VLB ARRAY MEMO No. 557

(860624)

VLBA SPECIFICATION SUMMARY

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INTRODUCTION

This document summarizes the essential specifications of the Very Long Baseline Array (VLBA) project in a brief list for quick reference. It is derived from the much more detailed information in the "VLBA Book" and Array memoranda, which should be consulted for definitive information. For the sake of brevity, however, no references are given.

Many of the VLBA specifications are now well established, but some areas of the Project are still under development. Thus the Summary will necessary be rather volatile. To ensure that the current version is always available, this document will be maintained in plain ASCII form on node CVAX of NRAO's computer network, in file UMA3:[VLBA]SUMMARY.TXT.

CONFIGURATION >-<

Code	Status *1*	Location *2*	N Latitude [o,',"]	W Longitude [o,',"]	Elevation [m; MSL]
PT	D	Pie Town, NM	34 18 03.61	108 07 07.24	2371
KP	D	Kitt Peak, AZ	31 57 22.39	111 36 42.26	1916
LA	A	Los Alamos, NM	35 46 30.33	106 14 42.01	1967
NL	A	N. Liberty, IA	41.772	91.575	240
BR	A!	Brewster, WA	48 07 52.80	119 40 55.34	255
SC	S	St. Croix, VI	17.742	64.612	98
ML	S	Mauna Loa, HI	19.54	155.61	3300
FD	A	Fort Davis, TX	30.635	103.944	1614
OV		Big Pine, CA	37.23	118.28	1235
NE		"Northeast"			

Notes: *1* S => Selection; A => Acquisition; D => Development;
E => Erection; T => Testing; F => Outfitting;
O => In Operation; ! => Phase complete, next pending.
2 Listed in planned order of construction.

ANTENNAS >-<

Main Reflector --

Diameter	25 m
f/D	0.354
Surface	Shaped figure of revolution
Accuracy	(see below)

Cassegrain Reflector *1* --

Diameter	3.5 m
Surface	Shaped asymmetric figure
Accuracy	0.150 mm

Structure --

Type	Wheel-and-track, with advanced-design reflector support structure.
Elevation Motion	0 -› 125 deg; 30 deg/min
Azimuth Motion	-90 -› +450 deg; 90 deg/min

Operating Conditions:	Precision	"Normal"	Survival
Temperature [C]	-18 -› +32	-30 -› +40	
Temp. Change [C/hr]	2	--	
Temp. Diff'l. [C]	3.5 *2*	--	
Wind [m/s]	6	18	50
Gusts [m/s]	1	2.5	
Rain [cm/hr]	None	5	
Snow or Ice	None	None	20 psf, OR 1 cm

Accuracy --

Main Surface (panel manufacturing RSS)		0.125 mm
Main Surface (total RSS)	*3* *4*	0.282 mm
Pointing (repeatable)	*4*	3'
Pointing (non-rep., short term)	*4*	8"
Pointing (non-rep., long term)	*4*	14"

Notes: *1* Not used for all bands; see "Frequencies".
2 This condition to be met for 95% of observations.
3 See "Frequencies" for corresponding aperture efficiencies.
4 Under precision operating conditions.

FREQUENCIES >-<

Band Codes *1*	Frequency Range [GHz]	Focus *2*	Feed Type *3*	Aper Effc *4*	Ampl Type	Optg Temp [K]	Rcvr Temp [K]	System Temp [K]
P 90	.312 -› .342	P	D	.50	FET	360	30	104
50	.580 -› .640	P	D	.49	FET	360	32	66
L 20	1.35 -› 1.75	C	CH	.57	FET	15	12	30
S 13	2.15 -› 2.35	C	H	.71	FET	15	16	36
C 6	4.6 -› 5.1	C	H	.72	FET	15	20	35
5 *5*	5.9 -› 6.4	C	(H)	.71	FET	15	20	34
X 4	8.0 -› 8.8	C	H	.71	FET/HEMT	15	27	48
3 *5*	10.2 -› 11.2	C	H	.71	FET	15	11	27
U 2	14.4 -› 15.4	C	H	.69	FET	15	45	63
K 1	21.7 -› 24.1	C	H	.66	HEMT	15	40	67
Q .7	42.5 -› 43.5	C	H	.51	SIS	3.5	40	75
W .3 *5*	86.? -› 92.?	C	H	.18	?	?3.5	?	?

Notes: *1* Conventional radio (and VLA) letter designations & Centimeter wavelength, to 1(+) significant figure.
2 P => Prime focus; C => Cassegrain focus.
3 D => Crossed dipoles; CH => Compact horn; H => Conventional horn.
4 Total aperture efficiency, including all known effects.
5 Optional receivers; not included in basic Array budget.

Dual-Frequency Pairs --

Planned:	S/X bands.
Options:	C/U, C/K, U/Q, U/W

SIGNALS >-<

IF Processing --	
Number of IFs	4
IF Frequency Range	500 -> 1000 MHz
Baseband Conversion --	
Number of Converters	8
Number of Channels	16 (USB and LSB from each converter)
Bandwidths	16, 8, 4, 2, 1, .5, .25, .125, .0625 MHz
LO Quantization	10 kHz
Aggregate Bandwidth	256 MHz
Sampling --	
Number of Samplers	16
Sample Rates	32, 16, 8, 4, 2 Msmp/s
Level Quantization	2 or 4 levels
Coding	1- or 2-bit one's complement
Aggregate Data Rates	512 Msmp/s, 1024 Mbit/s
Formatting --	
Number of Bitstreams	32 (1 or 2 bits per sample)
Fan-out	1, 2, 4 track/bitstream
Format	Programmable, including Mark 3
Framing	Programmable, non-data-replacement
Aggregate Bit Rate	512 Mbit/s
Recording --	
Number of Tracks	64 (on 2 recorders)
Record Rate per Track	8, 4, 2 Mbit/s
Passes per Tape	18
Duration per Pass	40 min
Aggregate Rate (average)	128 Mbit/s, unattended for 24 hours
Aggregate Rate (peak)	512 Mbit/s

CORRELATOR >-<

Dimensions --	
Stations	20
Channels	8
Spectral Points	1024
Timing --	
Sample Clock Rate	32, 16, 8, 4, 2, 1, .5, .25, .125 Msmp/s
Speedup Factor	1, 2, 4· (constant 8 Mbit/s playback)
Integration Period	0.1 -> 10 s
Archive Data Rate	0.5 Mbyte/s
Tracking *1* --	
Delay (static)	Arbitrary, via playback offset
Delay (dynamic)	0 -> 21.3 ms
Delay Rate	-50 -> +50 smp/s
Phase (RMS error in 0.1 s)	0.0001 turn
Phase Rate	-144 -> +144 kHz
Phase Acceleration	-10.4 -> +10.4 Hz/s

Modes --

Name	Channels	Polarization *2*	Spectral Points
1N	1	N	1024
2N	2	N	512
2P	2	P	256
4N	4	N	256
4P	4	P	128
8N	8	N	32
8P *3*	8	P	32

Notes: *1* For unit speedup only; ranges restricted (or performance degraded) for 2 & 4 speedup factors.
2 N => Normal (non-polarized) channelwise correlation;
P => Polarization (all 4 products) of L/R channel pairs.
3 Only 14 stations supported in mode 8P.