NATIONAL RADIO ASTRONOMY OBSERVATORY
Charlottesville, Virginia

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VLA COMPUTER MEMORANDUM #108

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VLA SYNCHRONOUS COMPUTER - GLOBAL COMMON--SYSTEM CONTROL BLOCKS PRELIMINARY SPECIFICATION

The body of this memorandum contains a synoptic description of the data area about which the VLA synchronous system computer programs will revolve. This description will be a primary reference for the detailing of the programs, as it describes the global common which is one of the primary means of communication between tasks (control communication will be by way of ACT/WAIT/RESUME services). Because of the great detail and the synoptic nature of the descriptions, this memorandum is not suitable as a general reference. A memorandum giving slightly more exposition is in preparation.

The system control blocks as described herein will appear in multiple copies. The number of copies to support the full, 27 element VLA as now envisioned is given in table one. The full control blocks will reside in the Boss computer. Truncated versions of the blocks will also reside in Monitor. The point of truncation is also given in table one.

All system control blocks will contain a pointer to the address of the next block of the same type. All device service routines will be entered with the address of the first control block of that type, procured from the array control block. After servicing the device, they will load the pointer to the next control block and reenter themselves, unless this pointer is zero, in which case they will return. In this way the code for the device service routines may be made independent of the location, number, contents, and, to some extent, the length of the various control blocks.

There is not a separate control block for each correlator - to provide one requires excessive amounts of core. Instead, a control block will be generated for each correlator found to be in error. The connectivity of the correlators will be handled by special programs.

For data output purposes it is convenient to order things by subarray, so a backwards link through the IF's connected to a subarray is provided.

Monitor data of each type is assumed stored all together and in identical format for each device of the same type.

The columns beyond the description give the variable type and scaling and the owning task. Floating point quantities are indicated by E (two word floating point) or by D (three word floating point). For fixed binary quantities, A B indicates single word, and an S indicates double word precision. The number following the letter gives the scaling. That is, B+0 indicates a binary point immediately following the sign bit of a sixteen bit word, S+31 indicates a binary point at the end of a double word, etc. Units are given in the following column. Only the owning task is permitted to modify the quantity, though other tasks may inspect it. To avoid interruption during modification, multiple precision quantities should be modified by a store file command.

TABLE 1

BLOCK TYPE	ABREVIATION	NUMBER	LENGTH	TRUNCATION POINT
Array Control	ARACB	1	70	46
Arm Control	ARMCB	3	3	3
Subarray	SCB	5	141	83
IF Group	IFGCB	4	11	6
Antenna	ACB	27	73	17
Front End	FECB	216	5	5
Preamp	PACB	54	4	4
IF	IFCB	108	23	7
Faulty Correlator	CCB	varies	4	4
			Approx. 7K	Approx. 3.5K

LOC	CONTENTS BIT SIGNIFICANCE		
0	WARNING	+	
1	ERROR	+	SET DURING NORMAL ARRAY OPERATION
2	SEVERE ERROR	+	
3	DANGER	+	
4	WARNING	+	
5	ERROR	+	SET DURING CALIBRATOR OBSERVATIONS ONLY
6	SEVERE ERROR	+	
7	DANGER	+	
8	WARNING	+	
9	ERROR	+	SET DURING SPECIAL TEST OPERATIONS ONLY
10	SEVERE ERROR	+	
11	DANGER	+	

THE [redacted] CONTROL [redacted]

