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NATIONAL RADIO ASTRONOMY OBSERVATORY Charlottesville, Virginia

Quarterly Report

RAD CASTRONOMY OBSERVATORY CHARLOTTESVILLE, VA. JUL 19 1976

April 1, 1976 - June 30, 1976

RESEARCH PROGRAMS

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140-Foot Telescope	Hours
Scheduled observing	1961.50
Scheduled maintenance and equipment changes	208.50
Scheduled tests and calibration	8.00
Time lost due to: equipment failure	87.00
power	5.25
weather	14.50
interference	1.25

The following line programs were conducted during this quarter.

Observer

Program

R.	Crutcher (Illinois)	Study of 1667 MHz OH within and near Perseus OB2, toward Heiles dust cloud 5, W40, NGC 2264, and selected stars. Search for 1665 and 1667 OH in Comet West.
K. D. P.	Johnston (NRL) Thacker (NRL) Schwartz (NRL)	An attempt to confirm high velocity 1665 and 1667 MHz OH features in W49, and a search for similar features in W51 and Sgr B2.
A. S. P. D.	Haschick (MIT) Kleinmann (MIT) Myers (MIT) Sargent (MIT)	Survey for 18-cm OH maser emission from selected sources from the Air Force Cambridge Research Laboratory infrared catalog.
G. R.	Knapp (Caltech) Brown	Observations of 14.488 GHz H ₂ CO (formalde- hyde) near early-type stars embedded in dark clouds.
N. K.	Fourikis (CSIRO, Australia) Takagi (U. Toyama, Japan)	Search for CH ₃ NHD (deuterated methylamine) at 10.310 GHz in Sgr B2 and Ori A, and a search for CH ₃ CH ₂ CHO (propion acetaldehyde) (cis) at 10.492 GHz.

N. Fourikis (CSIRO, Australia) S. Saito (Sagami Chemical Research Center, Japan)

B. Turner

- P. Bowers (Maryland)
- F. Kerr (Maryland)
- S. Simonson (Maryland)
- R. Giovanelli (Bologna, Italy) M. Haynes (Indiana)
- T. Giuffrida (MIT)
- H. Radford (Center for Astrophysics) R. Curl (Rice) J. Cook (Rice)
- G. Hills (Rice)

E. Chaisson (Center for Astrophysics) G. Field (Center for Astrophysics) S. Perrenod (Center for Astrophysics)

R. Whitehurst (Alabama) M. Roberts

- M. Guelin (NASA Institute for Space Studies)
- D. Cesarsky (Meudon, France) J. Lequeux (Meudon, France)
- S. Miller (Rensselaer)
- M. Guélin (NASA Institute for Space Studies)
- K. Tucker (Fordham)
- N. Evans (Texas, Austin)
- M. Kutner (Rensselaer)
 S. Miller (Rensselaer)

Program

Search for DC₃N (deuterated cyanoacetylene) at 8443 MHz, CH₃CH₂CHO (propion aldehyde) (gauche) at 8463 MHz, and CH₃C₃M (methyl cyanoacetylene) at 8269.9 MHz.

Observations to complete the 18-cm OH galactic survey.

Observations of 1612 MHz OH to verify detections made during the 300-foot telescope all-sky 1612 MHz OH survey and observations at 1667 MHz to check the classifications of these sources.

Search for 18-cm OH emission from high latitude, high velocity clouds.

Search for 9 GHz NH₂ emission from a representative group of molecular line sources.

Search at 350-450 MHz for redshifted hydrogen absorption in high redshift radio quasars.

Search for absorption or emission from the quark-electron hyperfine transition at 281 MHz.

Search for 4830 MHz H₂CO (formaldehyde) in planetary nebulae.

Observations of 6-cm 110α hydrogen and carbon recombination lines in NGC 1977.

Program

C. Heiles (Berkeley) Observations of 21-cm Zeeman line splitting T. Troland (Berkeley) to test a new technique for increased sensitivity, to acquire new Zeeman measurements, and to confirm previous Zeeman measurements.

The following continuum programs were conducted during this quarter.

