Quarterly Report
April - June 2001

National Radio
Astronomy
Observatory

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NRAO

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Science Highlights

Green Bank

21 cm HI observations with the 140 Foot Telescope have revealed a giant HI cloud (G28.17+0.05) in the Galactic plane that has unusual properties. The cloud is 150 pc in diameter, is at a distance of 5 kpc, and contains as much as 10^5 $M_\odot$ of atomic hydrogen. The cloud consists of a cold core, T ~ 40 K, and a hotter outer envelope, T ≥200 K. There is no observable difference in the HI line widths, ~7 km s^{-1}, between the core and the envelope. Anomalously-excited 1720 MHz OH emission, with a similar line width, is associated with the core of the cloud. The cloud core also contains ^{12}CO emission which indicates that most of the cloud mass is in molecules. The total mass of the cloud is > 2×10^5 $M_\odot$. The cloud has only a few sites of current star formation. The cloud lies on the edge of the Scutum spiral arm. It is believed that this cloud has been caught in the act of transforming from an atomic state to the molecular state.

Investigators: F. J. Lockman, A. Minter

Very Large Array

Young Star May Be Ejecting Spheres of Gas - VLBA observations in the Cepheus A star-forming region revealed an expanding arc of water masers near a very young, massive star. The arc fits a circle within one part in a thousand, leading to the conclusion that it is part of a spherical ejection from the young star. Additional evidence indicates that there were multiple ejections. Ejections of such spherical bubbles are difficult to reconcile with current models of collimated, bipolar outflows from young stars.

Investigators: J. Torrelles (IEEC/CSIC, Barcelona), N. Patel (CfA), J-F. Gomez (INTA, Madrid), P. Ho (CfA), L-F. Rodriguez (UNAM), G. Anglada (CSIC, Granada), G. Garay (Universidad de Chile, Santiago), L. Greenhill (CfA), and J. Canto (UNAM)

Gamma-Ray Burst Host Galaxy Detected - VLA observations of GRB 980703 have produced the first detection of a GRB host galaxy at radio wavelengths. Analysis of the galaxy's radio emission indicates a star-formation rate of about 500 solar masses per year, more than 25 times the rate indicated by optical observations. The difference is explained by dust extinction. This result offers the possibility of using GRB-selected galaxies to make an unbiased study of the history of star formation in the universe. GRB 980703 also is seen to have occurred in a region of active star formation in the host galaxy, providing further support for the collapsar model of the bursts.

Investigators: E. Berger and S. Kulkarni (Caltech), and D. Frail (NRAO)

World-Wide Effort Produces Detailed "Movie" of Microquasar Jet Activity - Using the VLBA, the EVN, and the Asia-Pacific Telescope Array, observers made a continuous series of VLBI images of the Galactic micro quasar Scorpius X-1 over a period of 56 hours. The images show multiple ejections of relativistic particles, and allowed the observers to directly measure the speed of energy flow in a cosmic jet for the first time.

Investigators: E. Fomalont (NRAO), B. Geldzahler and C. Bradshaw (George Mason University)

The ALMA project has made important progress during the current period. In addition to the major milestones listed in the table below, a number of very important programmatic and technical achievements occurred during this period. The milestones listed in the table are taken from the ALMA project WBS and represent the major milestones planned for completion during this quarter and the next.

WBS Element	Milestone	Original Deadline	Revised Deadline	Date Completed
2.10.10.15	PDR: Site Development Plan	01/15/00	09/01/01	
5.10.10.15	Deliver Prototype 80-240 GHz Tripler	05/01/01	06/01/01	06/01/01
1.05.22	Review: ALMA Mgmt Adv Committee	06/01/01	06/08/01	06/08/01
6.05.16	Back-end Subsystem CDR	06/01/01	09/01/01	
8.03.05.30	Deliver Phase 2 Computing Plan	06/01/01	06/01/01	06/01/01
9.12.35	Test Interferometer Test Site Complete	06/01/01	09/01/01	
5.10.05.15.	Deliver LO Bench Prototype	09/01/01		
6.10.20.15	Deliver Back-end Bench Prototype	09/01/01		
7.15.10.85	FIR Filter Performance Report	09/25/01		
9.12.35	Test Interferometer Test Site	08/16/01		

As described last period, the PDR for the Site Development Plan will be delayed because of delays in obtaining permissions in Chile for the ALMA project. The specific form of these permissions will have a major impact on the plans to be reviewed. The schedule for this PDR will be reviewed as the permissions issue is resolved.

A tripler has been delivered and tested for the evaluation receivers.

The AMAC met in Garching on June 8. See discussion below.

The CDR for the back-end subsystem has been rescheduled for September to allow a review at a more detailed level.

Completion of the test site for the prototype antennas has been delayed due to delays in completion by the antenna contractors of the foundation design. Those designs are now complete. A contract has been let for the Vertex foundation and construction of the foundation will begin in July. It will be completed well ahead of the new start date for on-site work by Vertex.

Other Significant Accomplishments

Programmatic

Significant progress was made during this quarter toward a tripartite project including the Japanese. Meetings of the ACC were held in Tokyo (April) and Garching (June). At the meeting in Tokyo, the ACC created two new entities, the Expanded ACC (EACC) and the Expanded AEC to direct and plan for a three way project. The EACC and EAEC include the original bodies augmented by our Japanese colleagues. The EACC charged the EAEC to recommend a scope and division of effort for a tripartite project that meets the principals outlined at the meeting. The AEC was to report progress at the Garching meeting.

At the Garching meeting, the EAEC reported that all of the deferred capabilities recommended by the ASAC for inclusion in a Tripartite ALMA could be accommodated if the funding provided by the partners was set to a level that saved the original partners 10 percent over the baseline bilateral project. The EACC agreed to plan the Tripartite project and seek funding at this level.

The EAEC was not able to provide a recommendation for a division of effort between the partners. Such a recommendation will be provided at the next EACC meeting scheduled for October 2001 in Washington.

The first meeting of the ALMA Management Advisory Committee (AMAC) was also held in June in Garching. The AMAC includes the members of the MMAOC plus an equal number of European reviewers. The AMAC received a comprehensive presentation of the current status of Phase 1 work plus plans for Phase 2. A written report of the committees finding will be delivered to the ACC.

Technical

The US antenna contractor, Vertex, has completed a review of the fabrication schedule for the prototype antenna. Vertex has undertaken several remedial actions to minimize the fabrication time, but were unable to recover the additional time spent on the design phase. The new delivery date supplied by Vertex is April 23, 2002, four months later than their previous schedule. Vertex has supplied a detailed fabrication schedule that includes intermediate milestones. These milestones will be carefully monitored.

Significant progress has been made in photonic mixers that may allow a fully photonic LO system. Significant power output at frequencies as high as 440 GHz have been demonstrated. Testing of noise performance when used to pump an SIS mixer is underway. A fully photonic LO has the potential to significantly reduce the complexity of the LO subsystem by reducing the number of components located at each antenna.

A prototype of the Finite Impulse Response (FIR) digital filter board, a component of the correlator, has been successfully tested. A detailed report of the performance of the filters will be available soon.

A Calibration PDR was held in June 2001 at Cambridge England. The PDR reviewed the current concepts for end-to-end phase and amplitude calibration for the ALMA system. Thirty five people attended the review from the US, Europe, and Japan. The panel consisted of sixteen people, including four external reviews.

During this quarter, eighteen new ALMA Memos were added to the series bringing the total number to 378. The ALMA Memo Series is available at http://www.nrao.edu/almamirror/memos/.

Outfitting

Milestone	Original Deadline	Revised Deadline	Date Completed
Assemble all cryo. components	07-14-00	06-30-01	06-30-01
Install lower feed arm lasers	09-15-00	09-30-01	
Complete Q-band tertiary	04-15-00	06-30-02	
Measure az track profile	09-15-99	09-30-01	
Recondition corner set tools	04-30-01		04-30-01
Reposition reflector surface	04-30-01	05-07-01	05-01-01
Reset surface panel corners	05-31-01	07-16-01	
Install optical guide scope	04-30-01	07-31-01	
Replace az wheel bearings	05-31-01	05-10-01	05-10-01
HVAC tests	05-28-01	06-03-01	06-03-01
Bolt azimuth track	06-22-01	06-08-01	06-08-01
Realign azimuth wheels	07-13-01		
Resume commissioning observations	07-16-01		
Contractor leaves GBT site	08-01-01		

GBT Electronics Development

Milestone	Original Deadline	Revised Deadline	Date Completed
Q-band Receiver available for use	12-31-00	10-01-01	
Active Surface / M&C integration & testing	02-28-01	09-30-01	
GBT new compressors & cryo system	07-14-00	08-31-01	

Mechanical Engineering and NRAO Central Instrument Shop

Milestone	Original Deadline	Revised Deadline	Date Completed
Install GBT spillover shield	01-24-01	04-20-01	05-10-01
Install mount for GBT optical telescope	04-27-01		06-12-01
Fab. and install GBT safety equipment	04-30-01		04-12-01
Fab. quadrant detector mirror	08-17-01		
Design & fab. feed arm laser rangefinder cover	09-28-01		
Design & fab. feed arm laser rangefinder handling container	08-24-01		

GBT Software and Computing

Milestone	Original Deadline	Revised Deadline	Date Completed
Spectrometer basic spectral line modes available	03-16-01	05-31-01	05-31-01
M&C / VLBA software integration	01-19-01	07-31-01	
Observer (GO) interface completion	03-23-01	07-31-01	
Optical pointing telescope development and installation	02-02-01	07-31-01	
Prepare for visiting observers	06-30-01	07-31-01	
Complete Doppler tracking capability	06-30-01	09-30-01	
Unify GBT FITS file formats	06-30-01	08-31-01	
Support for BCPM pulsar back-end	08-15-01		
Support for VLBI observations	08-15-01		

GBT Operations

Milestone	Original Deadline	Revised Deadline	Date Completed
Use of MainSaver by Telescope Operations	06-01-01	09-01-01	
First test of azimuth wheel bearing grease	06-30-01		06-29-01
Ship all the Navy hardware back to USNO	06-30-01		06-22-01
Plan for six-month structural inspection of GBT	07-30-01		
Operations of GBT from Jansky Lab	08-01-01		
Operations of GBT on 24/7 basis	08-18-01		
Restart GBT Science Observations	08-15-01		
Mothball GBI telescopes	09-30-01		

GBT Project Summary

Azimuth Track

Following two months of very successful commissioning and the first science observations on the GBT, operation was suspended in early April to work on the azimuth track. As described in previous reports, the azimuth track wear strips, on which the azimuth wheels roll, were shifting slightly in a circumferential direction as the wheels rolled over them. After repeated use, many of the bolts that hold down the wear strips to the track base plate were breaking. A number of attempts at solving this problem were tried without success prior to the April shutdown. Following the recommendation of a consulting engineer, the

retention system of one wear strip was modified by increasing the diameter of the retention bolts from 1.0 inch to 1.5 inches, and increasing the number of bolts in a segment from 14 to 36. Tests showed that the motion of the wear strip as the wheels rolled over it was greatly reduced. The contractor, Lockheed-Martin (LM), then began a program to modify all 48 wear strip segments in the track. This work was completed on June 8, nearly two weeks ahead of schedule. Following the wear strip modification, some of the azimuth wheels will need to be realigned to insure adequate clearance between the wheels and the retention bolt heads that now protrude above the track surface. The consulting engineer was commissioned to make a detailed review of the azimuth track design and to model its dynamic behavior.

Azimuth Wheel Bearings

The month of May was a previously scheduled maintenance period in which seven of the azimuth wheel bearings were to be replaced. This work was scheduled after an inspection last year showed that water had leaked through some of the seals and rusted those bearings. The bearing replacement work was conducted by a subcontractor, FEMCO. The work began on April 30 and was finished on May 10, two weeks ahead of schedule.

Active Surface System

On May 7, the active surface system performed its first full move. The system was commanded to remove the surface errors determined by the photogrammetry measurements taken last year. As the surface is brought into its initial figure, the relative positioning of the panel corners above each actuator must be adjusted. One round of corner setting was carried out last summer. To take advantage of the time available while the azimuth track work was underway, a program to perform another iteration of panel corner setting was begun in May. This work will be completed mid July.

HVAC System

The first system test of the GBT HVAC system was conducted on June 2-3. During the tests, temperatures in the Receiver, Servo, and Actuator Control Rooms were stable and did not vary with telescope elevation. Coolant flows to the air handlers in the rooms were measured and were found to be consistent with design specifications. Unlike the results of earlier tests, the motors on the coolant circulation pumps were not drawing excessive amounts of electrical current, even at a telescope elevation of 42.5 degrees where the GBT feedarm has its maximum vertical profile and the pump head is greatest. There is some evidence that the humidity control in the HVAC system can initiate excessive fluctuations in Receiver Room temperature, but this problem should be resolved with a minor revision to the software that controls room temperature. Monitoring and testing of the HVAC system will continue over the summer when ambient heat loads on the system are expected to be greatest.

Antenna Structure

LM completed the finite element analysis of the GBT structure. The NRAO reviewed the analysis, and used the model to independently verify that none of the members in the structure is over-stressed.

The NRAO and LM agreed to a list of paint and insulation concerns that need to be addressed by the contractor prior to its departure from the site. LM anticipates that it will complete its activities by August 1.

Rangefinder Measurements of the GBT Structure

On June 17, the GBT monitor and control system was used to command the ground laser rangefinders to track a retroreflector on the GBT structure and compute the x,y,z coordinates of the retroreflector in real time.

GBT Electronics Development

GBT Spectrometer Hardware

Modifications to the 1600 MHz phase-locked loops in the samplers have been designed and tested. These modifications reduce the levels of spurious components of the 1600 MHz signal by at least 30 dB, and tune the loop bandwidth to take better advantage of the phase stability of the VCXO. Presently, a printed circuit board is being designed to accommodate the required supply filtering. To enhance reliability, chip capacitors on the Long Term Accumulator boards are being replaced. To date, six of the ten have been completed.

Other GBT Back-ends

The Spectral Processor was used this quarter for debugging and RFI measurements, and is ready for general use as a GBT back-end. The Digital Continuum Receiver has also been in regular use in the GBT Mockup to test receivers and other equipment for gain stability, temperature stability, etc., and is ready for general use. Work on integrating the GBT VLBA terminal is in progress and will be completed in the third quarter of 2001.

GBT Active Surface

The Active Surface software is essentially complete. Work continues to seal the actuators against water infiltration. Some work remains in the interface between the Active Surface and the Metrology systems to allow calibration of the actuator using rangefinder data. System integration and testing should be completed in the third quarter of 2001.

Q-Band Receiver

The Q-band receiver has been fitted with an ambient temperature calibration load paddle. The Q-band receiver's M&C software has been tested, revealing an anomaly in the operation of the MCB interface. Work is underway to fix this problem. The receiver is ready for installation on the telescope in the fall.

GBT Cryogenics

Installation and commissioning of the cryogenics system at the GBT is complete. All lines have been cold-trapped. Several receivers have been cooled. Four of five compressors are installed.

GBT Receiver Cal Control

The Prime Focus, L-, S-, C-, and X-band receivers have been fitted with a correlated cal system that provides two cal levels. Work continues to complete this modification. All the GBT receivers are installed on the telescope, and ready for commissioning.

GBT Computing and Software Development

The control software for the GBT Spectrometer is now essentially complete for spectral line modes, and the spectrometer has been made available for commissioning. All auto- and cross-correlation modes have been implemented, although only a small subset have so far been tested. Some minor bugs remain and are being worked on. Software group staff participated in a number of meetings to discuss the Pulsar Spigot card, and a basic design approach has been agreed. No work will start on this, or the Spectrometer timing mode, until after October.

Detailed discussions were also held with Don Backer concerning the Berkeley-Caltech Pulsar Back-end (BCPM). A wrapper manager has been written to allow this back-end to appear as an integral part of the GBT control system from the user's perspective. This back-end will be commissioned in August. Work has started on implementing control of the VLBI back-end. Work continues on the GBTO interface to include these back-ends, and provide improved functionality in a variety of other areas.

Considerable work has been spent reviewing the GBT device and log FITS files, defining a common structure and core set of keywords to use across all files, and documenting the existing files. Work is now underway to modify all managers to meet this common standard. We have worked closely with the AIPS++ single dish group to define the requirements for an Interim Analysis and Realtime Display System. The core of this will be provided by the AIPS++ group, with the controlling framework provided by the GBT software group. We have also specified in detail the processing requirements within AIPS++ for the GBT Spectrometer.

While the telescope has been closed for track and other work, we have provided support for a number of engineering projects. Additional "cube" (servo) tests have been performed on the subreflector. The build

procedure for the CCU and SCU code has been simplified. We have assisted the electronics group with some adjuster problems encountered during the surface setting work. Support has been provided for elevation bull-gear and metrology XYZ measurements. The manager for the Q-band receiver has been debugged, and a CLEO application provided. Work is ongoing on the Optical Pointing Telescope, and has started on an Operator's Log facility.

