

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION  
Washington, D. C.

NASA Contract NASr-87

Final Report

November 14, 1966

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Submitted by

Electrical Engineering Research Laboratory  
MILLIMETER WAVE SCIENCES

The University of Texas  
Austin, Texas

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C. W. Tolbert,  
Director

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This is the synoptic final report of activities at The University of Texas associated with Contract NASr-87 over the time interval 13 November 1961 to 13 November 1966.

The principal procurement under this contract, a 16 foot millimeter wavelength parabolic reflector antenna, was acquired at a cost of \$370,000.00. Two additional items of equipment, radiometer heads operating at frequencies of 100 and 140 Gc, were acquired under Supplement #1 of this contract between 15 April 1964 and 30 June 1965 at a cost of \$74,000.00.

The antenna was accepted from the vendor 6 June 1963. Dedication ceremonies at Balcones Research Center were held 14 June 1963 with attendance of administrative and scientific dignitaries.

Funds from Lunar and Planetary Sciences, NASA Headquarters, have supported the operation and maintenance of the antenna system as a millimeter wavelength telescope from 1 April 1963 through the time of this reporting. Operation of the telescope in exploring the refraction and propagation characteristics of the Earth's atmosphere between the frequencies of 22.3 Gc and 325 Gc have been funded by Wright-Patterson Air Force Base and Air Force Cambridge Research Laboratories.

The following publications have resulted from investigations conducted with the antenna system:

### Technical Reports

- 1a "A 16-Foot Millimeter Wavelength Antenna Systems, Its Characteristics and Its Applications," by C. W. Tolbert and A. W. Straiton, Technical Report No. 1, EERL Report I-01, The University of Texas, 15 March 1964.
- 2a "An Investigation of Tau A and Sgr A Millimeter Wavelength Radiation," by C. W. Tolbert and A. W. Straiton, EERL Report No. 6-61, The University of Texas, 28 August 1964.
- 3a "An Investigation of 35 Gc, 70 Gc, and 94 Gc Cytherean Radiation," by C. W. Tolbert and A. W. Straiton, Technical Report No. 2, EERL Report I-02, The University of Texas, 15 October 1964.
- 4a "Millimeter Studies in Radio Astronomy," by C. W. Tolbert and A. W. Straiton, EERL Report No. 6-62, The University of Texas, 31 March 1965.

### Publications

- 1b "A Germanium Bolometer Detector of Millimeter Wavelength Thermal Energy," by D. G. Galloway and C. W. Tolbert, Rev. of Sci. Instr., Vol. 35, No. 5, May 1964, pp. 628-630. Additament, July 21, 1964.
- 2b "Solar Radiation at 3.2 mm During the 20 July 1963 Eclipse," by C. W. Tolbert, L. C. Krause and A. W. Straiton, Astrophy. J., Vol. 140, No. 1, July 1, 1964, pp. 306-312.
- 3b "An Investigation of 35 Gc, 70 Gc and 94 Gc Cytherean Radiation," by C. W. Tolbert and A. W. Straiton, Nature, Vol. 204, No. 1242, 26 December 1964.
- 4b "A 16-Foot Diameter Millimeter Wavelength Antenna System, Its Characteristics and Its Applications," by C. W. Tolbert, A. W. Straiton and L. C. Krause, IEEE Trans. on Antennas and Propagation, Vol. AP-13, No. 2, March 1965, pp. 225-229.

- 5b "An Investigation of Tau A and Sgr A Millimeter Wavelength Radiation,"  
by C. W. Tolbert and A. W. Straiton, Astron. J., Vol. 70,  
No. 2, March 1965, pp. 177-180.
- 6b "Millimeter Wavelength Spectra of the Crab and Orion Nebulae,"  
by C. W. Tolbert, Nature, Vol. 206, No. 4991, 26 June  
1965, pp. 1304-1307.
- 7b "Observed Millimeter Wavelength Brightness Temperatures of Mars,  
Jupiter and Saturn," by C. W. Tolbert, Astron. J., Vol. 71,  
No. 1, February 1966, pp. 30-32.

### Theses

- 1c "An Evaluation of the Texas Instrument's Germanium Bolometer at  
Millimeter Radio - Frequency Wavelengths," by D. G.  
Galloway, Master of Science in Electrical Engineering  
Thesis, The University of Texas, January 1964.
- 2c "A Low-Noise 100-MC Bandwidth Transistorized I-F Amplifier for  
Radio Astronomy," by R. A. Vivian, Master of Science in  
Electrical Engineering Thesis, The University of Texas,  
August 1964.
- 3c "Radio Astronomy Signal Spectrum Analyser," by J. H. Sizelan,  
Master of Science in Electrical Engineering Thesis,  
The University of Texas, September 1965.

Being prepared for publication are investigations of lunar and solar  
emission characteristics at frequencies of 35 Gc and 94 Gc.

Effectiveness of the 16 foot antenna system having been established  
and a "first look" survey of extraterrestrial subjects completed, the  
antenna is currently being moved from its present altitude of 750 feet  
to an altitude of 6,600 feet. The higher altitude will improve both the  
quality and quantity of data at the current operating frequencies of the  
telescope and allow an effective extension of the operating frequencies to

140 Gc. The parabola is being refigured and resurfaced during the relocation to insure its effectiveness at shorter millimeter wavelengths. The 6,600 foot altitude location on Mt. Locke is adjacent to the McDonald Observatory (30°40' N latitude, 104° W longitude). Relocation funding was provided by Lunar and Planetary Sciences, NASA Headquarters. Physical relocation of the telescope is expected to be completed 1 February 1967. Adjunctive millimeter wavelength telescopes and other millimeter wavelength propagation experiments for NASA and DoD are to be located at the Mt. Locke Millimeter Wave Sciences Observatory.