LOC	CONTENTS			
0	MODIFIED JULIAN ATOMIC DATE	S+31	CLOCKB	DAYS
1	"			
2	TIME, INTERUPT COUNTS SINCE 0 HOURS THIS DAY	S+31		
3	"			
4	TIME, INTERUPT COUNTS SINCE LAST 10 SEC INTERUPT	S+15		
5	CONTROL PROGRAM ID		COLD	
6	RESERVED TO IDENTIFY REDUNDANT SYSTEM		---	
7	ARRAY STATUS FLAGS		CHECK	
8	TIME, IAT, FRACTION OF A DAY, AT LAST 10 SEC INTERUPT	D	GEOM10	RADIANS=TWOPI*DAYS
9	"			
10	"			
11	TIME, LST, FRACTION OF A DAY, AT LAST 10 SEC INTERUPT	D		RADIANS
12	"			
13	"			
14	ARRAY STATUS WORD		CHECK	
15	REDUNDANT ITEMS STATUS			
16	POINTER TO FIRST ARM CONTROL BLOCK		COLD	
17	POINTER TO ARM MONITOR DATA			
18	LENGTH OF MONITOR DATA PER ARM			
19	POINTER TO FIRST SUBARRAY CONTROL BLOCK			
20	POINTER TO SUBARRAY MONITOR DATA			
21	LENGTH OF MONITOR DATA PER SUBARRAY			
22	POINTER TO FIRST IF GROUP CONTROL BLOCK			
23	POINTER TO IF GROUP MONITOR DATA			
24	LENGTH OF MONITOR DATA PER IF GROUP			
25	POINTER TO FIRST ANTENNA CONTROL BLOCK			
26	POINTER TO ANTENNA MONITOR DATA			
27	LENGTH OF MONITOR DATA PER ANTENNA			
28	POINTER TO FIRST FRONTEND CONTROL BLOCK			
29	POINTER TO FRONT END MONITOR DATA			
30	LENGTH OF MONITOR DATA PER FRONTEND			
31	POINTER TO FIRST PREAMP CONTROL BLOCK			
32	POINTER TO PREAMP MONITOR DATA			
33	LENGTH OF MONITOR DATA PER PREAMP			
34	POINTER TO FIRST IF CONTROL BLOCK			
35	POINTER TO IF MONITOR DATA			
36	LENGTH OF MONITOR DATA PER IF			
37	POINTER TO FIRST FAULTY CORRELATOR CONTROL BLOCK			
38	POINTER TO CORRELATOR MONITOR DATA			
39	LENGTH OF CORRELATOR MONITOR DATA			
40	COSINE SIDEREAL TIME LAST 10 SEC INTERUPT	D	GEOM10	
41	"			
42	"			
43	SINE SIDEREAL TIME, LAST 10 SEC INTERUPT			
44	"			
45	"			
46	TIME, IAT, AT NEXT 10 SEC INTERUPT	D		RADIANS
47	"			
48	"			
49	TIME, LST, AT NEXT 10 SEC INTERUPT			
50	"			
51	"			

LOC	CONTENTS			
52	COSINE TIME, NEXT 10 SEC INTERUPT	D		
53	"			
54	"			
55	SINE TIME, NEXT 10 SEC INTERUPT	D		
56	"			
57	"			
58	DERIVIATIVE OF UT1 WRT IAT	E	INIT	DAYS/DAY - 1
59	"			
60	DERIVIATIVE OF EQUATION OF THE EQUINOX	E		TURNS/DAY
61	"			
62	APPARENT LST OF MIDNIGHT IAT	D		RADIANS
63	"			
64	"			
65	REFRACTION CONSTANT FOR POINTING	B-12	INIT	TURNS
66	CURRENT SURFACE REFRACTIVITY	E		N-1
67	"			
68	ESTIMATED ATMOSPHERIC PHASE PATH	E		NANOSECONDS
69	"			

[redacted]

LOC	CONTENTS	
0	ARM ID	COLD
1	ARM STATUS WORD	CHECK
2	POINTER TO NEXT ARM CONTROL BLOCK	COLD

S[redacted]RAY [redacted]RCL[redacted]CK

LOC	CONTENTS				
0		SUBARRAY ID		COLD	
1		SOURCE NAME (8 CHARACTERS MAX)	ASCII	INIT	
2		"			
3		"			
4		"			
5		SOURCE NAME NUMERIC QUALIFIER	B+15		
6		OBSERVER AND PROGRAM ID	ASCII		
7		"			
8		"			
9		OBSERVATION MODE DESCRIPTORS			
10		"			
11		DATA SURPRESSION CONTROL		INIT	
12	RA +		D	INIT	RADIANS
13	" +				
14	" +				
15	DEC +	SOURCE POSITION (1950 OR OTHER REFERENCE EQUINOX)			
16	" +				
17	" +				
18	COS DEC +		D	GEOM10	
19	" +				
20	" +				
21	SIN DEC +				
22	" +				
23	" +				
24	COS RA +				
25	" +	TRIG FUNCTIONS OF SOURCE COORDINATES,			
26	" +	LAST 10 SEC INTERLPT			
27	SIN RA +				
28	" +				
29	" +				
30	COS HA +				
31	" +				
32	" +				
33	SIN HA +				
34	" +				
35	" +				
36		POINTER TO FIRST IF GROUP CONTROL BLOCK CORA RR		CONNEC	
37		POINTER TO SECOND IF GROUP CONTROL BLOCK CORA LL			
38		POINTER TO THIRD IF GROUP CONTROL BLOCK CORB RR			
39		POINTER TO FOURTH IF GROUP CONTROL BLOCK CORB LL			
40		POINTER TO NEXT SUBARRAY CONTROL BLOCK			
41		LO FREQ #1 CORA RR	D	INIT(GEOM10?)	GIGAHERTZ
42		"			
43		"			
44		LO FREQ #2 CORA LL			
45		"			
46		"			
47		LO FREQ #3 CORB RR			