Observer

Program

Ρ.	J. Peebles (Princeton)	Map the distribution of plasma in clusters
D.	Wilkinson (Princeton)	of galaxies from the scattering of 2.7° K
L.	Rudnick	radiation at 2-cm wavelength.

- L. Rudnick
- R. Porcas

Observations at 2-cm of the spectra and time variability of selected groups of radio sources.

The following very long baseline observations were conducted.

Observer

- K. Johnston (NRL)
- J. Spencer (NRL)
- D. Backer (Berkeley)
- J. Spencer (NRL)
- K. Johnston (NRL)
 P. Schwartz (NRL)
- G. Swenson (Illinois)
- J. Weber (Illinois) J. Moran (Center for Astrophysics)
- M. Reid (Center for Astrophysics)
- S. Hansen
- J. Broderick (VPI & SU) K. Kellermann

Program

Observations at 18-cm wavelength to evaluate the use of this 4-station network for establishing an accurate catalog of relative source positions, for the measurement of parallax, and for various geodetic programs -using the NRL 85-foot telescope, the Hat Creek 85-foot telescope, the OVRO 130-foot telescope, and the NRAO 140-foot telescope.

Observations at 18 cm to obtain spatial sizes and distributions of OH masering sources that display radiation over large radial velocity ranges using the NRL 85-foot telescope, the VRO 120-foot telescope, and the NRAO 140-foot telescope.

Survey of approximately 250 sources at 13-cm wavelength in an attempt to detect compact components using the Arecibo Observatory 1000-foot and the NRAO 140-foot telescopes.

M. Cohen (Caltech) R. Schilizzi (Caltech) D. Shaffer M. Cohen (Caltech) A. Moffet (Caltech) J. Romney (Caltech)

- R. Schilizzi (Caltech) G. Seielstad (Caltech)
- P. Wilkinson (Caltech)
- A. Readhead (Caltech)
- P. Wilkinson (Caltech)

K. Kellermann

- D. Shaffer
- B. Burke (MIT) A. Haschick (MIT) R. Walker (MIT) K. Johnston (NRL) K. Lo (Caltech) J. Romney (Caltech) J. Moran (Center for Astrophysics) M. Reid (Center for Astrophysics)
- G. Swenson (Illinois)
- J. Yen (Toronto, Canada)

Program

Observations at 13-cm wavelength of guasars and galaxies using the OVRO 130-foot telescope and the NRAO 140-foot telescope.

Observations at 2.8-cm wavelength of variable, complex, extragalactic objects using the Harvard, Fort Davis 85-foot telescope, the OVRO 130-foot telescope, and the NRAO 140foot telescope.

Observations at 18 cm of five strong sources to compare with angular structures previously measured at 50-cm wavelength, using the OVRO 130-foot telescope, the Hat Creek 85foot telescope, the Harvard-Fort Davis 85foot telescope, and the NRAO 140-foot telescope.

Observations at 18 cm to generate synthesis maps of four or five complex sources using the OVRO 130-foot telescope, the VRO 120foot telescope, the Harvard-Fort Davis 85foot telescope, the Haystack 120-foot tele-scope, the NRL 85-foot telescope, and the NRAO 140-foot telescope.

Observations at 1665 MHz to obtain images of maser spots in Ori A and of nearby quasistellar objects, using the Algonquin, Canada 150-foot telescope, the OVRO 130-foot telescope, the VRO 120-foot telescope, the Haystack 120-foot telescope, the Hat Creek 85-foot telescope, the Harvard-Fort Davis 85foot telescope, the NRL 85-foot telescope, and the NRAO 140-foot telescope.

Interferometer	Hours
Scheduled observing	1769.00
Scheduled maintenance and equipment ch	nanges 124.25
Scheduled tests and calibration	290.75
Time lost due to: equipment failure	32.75
power	11.25
weather	5.25
interference	0.00

<u>Observer</u>

- L. Rudnick
- F. Owen
- L. Rudnick
- R. Hjellming
- J. T. Stocke (Arizona) W. Tifft (Arizona)
- J. T. Stocke (Arizona) A. Pacholczyk (Arizona) J. Scott (KPNO)
- J. Dickel (Illinois) E. Greisen
- P. Kronberg (MPIR, Bonn, W.G.)
- M. Gearhart (Ohio State) J. Kraus (Ohio State)
- E. Pacht (Ohio State)
- H. Johnson (Lockheed)
- D. Gibson (Jodrell Bank, England) F. Owen

Program

Observations of approximately 75 radio galaxies taken from the 4C catalog, using the 45-foot telescope.