A well-known feature of software development is the difficulty in getting adequately specified requirements. We have been investigating the technique of writing "Use Cases" to attempt to improve in this area. Results so far have been encouraging. A considerable amount of time has been spent in general bug-fixing, and we have installed the Bugzilla package to improve the mechanisms for handling bug report. Members of the GBT software group have provided considerable input and assistance to the GB Infrastructure upgrades and operating system upgrades described under the Green Bank Site report.

Mechanical Engineering Development

May saw the final installation of both the spillover shield and the mount for the optical guide telescope. Final alignment of the optical guide telescope will be performed following completion of its systems checkout. This quarter also saw the completion of a major effort to fabricate and install safety equipment, guards, and barriers on the GBT. The shop's ongoing support of outfitting has generated a steady stream of boxes, enclosures, and brackets fabricated for GBT equipment.

In the next quarter the Mechanical Engineering Division expects to turn its attention to the installation of the laser rangefinders on the feed arm. This work will include remotely actuated weather covers and various handling equipment. In addition, attention will be given to design and fabrication of the quadrant detector mirror, mounting hardware, and access equipment.

GBT Operations Summary

Telescope Operations Personnel Changes

During the second quarter of 2001, one of the GBT Operators transferred out of operations leaving a vacancy. A summer student was hired to assist in the population of the Mainsaver database. Extensive effort has gone into the interviewing and selection of the new GBT Operator and the new Telescope Mechanic. Both will start in the first part of the third quarter. These unplanned activities and the unexpected illness of the lead Telescope Mechanic (absent for about one month) has resulted in the slippage of some Operations targets, most notably the first use of the work order software (Mainsaver) within Operations.

GBT Operations Documentation

Development and updating of operational procedures documentation continued into the second quarter of 2001. Drafts completed during the second quarter included: Az/El Servo system, Feed arm Servo System, Site Fire Alarm System, procedure for Site Fire Alarm, Active Surface, Maintenance of Corner Setting Tool, and Use of Corner Setting Tool. In addition various minor updates to existing documentation (including incorporation of PCD revisions) were completed.

The current version of the GBT Operators Manual is available on line. Effort has begun on the design of a new Telescope Operations home page from which relevant documentation will be readily available.

GBT Maintenance

The number of regular Preventative Maintenance duties continued to increase during the second quarter. Some of these included: Pintle bearing lubrication, track inspection, subreflector actuator limits, lubrication of alidade man lift, cleaning and inspection of drive motor blowers, cleaning and greasing of elevation gear and various miscellaneous repairs and inspections.

Grease samples for the first test of azimuth wheel bearing grease were taken from all bearings except the replaced bearings which have new grease. These tests were sent off for analysis.

The detailed plans for construction of the GBT hoist pads and modifications to the GBT Warehouse were completed during the second quarter. Information (notes, video and pictures) was collected on Az wheel the bearing replacement effort undertaken by LM. These will be incorporated eventually into operations documentation. More effort has continued in the plan for structural inspection.

GBT Operator Training

Some initial training in data processing using the AIPS++ system has begun. Other training has been limited by available time and other priorities such as the heavy commitment of Operators to the corner setting effort, testing (Az track, servo, lasers, fire alarm, track wheel/bolt clearance, etc.), outfitting and the removal and installation of equipment.

GB Maintenance Bookkeeping

Much of the effort in the implementation of the Mainsaver software continues in the definition of system parameters. With the aid of a summer student several thousand items have been entered into the inventory asset table during the last part of the second quarter. Only about fifty percent of the inventory will be entered during the third quarter. Several PM cycles have been entered and are ready to utilize once appropriate manpower is available (see comments under Operations Manpower) to complete the necessary information. A target date for the training of other employees on the use of Mainsaver has been established and final details for the training will be completed in the first part of the third quarter.

GBT Operations

Operations experience of controlling the telescope ceased during the second quarter because of the LM repairs to the GBT track, replacement of the Az bearings and the alignment of the Az wheels.

The preliminary version of the GBT operator logging program specifications was completed during the second quarter of 2001. Extensive participation with the computer division in developing their Use Case analysis of the operator's logging program was ongoing during the last part of second quarter.

The effort of converting the Operator Advancement Proposal into a plan was started in the second quarter. Although all of the plan details will not be finished before the end of 2001 the goal is to begin implementation before the end of the year.

Some operating procedures were developed and refined during the second quarter (listed under the GBT Documentation section above).

Operations continues to provide feedback on the CLEO and GO software systems.

Mechanical Engineering and Instrument Shop

Milestone	Original Deadline	Revised Deadline	Date Completed
Fab. dewars for Tucson	04-20-01	07-13-01	
Fab. two WR-10 MMIC amplifier bodies	04-18-01	07-13-01	
Fab. ten 510-690 MHz balanced amplifiers	04-30-01	08-24-01	
Fab. evaluation Rx flanges for Tucson	08-30-01		
Fab. 4 K-band feeds for VLA	10-05-01		
Fab. 4 K-band OMTs for VLA	08-24-01		
Fab. L-band OMT for Arecibo	11-15-01		

Astronomy Education Center Project

Milestone	Original Deadline	Revised Deadline	Date Completed
Design Review w/ NASA	01-04-01	04-12-01	04-12-01
Bid Advertisement for main AEC building	01-25-01	04-23-01	05-25-01
Pre-bid conference for building contractors	06-25-01		06-25-01
AEC main bldg. contractor bids due	07-17-01		
AEC main building contract awarded	08-13-01		
AEC dormitory 90% design review	09-10-01		
AEC main building construction complete	10-15-02		

Electronics Engineering

OVLBI Tracking Station

This quarter we continued a number of repairs to the OVLBI tracking station. Test equipment for troubleshooting the station was defined and some was purchased. This will help in increasing the station's reliability record, and reduce time to repair. Plans for the next quarter are to work on increasing reliability and decreasing the time to repair the station. This process is helped along by the increasing experience of the OVLBI engineering and technician staff.

General Site Support

Engineering support was provided to the Astronomy Education Center project for RFI suppression issues. Engineering was supplied to the Interference Protection Group for an RFI monitoring station. RFI testing of equipment was conducted.

Computing

Work on the site networking upgrades continue. The shielded rack for the Jansky Lab second floor network switches has passed inspection, and we have started transferring staff to 100 MBit connections. Additional network switches have been ordered from Infrastructure Funds to allow a 1 Gbit backbone between the main switches and servers. Work on the Residence Hall proceeds slowly due to the higher priority telescope outfitting work.

In the MIS area, the installation of the new upgraded business software (JD Edwards OneWorld) began in April. Entry of data into a test environment began in May with continued setup and testing through June. Production entry on a limited basis will begin in Green Bank during July. The Windows Terminal Server that will be used to serve the business software to Charlottesville, Socorro, Tucson, and AUI was installed in April and was used in Socorro training on the business software in May. The size of the training demo programs and data were quite large so using the WTS was both functional and a favorable test for the machine. All business related server machines have been moved within the 24/7 server area in the RFI shielded room. The servers include payroll, enterprise (JDE), timekeeping, and WTS's. Partitions will be ordered later for that area.

As part of our infrastructure upgrades, we have purchased a new dual processor Sun Ultra-60 workstation, and two RAID arrays. This will form the main file server for user home directories. Also with infrastructure funds, we have purchased a dual-processor Dell server which is being used as a testbed Linux server. Later in the year, this will be converted to a Windows NT metaframe server, and be replaced with a quad-processor Linux machine.

With the welcome assistance of Stephan Witz and James Robnett from the AOC, we have started the process of converting the site-wide servers, general user workstations and the GBT Solaris control computers from 2.6 to 2.8. Apart from the specific operating system upgrade, we are taking this opportunity to rationalize a number of aspects of the system configuration. We expect the bulk of this work to be finished in July. Linux upgrades will be performed later in the year.

As usual, we have had an extensive array of summer visitors, including students, teachers, and visiting scientists. This has consumed a considerable amount of effort, both in physical installation and relocation of machines to cover the load, and in sysadmin support. To aid both new and existing users, we have set up a web-based "help-desk" through which they can report problems, ask for advice and so on.

Chuck Van Tilburg, our Senior Systems Analyst resigned in May. We had already recognized the need to expand our Unix system support group; we are now actively recruiting for two vacancies. We also have open positions for the Head of Computing, and an Assistant Scientist/Software Developer. The lack of staff in these posts is causing a significant extra load on the remaining members of the group.

Mechanical Engineering

The Central Instrument Shop did several jobs for Tucson this quarter. The majority of this effort went into fabricating two large test dewars that will be completed and tested in the second week of next quarter.

A set of large anchor truss plugs and two equipment vault batches were also major projects completed by the Shop for Tucson. Two precision-cut Teflon lenses were also shipped to Tucson.

Other work included the first two in a run of eight K-band feeds and OMTs that were shipped to the VLA, and some air plenums supplied to Charlottesville.

The coming quarter will see the fabrication of two large receiver flanges for Tucson, an additional four K-band feeds and OMTs for the VLA, and a number of amplifiers for the CDL. The shop will likely also be contracted to provide an L-band orthomode transducer for Arecibo.

Operations - Other Telescopes

20 Meter, GBI, 85-3, and OVLBI Tracking Station

All of the USNO hardware and spare parts were returned to USNO during the second quarter. The 20 Meter will be mothballed after VLBI tests supporting the GBT have been completed, probably during the third quarter of 2001.

The two GBI telescopes will be mothballed during the third quarter of 2001.

The 45 Foot HALCA (OVLBI) tracking station continues operation in 2001. Routine preventative maintenance and general repair maintenance continued as resources permitted during the second quarter. The part time OVLBI operator hired during the last part of the first quarter has been in training all of the second quarter.

The 85-3 (Pulsar Monitoring) telescope had both routine maintenance and some repair work on the motors completed.

Routine lubrication of the 40 foot mechanical parts was completed during the second quarter.

Inspection and minor maintenance of the 140 Foot Telescope facilities were completed during the second quarter.

Education and Public Outreach

Green Bank Astronomy Education Center

The Green Bank Astronomy Education Center is a joint NSF and NASA funded project to construct a state-of-the-art education and visitor center. Exhibits are being developed via an NSF Informal Education grant, entitled "Catching the Wave." The building, an approximately 20,000 square-foot facility, will house a large exhibit hall, an auditorium, classrooms, a computer lab, an observing deck, as well as gift and café areas. The facility will serve the dual purpose of a visitor facility for the general public and an education center for K-16 programs. Green Bank already has a very active education program, and this facility will allow both the quantity and quality of those programs to be significantly enhanced.

During the last quarter, the detailed architectural design of the center was completed and a review meeting with NRAO, NASA, and the architects was held on April 12. The design went out for bid on May 25, and a contractors' pre-bid conference was held on June 25. Construction should begin in the third quarter of 2001.

Electronics

Milestone	Original Deadline	Revised Deadline	Date Completed
VLA/VLBA Pie Town Link (LO/IF)			
Complete construction & checkout of spares	01-31-01	11-30-01	
Reduce temperature sensitivity	01-31-01	11-30-01	
Propose & test scheme to measure round trip phase	06-30-01	08-31-01	
Reduce fiber use to single fiber	11-30-01		
Increase dynamic range	11-31-01		
Use spare VLA antennas in VLBI	06-30-02		
Receivers (FE)			
Complete Q-band build	12-31-02		
Complete solar calibration work	12-31-00	12-31-01	
Complete K-band build	12-31-02		
Build and install three more W-band receivers	10-31-01		
Replace Y-coupler on W-band receivers #2 to #4	08-30-01		
Build second "SOIDA" receiver test stand	12-31-01		
Test and begin replacement of new material for Dewar windows on L-band receivers (FE)	12-30-01		
Identify and correct moisture buildup problem in new VLA K-band feeds (FE)	12-30-01		
Test re-worked water vapor radiometers	12-31-01		
Upgrade for Pulsar High Time Resolution Processor (DCS, NM Tech)			
Release for construction, Fast Analog to Digital Converter (FADC) assembly	01-31-00	08-31-01	
Checkout of VME timing card & multi A/D FADC	01-31-01	07-31-01	
Checkout of full FADC	09-30-01		

Milestone	Original Deadline	Revised Deadline	Date Completed
Other VLA			
Construct VLA correlator controller (Correlator)			06-30-00
Continue development of 10 Gbps fiber optic link for ALMA project; work may transfer to EVLA project	12-31-01		
Modify helium lines to facilitate testing new receivers (Cryo)	01-31-01	12-31-01	
Test higher volume helium compressor (Cryo)	12-31-01		
Test vacuum pump upgrade (Cryo)	12-31-01		
VLBA Improvements for W-band (Special Projects, ES Division)			
Use prototype system to measure& correct panel errors at VLBAPT using microwave holography	12-31-00	08-31-01	
Adjust VLBA main reflector panels to achieve best efficiency at W-band	01-31-01	12-31-02	
Develop a means of measuring & correcting VLBA subreflector surfaces	12-31-01	12-31-02	
VLA 74 MHz dipoles (FE)			
Key H & V polarizations	05-30-01		06-30-01
Change FE filters to 3 MHz	12-31-01		
Iridium Filters (FE)			
Install & test prototype filters on VLA to reduce impact of spurious radiation in radio astronomy OH-band near 1612 MHz	01-31-01	08-30-01	05-01-01
Install filters on all VLA antennas if tests prove successful	12-31-01		
Hydrogen Masers (LO/IF)			
VLBA Hydrogen Maser repair (#4) (LO/IF)	12-31-00	12-31-01	
VLBA Hydrogen Maser #11, replace (LO/IF)	12-31-00	06-30-01	

Engineering Services

Milestone	Original Deadline	Revised Deadline	Date Completed
Los Alamos maintenance visit	04-17-01		04-23-01
Begin Kitt Peak antenna painting	06-05-01	06-11-01	06-11-01
Owens Valley antenna visit	06-05-01	06-11-01	06-19-01
Complete CnB-Array reconfiguration	06-08-01		05-31-01
Complete C-Array reconfiguration	06-29-01		06-29-01
Brewster maintenance visit	07-24-01	07-23-01	
Complete DnC Array reconfiguration	09-21-01		
Mechanical Group			
Assemble three spare Dichroic panels for VLBA	05-31-01	09-31-01	
Assemble one spare VLBA wheel assembly	03-30-01	05-15-01	05-15-01
Complete VLBA handrail fabrication	04-27-01		04-27-01
Replace Vicker 90 gpm pumps on Transporter 1 with newer model pumps	11-15-01		
Antenna 9 overhaul	04-12-01	04-23-01	04-23-01
Antenna dish panel adjustments on Antenna 18	05-28-01		04-27-01
Antenna 3 overhaul	05-29-01	06-19-01	06-19-01
Antenna 7 overhaul	05-29-01	07-31-01	
Prep and paint Antenna 2	05-25-01	06-15-01	06-18-01
Prep and paint Antenna 5	05-28-01	07-15-01	
Install W-band mount on Hancock VLBA Antenna	05-11-01		05-15-01
Antenna dish panel adjustments on Antennas 2	05-28-01		05-10-01
Antenna dish panel adjustments on Antennas 21	07-13-01		
Prep and paint Antenna 28	07-31-01		
Complete VLA fall arrest installation	08-31-01		
Antenna dish panel adjustments on Antenna 10	08-03-01		
Replace azimuth bearing on Antenna 17	08-31-01		

Milestone	Original Deadline	Revised Deadline	Date Completed
Antenna dish panel adjustments on Antenna 17	09-06-01		
Antenna dish panel adjustments on Antenna 11	09-21-01		
Electrical Group			
Complete minor HVAC component changes at Kitt Peak VLBA	03-30-01	04-03-01	04-03-01
Begin installation of new encoders	06-29-01		06-29-01
Tech Services UPS installation	07-31-01		
Cryo Air Conditioner installation	10-30-01		
Upgrade fire alarms	11-30-01		
Radio upgrade	12-28-01		
Site & Wye Group			
ALMA base course application	06-29-01	08-31-01	
Repair manhole at DE1	06-29-01		06-29-01
Redo Visitor Center parapet stucco	06-29-01	07-20-01	
Redo exterior stucco on Guest House	06-29-01		06-21-01
Repair Manhole at CE6	07-31-01		
Install 5,000 crossties on East Arm	09-30-01		
HAZMAT /waste oil storage	09-30-01		
ES Engineering Group			
Machine seven K-Q feed cones for Antennas 18-24	02-01-01	09-18-01	06-07-01
Start construction of ALMA antenna foundation	05-07-01	07-09-01	
Complete ALMA antenna foundation construction	08-06-01		
Administrative (Scheduling-Safety)			
Removal of sludge from used oil tanks	03-30-01	08-30-01	
HAZMAT/MSDS Refresher session	04-26-01		04-26-01

The machining of seven K-Q feed cones was rescheduled until September because they are not needed until that time. Arrangement for the removal of sludge from used oil tanks is delayed because the bids

received were too high. The bidding process will be reinitiated. The delay on the repair of the Visitor Center parapet was due to having received the wrong patching material. The delayed fabrication of spare Dichroic panels is due to a change in priorities.

