

VLB ARRAY MEMO No. 386

VLBA Electronics Memo No. 19

NATIONAL RADIO ASTRONOMY OBSERVATORY
Charlottesville, Virginia

September 10, 1984

TO: VLBA Electronics Group Members

FROM: A. R. Thompson

SUBJECT: VLBA Electronics Group meetings of August 6 & September 6

Attendees August 6: Bradley, Campbell, Dill, Hvatum, Kellermann,
Napier, Norrod, Thompson

September 6: Bradley, Brundage, Dill, Norrod, Simon,
Thompson

Cryogenics

On August 6 there was a discussion of the possible use of CTI model 350 refrigerators on the lower frequency front ends which have the greatest thermal loading. The two model 1020 helium compressors planned for each antenna each have a nominal capacity of 48 cfm (cubic feet per minute), that is 96 cfm total. Howard Brown suggests 40 cfm per compressor is a safer load. At 81 cfm maximum total load, compressors can supply the following combination of refrigerators:

- 9 model 22 (9 cfm each)
- 1 model 350 (17 cfm each) and 7 model 22
- 2 model 350 and 5 model 22
- 3 model 350 and 3 model 22

The number of front ends to be cooled to 15K is likely to be no more than 7, since the current plan calls for implementing only one of the group E frequencies (6 and 10.7 GHz), and at least one of the group D (22 and 43 GHz) systems is likely to be a maser or SIS mixer requiring an independent 3-4K cryogenic system. Thus the use of the model 350 refrigerator on the L and S band front ends would not increase the compressor requirement. Comparative parameters for the model 22 and 350 refrigerators are given below.

	<u>Model 22</u>	<u>Model 350</u>
Helium requirement	9 cfm	17 cfm
Cooling capacity (15K)	1 W	2-3 W
Displacer frequency	200 cycles/min	72 cycles/min
Weight	15 lbs	22 lbs
Approximate cost	\$3.5k	\$5.9K
Length of cooling section	7.1 inches	11.12 inches

With the larger Dewar required for the model 350 refrigerator, the weight of a front end would be 10-20 lbs greater than with the model 22 refrigerator. It was noted that a decision on the possible use of model 350 refrigerator units is not required until April 1, 1985. In the meantime, experience gained from the testing of the prototype L-band front end being constructed at Green Bank will provide information upon the capability of the model 22 refrigerator.

On September 6, the prototype L-band front end was expected to be ready for a first cool down the following week. The orthomode transition had been received from the manufacturer, A. J. Tuck, after being returned to remove excess copper because the original electroforming had made the unit too thick. The weight was reduced by only 1 1/2 lbs (from 19 to 17 1/2 lbs) because of machining difficulties. Roger Norrod estimates that the weight need not exceed about 12 1/2 lbs if the unit were made much thinner in the electroforming, and will take steps to order a lighter one in a few weeks.

In the refrigerator test setup in the 85/1 building at Green Bank two model 22 refrigerators are now running, mounted in Dewars of the 8.4 GHz design. Both units are cooling 3 lb copper blocks, and monitored temperatures are approximately 47K on the first stage and 14K on the second. One refrigerator has developed a squeak. The other one had also developed a squeak some weeks earlier, but has been taken apart and carefully reassembled in the Green Bank cryogenics shop and now works normally. A third refrigerator unit should be added to the test setup during September, and two more will follow later. There was some discussion of test procedures, and Roger Norrod suggests leaving at least one unit running without interruption, and on another performing warm-up and cool-down cycles once per week.

Front Ends

The 8.4 GHz front end at the VLA site has not yet been mounted on the antenna (No. 20) because the front end rack is still under maintenance. It is expected to be mounted during the week of September 10.

Tests of the first two HEMTs from the Cornell contract have been made by M. Pospieszalski at 8.4 GHz. These both gave single-stage receiver temperatures of 10-11K when cooled to 15K and illuminated with a light-emitting diode. The performance was stable and suggest that these transistors will make very good low-noise amplifiers.

Feeds

Peter Napier plans to procure during 1985 one subreflector and a set of feeds for 330 MHz, 610 MHz, and L, C, and K bands. The 330 and 610 MHz feeds will consist of crossed dipoles located in front of the subreflector.

Procurement Schedule

The reduction in the funding for 1985 and the postponement of spending until April 1 require detailed replanning of the electronics procurement schedule. Preliminary replanning for 1985 can be outlined as follows. During 1985 the amount allocated for electronics materials has been reduced from \$3084k to \$942k. Money for the main purchase of hydrogen masers will not be available until 1987. It is highly desirable that two masers be purchased out of 1985 funds for testing and for use with the first four antennas which become available in 1986 and 1987. Also \$163k is required in 1985 for the prototype subreflector and some of the feeds. This leaves about \$280k from which we can build nine cryogenic front ends (three each for L, C, and Ku bands) and the general electronics for one antenna including the local oscillator system, frequency convertors, 500-1000 MHz IF stages, front-end control units, racks, power supplies, etc.

Documentation

Harry Dill is setting us a central documentation system for drawings, etc. at the Ivy Road building.