Observations of low brightness radio structure in rich clusters of galaxies, using the 45-foot telescope.

Detailed measurements of the radio properties of Nova Cygni 1975, using the 45-foot telescope.

Studies of the spatial structure in the radio emission from isolated pairs of galaxies.

Map in detail five objects--two of which are known to be radio-tailed galaxies; the other three are possible radio-tailed galaxies.

Aperture synthesis of Cas A.

Map 3C 196 for comparison with maps generated in 1971 to test for changes in structure.

Accurate position measurements of 60 sources selected from the Ohio State University survey which exhibit centimeter-excess spectra, using the 45-foot telescope.

Follow-up studies of compact continuum sources in globular clusters and observations of two of the eight known X-ray sources near the nucleus of the galaxy.

Continuation of a survey to study the radio properties of RSCVn binaries.

The following pulsar programs were conducted during this quarter.

Observer

Program

D. Backer (Berkeley)

R. Sramek (NAIC, Puerto Rico)

Proper motion and parallax studies of pulsars and radio stars, using the 45-foot telescope.

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The use of the 45-foot telescope over a 35-km baseline (usually as a fourth element) is indicated in the program description.

The following continuum programs were conducted at 2695 and 8085 MHz unless otherwise indicated.

Observer

K. Lo (Caltech) R. Brown

P. Crane (MIT)

R. M. Price

- P. Gregory (British Columbia)
 E. Seaquist (Toronto)
- D. Altschuler (Maryland)
- J. Wardle (Brandeis)

I. Pauliny-Toth (MPIR, Bonn, W.G.)
M. Davis (NAIC, Puerto Rico)
J. Condon (VPI & SU)

J. Machalski (Jagellonian, Poland) D. Jauncey (CSIRO, Australia) J. Condon (VPI & SU)

W. Gilmore (Maryland)

- B. Zuckerman (Maryland)
- R. Brown

F. Owen

- L. Rudnick
- G. Miley (Leiden, Netherlands)
- F. Owen
- L. Rudnick

Program

Study of the time variations of the compact radio source in Sgr A, using the 45-foot telescope.

Survey of spiral galaxies, using the 45foot telescope.

Observations to confirm the detection and measure the positions of three new variable radio stars, to measure the linear polarization of Cyg X-3 in the event of an outburst, and to search for radio emission from several late-type emission line stars, using the 45-foot telescope.

Monitor the variability of flux and polarization of approximately 80 sources.

Measurements of the positions of a complete sample of flat-spectrum sources.

Accurate position measurements of flat spectrum sources found in the Parkes, Australia 11cm survey and the NRAO 21-cm survey.

A search for compact HII regions embedded in dark clouds.

Observations of sources lying in the direction of Abell clusters of galaxies and structure and polarization maps of the headtail galaxy NGC 1265, using the 45-foot telescope.

Observations to map three objects showing radio tails that have been found in Abell clusters of galaxies, using the 45-foot telescope. The following 21-cm line programs were conducted during this quarter.

	<u>Observer</u>	Program
F. S. E.	J. Lockman (Massachusetts) Goldstein (Virginia) Greisen	Study of the hydrogen absorption features in 3Cl36.1 and W31.
Ε.	Greisen	Re-observe the hydrogen absorption spectra of 3C123, 3C161, and 3C140.
Е. Т.	Greisen Cram	Aperture synthesis observations of high- velocity hydrogen clouds.
F. E.	J. Lockman (Massachusetts) Greisen	Aperture synthesis observations of hydrogen absorption in front of HII regions.

During this quarter preliminary tests were conducted for using the 85-1 telescope to transmit to a geostationary Canadian statellite which then transmits to Algonquin Park, Canada, with an ultimate goal of transmitting 140-foot very long baseline data. Also, preliminary tests were performed on new digital delay lines for the interferometer.