Computer Division

Systems Support Group

Milestone	Original Deadline	Revised Deadline	Date Completed
Arana Removal	09-30-00	09-30-01	
Video conferencing	01-31-01	Pending	
Solaris 2.8 installation	07-31-01	07-31-01	
RedHat 7.1 installation	07-31-01	07-31-01	
Web/ftp server	08-31-01	08-31-01	
New PC order/installation	04-15-01	05-30-01	05-15-01
2nd New PC order/installation	06-30-01	06-30-01	
Replacement public machines	09-30-01	09-30-01	
Off-load zia server	09-30-01	09-30-01	
Expand filehost file-server	06-30-01	06-30-01	06-30-01
Jobserve	02-28-01	04-30-01	06-04-01
VLA Web pages	06-30-01	09-30-01	
Upgrade Ingres to version 2.5	08-01-01		
Convert monitor data loader program	08-01-01		
Convert AOC Library Software to Java	09-01-01		
Correlator controller in continuum	05-31-01	08-15-01	
VLBA station computers upgrade	07-30-01		
Real time VLBA fringe searching	09-01-01		
VLBA Distribution system upgrade	09-01-01		
Full test of CMP on the VLA	04-30-01	06-04-01	06-04-01
Complete installation of CMP	09-30-01		
CMP/SLC interface software testing	09-30-01		
Dynamic Scheduling Enhancements in	05-30-01	09-30-01	
Integrate distribution archive in OMS	08-31-01		
Ancillary data procedures -> VLA Ops	05-30-01	09-30-01	
Modcomp replacement	10-31-01		
WBS EVLA M&C system	06-30-01		
ASG recruitment	08-31-01		
EVLA Software Design Document	08-31-01		

Arana Removal

Removal of the arana file server is still waiting for the conclusion of the VLA scheduling software rewrite based on Sybase. The old system uses Dbase IV, an obsolete product which is tied to arana.

Solaris 2.8 Installation

We have begun upgrading selected systems for testing purposes. The full upgrade of standard systems has been completed by mid June. The entire upgrade of operations systems and servers should be completed by late August. The start time of the project was delayed nearly a month while the CCE (NRAO-wide computing) group ironed out some installation details.

RedHat 7.1 Installation

We have begun upgrading selected Linux systems for testing purposes. As with the Solaris upgrade we expect the upgrade of desktop systems has been completed. The remaining systems should be done by late July. This project was delayed as well while the CCE ironed out installation and configuration details.

New PC Order/Installation

Eight new high-end PCs were installed; they replace older Sparc stations on the desks of the heaviest AIPS users. The new machines are three times as fast as their predecessors, and have twice as much disk space. The machines freed up by this purchase are currently in use by our 14 summer students.

Second New PC Order/Installation

We ordered ten more high-end PCs after the success of the original system. Four of these will temporarily replace Ultra-2 public systems; the other six will go to AIPS/AIPS++ users.

Expand Filehost File-server

Filehost has received a new disk array which effectively doubles the available disk storage. The increased storage will go primarily toward increased space for personal accounts, storage areas for the VLBA and development areas for the EVLA and ALMA projects.

Jobserve

Jobserve version 1.6.2 was released, immediately followed by 1.6.3. The former fixes a large number of bugs discovered while 1.6.1 was in use; the latter adds observe-style warnings about pointing close to the Sun, Moon, and planets.

Ingres Upgrade

Before upgrading the production machine, a trial installation on a test machine will take place. Specific data analyst tools currently written in Windows4GL will be ported to Java.

Convert Monitor Data Loader Program

This project aims at converting the VLBA Monitor Data loader from database loading to serialized Java objects.

AOC Library Software Conversion

The library software is based on Power Builder, a product with no other applications at the AOC. We can avoid expensive Power Builder upgrades and licenses by porting the library software to Java.

VLA Correlator Controller

Good progress was made on the VLA correlator controller upgrade. A few loose ends need to be tied up to make it fully functional in continuum mode. After that, spectral line mode follows.

VLBA Station Computers

A full OS update is planned with a driver for the new maser and elimination of dependence on the obsolete MVME050 hardware.

Real Time Fringe Searching on the VLBA Correlator

This is a student project by Andrea Petric which allows real time display of single baseline correlated data. The project now has been completed, and after some small refinements will be made available for use by the end of the summer.

VLBA Distribution System Minor Upgrade

This project aims at replacing current distribution drives with DDS4 and newer exabyte tape drives, and at merging of distribution script creation into the OMS.

Full Test of Control and Monitor Processor (CMP) on the VLA

The Interim CMP has been running in parallel with the Modcomps on the VLA since March. Monitor-side operations have been successful since March; command-side operations were successfully tested June 4, 2001.

Complete Physical/Mechanical Installation of CMP

This entails covering equipment rack openings and performing RFI testing of the new installation. We will access the need to build a better suited (in terms of RFI) interface cable between the Serial Line Controller (SLC) and the CMP.

Conduct Performance Testing of the CMP to SLC Interface Software

By knowing the processor load of this low-level driver software, we will be able to determine what portions of the application software can reside in the real-time processing unit.

Dynamic Scheduling Enhancements in OMS

The enhancements include several long-requested features that allow users to dynamically schedule a project using only OMS. The previous method required users to run programs outside of OMS and move the output generated by those programs to a location accessible by OMS. The improvements will allow dynamic scheduling to be performed by a number of users rather than a sole scheduler as it has been done in the past. This item was completed.

Integrate the Distribution Archive into OMS

The first release is scheduled to be completed by the end of the last quarter or early this quarter and will allow correlator operations to create distribution requests and view/edit the distribution request queue from within OMS. A second (and possibly third) release will allow the correlator operators to select specific jobs to be included in a distribution and will inter-operate with the program *xdist*.

Turn Over Ancillary Data Procedures to VLA Operations

This task refers to the processing and/or downloading of tipping data and VLBI@VLA calibration data. Both are partially done; we expect to finish this during the third quarter.

Modcomp Replacement

Work proceeds on the purchase of replacement Modcomps. At the time of writing (6/18) a purchase requisition is ready to go out. Delivery of the Modcomps could be as soon as two weeks after receipt of the order by Modcomp. An installation plan is being developed and scheduled for late summer/fall 2001.

WBS EVLA M+C System

WBS categories for the development of the EVLA Monitor and Control system have been developed. The associated cost data sheets will be submitted by the end of June 2001. Schedules and cost estimates in support of the information that will be entered on the cost data sheets are being developed.

Recruitment

We are busy recruiting for our two open positions in the Array support Group. We expect the new hires to be working exclusively on EVLA related work.

EVLA Software Architecture and Design Document

In March, 2001, we issued the first draft of the EVLA Software Architecture and Design Document. We expect the second version to come out some time during the third quarter.

AIPS

Versions

The 31DEC00 version of AIPS, both in its frozen form and in its previous incarnation as 31DEC99, has now been distributed 581 times, all but 13 of them by ftp. This includes 174 copies of the frozen 31DEC00 release, 58 of which occurred in the second quarter of 2001. Our counts include those who grab copies on multiple occasions from the ftp site, since we do not have an accurate count of repeat downloads. Almost all of the distributions have been of source code only. The 31DEC01 version, updated daily, has now been distributed 266 times. Of the 40 sites that have registered their use of 31DEC01, 2/3 report that Linux is their primary architecture and 1/3 Solaris.

Personnel

Pat Murphy, because of the press of his other duties, has asked to be relieved of all official duties in the AIPS group. He has been a valuable member of the Group for more than ten years and he will be missed. Like Bill Cotton before him, he has volunteered to advise the remaining group privately as needed.

Additional assistance with operating system matters will now be provided by the very capable members of the Computer Division at the Array Operations Center in Socorro.

Key Developments

1. Version 2.4.2 of the Linux kernel has been included in the RedHat 7.0 release of Linux, which contains numerous system improvements. Unfortunately, this and other Linux releases include the unofficial "GNU compilers version 2.96," not supported by the GNU compiler group. The AIPS group has recommended installation of the older GNU compiler suite version 2.95 along with RedHat release 7.1.
2. Wide-field imaging has been improved considerably, largely to facilitate VLA observations at 74 MHz. Considerable improvement has been made in the routines selecting and imaging multiple fields ("facets"), and in deciding which fields to clean.
3. Improvement of the VLBI data-reduction procedures has continued. New documentation is found in Appendix C of the AIPS Cookbook, "A Step-by-Step Guide to VLBA Data Calibration in AIPS," and in AIPS Memo No. 105, "AIPS Procedures for Initial VLBA Data Reduction, Version 2.0," dated April 26, 2001.
4. Several changes were made in FILLM to remove lingering bugs that caused problems with some aspects of data selection, or when frequencies or antennas changed during an observing run. A user option was added to permit the calculation of Channel 0 in AIPS rather than using the (suspect) Channel 0 computed by the VLA on-line system.
5. BPASS and CPASS were fixed to correctly incorporate source models in the normalization of the bandpass shapes.
6. Three new editing tasks were added. SNFLG, based on code submitted by Lincoln Greenhill and Mark Reid of CfA, flags data based on phase changes in SN or CL tables. DEFLG flags based on coherence losses, computed by comparing vector and scalar averages in a sliding window. VPFLG flags data in all polarizations if any individual polarization is flagged (important for proper polarization imaging).
7. The Brandeis VLBI group contributed AIPS Memo No. 106, "Making Movies from Radio Astronomical Images with AIPS," by Cheung et al., dated June 6, 2001.

Goals for Q3 2001

1. Continuing maintenance and user support.
2. Test capabilities of FRING vs. KRING for fringe-fitting under various conditions.
3. Continued low-level code development in support of NRAO instruments.
4. Move primary copy of AIPS to Socorro, and revise midnight job procedures.

EVLA

Milestone	Original Deadline	Revised Deadline	Date Completed
Build and install five more 7 mm receivers	01-31-01	01-30-03	
Installation of seven more K-band receivers (18-26.5 GHz) at VLA	01-31-01	01-30-03	
Demonstrate RFI from samplers & fiber optic transmitters can be reduced to acceptable levels (IPG)	12-31-01		
Monitor RFI environment at VLA 1 - 18 GHz (IPG)	12-31-01		
Develop block diagram for M&C, wyemon alarms, voice communication (DCS, LO/IF, Comp. Div, ES Div)	12-31-01		
ELA Project Book	08-15-01		
EVLA Management Plan	08-15-01		

$3M was allocated in the 2001 NRAO budget for further planning and development of Phase I of the EVLA Project. A Project Manager (P. Napier) was appointed on May 2 , 2001, and work on the project formally began at that time. The principal activities during the quarter were all related to the planning and management of the project.

An important task during the quarter was establishing the formal Work Breakdown Structure (WBS) for the project. The EVLA Project is the sixth entry in the NRAO-wide WBS. The 12 major subdivisions of the EVLA Project for management purposes are shown below as the Level 2 entries in the project WBS.

6.01 Project Management
6.02 System Integration and Testing
6.03 Civil Construction
6.04 Antennas
6.05 Front-end Systems
6.06 Local Oscillator System
6.07 Fiber Optic System
6.08 Intermediate Frequency System
6.09 Correlator
6.10 Monitor & Control System
6.11 Data Management and Computing
6.12 Education and Public Outreach

By the end of the quarter, the WBS had been defined down to Level 4 and preliminary cost data sheets containing manpower and budget requirements at this level had been generated by the managers and engineers assigned to the project from the NRAO operations staff in Socorro. Key project staff positions, either in place at the beginning of the project or appointed during the quarter, include Project Scientist (R. Perley), Systems Engineer – Electronics (J. Jackson), Systems Engineer – Software (G. Hunt), Project Scheduler/Budgeter (G. Cole), EVLA Monitor and Control Software Lead Designer (B. Sahr). Additionally, recruitment for a number of electronics and software engineering positions were initiated.

By the end of the quarter, a system of Project Financial Accounts had been defined and was being entered into NRAO's financial accounting system. Allocation of project funds to these accounts will be made during the next quarter.

With the initial WBS defined, the process of generating a detailed schedule for the project was beginning as the quarter ended. The initial WBS and schedule will be included as part of the EVLA Management Plan scheduled for delivery in August 2001. Some preliminary milestone goals for the Project are shown in the table below.

A number of routine management meetings were begun during the quarter. A monthly management meeting at the Division Head level and above, including representatives of the Canadian and Mexican partners, was initiated. Weekly meetings for engineers to coordinate the technical aspects of the project also were begun. Technical activities commenced during the quarter included definition of the project block diagram and a transition plan for the installation of the new correlator.

Another activity that was begun during the quarter was the writing of the EVLA Project Book. This document will be the principal summary statement of the performance goals and design of the EVLA. The chapter definitions and assignment of chapter authors were made with preliminary versions of the chapters due during the next quarter.

Discussions with the Canadian partners, the Herzberg Institute of Astrophysics (HIA), concentrated on establishing a formal agreement for provision of the EVLA correlator by HIA using Canadian funds. A Memorandum of Understanding between NRAO and HIA was drafted and was being exchanged for signature as the quarter ended. HIA sent a letter of intent to the appropriate Canadian funding agency for funds for the correlator project late in the quarter with a goal of securing funds by the end of the year. Preliminary specifications for the correlator and the enclosure required to house it at the VLA were exchanged.

The Mexican partner confirmed that $2M in Mexican funding for the EVLA was available and awaiting use when EVLA tasks can be identified that are suitable for allocation to Mexican companies.

Major Developments

Milestone	Original Deadline	Revised Deadline	Date Completed
Design L-band amp using InP devices	03-16-01	04-30-02	
Complete 84-116 GHz SIS mixer design	02-16-01	04-30-01	06-29-01
Study use of overmoded w/g in LO transmission	03-16-01	08-31-01	
Demonstrate 211-275 GHz balanced SIS mixer with integrated 4-12 GHz IF preamp	06-29-01	08-31-01	
Demonstrate 211-275 GHz balanced sideband-separating SIS mixer with integrated 4-12 GHz IF preamps	07-31-01	09-30-01	
Construct second test receiver	12-31-01		
Fabricate band 3 windows	09-30-01		
Analysis of band 6 optics	04-30-01		06-30-01
Design GBT Q-band optics	09-30-01		
Complete preliminary design of EVLA L-band feed	09-30-01		
ALMA Correlator: 1) Upgrade the station card to its final configuration by installing final RAMs and re-testing prototype card. 2) Write and release ALMA memo on the filter card testing. 3) Complete testing of the LTA prototype card. 4) Start design of the adder tree card. 5) Start design of a correlator card test fixture. 6) Send out correlator card for PCB fabrication. 7) Send out correlator chip test fixture card for PCB fabrication. 8) Start the design of the station back plane. 9) Start design of the correlator back plane. 10) Start design of the rack-to-rack paddle boards.	09-30-01		

Milestone	Original Deadline	Revised Deadline	Date Completed
ALMA Correlator:			
1) Perform final testing of the ALMA correlator filter using the card test fixture.			06-30-01
2) Perform final testing of the station cards using the card test fixture.		08-31-01	
3) Publish a test report on the filter card performance.			06-30-01
4) Complete testing of the LTA prototype card.		07-31-01	
5) Complete layout of the correlator card.	06-30-01		06-15-01
6) Approve correlator chip for prototype fabrication.		07-15-01	
7) Have working software for the correlator system Infineon microprocessor in both the LTA and filter/station card test fixture.			06-01-01 06-30-01
8) Perform final testing of the filter card using the test fixture.		07-15-01	
9) Approve correlator chip for prototype fabrication.			
Initial test of prototype ALMA correlator	12-21-02		
Construct 80/240 GHz frequency tripler	03-30-01	09-30-01	
Design MMIC doubler chips for ALMA band 7	06-01-01	09-30-01	
Beam-forming array - WBS	08-31-01		

Amplifier Design and Development

The amplifier group has continued to support the ALMA project with manpower and construction assistance in the SIS-integrated amplifier development effort. Technicians within the amplifier group have continued with modifications and improvements to the Apple II-based noise measurement systems. Recent improvements have increased the level of automation in the test system, allowing for faster and more consistent test and measurement of noise performance.

Amplifier Production

A total of 25 amplifiers was completed during the quarter. Production included nineteen 3-13 GHz amplifiers, the first volume production of this new design. These units are being used as IF amplifiers for SIS mixers used in millimeter-wave astronomy at several sites. They should also prove valuable in the EVLA upgrade program. Six K_a-band amplifiers were also completed. Work in progress includes additional K_a-band amplifiers, along with K- and W-band units. Production activity also included bias supply boards for amplifiers delivered to other scientific organizations.

The spaceflight amplifiers built for the MAP satellite were successfully launched on a Delta rocket on June 30.

