

May 12, 1960

MEMO TO: L.V. Berkner

FROM: Richard M. Emberson

This memo confirms oral estimates I gave you last week on the direct out-of-pocket costs through delay in completion of the 140-foot telescope.

Services we must maintain for as long as E. W. Bliss is fabricating and erecting the telescope include:

	(estimates are for one year)
1. N. L. Ashton	\$ 50,000
2. T. W. Brown	13,680
3. The Franklin Institute	7,280
4. Other consultants	8,000
5. Pittsburgh Testing Laboratory	108,196
6. Staff	42,980
	<u>\$229,936</u>

- Notes: 1) We hope that Bliss some time soon will complete the engineering necessary to get all the job into the shop, but although this phase of the work would taper off, I anticipate frequent demands for Professor Ashton's assistance on fabrication and erection problems, and have estimated the cost of his services at the same level as for the fiscal year now ending.
- 2) I estimate a greater demand for help from Mr. Brown, primarily at Green Bank. The figure given assumes about double the input of the past year at a cost adjusted according to the experience at Green Bank when Mr. Brown installed the DAPTIS sensors on the 85-foot Tatel telescope.
- 3) The Franklin Institute will be deeply involved in closing all technical details related to the hydrostatic bearings for the polar shaft and in checking these bearings when put into operation. The figure I have estimated assumes no extraordinary difficulties will be encountered. Inasmuch as these bearings are the largest of the kind, perhaps my estimate is too conservative.

- 4) This number is a pure guess and to that extent may be considered as a reserve fund or contingency.
- 5) The estimate for Pittsburgh Testing Laboratory services is based on an average of 5 men, working normal 8-hour, 5-day weeks, plus overtime for Saturday, Sunday, and holiday work. A contingency of 10% is added to cover the transportation item plus any miscellaneous tests we might require.
- 6) The staff positions in the Major Design and Construction Department are all charged against the capital budget for the 140-foot telescope. When other large projects are initiated, the Department will be expanded, but the portion pro rated for the 140-foot telescope will remain about as given.

A second type of cost to NRAO resulting from delay of the 140-foot telescope derives from the receivers and other electronic equipment that will be used with the telescope in the observing programs. We cannot wait for the completion of the telescope to initiate the design and construction of the electronic equipment. In fact, the electronic equipment must be ready when the telescope is completed, and as long as there is hope for completion at some early date, the electronic equipment program must be geared to this early date. Let us assume, therefore, that this equipment is ready but must then wait a year for completion of the telescope. Put a value of \$500,000 on this equipment. Dr. Findlay has clearly pointed out that technical advances are moving at a very rapid rate and that the electronic equipment for radio astronomy fast becomes obsolete. If we assume a five year useful life and assume a simple linear loss rather than a more probable complex exponential function, one arrives at a loss of \$100,000 per year.

In summary, a delay of one year beyond the earliest feasible date of completion of the 140-foot telescope directly costs NRAO \$230,000 in the construction budget and \$100,000 in the electronics budget, a total of \$330,000, which amounts to a rate of \$27,500 per month.