300-Foot Telescope	Hours	
Scheduled observing	2029.25	
Scheduled maintenance and equipment changes	143.00	
Scheduled tests and calibration	11.75	
Time lost due to: equipment failure	26.50	
power	5.00	
weather	3.50	
interference	0.00	

The following line programs were conducted during this quarter.

<u>Observer</u>	Program
V. Rubin (DTM) N. Thonnard (DTM) W. K. Ford (DTM) M. Roberts	Search at 1421 MHz for hydrogen emission from magnitude 12-14 spiral galaxies.
B. Burke (MIT) A. Haschick (MIT) W. Baan (MIT)	Search for 1421 MHz hydrogen in absorption or emission in the vicinity of galaxies.

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- G. Knapp (Caltech)
- S. Faber (California, Santa Cruz)
- J. Gallagher (Minnesota)
- S. Goldstein (Virginia)
- E. Greisen
- T. Cram
- S. Peterson (Cornell)
- M. Haynes (Indiana)
- R. Brown
- M. Roberts
- P. Shaver (Kapteyn Laboratories, Netherlands)
- A. Rots
- R. Whitehurst (Alabama)
- T. Cram
- M. Roberts
- W. Howard
- T. Thuan (Caltech)
- G. Knapp (Caltech)

A. Wolfe (Pittsburgh)

- A. Rots
- D. Shaffer

A. Marscher (Virginia) R. Brown

- R. Brown
- M. Roberts

G. Chincarini (Bologna, Italy)

- J. R. Fisher
- F. Owen

Program

Survey of a large number of bright nearby SO galaxies for 1421 MHz hydrogen emission.

Mapping of high-velocity hydrogen clouds at 1421 MHz.

Survey of 1421 MHz hydrogen in a statistically complete sample of optical pairs of galaxies.

Search for 1421 MHz hydrogen in absorption in the direction of clusters and groups of galaxies.

Observations of the recombination lines H166 α at 1424.7 MHz and H167 α at 1399.4 MHz in M82.

Observations to complete the mapping of 1421 MHz hydrogen distribution in M31.

Observations to map 1421 MHz hydrogen in M16.

Observations of 1421 MHz hydrogen redshifts in approximately 350 single galaxies.

Observations at 768 and 932 MHz to monitor hydrogen absorption features in AO 0235+16.

Search between 750-1000 MHz for highly redshifted hydrogen absorption in quasars.

Search between 750-1000 MHz for redshifted hydrogen in two quasistellar objects which exhibit MgII lines.

Observations of 1421 MHz hydrogen in galaxies of the Abell 262 cluster.

Program

Measurements of the 1421 MHz hydrogen distribution in large spiral galaxies whose angular diameters are greater than 9 minutes of arc and less than 35 minutes of arc.

The following continuum programs were conducted.

Observer

D. Altschuler (Maryland)

T. Gergely (Maryland)

A. Wolfe (Pittsburgh)

S. Spangler (Iowa)

A. Marscher (Virginia)

J. Broderick (VPI & SU)

A. Rots

D. Shaffer

R. Brown

L. Rudnick

Program

- W. Erickson (Maryland)
 J. R. Fisher
 J. Armstrong
 J. Armstrong
 Extension of the 250-1000 MHz variable source monitoring program and 1400 MHz observations of these sources.
 J. Armstrong
 Study at 220, 340 and 470 MHz of source brightness distributions and tests of methods of measuring solar wind speed from single station, multi-frequency observations.
 - Search at 6-cm wavelength for radio sources associated with the 3U catalog X-ray sources.

Observations at 768 and 932 MHz of the continuum flux of AO 0235+16.

Linear polarization measurements of selected radio sources at 20-cm wavelength.

Study at 1400 MHz the large scale continuum emission from dark clouds.

Measurements of the 20-cm total flux of selected 4C sources.

The following pulsar programs were conducted.

Observer

Program

J. Armstrong

R. Hulse

Observations at 265 and 408 MHz to attempt to re-detect pulsars found during a previous search, and an attempt to determine spectral indices and more precise dispersion measures for the stronger of these pulsars.