Superconducting (SIS) Millimeter-Wave Mixer Development

SIS Mixer Development

Band 3 (86-116 GHz) SIS mixer: The choice between SIS and HFET receivers for ALMA band 3 (84-116 GHz) is still open. To obtain a comparison between the two types of receiver, we are developing a tunerless SIS mixer for this band capable of operation with a 4-12 GHz IF. Work continued this quarter on the design and optimization of this circuit. Mixer block design and mask layout will follow when the mixer circuit design/optimization is completed next quarter.

Band 6 (211-275 GHz) harmonic sideband response: The response of an SIS mixer to harmonic sideband signals ($(nf_{LO} \pm f_{IF})$, $n > 1$) is important if the USB and LSB receiver noise temperature and gain are to be deduced accurately from hot and cold load measurements in the laboratory; this is discussed in ALMA Memo 357. Measurements using a dichroic plate indicate that the out-of-band response of our building-block Band-6 mixer is at least 30 dB below the USB and LSB response.

Band 6 (211-275 GHz) balanced sideband-separating mixer—A. Single-chip design: This design has three RF quadrature hybrids, an in-phase power divider, four SIS mixers and their RF tuning circuits on a single 2 x 1 mm quartz chip. The wafers were fabricated at UVA. The mixer block and 4-12 GHz IF preamplifiers are in the machine shop.

Band 6 (211-275 GHz) balanced sideband-separating mixer— B. Multi-chip design: This design uses four separate SIS mixers of established design, mounted in a block containing three waveguide quadrature hybrids and an in-phase power divider. The design of the E-plane split block waveguide components (E- and H-plane bends, matched Y-junction, waveguide to suspended-stripline transducer, quadrature hybrid) is now complete (see ALMA Memos 343 and 381), and work is under way on the design of a mixer block compatible with the 4-12 GHz IF preamplifiers.

Band 9 (602-720 GHz) SIS mixer: Seven mixers from the first SUNY/StonyBrook band 9 wafer have been tested with anomalous results. Although pumped I(V) characteristics showed a very distinct step when LO power was applied, the mixer response to signal sources was very weak. Two causes of the problem have been identified: 1) One wire grid of the Keating Martin-Puplett diplexer was at the wrong angle. 2) The SQUID resonance frequency of the two-junction mixers (which is a good indication of the RF tuning of the mixer) is too low (~ 450 GHz, instead of the target frequency of 660 GHz). The RF testing of the mixers was also severely hampered by the repeated failure of our two RPI solid-state LO sources. The wire grid and the two damaged LO sources have been returned to the vendors for repair. A new wafer with higher LC resonance has been delivered by SUNY/Stony Brook. Mixer evaluation will resume when grid and LO sources are repaired.

4-12 GHz IF Preamplifier Development

In the previous report, we found that after installing InP transistors from the latest batch into the preamp, the gain dropped off above 10.5 GHz. We will shorten the gate bond wires between the first and second stages, but this requires a modified substrate between stages. New substrates were received in mid-June, and we are now building the new amplifier.

We have completed a balanced cryogenic 4-12 GHz amplifier using discrete components. This will be used for characterizing mixers with the broad IF capability.

Components for Band 6 Mixer Production Test Set

In preparation for building two mixer production test sets, we have been designing some of the component parts. These components may eventually be used in the ALMA band 6 cartridges. (i) We are making measurements of the loss of mirrors of copper, aluminum, and gold-plated copper. (ii) To couple the LO power from the tripler (at 15 or 80 K) to the mixer at 4 K, an overmoded waveguide would be convenient if it is possible to ensure that there are no transmission suck-outs. We are investigating this with EM simulation and experimentally using scale models. (iii) Compact, multi-conductor heatsinks are required for the many bias and monitor wires in the test receiver. We are evaluating a compact design using Nanonics miniature connectors. (iv) In developing IR filters for the production test receivers, further measurements are being made of Zitex (single and multilayer), black polyethylene, grooved and un-grooved HDPE and Fluorogold, with the HP8510. These are nearing completion, and a report is being written.

Automatic SIS Mixer Testing

New programable mixer bias supplies are planned for the ALMA mixer production test receivers. We have successfully bench-tested prototypes of the key circuits. A digital potentiometer circuit and a balanced current amplifier were breadboarded and tested. It was found that voltage spikes, while sweeping the bias voltage, could be significantly reduced by changing the software to sequence the wipers of the cascaded potentiometers appropriately. The digital interface for the bias voltage uses the I2C bus, which is one of the outputs available from the standard ALMA CAN bus controller.

Because of the bottleneck at our single 4 K mixer test system, we are constructing a second test receiver which will be used for mixer testing and development of automatic mixer testing.

There is concern about the gain stability of the 4-12 GHz HEMT IF amplifiers. Software was written to record the noise power from the mixer test system and to compute the spectral density and Allan variance of this noise.

Excessive scatter in mixer noise temperatures during automatic measurement has been a problem. This has been traced to small amounts of condensation on the dewar vacuum window on humid days. An internal memo was written summarizing the findings and remedy.

A Fourier Transform Spectrometer is valuable for measuring the frequency response of SIS mixers, but the chopping frequency of the source can modulate the mixer bias, resulting in an incorrect operating point and misleading results unless the response of the bias supply is sufficiently rapid. The frequency response of the older "NRAO Type II" Mixer Bias Supply was measured and documented in an internal memo.

Vacuum Windows and IR Filters

We have completed and delivered to Tucson the multilayer quartz vacuum windows for the ALMA band 6 evaluation receivers. Windows for band 3 are now being fabricated. ALMA Memos 340 and 377 describe the design, fabrication and measurements.

Publications and Memos

D. Koller, A. Kerr, G. Ediss, and D. Boyd, "Design and Fabrication of Quartz Vacuum Windows with Matching Layers for Millimeter-Wave Receivers," ALMA Memo 377, 25 June 2001. http://www.alma.nrao.edu/memos/html-memos/alma377/memo377.pdf.

E. Lauria, A. Kerr, M. Pospieszalski, S.-K. Pan, J. Effland and A. Lichtenberger, "A 200-300 GHz SIS Mixer-Preamplifier with 8 GHz IF Bandwidth," 2001 IEEE International Microwave Symposium Digest, pp. 1645-1648, May 2001.

E. Lauria, A. Kerr, M. Pospieszalski, S.-K. Pan, J. Effland and A. Lichtenberger, "A 200-300 GHz SIS Mixer-Preamplifier with 8 GHz IF Bandwidth," ALMA Memo 378, 7 June 2001. http://www.alma.nrao.edu/memos/html-memos/alma378/memo378.pdf.

A. Kerr, "Elements for E-Plane Split-Block Waveguide Circuits," ALMA Memo 381, 1 July 2001. http://www.alma.nrao.edu/memos/html-memos/alma381/memo381.pdf.

J. Effland, "Error Sensitivities for Noise Temperature Measurements," NRAO CDL Internal Report, 1 May 2001.

J. Effland, "Frequency Response of Type II Mixer Bias Supply," NRAO CDL Internal Report, 3 May 2001.

J. Effland and R. Groves, "Comparison of Receiver Noise Temperatures Measured with Conical and Chopper-Based Loads," NRAO CDL Internal Report, 29 June 2001.

J. Effland and R. Groves, "Measurement of WR-10 Waveguide Windows," NRAO CDL Internal Report, 21 June 2001.

Electromagnetic Support

ALMA

An analysis of the band 6 (210-275 GHz) optics was completed. The analysis used the Physical Optics (PO) technique which is more accurate than the Gaussian Beam analysis. The feed pattern for the horn was calculated by mode matching. The beam waveguide consists of two ellipsoidal reflectors. The output pattern from the beam waveguide has tapers of -11.1 dB, -9.6 dB and -8.1 dB at 210, 243 and 275 GHz,

respectively, at the edge of the subreflector. By decreasing the spacing between the reflectors and using an ellipsoid of different eccentricity for the second reflector (compared to the original), tapers of -13.1 dB, -11.6 dB and -10.1 dB at the 3 frequencies can be obtained.

The effect of introducing a polarization splitter between the two reflectors was also analyzed.

Spectrometers/Correlators

Three main areas of activity were pursued during the last quarter by the ALMA correlator group:

1) completion of the correlator card design and PCB layout
2) advanced testing of the ALMA digital filter card
3) advanced testing of the ALMA long-term accumulator (LTA)

Two of these three items involved development of a considerable amount of microprocessor software.

The correlator card design and PCB layout are complete to the point of doing minor PCB layout changes to enhance manufacturability of the card. Actual submission of the layout for printed circuit board construction will wait for final approval of the ALMA correlator chip design and its submission to a silicon foundry for prototyping.

All design items for the 4096-lag ALMA correlator chip have been completed, and the NRAO is performing a final re-simulation of the design on a NRAO-owned software simulation package.

The ALMA digital filter card was successfully tested using a test fixture made for this purpose. All filter modes were tested, and the card seems to operate satisfactorily. An interim report was written summarizing the test results and posted on the web.

The LTA card was extensively tested during the quarter, and all stages up to the final output adder tree (which is yet to be tested) work satisfactorily.

Additional definition of the correlator card-to-LTA interface and the LTA-to-computer system interface was made during the quarter, and this required extensive re-design of the FPGA sequencers in the LTA. A revised LTA spec reflecting these changes was generated and posted on the web.

Both the filter card test fixture and the LTA card are being used as a development bed for system firmware centered around an Infineon C167 CPU. Software developed so far has later application to control cards in the correlator.

During the quarter, a small amount of assistance was rendered to Green Bank in support of the GBT spectrometer. A logic card to stream data from the GBT spectrometer onto a tape recorder system for pulsar observations was finished and PCB layout begun.

Work continued, but at a very low level, on a system to stream VLBA data from a VLBA playback unit onto high-density computer RAID disc.

ALMA LO Source

The purpose of this project is to develop a series of electronically-tunable, phase-locked sources operating near 100 GHz. These sources will be used to drive millimeter- and submillimeter-wave frequency multipliers that produce the first-LO signal for the ALMA receivers.

Work this quarter has focused on laying out and procuring parts for the band 3 and 6 engineering models. Some of the last remaining technical questions have been addressed, including the phase drift and power leveling concerns. Although we are still waiting for the 72-95 GHz and 100-120 GHz power amplifier MMICs, evaluation of the MMICs on hand continues. Work on LO cartridge integration, interface specifications, and design preparation for the production phase has begun.

Two ALMA memos were released during this quarter: #376 regarding measurements of a driver phase-locked to the photonic reference and #335 regarding phase drift measurements.

ALMA Frequency Multipliers

The purpose of this project is to develop millimeter- and submillimeter-wave frequency multipliers for use in laboratory experiments and receiver systems associated with ALMA. A series of multipliers using varactor and varistor circuits operating in the 50 to 950 GHz range are being developed.

80/240 GHz Frequency Tripler: The fabrication of the quartz-backed GaAs devices for the tripler was completed. Subsequently, the tripler was assembled and underwent several developmental tests during this period. Areas for improvement were identified and required a correction to the mask set. The corrected mask set was prepared and the new batch of diodes is nearing completion. Tests will be carried out as soon as these devices become available. At this time, the target is to have a working tripler before the ongoing research contract with the Semiconductor Device Laboratory at the University of Virginia expires in September 2001.

JPL/University of Michigan Collaboration: The Michigan group is working to deliver a discrete diode array for use in the existing 110/220 GHz doubler block. This collaboration was set up to develop a working knowledge of Michigan fabrication processes, and to set up design/data transfer protocols with the group. The masks have been fabricated, and two GaAs wafers have been procured by the Michigan group from their MBE company after solving initial doping profile problems. Test fabrication runs are currently under way.

Concurrently, work is in progress to develop viable substrates for MMIC work for ALMA band 7 doublers. Structures being investigated for this purpose are: (1) thinned down GaAs membranes, (2) thinned GaAs membranes with polyamide backing for mechanical support, (3) thinned GaAs membranes with patterned polyamide backing and (4) thinned GaAs membrane attached to a silicon frame. Test structures are being developed to test both the mechanical strength/handling as well as their electrical properties. Polyamide deposition processes have been developed and tested to calibrate the thickness of the deposit. Currently, wafer thinning processes that do not attack the polyamide are being investigated. Semi-

insulating wafers required for this work have been ordered. Development of beam-leads for use in ALMA MMIC work is also a part of this effort.

Fully-Sampled, Focal Plane Array Feed

The purpose of this long-term development project is to explore the technical challenges associated with the development of a "radio camera" for imaging applications on single-dish telescopes. The camera consists of a two-dimensional array of receiving elements located on the telescope's focal plane. These elements sample the focal plane electromagnetic field distribution, yielding complex signals that are processed using both analog and digital techniques to synthesize the desired number of telescope beams.

This project has taken on new significance with the goal of developing a prototype instrument for use on the GBT within a three to four year time frame. Time was spent this quarter formulating a WBS for the development and construction phases of this project. The development phase includes a detailed investigation into various DSP architectures, low-noise element designs, cryogenic cooling options, and electromagnetic field analyses . The construction phase will focus on an instrument for astronomy research in the 1.2-1.6 GHz band.

Meetings

ALMA Organization Meeting, Paris, France, May 10-11, 2001 (Webber)
IEEE MTT-S Symposium, Phoenix, AZ, May 20-25, 2001 (Bryerton, Kerr, Lauria)
ALMA SIS Mixer/Preamp Integration Meeting, JPL/CalTech, June 28-29, 2001 (Lauria)
Users Committee Meeting, Socorro, NM, June 28-29, 2001 (Webber).

e2e Project

Milestone	Original Deadline	Revised Deadline	Date Completed
DM architect hired	06-01-01		06-01-01
Archive proposal from STSCI due	04-29-01		05-16-01
e2e project initiated	07-01-01		
DM WBS out to 2006	02-01-01	08-01-01	
First version e2e project book	08-01-01		
Submit revised COBRA proposal	08-01-01		
DM review	09-17-01		
Archive RFP issued	10-01-01		

In this quarter, the Data Management Initiative was named as the End-to-End (e2e) project, and it was further defined and scheduled for initiation on July 1, 2001. Project manager, scientist, and architect are all now in place. Definition of the scope of the project proceeded by construction of a project book, initial WBS, and software management plan. The initial architecture was developed and documented in the project book. Project documentation is available at http://www.nrao.edu/e2e.

Funding of the e2e project will be via a variety of subcontracts from other parts of NRAO: EVLA, GBT, VLBA, and the ALMA project. The AIPS++ Project and DM staff will also contribute. Much of the planning activity this quarter has focused around establishing agreements with these groups as to the scope of work and associated resources.

Additional funding for e2e activities was sought from the NSF ITR program. Our proposal for $5M over five years was rejected, along with other similar proposals in the Astronomy division. However, we have been invited to resubmit a downsized proposal for no more than $550K to last one to two years.

We received an initial archive proposal from the Space Telescope Science Institute (STScI). Following some discussion of some of the technical details, we plan to proceed to a formal Request For Proposals in the next quarter.

An external, AUI-sponsored review of DM activities and management is planned for September 2001. The review committee will be chaired by Ethan Schreier of STScI, and includes experts on the main areas of DM activity: archiving, end-to-end processing, software development, computer system management, etc.

Technology Development

Milestone	Original Deadline	Revised Deadline	Date Completed
Start of GBT commissioning	11-29-00	01-19-01	01-19-01
AIPS++ tutorial at CV	12-17-00		12-17-00
AIPS 31DEC00 freeze	12-31-00	01-31-01	01-18-01
AIPS++ Developer's Pre-release	09-24-00	09-01-01	

Milestone	Original Deadline	Revised Deadline	Date Completed
AIPS++ booth at AAS	01-07-01		01-07-01
AIPS++ User Group meeting	01-29-01		01-29-01
Parallel wide-field imaging	03-01-01		01-31-01
AIPS++ Developer's meeting	04-23-01		04-29-01
AIPS++ Release v1.5	04-30-01	05-15-01	06-03-01
WBS for AIPS++ Release 1.6	05-15-01		05-07-01
DM Tech working groups established	05-20-01	08-15-01	
AIPS++ booth at AAS Pasadena	06-03-01		06-07-01
ALMA AIPS++ test	08-15-01	04-01-02	
Prototype VLA pipeline	09-01-01		
AIPS++ workshop in Washington D.C.	09-06-01		
GBT science observing	10-01-01		
AIPS++ Release v1.6	10-15-01		
WBS for AIPS++ Release v1.7	10-20-01		
31DEC01 AIPS release	12-31-01		
AIPS++ booth at AAS Washington D.C.	01-10-02		

During this quarter effort in DM Technology Development has remained focused primarily on AIPS++. The AIPS++ package is now in an operational phase, with a focus on scientific integration. This encompasses efforts to refine scientific completeness, usability and robustness, as part of the continuing deployment of the package to the scientific user community and includes public outreach to that community. AIPS++ is in a regular six-month release cycle at present. During this quarter, the fourth public release of the system (v1.5) was made at the Pasadena meeting of the AAS in early June 2001. Each development cycle proceeds by phases of planning, WBS definition, and implementation and release preparation. Planning for the next public release (v1.6), scheduled for October 2001, was completed at a week long AIPS++ developers meeting held in Green Bank from 23-29 April 2001. The planning document was made publicly available on May 7, 2001. The planning phase takes as input the scientific advice received from individual consortium user groups and the umbrella AIPS++ User Group, which met in January 2001.

