NATIONAL RADIO ASTRONOMY OBSERVATORY
SOCORRO, NEW MEXICO
VERY LARGE ARRAY PROGRAM

VLA TEST MEMORANDUM NO. 127

IMPROVED ANTENNA PAD LOCATIONS FOR THE A AND B ARRAY CONFIGURATIONS

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Since 1976, a significant number of antenna-pad baselines have been determined from observations of radio sources. Initial baseline estimates were determined by C. M. Wade (see VLA Test Memorandum 103 and 107), using the ground coordinates and elevation above mean sea level for each pad as determined by survey.

The astronomically measured baselines, when compared to those estimated by Wade, show a systematic deviation from the predicted values. In particular, the baseline difference (predicted baseline minus measured baseline) has been formed for the components Bx, By and Bz of each occupied pad on each of the three arms. These differences were then plotted as a function of distance from the array center. The absolute value of the baseline differences generally tends to increase with distance and can be described to first order by fitting a least-squares line to the difference vs. distance data. The initial slopes and zero-points for the lines found in this treatment of the data are listed in Table 1. For each component, Table 1 displays the baseline slope in units of nanoseconds per kilometer and the zero-point (distance at 0 km) in nanoseconds.

Table 1

Arm	Bx		By		By	
	Slope (nsec/km)	Zero-pt (km)	Slope	Zero-pt	Slope	Zero-pt
W(l.t. 2km)	-0.124	0.059	-0.197	0.156	0.015	-0.077
W(g.t. 2km)	0.083	-0.289	0.124	-0.608	-0.039	0.143
E	0.053	0.019	-0.012	-0.075	0.057	-0.044
N	-0.042	-0.032	-0.100	-0.093	-0.002	-0.012

The baseline corrections as listed in Table 1 were used in the reconfiguration to the C array in July 1980 with reasonable success; however, they should be applied while heeding the following two warnings:

1.) The baseline correction (= distance from array center times slope plus zero-point) should be subtracted from the appropriate value given by Wade in Memorandum No. 107;

2.) Although the prescribed values in Table 1 correct the predicted baselines to first order, there appears to be genuine variations in baseline components for each pad independent of the linear trend.

A timely application of the baseline corrections in Table 1 is to generate the updated baselines to be used in the Modcomp Antennas file for the upcoming reconfiguration to the A array in October. Table 2 lists baseline components Bx, By and Bz for all A and B array antenna-pad locations, having been modified using the linear corrections described above. A array antenna-pad locations marked with * in Table 2 represent pads which have never been occupied and therefore have baseline corrections based on an extrapolation of the values given in Table 1. All other baselines listed in Table 2 should be accurate to within roughly one wavelength at 6 centimeters. Revisions to the values listed in Table 1 and Table 2 will be made when more data become available.

The baseline predictions listed in Table 1 may be improved by using the specific baseline parameters measured at previously occupied pads. The baseline components for an unoccupied pad may be predicted using a linear interpolation between surrounding occupied pads. This technique should help to remove variations in the baseline parameters which seem to be independent of the least-squares prediction. Table 3 lists the baseline components using previously measured values or values estimated from a linear interpolation scheme. Pad locations marked with † denote values identical to the least-squares prediction. Such pads are either more distant than previously occupied pads or are suspected to have baseline parameters not well represented by the interpolation scheme. Table 3 should be used for initial baselines in the A array configuration.

Table 2
West Arm

Pad	Bx	By	Bz
B1	156.73	-407.62	-225.66
B2-A1	509.52	-1338.52	-745.19
B3	1021.26	-2683.74	-1449.64
B4-A2	1667.35	-4396.59	-2452.47
B5	2446.39	-6447.58	-3596.01
B6-A3	3353.69	-8815.98	-4910.91
B7	4391.16	-11485.51	-6382.82
B8-A4	5470.49	-14443.20	-8061.15
B9	6671.49	-17678.24	-9883.07
A5	7988.71	-21181.43	-11844.58
A6	10924.66	-28961.76	-16194.01
A7	14206.55	-37731.76	-21114.79
A8	17842.72	-47447.10	-26566.65
A9*	21802.65	-58074.10	-32541.47

Table 2
East Arm

Pad	Bx	By	Bz
B1	118.74	445.46	-170.36
B2-A1	381.67	1463.27	-565.35
B3	765.42	2933.99	-1133.72
B4-A2	1257.49	4806.67	-1854.98
B5	1868.20	7049.09	-2704.03
B6-A3	2552.40	9638.33	-3698.71
B7	3330.98	12556.58	-4814.70
B8-A4	4180.17	15789.89	-6060.42
B9	5118.44	19326.44	-7416.44
A5	6127.02	23156.18	-8889.88
A6	8324.92	31661.59	-12190.81
A7*	10814.34	41248.34	-15903.30
A8*	13536.66	51869.57	-20040.40
A9*	16206.62	63679.39	-24273.24

Table 2
North Arm

Pad	Bx	By	Bz
B1	-249.54	-39.16	372.25
B2-A1	-812.70	-126.80	1201.03
B3	-1632.06	-254.47	2406.76
B4-A2	-2673.19	-417.01	3943.22
B5	-3917.13	-611.49	5784.74
B6-A3	-5352.38	-836.21	7911.95
B7	-6976.53	-1089.35	10305.22
B8-A4	-8769.73	-1369.85	12961.00
B9	-10732.43	-1676.71	15864.96
A5	-12857.77	-2008.95	19009.57
A6*	-17582.71	-2746.92	25990.66
A7*	-22918.52	-3578.67	33852.13
A8*	-28826.69	-4500.02	42564.59
A9*	-35282.47	-5507.96	52098.42

Table 3

West Arm

Pad	Bx	By	Bz
A1	509.52	-1338.51	-745.23
A2	1667.30	-4396.29	-2452.42
A3	3353.71	-8816.12	-4910.71
A4	5470.54	-14443.16	-8061.23
A5	7988.64	-21181.39	-11844.79
A6	10924.71	-28961.66	-16194.07
A7	14206.43	-37731.08	-21114.60
A8	17842.80	-47447.28	-26566.68
A9†	21802.65	-58074.10	-32541.47

East Arm

Pad	Bx	By	Bz
A1	381.68	1463.32	-563.36
A2	1257.46	4806.64	-1854.96
A3	2552.44	9638.20	-3698.90
A4†	4180.17	15789.89	-6060.42
A5†	6127.02	23156.18	-8889.88
A6	8324.90	31661.65	-12190.73
A7†	10814.34	41248.34	-15903.30
A8†	13536.66	51869.57	-20040.40
A9†	16206.62	63679.39	-24273.24

North Arm

Pad	Bx	By	Bz
A1	-812.59	-126.88	1200.98
A2	-2673.22	-416.90	3943.09
A3†	-5352.38	-836.21	7911.95
A4	-8769.72	-1369.82	12961.02
A5	-12857.77	-2009.00	19009.61
A6†	-17582.71	-2746.92	25990.66
A7†	-22918.52	-3578.67	33852.13
A8†	-28826.69	-4500.02	42564.59
A9†	-35282.47	-5507.96	52098.42