A. Rots

R. Backus (Massachusetts)

D. Helfand (Massachusetts) J. Taylor (Massachusetts)

Program

R. Hulse	
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Search at 410 MHz for new high latitude pulsars.

Observations at 610 MHz of the positions, proper motions, and timing of known pulsars, and a search for new sources exhibiting pulsar-like characteristics.

36-Foot Telescope	Hours
Scheduled observing	1966.50
Scheduled maintenance and equipment changes	142.50
Scheduled tests and calibration	75.00
Time lost due to: equipment failure	52.0
weather	135.50
power	0.00
interference	0.00

Observer

B. Balick (Washington)

J. Gallagher (Minnesota) S. Faber (Lick Observatory)

G. Blair (Texas, Austin) N. Evans (Texas, Austin)

W. Peters (Texas, Austin) P. Vanden Bout (Texas, Austin)

J. Broderick (VPI & SU)

W. Dent (Massachusetts)

R. Hobbs (NASA, Goddard)

E. Churchwell (MPI, Bonn, W.G.) G. Winnewisser (MPI, Bonn, W.G.)

G. Knapp (Caltech)

R. Brown

Program

Mapping of HCO^+ and N_2H^+ in regions of high M. Allen (Caltech) G. Knapp (Caltech) electron density. M. Morris (Caltech)

Search for CO in early-type galaxies.

Investigation of small $H\alpha$ regions by CO, HCH and CS emissions.

Study of 3-mm continuum flux from dark clouds with O and B stars.

Map of HNCO in Sgr B_2 and search for HNCS.

Flux density variations of variable extragalactic radio sources.

R. Gammon (McKenzie U., Sao Paulo) B. Balick (Washington) E. Chaisson (Harvard)

- C. Gottlieb (Harvard) J. Ball (Harvard) M. Litvak (Harvard)
- A. E. Lilley (Harvard)
- C. Gottlieb (Harvard)
- J. Ball (Harvard)
- M. Litvak (Harvard)
- A. E. Lilley (Harvard)
- M. Guélin (NASA Inst. for Space Studies)
- P. Thaddeus (NASA Inst. for Space Studies)

M. Guélin (NASA Inst. for Space Studies)

- P. Thaddeus (NASA Inst. for Space Studies)
- C. Heiles (Berkeley)
- T. Troland (Berkeley)
- J. Hollis
- D. Buhl (NASA, Goddard)
 L. Snyder (Illinois)
- F. Lovas (NBS)
- 1. LUVAS (NDS)

H. Johnson (Lockheed)

G. Knapp (Caltech)
A. Sargent (Caltech)

G. Knapp (Caltech)
M. Morris (Caltech)

M. Kutner (Rensselaer)
K. Tucker (Fordham)

Program

Maps of C⁺ and CO in the vicinity of HII regions.

Search for urea and glycine.

Distribution of SO emission in the Rho Ophiuchus cloud.

Search for methyl isocyanide.

Search for cyanodiacetylene, methyldiacetylene and methylcyanoacetylene.

Search for CO in absorption.

Search for DCO^+ and SO_2 .

Search for continuum emission from globular clusters.

CO observations of dust clouds in Perseus and Cepheus OB associations.

Search for high velocity CO emission in directions of W49N and W51.

Maps of molecular clouds associated with reflection nebulae.

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M. Kundu (Maryland) C. Alissandrakis (Maryland) S. Liu (Maryland) J. Kwan (SUNY, Stony Brook) A. Lane (Massachusetts) N. Scoville (Massachussets) H. Liszt W. B. Burton H. Liszt S. Mufson (NASA Marshall Space Flight Center) N. Kaifu (Tokyo) K. Lo (Caltech) M. Morris (Caltech) R. Partridge (Haverford) G. Lake (Princeton) N. Scoville (Massachusetts) J. Kwan (SUNY, Stony Brook) nebula. A. Lane (Massachusetts) L. Snyder (Illinois) F. Lovas (NBS) range. D. Johnson (NBS) D. Buhl (NASA-Goddard) P. Thaddeus (NASA Inst. for Space Studies) I. Dubois (Institute de Astrophysique, France) B. Turner R. Brown B. Turner M. Morris (Caltech) B. Zuckerman (Maryland) P. Palmer (Chicago) B. Zuckerman (Maryland) M. Morris (Caltech) B. Turner P. Palmer (Chicago) T. Kuiper (JPL)

Program

Observations of solar filaments at 3 mm.

