sector at address 000 as soon as it verifies the second data command. Blocks of 17 LVDC words will be interleaved with other LVDC telemetry outputs until all 256 (16 blocks) LVDC locations (or some multiple of 256 if more than one sector is requested) have been telemetered one time each. Each word of the block will have a unique tag. The first word of each block will identify the information in the block by indicating the data portion of the LVDC word the (a) module, (b) sector, and (c) block number of the sector (1-16). The total time to dump one sector is approximately 8.0 seconds. A "Terminate" mode command received any time before the last word of the last block is telemetered will cause the LVDC to return to the main orbital program.

e. Telemeter Single Memory Location: This routine provides the capability to telemeter one LVDC memory location on command of the ground station. Upon entry into this routine, the LVDC will telemeter the "Telemeter Single Location" status code twice and return to the main orbital program, prepared to receive three data commands or a "Terminate" mode command. After the third data command has been verified, the LVDC will telemeter the requested location 5 times in succession and return to the main orbital program. The word to be telemetered will have a unique combination of the LVDA's 8 tag bits as an identifier.

f. Launch Abort: This routine provides the capability for a ground-originated abort during powered flight of the S-IVB after jettison of the LES. First active vehicle is AS-206.

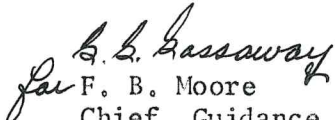
g. Maneuver Inhibit: This routine provides capability to bypass certain preplanned attitude maneuvers during S-IVB coast.

h. Maneuver Update: This routine provides capability to change the initiation times of maneuvers by \pm 31 minutes. When a maneuver update follows an inhibit command for the same maneuver, the inhibit is immediately released. The update times are cumulative for a given maneuver.

i. Alternate Sequence (AS): Alternate sequences are, in general, defined as alternate paths that may be taken in the switch selector table as a function of ground command. The events to be executed in the AS are pre-programmed and will be executed only if the ground command for any given AS is received during a specified time interval. At all other times, the command will be rejected. If an AS is commanded, any functions in the main switch selector path which should occur during the same period as the AS will be skipped.


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