NATIONAL RADIO ASTRONOMY OBSERVATORY

SOCORRO, NEW MEXICO

September 12, 1975

VLA COMPUTER MEMORANDUM #125

DESCRIPTION OF THE DCS TASK

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This memo is based on and explains implementational changes to Computer Memos #113 and #114.

The two tasks, CMD and DMPX, described there have been subsumed into one task, DCS, which is interrupt driven by the serial line controller (SLC) and, in turn, controls the functioning of two subroutines, CMD and DMPX. The complete task consists of a resident interrupt handler, DCSHH, to field unexpected interrupts, and a currently nonresident task, DCS, which does all the real work and communicates with global common and to some extent with the outside world. All buffer areas used by DCS are relegated to "hidden core" (above #A000) to conserve on Monty's foreground memory pool. The following files are assigned at load time:

Name	Assignment	Default	Use
MDO	NO	NO	Monitor data streaming.
CMO	NO	NO	Command data streaming.
LO	SB1	SB1	Timing error messages.
BOS	COR	COR	For talking to Boss.
DCS	DCS	DCS	For internal machinations.

The rest of this memo describes the implementation of CMD and DMPX.

THE COMMAND GENERATING PROGRAM

Computer Memo #113 may be consulted for background information.

There are four sources or channels of command information: Word A for antenna positioning, Word B for IF/LO working, Word C primarily for front end control, and Word D used for manual input only. Each of these sources may be in one of four modes: NORMAL, AUX, MAN or NULL.

	NORM	AUX	MAN	NULL
Word A	X	NULL	X	X
Word B	X	NULL	X	X
Word C	X	AUX	X	X
Word D	NULL	NULL	X	X

The above chart describes the treatment accorded to each word, dependent upon its mode. "X" indicates it is treated as shown at the head of the column. The first 32 words of the DCS area of global common contain control words for the 32 channels of the Serial Line Controller, one of which is dedicated to each VLA antenna.

The command generator is activated each cycle provided that the DCS interrupt routine has properly disposed of (sent out) the previous buffer-full of commands. It then generates, in order, Word A for all antennae, followed by Word B for all antennae. When it has completed, it measures the size of the buffer and signals the interrupt routine that there is a fresh buffer to output.

Manual buffer operation is rather more complicated than outlined in the memo. The current command pointer is now constrained to be zero if the buffer is empty. Otherwise, spurious commands would be generated whenever something were set to MAN. Thus, to maintain proper functioning, the first person to insert a command in the buffer must make the pointer non-zero, and the last person to remove a command from the buffer must make the pointer zero. This policy has been adhered to in DMT.

The buffer pointer cranking routine has been changed to recognize the presence of bit 6 in the first word of each command prototype. If set, this command is deleted from the buffer and all succeeding ones moved down one notch to close the gap. This allows other programs to selectively remove commands merely by setting a bit and also ensures that no one will do any buffer manipulations which may be interrupted by the DCS task.

If option bit 'UO' is set, each generated command buffer will be written into 'CMO'. CMO should be assigned to an appropriate device and rewound before setting UO. A record is generated each cycle: Words 0 - 2 are Modcomp standard binary control words, Words 3 - 7 are copied from ARACB to ARACB+4 at the beginning of command generation, and Words 8 and on are the generated commands. An EOF is written on 'CMO' when UO is reset. The buffer written from is the same one which is used for the DCS. If Boss is slow writing the disk record, commands from some cycles may be missed.

A 32 word buffer has been identified to the link handler with the name @AUX. The first word of this buffer is normally zero; if made non-zero, it is assumed that Boss has filled the buffer with antenna or receiver initialization commands. Antennae which are in NULL or MAN are not initialized. All antennae specified by Boss have their current control word saved and restored.

The processing for NORMAL mode of words A and B has been changed to access the proper ACB or IFCB. For each antenna, the ACB chain or appropriate IFCB chain is searched from the beginning to find the one that points to an ACB with this DCS address. This block is the one which is used. If no such block is found, no commands are generated for this antenna.

THE MONITOR DATA DEMUXING PROGRAM

The data demuxing program differs only slightly from what is described in Computer Memo #114. These changes are due mainly to curiously implemented hardware features. Code has also been added to "stream" monitor word two data onto disk or tape. The streaming of monitor data is controlled by a set of 32 words in global common following the command control words. Each word reflects for antenna 0 to 31 the following:

	Response			Monitored		
Word i	DS1	....	DS7	DS1	....	DS7

Each bit on in the left byte of word i represents the presence of at least one word from antenna i DS j during this cycle. Each bit on in the right byte signals that the corresponding dataset is in 'selected' (sometimes called random) mode and monitor word two data is to be buffered and streamed into file 'MDO'. This operation is double buffered, so there is little likelihood of lost data unless an unusually large number of points ($\sim$40) is being monitored.

At present, there is no strong correlation between the DCS address of a monitor point and its position in the 1152 word buffer. So, we use the response bit to distinguish between monitor words one and two: the first occurrence of a word for a data set is called monitor word one and sets the appropriate response bit. The second, if any, occurrence is defined by the response bit already being set and is called monitor word two. Words flagged as containing parity errors have already been removed by this time, so it can be seen that confusion will occasionally result. The set of response bits is set to zero just before each buffer of data is to be demuxed.

Each DCS word is translated into 3 computer words and each analog monitor word contains two values, called a left half and a right half. As it happens, words 2 and 3 of each triplet are exchanged, and the left and right halves of each analog monitor word are exchanged. Both these inversions are corrected before data is demuxed.

The Antenna Control Unit (Data set 0) is rather nonstandard in its operation. The normal meaning of monitor word one and two has been perverted and data that we really care about appears in monitor word two. Further, monitor word two and command address 192 do not function as with ordinary data sets. To accommodate this, the data demuxer allows for a special case of DS=0. When DS=0, the response bit test is ignored and all data looks like monitor word one data. The cost of this is that there is never any monitor word two data and thus no data streaming can occur for data set 0.

There is a task, referred to on Page 2 as DMT, used to interface the DCS program to people at a very basic level. Provision is made to inspect and alter some of the global common control parameters and to stuff commands into the word D manual buffer. Data displays are available which are oriented to the needs of the digital engineer. This task shall be further described in a future memo.