LOC	CONTENTS				
48		"			
49		"			
50		LO FREQ #4 CORB LL			
51		"			
52		"			
53	COS Z	+	E	GEOM10	
54	"	+			
55	SIN Z	+			
56	"	+			
57	COS A	+			
58	"	+			
59	SIN A	+ ALTAZ COORDINATES LAST 10 SEC INTERUPT			
60	"	+			
61	COS ETA	+			
62	"	+			
63	SIN ETA	+			
64	"	+			
65	Z	+	S+1		TURNS
66	"	+			
67	A	+			
68	"	+			
69		CHANGE IN AZIMUTH SINCE LAST 10 SEC INTERUPT	B-6		TURNS
70		CHANGE IN ZENITH ANGLE SINCE LAST 10 SEC INTERUPT			
71	COS DEC	+	D	INIT	
72	"	+			
73	"	+			
74	SIN DEC	+			
75	"	+			
76	"	+ TRIG FUNCTIONS OF SOURCE COORDINATES			
77	COS RA	+ REFERRED TO MIDNIGHT TODAY			
78	"	+			
79	"	+			
80	SIN RA	+			
81	"	+			
82	"	+			
83	D RA/DT	+	E	INIT	TURNS/DAY
84	"	+			
85	D DEC/DT	+ DERIVITIVES OF SOURCE POSITION			
86	"	+			
87	D V/DT	+	E	INIT	LIGHTS/DAY
88	"	+			
89	COS DEC	+	S+0		TURNS
90	"	+			
91		GAIN CODE			
92	COS DEC	+	D		
93	"	+			
94	"	+			
95	SIN DEC	+			
96	"	+			
97	"	+			
98	COS RA	+			
99	"	+ TRIG FUNCTIONS OF SOURCE COORDINATES,			
100	"	+ NEXT 10 SEC INTERUPT			

[redacted]RRA[redacted]NTR[redacted]CCK[redacted]

LOC	CONTENTS				
101	SIN RA	+			
102	"	+			
103	"	+			
104	COS HA	+			
105	"	+			
106	"	+			
107	SIN HA	+			
108	"	+			
109	"	+			
110	COS Z	+		E	
111	"	+			
112	SIN Z	+			
113	"	+			
114	COS A	+			
115	"	+			
116	SIN A	+	ALTAZ COORDINATES NEXT 10 SEC INTERUPT		
117	"	+			
118	COS ETA	+			
119	"	+			
120	SIN ETA	+			
121	"	+			
122	Z	+		S+1	TUPPS
123	"	+			
124	A	+			
125	"	+			
126			POINTER TO THE FIRST IF CONNECTED TO THIS SUBARRAY		CONNEC
127		+		B+1	INIT
128		+			
129		+			
130		+			
131		+	PRECESSION MATRIX		
132		+			
133		+			
134		+			
135		+			

GRO[redacted]CNT[redacted]BLO[redacted]

LOC	CONTENTS					
0	IF GROUP ID				COLD	
1	IF GROUP STATUS FLAGS				CHECK	
2	POINTER TO SUBARRAY CONTROL BLOCK				CONNEC	
3	POINTER TO NEXT IF GROUP CONTROL BLOCK				COLD	
4	SYNTHESIZER SETTING NOW +	DOPPLER DATA FOR LINE OBSERVATIONS	S+31	GEOM10		HZ
5	" +					
6	LINE REST FREQUENCY +		D	INIT		GHZ
7	" +					
8	" +					
9	SYNTHESIZER SETTING FOR 0 H TODAY +		S+31			HZ
10	" +					

[redacted]

