Quarterly Report
July - September 2001

National Radio
Astronomy
Observatory

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NRAO

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Executive Summary

EVLA

The outline of the EVLA Project is contained in two recently completed documents: the Project Work Breakdown Structure and the Project Management Plan. A workshop was held in August to determine the goals for the second phase. Preliminary Design Reviews in Electronics, in Computing, and on the correlator, will be held in the fourth quarter of this year. An MOU for the provision of the EVLA correlator by the Herzberg Institute of Astrophysics was completed in September.

Green Bank Telescope

Good progress was made in clearing the remaining construction issues. The azimuth track was stabilized by increasing the number and size of the retaining bolts, and all rusted azimuth wheel bearings were replaced. Tests showed that in a hard stop the brakes apply too rapidly, producing excess force. The braking system has been redesigned and the new system will be installed during the fourth quarter. The second phase of panel corner adjustments was completed, and the active surface system was checked out. LMGT vacated the site in early August, but continued to work on problems in the telescope servo and HVAC. The computing effort focused on systems integration and commissioning. Planning for future developments in the areas of precision telescope control, the 3 mm receiver, and a beam forming array continued. Documentation of operations and maintenance was developed and updated.

Green Bank Site

A contract was awarded for the construction of the Green Bank Astronomy Education Center, a joint project of NSF and NASA. Construction is to begin early in the fourth quarter, with completion by the end of 2002.

Three dual-processor work stations have been ordered to enhance the capability for analysis of intensive pulsar and spectral line on-the-fly data sets. Improvements were made to the OVLBI tracking station. The two elements of the Green Bank Interferometer were moth-balled, and preparations were made to moth-ball the 20 Meter after VLBI tests supporting the GBT are completed in the fourth quarter. The 85-3 pulsar monitoring telescope continues in operation.

Very Large Array and Very Long Baseline Array

Work continued to improve the successful Pie Town link. The surface of the primary of the Pie Town antenna was measured and additional tests are needed to improve the accuracy of the measurement. The surfaces of four VLA antennas were adjusted, and the azimuth bearing of Antenna 17 was replaced. The installation of 5,000 cross ties on the east arm of the track continues, and should be completed early in the fourth quarter.

Several significant upgrades were made or started in the computing systems. Eight new public PC's have been ordered which will provide users with 1.7GHz processors and an unprecedented amount of disk space. A plan has been developed for a Storage Area Network to allow the entire VLA archive to be moved online. The system can be expanded at a later date to accommodate the VLBA archive. And after long delays, the computers required to replace the aging online Modcomps arrived late in the quarter. The goal is to switch to the new units by the end of the year.

The code which allows real time display of a single VLBA baseline correlated data is complete but testing and refinement is needed before the tool is released for general use. The AIPS group is working toward moving the midnight update job and the master version of AIPS from Charlottesville to Socorro. Some data reduction utilities were cleaned up, precession routines were enhanced, and tests were made of fringe-fitting routines.

Central Development Laboratory

A significant part of the effort this quarter was allocated to ALMA development. A study is being conducted to determine the choice between SIS and HFET for the ALMA Band 3 (84-116 GHz). A second study is exploring the merits of two SIS designs for ALMA Band 6 (211-275 GHz). Problems in the manufacture of junctions for Band 9 (602-720 GHz) appear to have been solved. New mixers have been built and tested for use as preamplifiers in the IF band 4-12 GHz and the performance at the upper edge has been improved. Work is continuing on the Band 6 component parts, such as the overmoded waveguide, and two problems with the optics, the illumination and the measurement of the insertion loss in the vacuum window, are being examined. The development of LO sources and frequency multipliers is continuing. A number of prototype components for the LO system were completed, as were the GaAs devices for the tripler.

Work on the baseline ALMA correlator include the release of the correlator card for PCNB fabrication, the testing of the prototype station card in its final configuration, and the design of

a signal interface paddle board which meets all requirements both for the prototype and final correlator systems. Final approval of the correlator chip design was given and the prototype run is ready to commence when the budget situation for next year is clarified.