The fourth public release (v1.5) completed this quarter contained significant improvements as part of the scientific integration effort. Scientific completeness efforts at NRAO focused on demonstrated end-to-end reduction of designated VLA test data covering a range of observing modes including continuum, line and polarimetry. These test data were checked-in to the AIPS++ system with the associated reduction scripts, and a continuing effort is being made to incorporate them as examples in our scientific end-user documentation. User feedback from the local test groups at NRAO and elsewhere has also been used to improve usability, robustness and performance. Development in support of scientific integration has covered a wide range of areas but with a specific focus on applications visible to scientific end-users. These have included improvements in interactive data display and editing, automated data editing, 3-D image visualization, and single-dish imaging, amongst other areas. In other development, initial VLBI capabilities

have been added in the form of a FITS-IDI filler and a prototype single-band, coherent fringe-fitter supporting the Alef-Porcas globalization algorithm.

Public outreach efforts remain a high priority as part of deployment of the package to the user community. During this quarter we have continued to work with the local NRAO synthesis users' group. In addition, the Green Bank site management have assisted in forming a single-dish users' group which will perform a similar function to the synthesis users' group in testing single-dish capabilities in AIPS++. We staffed an exhibitor booth at the Pasadena AAS meeting in June 2001, and plan to continue that effort at future meetings. AIPS++ also participated in the Arecibo single-dish summer school in June 2001, both in presenting an AIPS++ tutorial and in assisting with student data reduction using AIPS++. An AIPS++ community workshop is planned for early September in the Washington D.C. area for NRL, USNO, UMd and other local institutes.

An important milestone was achieved this quarter in the area of ALMA use of AIPS++. We agreed with the ALMA project on an evaluation process of AIPS++ for ALMA reduction needs. This test, which will run through April 2001 in two phases, will demonstrate AIPS++ reduction of designated IRAM test data from the Plateau de Bure millimeter array. A working group has been formed comprising members of AIPS++ and ALMA which meets monthly by teleconference. In addition, the ALMA project has applied to the AIPS++ Executive Committee for membership of the consortium.

DM Technology will assist the e2e Project primarily in the area of pipeline support. Efforts in this area are underway due to the overlap with high-level AIPS++ applications development. A coordination plan has been agreed with NRAO ALMA Computing to work jointly on pipeline issues of mutual interest.

During this quarter, Wes Young transferred to the AIPS++ main budget as AIPS++ system manager from the NCSA parallelization grant. Efforts are continuing to fill vacancies in the parallelization and visualization grants.

AIPS continues to be supported by a three-person group. Yearly releases are planned for a few years yet to come. Some moderate development continues as required to support new capabilities on the VLA and VLBA, but the bulk of the effort is in maintenance and support. The next release will be December 15, 2001. More details on recent AIPS activities are given in the report for VLA/VLBA.

Central Computing Services

Members of the core Data Management group track tasks and milestones related to all of the projects described below. The managers of the staff members involved in the projects meet biweekly and are responsible for assigning priorities and reconciling Observatory-wide priorities with local site support requirements.

Milestone	Original Deadline	Revised Deadline	Date Completed
Revise Security Policy	02-15-01	08-15-01	
Upgrade SSH in GB, NM	03-01-01	08-31-01	
Testbed VPN	09-30-01		
Web-server deployment in CV	03-01-01	04-30-01	04-30-01

Milestone	Original Deadline	Revised Deadline	Date Completed
Purchase mirroring Web servers	04-30-01	06-30-01	06-30-01
Web-server deployment in GB, NM, TU	07-31-01	08-31-01	
CCE design (to OS install/patch level)	03-31-01	06-15-01	06-15-01
Begin CCE-compliant UNIX OS upgrades	06-30-01		06-30-01
Complete CCE-compliant UNIX OS upgrades	10-15-01		
CCE design (to infrastructure level)	10-31-01		
W2K Active Directory decision	06-01-01		04-27-01
W2K Active Directory testing	08-15-01		
Final W2K domain design	09-01-01	10-01-01	
Begin W2K domain deployment	10-15-01		

While no measures can be 100 percent bulletproof in today's hostile Internet, the security environment that now prevails at the NRAO would have prevented essentially all of the previous intrusions we have experienced. We continue to see benefits from the increased protection and vigilance now maintained at all NRAO sites, and from the heightened awareness of computing security issues on the part of both support staff and general users alike. Unfortunately, due to the resignation of the UNIX system administrator in Green Bank, and temporary coverage by Socorro staff members to ensure that GBT commissioning is supported, the SSH upgrade at these two sites has been unavoidably delayed. Charlottesville and Tucson were able to complete this migration as scheduled, however.

Other security tasks currently planned or underway include:

- Investigating Virtual Private Networking (VPN) solutions to address the needs of employees who are required to work frequently or for extended periods of time at non-NRAO locations, and in support of telecommuting during construction at Edgemont Road in Charlottesville; and
- Revising the Computing Security Policy to accommodate special-purpose Web servers and VPN issues.

In addition, during the next quarter we hope to begin examination of techniques to make status monitoring and network-based intrusion detection manageable with the current staff. One-time supplemental funding resulting from the change in fiscal year-end may allow us to purchase a commercial product for all four sites which, after initial deployment, should reduce the staff time that would otherwise be needed to perform this task. Security Committee members were able to take some steps in this direction by instrumenting the standard Solaris and Linux operating system installation procedures (see CCE project, below) for host-based monitoring and intrusion detection, using tools such as *tcpwrappers* and file integrity checking.

During this past quarter, significant progress continued on several major projects involving NRAO computer systems support staff. These projects include:

1. Improving Web services: The first Web server compliant with the design completed last quarter was put into production in Charlottesville, serving www.nrao.edu, at the end of April 2001. The new

system supports emerging standards for Web development and dynamic content (such as PHP) that have not been available at the NRAO until now. Identical mirroring servers for all four sites have been purchased and will be configured in Charlottesville before being deployed at their final locations during the next quarter. Each will host both local site pages and a mirror of the main NRAO Web pages. These mirrors of the primary NRAO Web site will allow load sharing and provide greatly increased reliability of access for our user community and the general public.

2. The Common Computing Environment project, or CCE: Common procedures for UNIX operating system installation and patching at all NRAO sites have been established, and a number of critical standards determined for the inter-site services which effect all networks at the NRAO. These processes are now being used for major UNIX upgrades at all sites, to Solaris 8 and RedHat Linux 7.1, which began at the end of this quarter. The upgrades of all non-specialized Solaris and Linux systems at the NRAO should be complete by mid-October 2001. During this time, the group will complete the definition of standards in the remaining infrastructure areas, such as electronic mail delivery.
3. Planning for Windows 2000 deployment: The design group, composed of Windows system administrators from all sites in addition to some UNIX-oriented support staff, has evaluated the costs and benefits of adopting Active Directory (AD) and decided that its advantages greatly outweigh the potential difficulties. The group, now known as the Windows CCE working group, is developing an NRAO-wide AD design and migration plan for the new domain, and will also work toward common OS installation and application standards under Windows 2000, as the UNIX CCE group is doing in the UNIX environment. Meeting and decision procedures have been agreed upon which parallel those successfully used for the UNIX effort. The Windows group has scheduled a week of NRAO-wide AD design testing in early August, to gain further hands-on experience and help determine whether their draft design will be feasible.

Observatory-wide Communications

Milestone	Original Deadline	Revised Deadline	Date Completed
Improved documentation for video conference use	04-30-01		04-30-01
Proposal for additional video equipment	05-31-01		04-30-01
Satellite ISDN link to Chajnantor	02-01-01	05-31-01	05-15-01
Deploy new Intranet service	04-01-01	06-30-01	05-15-01
Decision on long distance service to VLBA sites	05-31-01		05-31-01
Change long distance service in Green Bank	05-31-01	09-30-01	
Change long distance service in Tucson	05-31-01	09-30-01	
Decision on Intranet contract for next years	12-31-01		

Data Management

As reported last quarter, a new contract for the frame relay Intranet was awarded. On our behalf, the Department of the Interior solicited bids for this service with AT&T. The cost of the low bid represents a 35 percent increase in our costs compared to 2000. This contract was awarded to begin at the beginning of April. Because of delays in provisioning the new services by AT&T, the change-over did not occur until mid May. As hoped, the change-over to the new service went with no interruption of service.

The ISDN satellite connection to the ALMA site in Chile has been undergoing tests between Tucson and Charlottesville. Progress was significantly delayed due to problems routing the calls between the different service providers involved in supplying the end-to-end connection. The system was shipped to Chile and successful operation began mid May.

We continue to improve the support for video conferences between the NRAO sites and with other organizations, such as the Max Planck Institut fuer Radioastronomie (MPIfR, Bonn) and the European Southern Observatory. We have developed a completely new set of operating instructions. We are also developing procedures to allow the cameras at remote sites to be centrally controlled using the new capabilities of the updated operating software. In addition, we have successfully used video conferencing over the commodity Internet for extended meetings with colleagues in Spain and Canada.

We have proposed additional video equipment at the major NRAO sites, particularly to allow much easier access to scientific colloquia between sites.

A position to assist with the management of telecommunications has been successfully filled. Due to the lack of manpower earlier in the year, we made the decision to delay the change of long distance service at Green Bank and Tucson; we will not change the service at the VLBA sites.

Telescope Usage

The following telescopes have been scheduled for research and maintenance in the following manner during the fourth quarter of 2000.

	VLA	VLBA
Scheduled Observing (hrs)	1632.2	1131.3
Scheduled Maintenance and Equipment Changes	250.9	350.0
Scheduled Tests and Calibration	308.0	144.0
Time Lost	94.3	42.4
Actual Observing	1537.9	1088.9

VLA Observing Programs

Quarterly Report April - June 2001

The following research programs were conducted with the VLA during this quarter:

No.	Observer(s)	Programs
AA255	Anantharamaiah, K. (Raman Institute) Pedlar, A. (Manchester) Goss, W. M. Viallefond, F. (Paris Obs)	8 GHz radio recombination line observations of M82. 3.6 cm
AA256	Anglada, G. (IAA, Andalucia) Rodriguez, L. (Mexico/UNAM) Estalella, R. (Barcelona) Beltran, M. (CfA) Torrelles, J. (IAA, Andalucia)	Disk of the embedded companion of SBS13. 0.7 cm
AA260	Andre, P. (Cambridge) Belloche, A. (CNRS, France) Kaas, A. (Nordic Optical) Bontemps, S. (Bordeaux) Motte, F. (MPIfR, Bonn)	Characterizing new proto stellar condensations in Serpens. 3.6 cm
AB0950	Becker, R. (UC, Davis) White, R. (STScI) Helfand, D. (Columbia)	The FIRST survey. 20 cm
AB0978	Best, P. (Royal Obs) Cimatti, A. (Arcetri) Rottgering, H. (Leiden)	Radio source size and polarization evolution. 3.6, 6 cm
AB0989	Berger, E. (Caltech)	Radio survey of bona fide and candidate brown dwarfs. 3.6 cm
AB0992	Boonyasait, V. (Florida) Gottesman, S. (Florida) Beckman, J. (Laguna)	Correlating H alpha and HI structures near HII regions. 20 cm
AB0994	Berger, E. (Caltech)	Multi-frequency monitoring of the Brown Dwarf LP944-20. 1.3, 3.6, 6, 20 cm
AB0997	Best, P. (Royal Obs) Rottgering, H. (Leiden) Arts, J. (Leiden) Rengelink, R. (Leiden)	Radio sources in the ESO Imaging Survey area. 20 cm

AB0998	Bower, G. (UC, Berkeley) Falcke, H. (MPIfR, Bonn) Brunthaler, A. (MPIfR, Bonn) Mellon, R. (Penn State)	Linear and circular polarization of M81. 1.3, 2, 3.6, 6 cm
AC524	Cartwright, J. (Caltech) Taylor, G. Readhead, A. (Caltech) Pearson, T. (Caltech)	Polarization monitoring observations of 3C273. 0.7, 1.3 cm
AC571	Carilli, C. Bertoldi, F. (MPIfR, Bonn) Cox, P. (IAP) McMahon, R (Cambridge) Menten, K. (MPIfR, Bonn) Omont, A. (IAP)	Sensitive search for radio emission from dust emitting, high redshift QSOs from the Palomar Digital Sky Survey. 20 cm
AC572	Clarke, T.	High resolution Faraday study of compact cluster core sources. 6 cm
AC575	Caccianiga, A. (Lisbon) Marcha, M. (Lisbon)	Core dominance parameter for a sample of mini blazars. 20 cm
AC577	Carilli, C. Kohno, K. (NAO, Japan) Kawabe, R. (NAO, Japan) Ohta, K. (Kyoto)	Imaging the CO emission from the z=4.7 QSO 1202-0725. 0.7 cm
AC582	Clarke, T.	Faraday study of galaxy cluster core sources. 20 cm
AC587	Carilli, C. Bertoldi, F. (MPIfR, Bonn) Menten, K. (MPIfR, Bonn) Hasinger, G. (API, Potsdam)	Deep VLA imaging the Lockman hole field. 20 cm
AC591	Curiel, S. (Mexico/UNAM) Girart, J. (Illinois) Raga, A. (Mexico/UNAM)	First epoch for proper motions of the SiO emission in L1488. 0.7 cm
AC597	Cohen, A. (NRL) Kassim, N. (NRL) Neumann, D. (CNRS, France) Clarke, T. Colafrancesco, S.	Radio halo and relics in Abell 2657. 90 cm

AD444	Dennett-Thorpe, J. (Groningen/Kapteyn) Best, P. (Royal Obs) Kaiser, C. (MPIfEP, Garching)	Depolarization properties of FR II radio galaxies. 6, 20 cm
AD445	Duc, P. (CNRS, France) Braine, J. (Bordeaux) Brinks, E. (Guanajuato U.) Charmandaris, V. (Cornell) Leon, S. (Cologne) Lisenfeld, U.	Tidal dwarf galaxies in HI Tails of Arp 245 and Arp 105. 20 cm
AD446	Dunlop, J. (Edinburgh) Ivison, R. (U. College London) Almaini, O. (Edinburgh) Blain, A. (Cambridge) Hughes, D. (INAOE, Mexico) Ciliegi, P. (Bologna)	Exploring the nature of the SCUBA/X ray source population. 20 cm
AE134	Eyres, S. (Liverpool JMU) Bode, M. (Liverpool JMU) O'Brien, T. (Manchester) Davis, R. (Manchester) Ivison, R. (U. College London) Evans, A. (Keele)	Target of opportunity observations of classical novae. 1.3, 2, 3.6, 6, 20 cm
AE140	Eyres, S. (Liverpool JMU) Bode, M. (Liverpool JMU) O'Brien, T. (Manchester) Davis, R. (Manchester) Richards, A. (Manchester) Crocker, M. (Manchester) Taylor, A. (Calgary) Dougherty, S. (DRAO) Ivison, R. (U. College London) Kenny, H. (Canadian Military)	Symbiotic stars. 3.6, 6 cm
AE142	Edge, A. (Durham) Ebeling, H. (Hawaii)	Radio galaxies in X-ray selected galaxy clusters. 20 cm

AF370	Falcke, H. (MPIfR, Bonn) Brunthaler, A. (MPIfR, Bonn) Bower, G. (UC, Berkeley) Aller, M. (Michigan) Aller, H. (Michigan) Terasranta, H. (Helsinki)	III Zw 2, a superluminal jet in a spiral galaxy. 0.7, 1.3, 2, 3.6, 20, 90 cm
AF377	Fassnacht, C. (STScI) Rusin, D. (Pennsylvania) Xanthopoulos, E. (Manchester) Koopmans, L. (Caltech)	Monitoring of JVAS and CLASS gravitational lenses. 2, 3.6, 6 cm
AF381	Fish, V. (CfA) Reid, M. (CfA)	HII regions associated with OH masers. 2, 6 cm
AF383	Fomalont, E. Kellermann, K. Rossi, P. (MPIfEP, Garching) Shaver, P. (ESO)	Chandra Deep Field South. 6, 20 cm
AF384	Fender, R. (Amsterdam) Jonker, P. (Amsterdam) Rupen, M. van der Klis, M. (Amsterdam) Homan, J. (Amsterdam) Mendez, M. (La Plata Obs.)	RXTE and VLA observations of the Atoll source 4U 1728-34. 3.6, 6 cm
AG589	Gudel, M. (SFIT, ETH) Beasley, A. (Caltech) Audard, M. (SFIT, ETH) Benz, A. (SFIT, ETH) Mewe, R. (Utrecht) Brinkman, A. (Utrecht) Savin, D. (Columbia)	Bright stellar coronae observed with XMM. 3.6, 6 cm