Millimeter emission from circumstellar envelopes of late-type stars.

Maps of galactic center in CS.

Survey of HCO emission.

Search for CO in late-type galaxies.

Continuum observations of galaxies exhibiting X-ray emission.

Study of line profiles in the Kleinmann-Low nebula.

Search for several molecules in the 30-50 GHz range.

Search for SiC.

Observations of HCO^+ , N_2H^+ and HCN in dark clouds with enhanced ionization.

Confirmation and survey of NH₂D.

Investigation of carbon stars, planetary nebulae and irregular IR objects.

ELECTRONICS DIVISION

Green Bank

Manpower Assignments	_%
Visitor support and maintenance New receiver development	38 24
Interferometer digital delaySick leave and vacation	9 8
140-ft On-line Mod Comp	8 6
Digital standard receiver	3
I4U-ft Cassegrain improvements Interference control	2

The modification of the 8.4 GHz receiver is finished, and it is in use. Work has begun on adding a low-noise ambient temperature paramp to the 5-10 GHz box centered on 6.035 GHz. The 25/6-cm receiver is undergoing final tests in the lab and is scheduled for telescope tests in mid-July. The 9-cm receiver is scheduled for telescope tests in mid-August. One stage of the 4-stage 18-25 GHz maser is operational at JPL and delivery of the maser in a dewar is expected in August.

First operational tests of the interferometer digital delay system were made near the end of June. Full operation of this system is anticipated when the interferometer goes back to continuum operation in the fall. Interface electronics continues to be built for the 140-foot on-line Mod Comp computer with most of it to be finished by fall.

The first IVC VLBI terminal is complete and has been used at Arecibo.

Tucson

During this quarter a considerable amount of effort has been expended on operational problems at the telescope.

The 256-channel filter banks have been worked on at every opportunity, and we now have only four bad channels out of a total of 1024. This represents a considerable improvment over the 20-30 bad channels of a month or so ago.

The limiting factor in extragalactic CO surveys has proved to be baseline stability. The major cause of instability is the time variation of standing waves resulting from the Cassegrain configuration. We have installed an adjustable vertex plate to cancel the standing waves, and this seems to have helped the problem. At the request of continuum observers, a new beam switching system has been developed that permits observations to be made on extended continuum sources.

For the detection of DCO^+ improvements were made to the 67-85 GHz prime focus receiver resulting in a decrease in noise temperature from 2400 K S.S.B. to 1400 K S.S.B.

During this quarter operators have been trained to make klystron changes; this has resulted in less trips to the mountain for electronics personnel.

Construction work during this quarter has centered around three major projects.

1. The 30 kHz 128-channel filter bank

This filter bank is now complete and ready for testing at the telescope.

2. The 9-mm Cassegrain receiver

We experienced considerable difficulty with the mixer pre-amps for this system. The problem has now been solved and the receiver will be finished in September. The sensitivity will be such as to give a factor of 30 improvement in integration time over the existing prime focus receiver.

3. The 33-50 GHz, 80-120 GHz receiver

We now have all the components necessary to finish this receiver. The estimated completion date is September.

In addition, during this quarter, we have designed and built a quasi-optical polarizer for use in the 80-120 GHz band. This has to be tested and if successful will enable polarization studies to be made both in the continuum and for spectral lines.

Charlottesville

The expansion of the VLBI processor to three stations has been completed. A 0.25 seconds, 4 Mb/s digital delay system for use in satellite VLBI has been completed.

Development of a 33-50 GHz mixer has been completed and two units have been shipped to Tucson. Work is continuing on a 109-116 GHz varactor-mixer and a 127-174 GHz resistive-mixer.