LOC		CONTENTS			
0		ANTENNA ADDRESS ON COMMUNICATION SYSTEM		COLD	
1		ANTENNA ID		CONNEC	
2		STATION ID			
3		ANTENNA CONTROL STATUS, INCLUDING RECEIVER SELECT		INIT	
4		ANTENNA STATUS WORD		CHECK	
5		POINTER TO SUBARRAY CONTROL BLOCK		CONNEC	
6		POINTER TO ARM CONTROL BLOCK			
7		POINTER TO NEXT ANTENNA CONTROL BLOCK		COLD	
8	A	+ CURRENT ANTENNA COORDINATES	S+1	GEOMA	TURNS
9	"	+			
10	Z	+			
11	"	+			
12		FOCUS		INIT?	
13	A	+	S+1	GEOM10	TURNS
14	"	+ ANTENNA COORDINATES LAST 10 SEC INTERUPT			
15	Z	+			
16	"	+			
17		WAVE DELAY, LAST 10 SEC INTERUPT	D	GEOM10	NANOSECS
18		"			
19		"			
20		WAVE DELAY, LAST 10 SEC INTERUPT	B+10		10'S OF NANOSECS
21		CHANGE OF DELAY SINCE LAST 10 SEC INTERUPT	B+10	GEOMDL	10'S OF NANOSECOND
22	BX	+	D	CONNEC	NANOSECONDS
23	"	+			
24	"	+			
25	BY	+			
26	"	+			
27	"	+ ANTENNA LOCATION, NANOSECONDS,			
28	BZ	+			
29	"	+			
30	"	+			
31	BA	+	E		NANOSECONDS
32	" (K TERM)	+			
33	DELAY	+			
34	"	+			
35	"	+			
36		ANTENNA HEIGHT (RELATIVE TC ARRAY CENTER)	E	INIT	NANOSECONDS
37		"			
38		DIFFERENTIAL PHASE PATH DUE TO REFRACTION	E	GEOM10	NANOSEC
39		"			
40	A	+	S+1		TURNS
41	"	+ ANTENNA COORDINATES, NEXT 10 SEC INTEPUPT			
42	Z	+			
43	"	+			
44	U	+	B+19	GEOM10	NS
45	V	+ ANTENNA MOTION DERIVATIVES, LAST 10 SEC INTERUPT			
46	W	+	B+5		3'S OF NANOSECS/SE
47	U	+	B+19	GEOM10	NS
48	V	+ ANTENNA MOTION DERIVATIVES, NEXT 10 SEC INTERUPT			
49	W	+	B+5		3'S OF NANOSECS/SE
50	U	+	D		NANOSECS
51	"	+			

[redacted]EN[redacted]NTR[redacted]LOC[redacted]

LOC		CONTENTS				
52		"	+			
53		U'	+		E	
54		"	+			
55			WAVE DELAY, NEXT 10 SEC INTERUPT		D	GEOM10	NANOSECS
56			"			
57			"			
58			WAVE DELAY, NEXT 10 SEC INTERUPT			
59	+		+		B-8	INIT	TURNS
60	+		+			
61	+		+			
62	+	AZ	+			
63	+		+			
64	+		+			
65	+		+	ANTENNA POINTING CONSTANTS	S+1		TURNS
66	+		+			
67		+	+		B-8		TURNS
68		+	+			
69		+	EL	+			
70		+		+			
71		+		+	S+1		TURNS
72		+		+			

LOC	CONTENTS		
0	FRONT END ID		COLD
1	POINTER TO ANTENNA CONTROL BLOCK		CONNEC
2	FRONT END STATUS FLAGS		CHECK
3	FIRST LO FREQUENCY	CODE	INIT
4	POINTER TO NEXT FRONT END CONTROL BLOCK		COLD

LOC	CONTENTS	
0	PREAMP ID	COLD
1	POINTER TO FRONTEND CONTROL BLOCK	INIT
2	PREAMP STATUS FLAGS	CHECK
3	POINTER TO NEXT PREAMP CONTROL BLOCK	COLD

[redacted]CCN[redacted] BLO[redacted]

LOC	CONTENTS			
0	IF ID		COLD	
1	IF PECULIAR PHASE	B+0	INIT	TURNS
2	IF PECULIAR DELAY	B+11		10'S OF NANOSECS
3	PHASE + CURRENT OUTPUT	BCD	GEOMLR	TURNS
4	RATE +	S+12		KHZ
5	" +	B+10		10'S OF NANO SECS
6	DELAY +	B+10	GEOMDL	
7	PHASE +	B+0	GEOM10	TURNS
8	RATE + LAST 10 SEC INTERUPT	S+0		KHZ
9	" +			
10	QUAD TERM +	B-15		0.3'S OF KHZ/SEC
11	IF STATUS WORD		CHECK	
12	POINTER TO FRONT END CONTROL BLOCK		CONNEC	
13	POINTER TO ANTENNA CONTROL BLOCK			
14	POINTER TO IF GROUP CONTROL BLOCK			
15	POINTER TO THE NEXT IF CONNECTED TO THIS SUBARRAY			
16	POINTER TO NEXT IF CONTROL BLOCK		COLD	
17	PHASE +		GEOM10	
18	RATE + NEXT 10 SEC INTERUPT			
19	" +			
20	QUAD TERM +			
21	IF NOMINAL SENSITIVITY	?	?	?
22	NOISE TUBE SYNCHRONOUS DETECTOR			
	NOTE--GAIN = SQRT(NOM.SENS.*SYNC.DET)			
	FLUX (IN JY) = GAIN(1)*GAIN(2)*CORR.COEFF			
	(IN THEORY, ANYWAY)			

LOC	CONTENTS	
0	CORRELATOR ID	CHECK
1	BASELINE ID	
2	CORRELATOR STATUS WORD	
3	POINTER TO NEXT FAULTY CORRELATOR CONTROL BLOCK	