AG592	van Gorkom, J. (Columbia) Bravo-Alfaro, H. (Guanajuato U.) Dwarakanath, K. (Raman Institute) Guhathakurta, P. (UC, Santa Cruz) Poggianti, B. (Padova) Schiminovich, D. (Caltech) Valluri, M. (Rutgers) Verheijen, M. (Wisconsin) Wilcots, E. (Wisconsin) Zabludoff, A. (Arizona)	HI survey of clusters in the local universe. 20 cm
AG604	Giovannini, G. (Bologna) Brunetti, G. (Bologna) Feretti, L. (Bologna) Govoni, F. (Bologna) Setti, G. (Bologna)	A665 and A2163 halo sources. 90 cm
AG605	Gaensler, B. (MIT) Kassim, N. (NRL) Lazio, T. J. W. (NRL) Slane, P. (CfA) Schulz, N. (MIT) Safi-Harb, S. (Manitoba) Harrus, I. (NASA/GSFC)	Deep search for a shell around the Crab-like SNR G21.5-0.9. 20, 90 cm
AG607	Gomez, Y. (Mexico/UNAM) Rodriguez, L. (Mexico/UNAM) Garay, G. (Chile)	Hyper compact radio sources in HII region GGD 14. 3.6, 6 cm
AG610	Gopal-Krishna (NCRA, India) Wisotzki, L. (Hamburg U.) Bhatnagar, S. (NCRA, India) Stalin, C. (UPSO)	Radio continuum from Hamberg-ESO survey QSOs. 3.6, 6, 20 cm
AG614	Gross, C. (NRL) Lazio, T. J. W. (NRL) Kassim, N. (NRL) Lane, W. (Groningen/Kapteyn) Perley, R. Enslin, T. (MPIAP, Munich) Kronberg, P. (Toronto)	Ultra steep spectrum source sources found at 74 MHz. 20 cm

AH685	Haarsma, D. (Calvin College) Hewitt, J. (MIT) Langston, G. Moore, C. (Groningen/Kapteyn)	Time delay monitoring of gravitational lens 2016+112. 3.6, 6 cm
AH707	Helfand, D. (Columbia) Becker, R. (UC, Davis) White, R. (STScI) Warwick, R. (Leicester)	A new X-ray/radio image of the Milky Way. 20 cm
AH714	Hardcastle, M. (Bristol, UK)	Jets and the emission line gas around 3C171. 1.3, 2 cm
AH717	Hardcastle, M. (Bristol, UK) Sakelliou, I. (MRAO)	Jets and their termination in wide angle tail radio galaxies. 3.6 cm
AH730	Harris, D. (CfA) Siemiginowska, A. (CfA)	Radio/X-ray jet in PKS 1127-145. 1.3, 6 cm
AH733	Healy, K. (Arizona State) Claussen, M. Hester, J. (Arizona State)	Water maser activity in young low-mass stars in HII regions. 1.3 cm
AH739	Ho, L. (DTM/Carnegie) Ulvestad, J.	Search for nearby, inverted spectrum, galaxy nuclear sources. 0.7, 1.3 cm
AH741	Ho, P. (CfA) Keto, E. (CfA)	Hot molecular cloud cores in W31. 1.3 cm
AH743	Harris, D. (CfA) Vrtilek, J. (CfA) Ponman, T. (Birmingham)	Search for ancient radio lobes in HCG 62. 20 cm
AI091	Ivison, R. (U. College London) Dunlop, J. (Edinburgh) Smail, I. (Durham) Jenner, C. (U. College London) Dey, A. (KPNO-NOAO)	High redshift AGN fields with SCUBA maps. 20 cm
AK509	Kulkarni, S. (Caltech) Frail, D. Galama, T. (Caltech) Bloom, J. (Caltech) Berger, E. (Caltech) Harrison, F. (Caltech)	Radio afterglows from gamma-ray bursts.

AK518	Koopmans, L. (Caltech) de Bruyn, A. (NFRA) Fassnacht, C. Wambsganss, J. (API, Potsdam) Blandford, R. (Caltech)	Radio micro lensing in B 1600+434. 2, 3.6, 6, 20 cm
AK526	Kaufman, M. (Ohio State) Brinks, E. (Guanajuato U.) Elmegreen, B. (IBM) Elmegreen, D. (Vassar College)	An unusually energetic region on an outer spiral arm of NGC 2207. 6 cm
AK528	Kwok, S. (Calgary) Lee, T. (Calgary) Lim, J. (SA/IAA, Taiwan)	Radio morphologies of planetary nebulae. 3.6 cm
AK531	Kaplan, D. (Caltech) Frail, D. Kulkarni, S. (Caltech)	Nearest neutron stars. 20 cm
AK532	Kobulnicky, C. (Wisconsin) Martin, C. (Caltech)	NGC 1569, the nearest star burst with a galactic wind. 6, 20, 90 cm
AK536	Kern, J. (NMIMT) Hankins, T. (NMIMT) Dickerson, J. (NMIMT)	Dual frequency observations of the Vela pulsar. 2, 3.6, 6 cm
AL511	Lang, C. (Massachusetts) Goss, W. M.	The Snake galactic center filament. 3.6, 6 cm
AL535	Lim, J. (SA/IAA, Taiwan) Ho, P. (CfA)	HI environment of low redshift QSOs. 20 cm
AL537	Leon, S. (Cologne) Lim, J. (SA/IAA, Taiwan) Borne, K. (NASA/GSFC) Verde-Montenegro, L. (IAA, Andalucia)	Ultraluminous infrared galaxies in multiple interactions. 3.6 cm
AL541	Lim, J. (SA/IAA, Taiwan) Ho, P. (CfA)	HI imaging of low redshift QSO hosts and their environments. 20 cm
AL546	Lang, C. (Massachusetts) Kim, S. (CfA) Goss, W. M. Zhao, J. (CfA)	HI absorption mosaic of the galactic center region. 20 cm

AM661	Monnier, J. (CfA) Greenhill, L. (CfA) Tuthill, P. (Sydney) Danchi, W. (NASA/GSFC)	Spectral variability of the WR 112 binary system. 0.7, 1.3, 2, 3.6, 6, 20 cm
AM665	McHardy, I. (Southampton) Uttley, P. (Southampton)	Radio variability of the Seyfert galaxy NGC 4051. 3.6, 6 cm
AM671	Muxlow, T. (Manchester) Pedlar, A. (Manchester) Wills, K. (Sheffield) McDonald, A. (Manchester)	Starburst galaxy M82. 2 cm
AM672	Murphy, D. (JPL) Marshall, H. (MIT) Lovell, J. (CSIRO) Jauncey, D. (CSIRO) Preston, R. (JPL) Birkinshaw, M. (Bristol, UK) Worrall, D. (Bristol, UK) Schwartz, D. (CfA)	A sample of core dominated radio sources. 3.6, 6 cm
AM674	Mohan, R. N. (Raman Institute) Kurtz, S. (Mexico/UNAM) Anantharamaiah, K. (Raman Institute)	Extended emission around ultra compact HII regions. 6 cm
AM676	Morrison, G. (IPAC) Ledlow, M. (KPNO-NOAO) Owen, F. Dressler, A. (Mt. Wilson) Oemler, A. (Mt. Wilson)	Star formation in the richest Abell clusters. 20 cm
AM681	Miller, N. (Cornell) Ledlow, M. (KPNO-NOAO)	Radio continuum survey of the Shapley super cluster. 20 cm
AM683	May, J. (Chile) Gyulbudaghian, A. (Byurakan Obs) Rodriguez, L. (Mexico/UNAM)	Exciting sources of new CO bipolar outflows. 3.6 cm
AM685	Mullan, D. (Delaware) Lazio, T. J. W. (NRL)	Flare star ejecta as the sources of extreme scattering events. 20 cm

AM687	Monnier, J. (CfA) Greenhill, L. (CfA) Tuthill, P. (Sydney) Danchi, W. (NASA/GSFC)	Monitoring the WR 112 binary system. 0.7, 1.3, 2, 3.6, 6, 20 cm
AM688	Myers, S. Brogan, C.	Survey of circular polarization in AGN. 3.6, 6, 20 cm
AM689	Murgia, M. (Bologna) Parma, P. (Bologna) Mack, K. (NFRA) de Ruiter, H. (Bologna)	Imaging of relic radio galaxy candidates. 6, 20 cm
AM690	Muno, M. (MIT) Remillard, R. (MIT) Dhawan, V. Pooley, G. (Cambridge) Morgan, E. (MIT)	Coincident VLA/Chandra observations of GRS 1915+105. 1.3, 3.6, 20 cm
AM692	McNamara, B. (Ohio University) Carilli, C. O'Dea, C. (STScI) Wise, M. (MIT)	Cavities in Abell 2597's X-ray atmosphere. 20 cm
AM693	Myers, S. Becker, R. (UC-Davis)	C-band C-array mini-survey of the NOAO deep wide field. 6, 20 cm
AO155	Oosterloo, T. (NFRA) Morganti, R. (NFRA) Tadhunter, C. (Sheffield) Wills, K. (Sheffield) van Moorsel, G.	HI absorption in radio galaxy Coma A. 20 cm
AO157	Omar, A. (Raman Institute) Anantharamaiah, K. (Raman Institute) Rupen, M.	OH in water megamaser galaxies. 20 cm
AO158	Osorio, M. (Mexico/UNAM) Anglada, G. (IAA, Andalucia) Rodriguez, L. (Mexico/UNAM) Lizano, S. (Mexico/UNAM)	Ammonia (4,4) and (5,5) in hot molecular cores. 1.3 cm

AO159	Owen, F. O'Dea, C. (STScI) van der Marel, R. (STScI) Laine, S. (STScI) Postman, M. (STScI) Lauer, T. (KPNO-NOAO)	Radio sources and black holes in brightest cluster galaxies. 20 cm
AP422	Perlman, E. (STScI) Jones, L. (Birmingham) Scharf, C. (STScI) Ebeling, H. (Hawaii) Horner, D. (NASA/GSFC) Horner, D. (NASA/GSFC) Fairley, B. (Birmingham)	Radio galaxies in clusters with redshifts 0.5 to 1.0. 20 cm
AR435	Rudnick, L. (Minnesota) Koralsky, B. (Minnesota) Petre, R. (NASA/GSFC) Gotthelf, E. (Columbia) Holt, S. (NASA/GSFC)	Cas A: probing the X-ray/radio connections. 6 cm
AR440	Rudnick, L. (Minnesota) Young, A. (Minnesota) Makishima, K. (Tokyo U.) Tshiro, M. (Tokyo U.) Iyomoto, N. (Tokyo U.) Kassim, N. (NRL) Worrall, D. (Bristol, UK)	Radio lobe physics - radio spectra and inverse Compton X-rays. 20, 90 cm
AR441	Rudnick, L. (Minnesota) Young, A. (Minnesota) Kassim, N. (NRL) Slee, O. (CSIRO) Sarazin, C. (Virginia) Andernach, H. (Guanajuato U.) Roy, A. (MPIfR, Bonn)	Cluster "relic" physics - spectral and x-ray studies. 20, 90 cm
AR454	Rodriguez, L. (Mexico/UNAM) Gomez, Y. (Mexico/UNAM) Lopez, J. (Mexico/UNAM)	Time variation in the morphology of planetary nebula KJPN 8. 3.6 cm
AR458	Rupen, M. Mioduszewski, A. Dhawan, V.	Radio and X-ray activity in Galactic black hole X-ray transients. 0.7, 1.3, 2, 3.6, 6, 20 cm

AR459	Ratay, D. (Florida) Gottesman, S. (Florida)	Barred spiral NGC 1784. 20 cm
AR461	Reynolds, C. (Colorado/JILA) Rosenberg, J. (Colorado/JILA) Heinz, S. (MPIfEP, Garching) Begelman, M. (Colorado/JILA)	A cluster/radio galaxy interaction: Abell 4059/PKS 2354-35. 6, 20 cm
AR462	Roberts, M. Gaensler, B. (MIT) Romani, R. (Stanford)	Two potential pulsar wind nebula associated with gamma-ray sources. 6, 20 cm
AR463	Roberts, M. (McGill) Kaspi, V. (McGill)	Expansion of the shell and pulsar wind nebula of SNR G11.2-0.3. 2, 6, 20 cm
AS687	Soifer, B. (Caltech) Helou, G. (IPAC) Helou, G. (IPAC) Werner, M. (JPL) Shupe, D. (Caltech) Storrie-Lombardi, L. Condon, J. Cotton, W.	The SIRTF first-look survey. 20 cm
AS697	Schoenmakers, A. (NFRA) Rottgering, H. (Leiden) de Bruyn, A. G. (NFRA) Kaiser, C. (MPIfEP, Garching)	Structure and formation of double-double radio galaxies. 3.6, 6, 20 cm
AS701	Sokoloski, J. (Southampton) Kaiser, C. (MPIfEP, Garching) Charles, P. (Southampton)	Symbiotic binaries during outburst. 3.6, 6, 20 cm
AS710	Shirai, T. (Tokyo U.) Imai, H. (NAO, Japan) Oyama, T. (Tokyo U.) Sinsuke, A. (Tokyo U.)	Search for extra terrestrial intelligence at water frequency. 1.3 cm
AS713	Schmitt, H. Calzetti, D. (STScI) Armus, L. (Caltech)	Local starbursts galaxies. 2, 3.6 cm
AT256	Taylor, G. Peck, A. (MPIfR, Bonn)	Searching for HI absorption in TX 2226-2475. 20 cm

AT260	Tarchi, A. (Bonn U.) Henkel, C. (MPIfR, Bonn) Peck, A. (MPIfR, Bonn) Menten, K. (MPIfR, Bonn)	H_2O kilomaser in NGC 2146: disk or nuclear emission. 1.3 cm
AT262	Tarchi, A. (MPIfR) Henkel, C. (MPIfR) Menten, K. (MPIfR) Peck, A. (MPIfR)	H_20 maser in IC 342: massive stars or a circum nuclear disk? 1.3 cm
AT264	Taylor, G. Peck, A. (MPIfR, Bonn)	Confirmation of HCO+ in a CSO candidate. 1.3 cm
AU087	Umana, G. (Bologna) Trigilio, C. (Bologna)	Search for very young planetary nebulae. 3.6 cm
AW550	Watson, C. (Wisconsin) Sewilo, M. (Wisconsin) Churchwell, E. (Wisconsin)	Radio recombination line study towards UC HII regions. 1.3 cm
AW555	Wilcots, E. (Wisconsin) Sanders, W. (Wisconsin)	Searching for local bubbles in face-on spirals. 20 cm
AW556	Willson, R. (Tufts) van Driel-Gestelyi, L. (Paris Obs) Klein, K. (Paris Obs) Bentley, R. (U. College London)	Collaborative observations of Type I noise storms. 20, 90 cm
AY121	Yun, M. (Massachusetts) Sanders, D. (Hawaii) Kawara, K. (Tokyo U.) Taniguchi, Y. (Tohoku)	The Lockman Hole ROSat/XMM/ISO deep survey field. 20 cm
AZ129	Zhao, J. (CfA) Bower, G. (UC, Berkeley) Goss, W. M. McGary, R. (CfA)	Monitoring Sgr A*. 0.7, 1.3, 2 cm
BD069	Diamond, P. (Manchester) Kemball, A.	TX Cam: the final curtain. 0.7 cm

BG113	Gomez, J-L. (IAA/Andalucia) Marscher, A.P. (Boston) Marchenko-Jorstad, S. (Boston) Alberdi, A. (IAA) Agudo, I. (IAA) Marti, J.M. (U. Jaen) Aloy, M.A. (Valencia) Ibanez, J.M. (Valencia)	Monitoring super luminal components in 3C120. 0.7, 1.3, 2 cm
BG118	Greenhill, L. (CfA) Chandler, C. Diamond, P. (Manchester) Moran, J. (CfA) Reid, M. (CfA)	SiO maser motions in Orion BN/KL. 0.7 cm
BG119	Guedel, M. (Scherrer) Smith, K. (ETH) Beasley, A. (OVRO) Audard, M. (Paul Scherrer) Brinkman, A. (Utrecht) Mewe, R. (Utrecht) Savin, D. (Columbia) Benz, A. O. (ETH)	Observations of RS Cvn stars with XMM. 3.6, 6 cm
BL101	Leahy, J. (Manchester) Spencer, R. (Manchester) Taylor, G. Harris, D. (CfA)	Hot spots of 3C295 at 327 MHz. 90 cm
BM145	Mantovani, F. (Bologna) Junor, W. (New Mexico) Saikia, D. (NCRA) Salter, C. (Arecibo)	Polarization and rotation measure in CSS QSOs. 3.6, 6 cm
BM159	Momjian, E. Romney, J. Carilli, C. Troland, T. (Kentucky)	VLBA observations of the ultra luminous infrared galaxies. 20 cm