A number of amplifiers have been completed for use at the VLA and VLBA. A long-term project to develop a 21 cm imaging array for the GBT began with a meeting of the Beam-Forming Array (BFA) Project Group in August, in Green Bank. A WBS has been created, and a concept design review will be convened during the next quarter. Technical activities in support of this project have begun, including the planning of upgrades to the antenna test range and the design of an advanced RFI monitoring system.

Data Management

During this quarter, the End-to-End Project (e2e) was initiated and the definition of the scientific requirements was filled out. An early goal is to deploy interim archive and pipeline capabilities for the VLA by the middle of next year.

The effort in DM Technology development has remained focused primarily on AIPS++. The AIPS++ package is now in an operational phase with focus on scientific integration, and is in a regular six-month release cycle. Significant time was devoted to single-dish integration in support of the GBT. Public outreach included tutorials at institutions in the DC area. An ALMA AIPS++ test was initiated over the summer.

Central Computing Services introduced enhancements to the Observatory computer security, and it is anticipated that it can be upgraded even further with the purchase of software/hardware in the next quarter. Common Computer Environment upgrades in UNIX were completed in Green Bank and Tucson, and are close to completion in Socorro and Charlottesville. A similar plan for Windows is being developed. The recently-implemented Web services support emerging standards for Web development and dynamic content.

The use of video conferencing has grown to the point where the equipment must be augmented. It is planned that eventually there will be support for video conferencing in eight different facilities. In Socorro, Green Bank, and Charlottesville both the auditorium and the conference room will be equipped, and there will be one system in the conference rooms in Tucson and at the VLA site.

Green Bank

The second call for GBT proposals was held this quarter, with the deadline for receipt October 1. The call was for frequencies through 26.5 GHz (K-band). Proposals will be scheduled during the spring of 2002, and time will be shared with ongoing astronomical commissioning operations. Sixty-five proposals were received, requesting 162 days of observing. Approximately 60 days of observing will be made available for these proposals about 50 percent of the time available in the trimester, with the remainder going to commissioning, outfitting, and maintenance activities.

Very Large Array

New 74 MHz System Detects Radio Relics - Using the VLA's new 74 MHz receiver system, observers were able to detect steep-spectrum radio emission straddling the center of the merging cluster system Abell 754. Because of the steep spectrum of the radiation it was detected only at 74 MHz and not with the 330 MHz observing system of the VLA. The location, morphology, and spectrum of the radio emission, as well as the merger shock waves identified at X-ray wavelengths, support the identification of the steep-spectrum radio sources as "radio relics" whose particle acceleration may have resulted from the cluster mergers.

Investigators: *N. Kassim (NRL), T. Clarke, T. Ensslin (Max-Planck Institute), A. Cohen (NRL), and D. Neumann (CEA Saclay).*

Radio Emission Detected from Gamma-Ray Burst Host Galaxy - Observers have made the first detection of radio emission from the host galaxy of a gamma-ray burst (GRB), long after the GRB afterglow has faded away. The detection of the persistent radio source in the distant host galaxy used more than 70 hours of VLA integrations at several frequencies, over the time period between 1 - 3 years after the burst. The combination of the non-variable radio emission with optical spectroscopy provides strong evidence that the persistent radio source comes from a starburst in which over 100 solar masses per year are turned into stars more massive than five times the mass of the Sun. This result, recently published in the Astrophysical Journal, is perhaps the best evidence yet that GRBs are related to massive stars.

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

Very Long Baseline Array

Six-Image Gravitational Lens System Discovered - Using the VLBA and HST, researchers have found the first gravitational lens in which the image of a single background galaxy has been split into six individual images. The lensing is produced by the gravitational field of three intermediate galaxies along the line of sight to Earth. The system is of considerable interest as an intermediate case between lensing produced by single galaxies and that produced by clusters of more numerous galaxies, and thus can be used as a test bed for computational models. VLBA spectral-index data on the individual components was critical to confirming the system as a lens.

