VLA Test Memo 166
January, 1993

Response Time of VLA Antennas to Small Step Functions

K. Sowinski

This memo serves to record measurements made to determine the time to settle to a new pointing position after a small change. The reason for carrying out these tests was to provide information for designing the L band survey, but the results may be of interest to a wider audience.

A program was written to measure the pointing error for each axis by subtracting the current ACU readout from the most recent commanded value. The results were encoded into a command and distributed so as to be available to a chart recorder. The array was put into pointing mode to provide deflections of one-half beam and a full beam. Only antenna 2 was used for these tests. The elevation during the tests was 35-40 degrees, so the actual motion about the azimuth axis was about 20 per cent more than the nominal half beam. To examine the response to larger deflections, the program that generates pointing offsets was modified to move the antennas through full beam deflections rather than half beam. Data was collected for the normal and doubled deflections.

The results are presented in the following table. For each axis, the number represents the time in seconds to settle to within one or two minutes of arc, as indicated, of the correct position in response to the deflection given in arc minutes.

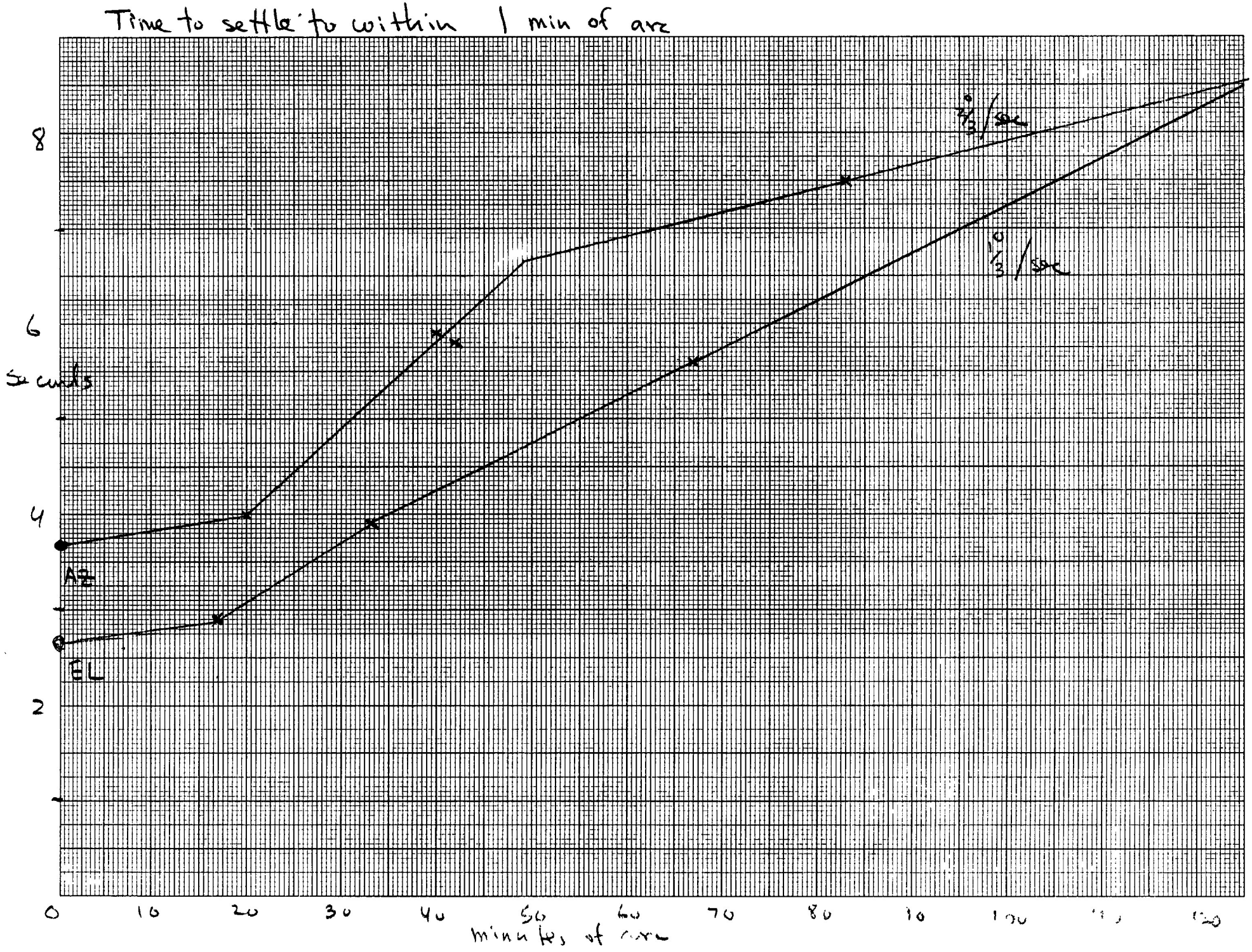
Deflection	Az(1′)	El	Az(2′)	El
17		2.9		2.4
33		3.9		3.4
67		5.6		5.0
20	4.0		3.5	
40	5.9		4.0	
42	5.8		4.1	
83	7.5		5.0	