ENGINEERING DIVISION

Engineering and inspection assistance was provided Green Bank, Tucson, and Charlottesville operations and the VLA project. Research and conceptual design continued on a proposed 25-meter millimeter-wavelength antenna and an associated astrodome. Research and tests with resulting specifications and purchase orders for spare components for the brakes on the 140-foot telescope were completed. Specifications with sketches and requests for proposals were completed for installation of thermal insulation on sections of the 140-foot telescope. Specifications and control drawings were developed for a deformable subreflector. Further studies were made of the 36 foot structure toward correcting thermal deformations.

COMPUTER DIVISION

<u>140-foot telescope</u> - Temperature, pressure and dew point are now being used to calculate the magnitude of refraction in the pointing equation.

<u>VLBI</u> - The processor control software for the 3-station system is in use. For spectral line studies, a Fast Fourier Transform (FFT) device has been implemented in the control program. Checkout work is in progress.

<u>360 System</u> - A text editor terminal working into PANDORA has been added in the visitors office in Charlottesville.

<u>Spectral line reduction progress</u> - A verb enabling the removal of a sinusoidal function in a line profile has been incorporated. This feature facilitates the removal of standing waves which is especially useful for 36 foot data because of the higher standing wave frequency and larger detected bandwidth.

VLA PROJECT

Site and Wye Division

Phase II construction was completed during this quarter. The control building and cafeteria were accepted from the contractor on May 14, 1976. Inspection of details and balance of the mechanical systems and controls are being completed.

The site warehouse and maintenance shop buildings were completed and occupied.

Phase III construction, consisting of 8.1 miles of wye trackage, 49 antenna foundations, and wye utilities, is now 79% complete.

Antenna Division

Antenna No. 3 was moved to station CW-6 upon completion of outfitting June 4, 1976.

Antenna No. 4 was accepted on June 7, 1976 and moved to the maintenance pad for installation of AUI equipment.

Antenna No. 5 is on the master pad for acceptance testing.

Antenna No. 6 is being assembled in the assembly building.

Antenna No. 7 parts are arriving at the site.

Electronics Division

The prototype model of the new 6-cm wavelength feed was received during June and installed on Antenna No. 1 on June 24, 1976. Preliminary measurements indicate a higher efficiency than the original design, but detailed measurements to obtain an accurate figure are still in progress.

A small offset between beams with circularly polarized feeds has been found in the antennas. Studies to determine the cause of the offsets and their effect on the system performance are being made.

An order has been placed with the Applied Electronics Division of AIL for parametric amplifiers for antennas 7 through 10. This is a new supplier, and the amplifiers are two stage rather than the three stage units used in the earlier design.

The waveguide signal distributors were mounted in the control building and have been tested and accepted.

The 17-20 GHz local oscillator modules were put into operation, and fringes at 2-cm wavelength were obtained for the first time on June 29, 1976.

Computer Division

Asynchronous subsystem - On June 14, the VLA asynchronous computer system in Charlottesville was dismantled for shipment to the VLA site. It arrived at the site on June 21, 1976, and DEC personnel then began checkout and reinstallation in the computer room of the VLA control building. The system should be ready for continued software development and use by the middle of July.

<u>Synchronous subsystem</u> - During the second quarter the synchronous computer group continued to support the scheduled periods of test observations. In addition, a pointing analysis and an investigation of the pointing difference between left and right circular polarization have been made.

Systems Integration Division

Continued support of observing sessions during the second quarter dominated activity. Eight 40-hour sessions were completed during May and June. Aperture efficiency tests were performed and outfitting of antennas progressed.

Project Management Division

During this quarter the take up of rail has been completed at Redstone Arsenal; Myrtle Beach Air Force Base; Bastrop, Texas; Fort Sam Houston; Reese Air Force Base; Mare Island Naval Shipyard; and McClellan Air Force Base. Take up work is underway at Torrence, California and Crab Orchard Wildlife Refuge in Illinois.

The installation of cabling and cable trays in the control building is proceeding on schedule and is 75% complete. The furnishing of the control and cafeteria buildings has been essentially completed and the cafeteria will commence operation prior to mid-July.