Investigators: *D. Rusin (U. Penn.); C. Kochanek, E. Falco, J. Lehar, B. McLeod (CfA); M. Norbury (Manchester); C. Impey, C. Peng, and C. Keeton (Steward Obs.); H. Rix (MPIfA); and J. Munoz (Astrophysical Institute of the Canaries).*

Black-Hole Microquasar May Be Relic of Early Globular-Cluster Star - An X-ray binary including a 7-solar-mass black hole and a 0.3 solar-mass companion has been shown to have an orbit in the Galaxy's halo, leading researchers to conclude that the black hole is the relic of a very massive star that formed in a globular cluster in the early stages of the Galaxy's history. VLBA observations revealed the object's proper motion, and its proper-motion history later was extended back 43 years by use of the digitized POSS data produced by STScI for the Guide Star Catalog. The halo orbit is believed to be the result of the black hole's ejection from the globular cluster through gravitational interaction with other cluster black holes. The companion, now stripped of its outer layers by the black hole, is presumed to have been captured prior to the ejection. This is the first direct evidence found for a black-hole remnant of one of the Galaxy's very early supermassive stars.

Investigators: *F. Mirabel (CEA, Saclay, and IAFE, Argentina); V. Dhawan; R. P. Mignani (ESO); I. Rodriguez (CEA, Saclay); and F. Guglielmetti (STScI).*

Progress for the ALMA-U.S. project is reported separately and can be found at the following URL - http://www.alma.nrao.edu/library/.

Beginning in July, the frequency of these reports was changed from monthly to bimonthly in order to reduce administrative overhead. A single-month report was submitted for September in order to synchronize the later bimonthly reports with the start of the new fiscal year in October.

Milestone	Original Deadline	Revised Deadline	Date Completed
M/C Computing engineering requirements	12-10-01		
M/C Computing operations requirements	12-10-01		
Prototype Displays	12-10-01		
Software Design Document	08-31-01	12-04-01	
System PDR preparation	12-04-01		
M&C PDR preparation	02-19-02		
Complete Q-band build	12-31-02		
Complete K-band build	12-31-02		
Continue development of 10 Gbps fiber optic link for ALMA project; work may transfer to EVLA project	12-31-01		
Build and install five more 7 mm receivers	01-31-01	01-30-03	
Start construction of Fiber Room	06-01-02		
Start fiber installation	08-01-02		
Patch panel	09-01-02		
Trench fiber	09-01--04		
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	12-31-01		
Monitor RFI environment at VLA 1 - 18 GHz	12-31-01		
Develop block diagram for M&C, wye alarms, voice communication (DCS, LO/IF, Comp. Div, ES Div)	12-31-01		
EVLA Project Book	08-15-01	11-15-01	
EVLA Management Plan	08-15-01		09-27-01

Management

The principal activity for the quarter was the completion of the Project Work Breakdown Structure (WBS) and the Project Management Plan. The latter document was delivered to the NSF on September 25. Responses to various questions raised by the NSF were provided in preparation for the Project being presented to the National Science Board in November. In all areas of the project a major work item was writing the initial version of the EVLA Project Book, which is scheduled for first release early next quarter. Recruiting for most areas of the project proceeded well with seven staff employees charged to the project budget by the end of the quarter. Recruitment of software engineers required for the EVLA Monitor and Control system is proving to be more difficult.

Science

A workshop, "EVLA Planning Workshop: Defining the Second Phase" was held in Socorro on August 23-25 to determine the interest and goals of the VLA User Community for the second phase of the EVLA Project. The meeting was well attended by 50 scientists from outside the NRAO, plus 50 NRAO staff members—the discussion was lively. There was a clear consensus that the NRAO should proceed to plan for the completion of the EVLA Project.

Electronics

In the electronics area, work was concerned with further defining the overall electronics system and the production of the preliminary block diagrams. This information is required for the EVLA Project Book and for the EVLA System Preliminary Design Review (PDR) scheduled for December. PDR's for the various EVLA subsystems will be held early in 2002. Discussions with a fiber optic cable supplier begun this quarter will culminate in an open "roundtable" discussion in October so that a detailed and complete fiber recommendation will be ready for the system PDR and, subsequently, for submission of a purchase order once funds are available. Installation of the long fiber runs for the EVLA is scheduled to begin in August 2002.

Computing

A major activity for the quarter was detailed analysis of the personnel requirements for the EVLA software effort and recruiting to fill the three positions for software engineers currently open. Unfortunately no hires were made.