BR071	Ratner, M.I. (CfA) Bartel, N. (York) Bietenholz, M. (York) Lebach, D. (CfA) Lestrade, J-F. (Meudon) Ransom, R. (York) Shapiro, I. (CfA)	Astrometry of HR 8703 in 2001 for the gravity probe-b mission. 2, 3.6, 6 cm
BS091	Sahai, R. (JPL) Claussen, M. Morris, M. (UCLA)	The high velocity H_2O jet in IRAS 16342-3814. 1.3 cm
GB042	Bartel, N. (York) Rupen, M. Bietenholz, M. (York) Beasley, A. (OVRO) Graham, D. (MPIfR) Altunin, V. (JPL) Venturi, T. (Bologna) Umana, G. (Noto) Cannon, W. (York) Conway, J. (Onsala)	SN 1993J and the core jet counter jet in M81. 3.6, 6, 20 cm
GG038	Giovannini, G. (Bologna) Feretti, L. (Bologna) Venturi, T. (Bologna) Cotton, W. Lara, L. (IAA) Taylor, G.	Symmetrically expanding FRI radio galaxy 3C338. 2, 3.6 cm
GM044	McDonald, A. (Manchester) Pedlar, A. (Manchester) Muxlow, T. W. B. (Manchester) Diamond, P. (Manchester) Wills, K. (Sheffield U.) Garrett, M. (JIVE) Wilkinson, P.	The compact, ultra luminous source in M82. 6 cm
GR016	Ros, E. (MPIfR) Marcaide, J. (Valencia) Guirado, J. (Valencia) Perez-Torres, M. (Bologna) Lara, L. (IAA) Alberdi, A. (IAA)	Proper motions in quad gravitational lenses. 3.6 cm

GS017	Spencer, R. (Manchester) McCormick, D. (Manchester) Stirling, A. (Lancashire) Garrett, M. (JIVE) Fender, R. (Amsterdam)	Jet precession in Cygnum X-1. 3.6 cm
W407	Slysh, V. (Lebedev) Voronkov, M. (Lebedev) Migenes, V. (Guanajuato U.) Fomalont, E. Shibata, K. (NAO, Japan) Altunin, V. (JPL)	Sensitive high resolution observations of OH maser spots. 20 cm

VLBA Observing Programs

The following research programs were conducted with the VLBA during this quarter:

No.	Observer(s)	Programs
BA051	Aller, H. (Michigan) Aller, M. (Michigan) Homan, D. (Brandeis) Hughes, P. (Michigan) Roberts, D. (Brandeis) Wardle, J. (Brandeis)	Oblique shocks in jets: the evolution of Parsec-scale structures of sources with rapidly variable polarization. 1.7, 2, 4 cm
BB121	Bower, G. (UC, Berkeley)	Probing small scale structure in galactic molecular gas with the VLBA at 3 mm. 3, 7 cm
BB132	Brunthaler, A. (CfA) Falcke, H. (MPIfR) Henkel, C. (MPIfR) Reid, M. (CfA)	First epoch observations for extra-galactic proper motions in the local group with the VLBA. 1 cm
BB136	Brisken, W. (Princeton) Golden, A. (Galway) Goss, W. M. Thorsett, S. (UC, Santa Cruz)	Parallax for PSR B0656+14 and measuring the radius of a neutron star. 18 cm
BC111	Cotton, W. Mennesson, B. (Leiden) Vlemmings, W. (Leiden) Perrin, G. (Paris Obs) Coude du Foresto, V. (Paris Obs) Chagnon, G. (Paris Obs) Diamond, P. (Manchester) van Langevelde, H. (NFRA) Ridgway, S. (KPNO-NOAO) Morel, S. (CfA) Traub, W. (CfA) Carleton, N. (CfA) Lacasse, M. (CfA) Waters, R. (Amsterdam)	Bright O-rich Mira stars. 0.7 cm
BC112	Costa, M. (Tasmania) Beasley, A. (OVRO) Ellingsen, S. (Tasmania)	44 GHz Class I maser in a ring? 7 cm

BC114	Clark, T. (NASA/GSFC) Ma, C. (NASA/GSFC) Johnston, K. (USNO) Fey, A. (USNO) Gordon, D. (NASA/GSFC) Gaume, R. (USNO) Boboltz, D. (USNO) Kingham, K. (USNO) Vandenberg, N. (Interferometrics) Himwich, E. (Interferometrics) Shaffer, D. (Radiometrics) Fomalont, E. Walker, R. C.	Geodesy/astrometry observations for 2001. 3.6 cm
BC115	Chatterjee, S. (Cornell) Cordes, J. (Cornell) Goss, W. M. Fomalont, E. Beasley, A. (OVRO) Benson, J. Lazio, T. J. W. (NRL) Arzoumanian, Z. (NASA/GSFC)	Neutron star kinematics: gated VLBA pulsar astrometry. 18 cm
BD069	Diamond, P. (Manchester) Kemball, A.	TX Cam: the final curtain. 0.7 cm
BD071	Doeleman, S. (Haystack) Predmore, C. R. (U Mass)	Search for overlap of maser emission from Two SiO Isotopes. 3, 7 cm
BD073	Doeleman, S. (Haystack) Attridge, J. (Haystack) Lonsdale, C. (Haystack)	Magnetic fields in environments of SiO masers. 3, 7 cm
BE022	Edwards, P. (ISAS) Dingus, B. (Wisconsin)	Two high energy GeV gamma-ray sources. 4, 6 cm
BF067	Fassnacht, C. (STScI)	Structure in gravitational lens CLASS B1608+656. 3.6 cm
BF069	Fish, V. (CfA) Argon, A. (CfA) Reid, M. (CfA)	Mapping magnetic fields in massive star forming regions. 20 cm
BG103	Gabuzda, D. (JIVE) Pushkarev, A. (ASC)	Unique parsec-scale properties of the BL Lac object 0820+225. 2, 4, 6 cm

BG113	Gomez, J-L. (IAA, Andalucia) Marscher, A. (Boston) Marchenko-Jorstad, S. (Boston) Alberdi, A. (IAA, Andalucia) Agudo, I. (IAA, Andalucia) Marti, J. (Jaen) Aloy, M. (Valencia) Ibanez, J. (Valencia)	Monitoring super luminal components in 3C120. 0.7, 1.3, 2 cm
BG114	Gabuzda, D. (JIVE) Cawthorne, T. (Lancashire) Pushkarev, A. (ASC)	Toroidal B fields in BL Lac objects. 1, 2, 4, 6 cm
BG117	Gabuzda, D. (JIVE) Agudo, I. (IAA) Cawthorne, T. (Lancashire) Gomez, J-L. (IAA, Andalucia)	Clues to unusual bending in 0735+178. 1, 2, 4 cm
BG118	Greenhill, L. (CfA) Chandler, C. Diamond, P. (Manchester) Moran, J. (CfA) Reid, M. (CfA)	SiO maser motions in Orion BN/KL. 0.7 cm
BG119	Guedel, M. (Paul Scherrer) Smith, K. (SFIT, ETH) Beasley, A. (Caltech) Audard, M. (SFIT, ETH) Brinkman, A. (Utrecht) Mewe, R. (Utrecht) Savin, D. (Columbia) Benz, A. (SFIT, ETH)	Observations of RS CVn stars with XMM. 3.6, 6 cm

BH077	Kachisuka, K. (Graduate Univ.) Fujisawa, K. (NAO) Honma, M. (NAO) Imai, H. (NAO) Kameya, K. (NAO) Manabe, S. (NAO) Miyoshi, M. (NAO) Mochizuki, N. Graduate Univ.) Nisio, M. (Kagoshima Univ.) Omodaka, T. (Kagoshima Univ.) Sasao, T. (NAO) Sawada-Satoh, S. (NAO)	Detection of an annual parallax of water masers in W3 (OH). 1 cm
BH080	Hough, D. (Trinity)	Variability in the nuclei of lobe-dominated quasars. 4 cm
BH081	Healy, K. (Arizona State) Claussen, M. Hester, J. (Arizona State)	Proto stars and water masers in M16, the Eagle Nebula. 1 cm
BJ038	Junor, W. (UNM)	Core of Virgo A. 3, 7 cm
BK076	Kurayama, T. (NAO) Sasao, T. (NAO)	Parallax measurement of Miras for period-luminosity relation. 1 cm
BL086	Lobanov, A. (MPIfR) Ros, E. (MPIfR) Zensus, J. A. (MPIfR, Bonn)	Monitoring the ongoing flare in the VLBI core of 3C345. 0.7, 1, 2 cm
BL098	Lovell, J. (ATNF) Edwards, P. (ISAS) Jauncey, D. (ATNF) Jones, D. (JPL) Reynolds, J. (ATNF) Tzioumis, A. (ATNF) Wieringa, M. (ATNF)	Improving the precision of Ho measured from gravitational lens 1830-211. 1, 2, 4 cm
BL099	Langston, G. Avruch, I. (NFRA) Minter, A. Perlman, E. (STScI)	Monitoring PKS 1413+135 for superluminal motion and spectral evolution. 2, 4, 6 cm

BL101	Leahy, J. (Manchester) Spencer, R. (Manchester) Taylor, G. Harris, D. (CfA)	Hotspots of 3C 295 at 327 MHz. 90 cm
BL104	Lobanov, A. (MPIfR, Bonn) Roland, J. (IAP) Ros, E. (MPIfR, Bonn) Zensus, J. A. (MPIfR, Bonn)	Cross-band monitoring of a flare in the VLBI core of 3C345. 0.7, 1, 2 cm
BM136	Marscher, A. (Boston) Cawthorne, T. (Lancashire) Stirling, A. (Lancashire) Gear, W. (Wales) Stevens, J. (Cambridge) Marchenko, S. (Boston) Lister, M. Gabuzda, D. (NFRA) Gomez, J-L. (IAA, Andalucia) Smith, P. (KPNO-NOAO) Forster, J. (UC, Berkeley) Yurchenko, A. (St. Petersburg)	Bright millimeter sources. 0.7 cm
BM139	Minier, V. (Onsala) Booth, R. (Onsala) Ellingsen, S. (Tasmania) Norris, R. (ATNF)	Proper motion studies of 12.2 GHz methanol masers. 2 cm
BM145	Mantovani, F. (Bologna) Junor, W. (New Mexico) Saikia, D. (TIFR) Salter, C. (NAIC)	Polarization and rotation measure in CSS QSOs. 3.6, 6 cm
BM146	Miyoshi, M. (NAO) Deguchi, S. (Nobeyama) Imai, H. (NAO) Nakashima, J. (Graduate Univ.)	Precise proper-motion measurement of the SiO maser sources at the Galactic Center relative to Sgr A*. 7 cm
BM152	Marecki, A. (Torun) Spencer, R. (Manchester)	Study of very compact steep spectrum objects - part II. 20 cm

BM154	Marvel, K. (AAS) Alcolea, J. (OAN) Boboltz, D. (USNO) Bujarrabal, V. (OAN) Colomer, F. (OAN) Desmurs, J. (OAN) Diamond, P. (Manchester) Kemball, A.	Spatial distribution of SiO masers in AGB stars at 43 and 86 GHz. 3, 7 cm
BM159	Momjian, E. (Kentucky) Carilli, C. Romney, J. Carilli, C. Troland, T. (Kentucky)	Observations of the ultra-luminous infrared galaxies. 20 cm
BM160	McKean, J. (Manchester) Browne, I. (Manchester) Jackson, N. (Manchester) Rusin, D. (Manchester) Wilkinson, P. (Manchester)	Structures of flat-spectrum radio sources at low flux-densities. 4 cm
BM162	Marscher, A. (Boston U) Aller, M. (U. Michigan) Jorstad, S. (Boston U) McHardy, I. (Southampton)	Relationship between X-ray flares and superluminal ejections in blazars. 0.7, 1 cm
BP078	Phillips, R. (Haystack) Attridge, J. (Haystack) Boboltz, D. (USNO) Doeleman, S. (Haystack) Lonsdale, C. (Haystack) Sivakoff, G. (U. Virginia)	Observations of the bright SiO giant R Cas. 3 cm
BR071	Ratner, M. (CfA) Bartel, N. (York U.) Bietenholz, M. (York U.) Lebach, D. (CfA) Lestrade, J-F. (Paris Obs) Ransom, R. (York U.) Shapiro, I. (CfA)	Astrometry of HR 8703 in 2001 for the gravity probe-b mission. 2, 3.6, 6 cm

BR072	Reynolds, C. (JIVE) Cawthorne, T. (Lancashire) Gabuzda, D. (JIVE) Pushkarev, A. (ASC)	Non-uniform Faraday rotation in BL Lac objects. 1, 2, 4, 6 cm
BS085	Stanghellini, C. (CNR) Baum, S. (STScI) Dallacasa, D. (Bologna) Fanti, C. (Bologna) Fanti, R. (Bologna) O'Dea, C. (STScI) Perez-Torres, M. (CNR)	VLBA observations of GHz-peaked spectrum radio sources. 1, 2, 4, 6, 20 cm
BS087	Sudou, H. (Tohoku Univ.) Iguchi, S. (NAO) Murata, Y. (ISAS) Taniguchi, Y. (Tohoku Univ.)	Phase-referencing VLBI observations of 3C 66B. 1, 4, 13 cm
BS090	Shepherd, D. Claussen, M. Kurtz, S. (UNAM)	Water masers in the massive accretion disk of G192.16. 1 cm
BS091	Sahai, R. (JPL) Claussen, M. Morris, M. (UCLA)	Imaging the high velocity H20 jet in water-fountain nebula, IRAS 16342-3814. 1, 2 cm
BT056	Taylor, G. Vermeulen, R. (NFRA)	Measuring absolute motions in the bi-directional jets of 1946+708. 2, 4 cm
BT057	Trigilio, C. (IRA) Buemi, C. (IRA) Leone, F. (IRA) Leto, P. (IRA) Umana, G. (IRA)	VLBI observations of the magnetic chemically peculiar star CU Virgins. 4 cm
BV040	Vlemmings, W. (Leiden) Baudry, A. (Bordeaux) Diamond, P. (Manchester) Habing, H. (Leiden) Schilizzi, R. (JIVE) van Langevelde, H. (JIVE)	20 cm

BV042	~~Gabuzda, D. (~~JIVE) Venturi, T. (CNR) ~~Cawthorne, T. (~~Lancashire) Dallacasa, D. (Bologna) Mantovani, F. (CNR) ~~Pushkarev, A. (~~ASC)	Second epoch monitoring of gamma-ray loud quasars. 1, 4 cm
BW050	Wrobel, J. Fassnacht, C. (STScI) Myers, S. Taylor, G.	FIRST Sources in the NOAO Deep Wide Field J1432+3416. 6 cm
BW055	Wiik, K. (Tuorla) Savolainen, T. (Tuorla) Tornikoski, M. (Metsahovi) Valtaoja, E. (Tuorla)	Multi-frequency observations of new high-peaked GPS sources. 0.7, 1, 2 cm
BZ026	Zavala, R. (NMSU) Taylor, G.	Faraday rotation measure study of the AGN environment. 2, 4 cm
CA002	Attridge, J. (Haystack) Homan, D. (Brandeis) Wardle, J. (Brandeis) Phillips, R. (Haystack) Doeleman, S. (Haystack)	Polarization of AGN. 0.3 cm
CD019	Doeleman, S. (Haystack) Rogers, A. (Haystack) Bower, G. (UC, Berkeley) Backer, D. (UC, Berkeley) Wright, M. (UC, Berkeley)	Structure of Sgr A*. 0.3 cm
CK013	Krichbaum, T. (MPIfR, Bonn) Zensus, J. (MPIfR, Bonn) Graham, D. (MPIfR, Bonn) Witzel, A. (MPIfR, Bonn) Romney, J.	3C 273 and 3C 279. 0.3 cm
CK014	Klare, J. (MPIfR, Bonn) Krichbaum, T. (MPIfR, Bonn) Zensus, J. A. (MPIfR, Bonn) Ros, E. (MPIfR, Bonn) Lobanov, A. (MPIfR, Bonn)	3C 345. 0.3 cm