PERSONNEL

Appointments

Harvey S. Liszt Jesse E. Davis, Jr. D. Richard Decker	Associate Scientist Electronics Engineer I Electronics Engineer I	5/24/76 5/28/76 6/21/76	
Terminations			
Anthony Wojtowicz	Electronics Engineer I	5/07/76	
Return from Leave of Absence			
David S. Heeschen	Director	6/01/76	

SUMMER STUDENT PROGRAM

In November, 1975, announcements of our summer student program for 1976 were mailed to more than 125 colleges and universities. From the more than 150 applications received, 20 students were selected to participate in the program as research assistants to the scientific staff and in the electronics and computer divisions. Thirteen students are working in Charlottesville, four in Green Bank, one in Tucson and two in Socorro. Twenty-three lectures will be given by the staff on various topics in radio astronomy and instrumentation. Students are also encouraged to attend the regular NRAO colloquia and seminars. They will also assist as tour guides in our public education program in Green Bank. Including this year's students, 422 students have participated in the program since its beginning in 1959. Several students have returned to NRAO as thesis students and some as full-time employees.

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The names of the 1976 students, their academic year and school are given below.

Name	Academic Year	School
Adams, Mark T.	U-4	Pennsylvania State
Buta, Ronald J.	G-2	Michigan State
Froelich, Robert K.	U-5	University of Michigan
Hansen, Sven-Olov		Chalmers University, Sweden
Harrison, Robert W.	U-4	Caltech
Harper, Kathy L.	U-4	Iowa State
Kovalan, Mark A.	U-3	West Virginia University
McGrath, Melissa	U-3	Mt. Holyoke
Neff, Susan G.	U-4	Vanderbilt
Peterson, Bradley M.	G-2	Arizona
Picklum, Roger E.	U-4	Iowa State
Pimentel, Juan		National University of San Marcos
Rehm, Eric	U-3	Purdue
Rothman, Tony	G-1	Cambridge University, England
Rumpl, William	G-2	Wisconsin
Spencer, Richard	U-3	California, Berkeley
Teyssier, Edward M.	U-4	California, Berkeley
Tobin, William	G-1	Wisconsin
Uury, Claudia	U-3	Tufts
Wallis, Nancy	U-4	Duke

OBSERVATORY COLLOQUIA

Speakers for the NRAO colloquium program are usually invited by the scientific staff and talk on topics of current interest in radio astronomy or closely allied fields. The Astronomy Department of the University of Virginia also invites speakers to their own colloquium series. These two series are jointly announced and well attended by our staff, university physicists, and astronomers. The 27 speakers in the NRAO colloquium program for the year ending June 30, 1976 are outlined below.

Speaker	Institution	Date
Allen, R.	University of California, Berkeley	6/3/76
Aarons, J.	University of California, Berkeley	3/31/76
Baldwin, J. E.	Cambridge University, England	6/7/76

Speaker	Institution	Date
Speaker Bosma, A. Burkhead, M. S. Chow, Y. L. Colgate, S. A. Gingerich, O. J. Goldstein, S. J. Hall, D. S. Harris, D. E. Jaffe, W. Kellogg, E. M. Larson, R. B. Lea, S. M. Margon, B. McCray, R. Pankonin, V.	Institution Kapteyn Astronomical Institute Indiana University University of Waterloo Unaffiliated Harvard University University of Virginia Vanderbilt University Dwingeloo, The Netherlands Institute for Advanced Study Smithsonian Astrophysical Observatory Yale University NASA, Ames Research Center University of California, Berkeley Joint Institute for Laboratory Astrophysics Max-Planck-Institut fur Radioastronomie	Date 4/27/76 4/15/76 2/9/76 2/5/76 9/18/75 7/17/75 6/18/76 2/9/76 2/19/76 2/26/76 2/12/76 1/30/76 4/29/76 1/28/76
Price, R. M. Price, R. M. Reber, G. Sanders, R. H. Scoville, N. J. Seeger, C. L. Stecker, F. W. Stull, M. A. Swarup, G. Wardle, J.F.C.	National Science Foundation CSIRO, Division of Radiophysics University of Pittsburgh University of Massachusetts NASA Ames NASA Goddard Space Flight Center NASA Ames Tata Institute of Fundamental Research, India Brandeis University	12/18/75 11/21/75 11/6/76 3/11/76 2/2/76 10/9/75 2/2/76 7/7/75 4/22/76

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Institution