Interoffice

National Radio Astronomy Observatory

Green Bank, West Virginia

To: 25m - Millimeter Antenna File 3 June 1976
Memo No. 43

From: Buck Peery

Subject: VISIT TO BELL LABS - 7m "OFF-SET" ANTENNA

Sebastian von Hoerner, W. Y. Wong, and the writer visited Dr. Robert Wilson at Bell Laboratories in Holmdel, New Jersey, May 19, 1976. The purpose of the visit was to see their 7m "off-set" antenna, which is under construction, and observe their method of setting the panels and field checking the surface.

Some interesting facts:

1. Elevation - Azimuth configuration.
2. Pedestal with large pintal bearing with cross roller bearings.
3. Structure rigid and very heavy - reflector back up structure galvanized bolted steel.
4. Cassegrain operation only.
5. Total estimated error approximately 100 μm rms. This includes manufacturing accuracies of reflector surface and setting accuracies. They feel gravitational and thermal deformations will be minimum.
6. Two equipment or receiver buildings - one at the focal point of the secondary reflector which moves in elevation as well as azimuth. The other is off the end of the elevation shaft and moves in azimuth only. The buildings are approximately 8 ft cube.
7. Mirrors are used extensively in the feed system and between stages of amplification. This simplifies transfer of data from moving (elevation) equipment and equipment on the azimuth platform. The route is through one of the elevation bearings on the center line of the elevation axis.
8. The approximate cost is 950K. It is estimated the off-set designed caused this cost to be 25% higher than it would be for a similar center feed antenna.
9. The basic reason for the off-set design is to obtain a very clean beam of approximately 1 arc minute in width with a pointing accuracy of 10 arc seconds.
10. The main use is for communication research in the 20 to 50 GHz range with synchronous satellites. The secondary use is radio astronomy (when time is available) and they hope to do some 1 mm work.

11. The antenna is to be used outside, exposed to the elements - no radome. All surfaces, except reflective surfaces, are insulated - 1 inch of sprayed foam on the back side of the panels, 3 inch thick fiber or spun glass panels) roof deck type) on the pedestal, yoke arms and around the back up structure of the main reflector. Ambient air is blown through the cavity behind the main reflector and through the support legs of the secondary reflector (sub reflector).

12. The main reflector panels are cast machine panels with a surface accuracy of approximately 50 μm rms, based on manufacturers measurements. These panels are similar to the prototypes for the 25 m except they are much heavier. They weigh 6.75 p.s.f. (34.5 kg/m^2), have 8 inch (20.3 cm) ribs, and a thick surface.

13. The surface of the panels are painted (at factory) with a white diffusing paint 1.5 to 2 1000ths thick (38 μm to 51 μm). This was carefully checked with an ultra sonic paint thickness measurement instrument. Control of thickness was dependant on the ability of the painters.

14. Surface plates were supported near each corner with 1 inch diameter coarse threaded rod with ball and socket on the panel and two nuts and spherical washers at the back up structure. The sockets were equipped with spring steel to keep pressure on the ball. Adjustment is made by holding threaded rod with channel locks - loosening one of the nuts at the back up structure then turning the support or the other nut to adjust the position of the surface plate, then tightening the nut to hold the support in place.

15. Field check of surface plates and final setting of the total surface is done with a two piece template supported from a long arm pivoted on a center post. The template was cut to within 1 mil (25 μm) of the theoretical curve of the telescope. Adjustments, checking and setting of panels is done in conjunction with tilt meters on the pedestal and center posts, optical targets on the template, dial indicators on the template, and electrical transducers on the template.

16. Access to various sections of the telescope were by steep stairs (ships ladders) similar to VLA and appeared to be very adequate. A small job hand crane was located at the corner of the platform in front of the fixed control room for hoisting equipment up to that level.

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