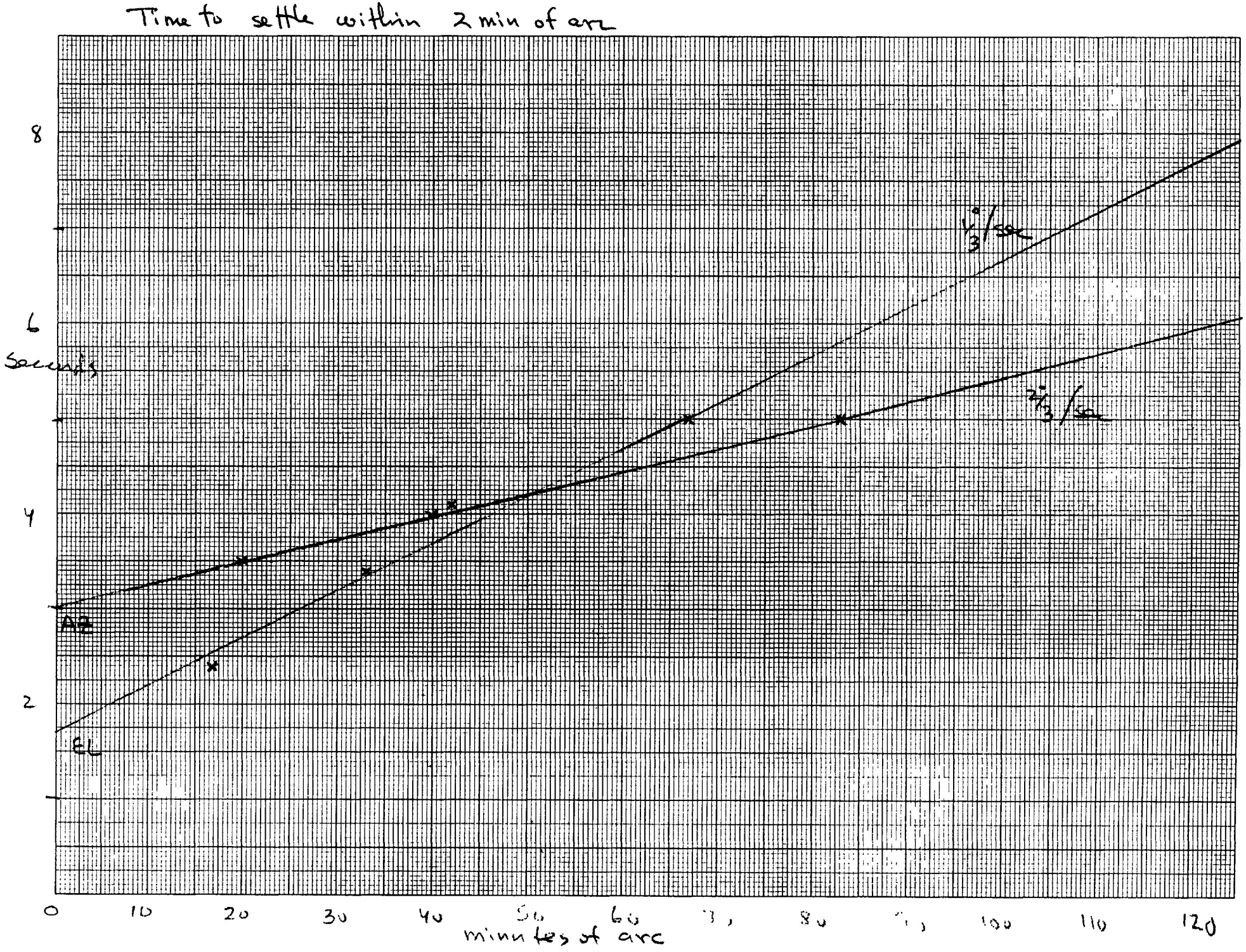
Figure 1 and 2 present this graphically for each of the two tolerances chosen. The line beyond the last point is extrapolated based on the nominal slew rate of the antenna. The intercept at zero time is estimated from independent measurements of antenna response to very small deflections.

The shape of the azimuth response curve is not what one might expect; I attribute this to a non-linearity in response time due to overshoot. At the smaller tolerance (1′) the magnitude of servo overshoot is enough to lengthen the response time significantly. Figure 2 shows the time for the antenna to settle to within 2′ of the correct position. In azimuth, the settling time is asymptotically about 2 seconds faster.

In summary, I present a table of maximum deflection allowable, in arc minutes, given a maximum settling time of 6.5 seconds.

	Az	El
1 minute tol.	45	80
2 minute tol.	120	90


Time to settle to within 1 min of arc
8
6
4
2
0
10
20
30
40
50
60
70
80
90
100
120
seconds
minutes of arc
AZ
EL


Time to settle within 2 min of arc
8
6
Seconds
4
2
AE
EL
1/3°/sec
2/3°/sec
0
10
20
30
40
50
60
80
100
110
120
minutes of arc