GB042	Bartel, N. (York U.) Rupen, M. Bietenholz, M. (York U.) Beasley, A. (OVRO) Graham, D. (MPIfR, Bonn) Altunin, V. (JPL) Venturi, T. (Bologna) Umana, G. (Bologna) Cannon, W. (York U.) Conway, J. (Chalmers, Onsala)	SN 1993J and the core jet counter jet in M81. 6 cm
GG038	Giovannini, G. (Bologna) Feretti, L. (Bologna) Venturi, T. (Bologna) Cotton, W. Lara, L. (IAA, Andalucia) Taylor, G.	Symmetrically expanding FRI radio galaxy 3C338. 2, 3.6 cm
GG046	Gabuzda, D. (NFRA) Cawthorne, T. (Lancashire) Garnich, N. (Moscow/SSAI)	Investigating IDV with multi-frequency global polarization obs. 3.6, 6 cm
GG047	Garrington, S. (Manchester) Hoare, M. (Leeds) van Langevelde, H. (NFRA) Gunn, A. (Manchester) Meaburn, J. (Manchester)	PMS star theta 1 Orionis A. 6 cm
GM044	McDonald, A. (Manchester) Pedlar, A. (Manchester) Muxlow, T. (Manchester) Diamond, P. (Manchester) Wills, K. (Sheffield) Garrett, M. (NFRA) Wilkinson, P. (Manchester)	The compact, ultra luminous source in M82. 6 cm
GR016	Ros, E. (MPIfR, Bonn) Marcaide, J. (Valencia) Guirado, J. (Valencia) Perez-Torres, M. (Bologna) Lara, L. (IAA, Andalucia) Alberdi, A. (IAA, Andalucia)	Proper motions in quad gravitational lenses. 3.6 cm

GS017	Spencer, R. (Manchester) McCormick, D. (Manchester) Stirling, A. (Lancashire) Garrett, M. (NFRA) Fender, R. (Amsterdam)	Jet precession in Cygnus X-1. 3.6 cm
RDV027	Clark, T. (GSFC) Fey, A. (USNO) Gordon, D. (GSFC) Johnston, K. (USNO) Ma, C. (GSFC)	Geodesy/astrometry observations for 2001. 3.6 cm
W058	King, E. (CSIRO) Jauncey, D. (CSIRO) Reynolds, J. (CSIRO) Tzioumis, A. (CSIRO) McCulloch, P. (Tasmania) Costa, M. (Tasmania) Lovell, J. (CSIRO) Preston, R. (JPL) Murphy, D. (JPL)	Imaging of strong GPS sources. 18 cm
W313	Preston, R. (JPL) Lister, M. Murphy, D. (JPL) Piner, B. (JPL) Jones, D. (JPL) Meier, D. (JPL) Tingay, S. (CSIRO) Hirabayashi, H. (ISAS, Japan) Murata, Y. (ISAS, Japan) Kobayashi, H. (NAO, Japan) Inoue, M. (NAO, Japan)	High brightness objects in the Pearson-Readhead AGN Survey. 6, 18 cm
W330	Kameno, S. (NAO, Japan) Wajima, K. (ISAS, Japan) Zhi-Qiang, S. (ISAS, Japan) Inoue, M. (NAO, Japan) Sawada-Satoh, S. (ISAS, Japan)	Complementary multi-frequency GPS survey. 6 cm

W402	Murphy, D. (JPL) Lister, M. Preston, R. (JPL) Hirabayashi, H. (ISAS, Japan) Edwards, P. (ISAS, Japan) Tingay, S. (CSIRO)	High ecliptic latitude monitoring program. 6 cm
W409	Gabuzda, D. (NFRA) Pushkarev, A. (Lebedev) Cawthorne, T. (Lancashire)	Polarization observations of BL Lac objects. 6 cm
W410	Kameno, S. (NAO, Japan) Shen, Z. (ISAS, Japan) Inoue, M. (NAO, Japan) Fujisawa, K. (NAO, Japan) Wajima, K. (ISAS, Japan)	Second epoch observations of 3C 380. 6, 18 cm
W416	Gwinn, C. (UC, Santa Barbara) Reynolds, J. (CSIRO) Jauncey, D. (CSIRO) Quick, J. (HartRAO) McCulloch, P. (Tasmania)	Structure of the Vela pulsar's radio emission at 5 GHz. 6 cm
W418	Gurvits, L. (NFRA) Dennett-Thorpe, J. (Groningen) de Bruyn, A. (NFRA)	Extremely variable IDV source J1819+3845. 6 cm
W424	Edwards, P. (ISAS, Japan) Hirabayashi, H. (ISAS, Japan) Murata, Y. (ISAS, Japan) Asaki, Y. (ISAS, Japan) Wajima, K. (ISAS, Japan)	Three 'missing' 2 cm survey sources. 6 cm
W504	Murata, Y. (ISAS, Japan) Edwards, P. (ISAS, Japan) Hirabayashi, H. (ISAS, Japan) Wajima, K. (ISAS, Japan) Fomalont, E. Frey, S. (FOMISGO) Doi, A. (Tokyo U.)	Highest visibility sources. 6, 18 cm

W512	Jauncey, D. (CSIRO) Lovell, J. (CSIRO) Tingay, S. (CSIRO) Kedziora-Chudczer, L. (AAO) Reynolds, J. (CSIRO) Tzioumis, A. (CSIRO) Macquart, J. (RCfTA) McCulloch, P. (Tasmania) Dodson, R. (Tasmania) Hirabayashi, H. (ISAS, Japan) Edwards, P. (ISAS, Japan) Bignall, H. (Adelaid) Nicolson, G. (HartRAO)	Scattering in IDV and core-dominated sources. 6, 18 cm

NEW HIRES

Brisken, Walter	Electronics Engineer I	6/18/01
Dennison, Brian	Visiting Scientist	6/25/01
Kern, Jeffrey	Jr Research Associate	4/02/01
Langley, Christopher	Electronics Engineer II	5/29/01
Peereboom, Nick	Electronics Engineer I	5/30/01
Ray, Jason	Electronics Engineer III	5/21/01
Singhal, Alok	Jr Eng Associate	6/04/01
Spuhler, Philipp	Jr Eng Associate	5/21/01
Tifft, William	Visiting Scientist	6/01/01
Van Buskirk, Patricia	Sci Prog Analyst	4/11/01
Wallace, Michael	Research Associate	5/29/01
Williams, Melissa	Research Associate	5/29/01
Wirt, Donald	Facilities Engineer I	6/18/01

TERMINATIONS

Moorey, Graham	Electronics Engineer I	4/09/01
Van Tilburg, Charles	Senior Systems Analyst	5/25/01

CHANGE IN TITLE

Rebinski, Christine	Sci Prog Analyst (from Research Asst)	5/14/01

PROMOTIONS

McKinnon, Mark	to Sci-Dep Asst Dir SO Ops	6/18/01
Myers, Charles	to Systems Analyst	4/01/01
Napier, Peter	to Project Manager, EVLA	5/01/01
Prestage, Richard	to Dep Asst Dir-GB	6/15/01
Richardson, Warren	to Systems Analyst	4/01/01
Shelton, Amy	to Sr Sci Prog Analyst	6/01/01

Publications

Attached is a listing of all preprints received in the NRAO Charlottesville library during the reporting period authored by NRAO staff or based on observations on NRAO telescopes.

PREPRINTS RECEIVED, APRIL - JUNE 2001

ATTRIDGE, J.M. 86 GHz Very Long Baseline Polarimetry of 3C 273 and 3C 279 with the Coordinated Millimeter VLBI Array.

BERGER, E.; DIERCKS, A.; FRAIL, D.A.; KULKARNI, S.R.; BLOOM, J.S.; SARI, R.; HALPERN, J.; MIRABEL, N.; TAYLOR, G.B.; HURLEY, K.; POOLEY, G.; BECKER, K.M.; WAGNER, R.M.; TERNDRUP, D.M.; STATLER, T.; WIK, D.R.; MAZETS, E.; CLINE, T. GRB 000418: A Hidden Jet Revealed.

BIETENHOLZ, M.F.; BARTEL, N.; RUPEN, M.P. SN 1993J VLBI. I. The Center of the Explosion and a Limit on Anisotropic Expansion.

BLOOM, J.S.; FRAIL, D.A.; SARI, R. The Prompt Energy Release of Gamma-Ray Bursts Using a Cosmological k-Correction.

BOWER, G.C.; BACKER, D.C.; SRAMEK, R.A. VLBA Observations of Astrometric Reference Sources in the Galactic Center.

BRAATZ, J. Testing Extragalactic H2O Masers Against the Thin Disk Model: The Present and the Future.

BROGAN, C.L.; CLAUSSEN, M.J.; GOSS, W.M. Magnetic Fields in Supernova Remnant OH (1720 MHz) Masers.

BROGAN, C.L.; TROLAND, T.H. VLA HI and OH Zeeman Observations Toward M17.

CARILLI, C.L.; BERTOLDI, F.; RUPEN, M.P.; FAN, X.; STRAUSS, M.A.; MENTEN, K.M.; KREYSA, E.; SCHNEIDER, D.P.; BERTARINI, A.; YUN, M.S.; ZYLKA, R. A 250 GHz Survey of High Redshift QSOs from the Sloan Digital Sky Survey.

CECIL, G.; BLAND-HAWTHORN, J.; VEILLEUX, S.; FILIPPENKO, A.V. Jet- and Wind-Driven Ionized Outflows in the Superbubble and Star-Forming Disk of NGC 3079.

CHANG, T.-C.; VAN GORKOM, J.H.; ZABLUDOFF, A.I.; ZARITSKY, D.; MIHOS, J.C. A Search for H I in E + A Galaxies.

CID FERNANDES, R.; HECKMAN, T.; SCHMITT, H.; GONZALEZ DELGADO, R.M.; STORCHI-BERGMANN, T. Empirical Diagnostics of the Starburst-AGN Connection.

CLAUSSEN, M. Water Masers and the Near-Stellar Environment.

CROSTHWAITE, L.P.; TURNER, J.L.; HURT, R.L.; LEVINE, D.A.; MARTIN, R.N.; HO, P.T.P. CO and Neutral Gas in the Disk of the Spiral Galaxy IC 342.

FAISON, M.D.; GOSS, W.M. The Structure of the Cold Neutral Interstellar Medium on 10-100 AU Scales.

FASSNACHT, C.D.; TAYLOR, G.B. Compact Symmetric Objects as Radio Flux Density Calibrators.

FOMALONT, E.B.; GELDZAHLER, B.J.; BRADSHAW, C.F. Sco X-1: The Evolution and Nature of the Twin Compact Radio Lobes.

FOMALONT, E.B.; GELDZAHLER, B.J.; BRADSHAW, C.F. Scorpius X-1: Energy Transfer from the Core to the Radio Lobes.

FURUYA, R.S.; KITAMURA, Y.; WOOTTEN, H.A.; CLAUSSEN, M.J.; KAWABE, R. Imaging of 2-mm Dust Continuum Emission Toward S106 FIR and Its Spectral Energy Distribution.

FURUYA, R.S.; KITAMURA, Y.; WOOTTEN, H.A.; CLAUSSEN, M.J.; KAWABE, R. Multi-epoch Water Maser Survey Toward Low-Mass YSOs.

GAENSLER, B.M.; SLANE, P.O.; GOTTHELF, E.V.; VASISHT, G. Anomalous X-ray Pulsars and Soft Gamma-Ray Repeaters in Supernova Remnants.

GALLIMORE, J.F.; HENKEL, C.; BAUM, S.A.; GLASS, I.S.; CLAUSSEN, M.J.; PRIETO, M.A.; VON KAP-HERR, A. The Nature of the Nuclear H2O Masers of NGC 1068: Reverberation and Evidence for a Rotating Disk Geometry.

GIACANI, E.B.; FRAIL, D.A.; GOSS, W.M.; VIEYTES, M. Pulsar Wind Nebulae Around the Southern Pulsars PSR B1643-43 and PSR B1706-44.

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HALFEN, D.T.; APPONI, A.J.; ZIURYS, L.M. Evaluating the N/O Chemical Network: The Distribution of N2O and NO in the Sagittarius B2 Complex.

HOMAN, D.C.; ATTRIDGE, J.M.; WARDLE, J.F.C. Parsec-Scale Circular Polarization Observations of 40 Blazars.

HUNTER, D.A.; ELMEGREEN, B.G.; VAN WOERDEN, H. Neutral Hydrogen and Star Formation in the Irregular Galaxy NGC 2366.

ISHIHARA, Y.; NAKAI, N.; IYOMOTO, N.; MAKISHIMA, K.; DIAMOND, P.; HALL, P. Water-Vapor Maser Emission from the Seyfert 2 Galaxy IC 2560: Evidence for a Super-Massive Black Hole.

JORSTAD, S.G.; MARSCHER, A.P.; MATTOX, J.R.; ALLER, M.F.; ALLER, H.D.; WEHRLE, A.E.; BLOOM, S.D. Multi-Epoch VLBA Observations of EGRET-Detected Quasars and BL Lac Objects: Connection Between Superluminal Ejections and Gamma-Ray Flares in Blazars.

LAZIO, T.J.W.; WALTMAN, E.B.; GHIGO, F.D.; FIEDLER, R.L.; FOSTER, R.S.; JOHNSTON, K.J. A Dual Frequency, Multi-Year Monitoring Program of Compact Radio Sources.

MARVEL, K.B.; CLAUSSEN, M.; WOOTTEN, A. Preliminary Observations of Water Masers Associated with IRAS4A and IRAS4B.

MILLER, N.A.; OWEN, F.N. Current Star Formation in Post-Starburst Galaxies?

MOHAN, N.R.; ANANTHARAMAIAH, K.R.; GOSS, W.M. VLA Observations of Radio Recombination Lines from Blue Compact Dwarf Galaxies NGC 5253 and Henize 2-10: Ionized Gas Around Super Star Clusters.

PECK, A.B.; TAYLOR, G.B. Evidence for a Circumnuclear Disk in 1946+708.

PHILLIPS, P.M.; BROWNE, I.W.A.; JACKSON, N.J.; WILKINSON, P.N.; MAO, S.; RUSIN, D.; MARLOW, D.R.; SNELLEN, I.; NEESER, M. The JVAS/CLASS Search for 6" to 15" Image Separation Lensing.

RECTOR, T.A.; STOCKE, J.T. The Properties of the Radio-Selected 1Jy Sample of BL Lacertae Objects.

ROSHI, D.A.; ANANTHARAMAIAH, K.R. Hydrogen Recombination Lines Near 327 MHz - II: A Galactic Plane Survey with a 2 deg x 6' Beam.

RUSIN, D.; MARLOW, D.R.; NORBURY, M.; BROWNE, I.W.A.; JACKSON, N.; WILKINSON, P.N.; FASSNACHT, C.D.; MYERS, S.T.; KOOPMANS, L.V.E.; BLANDFORD, R.D.; PEARSON, T.J.; READHEAD, A.C.S.; DE BRUYN, A.G. The New Two-Image Gravitational Lens System CLASS B2319+051.

SARMA, A.P.; TROLAND, T.H.; ROMNEY, J.D. VLBA Observations of the Zeeman Effect in H2O Masers in W3 IRS5.

STAIRS, I.H. Radio Pulsar Polarimetry.

STAIRS, I.H.; MANCHESTER, R.N.; LYNE, A.G.; KASPI, V.M.; CAMILO, F.; BELL, J.F.; D'AMICO, N.; KRAMER, M.; CRAWFORD, F.; MORRIS, D.J.; POSSENTI, A.; MCKAY, N.P.F.; LUMSDEN, S.L.; TACCONI-GARMAN, L.E.; CANNON, R.D.; HAMBLY, N.C.; WOOD, P.R. PSR J1740-3052 -- A Pulsar with a Massive Companion.

STOCKDALE, C.J.; RUPEN, M.P.; COWAN, J.J.; CHU, Y.-H.; JONES, S.S. The Fading Radio Emission from SN 1961V: Evidence for a Type II Peculiar Supernova?

TAKAHASHI, M.; SHIBATA, S.; TORII, K.; SAITO, Y.; KAWAI, N.; HIRAYAMA, M.; DOTANI, T.; GUNJI, S.; SAKURI, H.; STAIRS, I.H.; MANCHESTER, R.N. Pulsed X-ray Emission from the Fastest Millisecond Pulsar PSR B1937+21 with ASCA.

TAYLOR, G.B.; GOVONI, F.; ALLEN, S.A.; FABIAN, A.C. Magnetic Fields in the 3C 129 Cluster.

TAYLOR, G.B.; HOUGH, D.H.; VENTURI, T. VLBA Polarimetry of Three Powerful Radio Galaxy Cores.

ULVESTAD, J.S.; HO, L.C. Statistical Properties of Radio Emission from the Palomar Seyfert Galaxies.

VAN ZEE, L.; SKILLMAN, E.D. Kinematic Constraints on Evolutionary Scenarios for Blue Compact Dwarf Galaxies. I. Neutral Gas Dynamics.

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WALTER, F.; BRINKS, E. The Neutral Interstellar Medium of the Dwarf Irregular Galaxy DDO 47 and Its Companion.

WELCH, G.A.; SAGE, L.J. The Interstellar Medium of M32.

WOOTTEN, A.; MARVEL, K.; CLAUSSEN, M.; WILKING, B. Proper Motion of Water Masers near NGC1333-SVS13.

WROBEL, J.M.; FASSNACHT, C.D.; HO, L.C. The Inner Light-Year of the Nearest Seyfert 1 Nucleus in NGC 4395.

WROBEL, J.M.; TAYLOR, G.B.; GREGORY, P.C. Phase Calibration Sources in the Northern Sky at Galactic Latitudes $|b| < 2.5$.