A concerted effort began to gather both engineering and operations requirements for the monitor and control (M&C) system of the EVLA. The completion dates are driven by the System PDR on December 4, 2001, and by no means imply a finished product. Work also started on several prototype displays which are needed prior to the EVLA System PDR.

A first draft of the EVLA Software Architecture and Design Document was written. The current, near-term targets for written material relating to EVLA software architecture and design are a) the EVLA System PDR, for which a functional diagram of the Monitor and Control hardware and software is needed, and b) the EVLA Monitor and Control System PDR. Tests are under way to find an alternative to nine-track as the medium to which VLA data are written initially.

Replacements for the Modcomps were ordered and are now being made ready for installation in the VLA control building.

Engineering Services

The Engineering Services Division made progress in the Feed and Feed Cone Design work. A Vertex Room mockup will be built prior to building prototype feed cones. Space requirements to fit the Correlator in the Control Building were obtained and a plan for its placement is being considered. Fiber optic selection is being made and a fiber installation route to the telescopes is being formulated.

Correlator

Signing of the MOU for the provision of the EVLA correlator by the Herzberg Institute of Astrophysics (HIA) was completed on September 27. During the month, a Letter of Intent was sent by the University of Calgary and HIA to the Canadian Foundation for Innovation (CFI) for funding for the correlator. A positive response was received from the CFI and a full proposal for funding is now being prepared. A final decision on funding from CFI is expected at the end of the year. In the meantime, the Canadian NRC has provided funds to allow recruitment of key

engineering positions to begin. A document providing the next level of detail for the correlator design was completed and issued as EVLA Memo 31. The document will be reviewed at the Correlator Conceptual Design Review scheduled for November in Socorro.

Outfitting

Milestone	Original Deadline	Revised Deadline	Date Completed
Install lower feed arm lasers	09-15-00	06-03-02	
Complete Q-band tertiary	04-15-00	Postponed	
Measure az track profile	09-15-99	12-31-01	
Reset surface panel corners	05-31-01	07-16-01	07-16-01
Install optical guide scope	04-30-01	10-31-01	
Realign azimuth wheels	07-13-01		07-13-01
Resume commissioning observations	07-16-01		07-23-01
Contractor leaves GBT site	08-01-01		08-01-01
Install new Az and El Brakes	11-30-01		

GBT Mechanical Engineering and Central Instrument Shop Work

Milestone	Original Deadline	Revised Deadline	Date Completed
Fab. Quadrant detector mirror	08-17-01		08-28-01
Design & fab. feed arm laser rangefinder cover	09-28-01	03-15-02	
Design & fab. feed arm laser rangefinder handling container	08-24-01	11-05-01	
Design & fab. quadrant detector mount	04-18-02		
PF2 Dewar mount & cart	11-09-01		
100 GHz MMIC Amps (10)	10-26-01		

GBT Software and Computing

Milestone	Original Deadline	Revised Deadline	Date Completed
M&C / VLBA software integration	01-19-01	10-31-01	
Observer (GO) interface completion	03-23-01	12-31-01	
Optical pointing telescope development and installation	02-02-01	07-31-01	07-31-01
Prepare visiting observer accounts	06-30-01	11-15-01	
Complete Doppler tracking capability	06-30-01	10-15-01	

Milestone	Original Deadline	Revised Deadline	Date Completed
Unify GBT FITS file formats	06-30-01	11-30-01	
Support for BCPM pulsar back-end	08-15-01		09-21-01
Support for VLBI observations	08-15-01	10-31-01	

GBT Operations

Milestone	Original Deadline	Revised Deadline	Date Completed
Use of MainSaver by Telescope Operations	06-01-01	10-22-01	
Six-month structural inspection plan for GBT	07-30-01	12-30-01	
Operations of GBT from Jansky Lab	08-01-01	12-01-01	
Operations of GBT on 24/7 basis	08-18-01		08-18-01
Restart GBT Science Observations	08-15-01		08-15-01
Mothball GBI telescopes	09-30-01		08-10-01
Installation of GBT Hoist pads & walkways	10-30-01		
Installation of new GBT brakes	11-30-01		
Mothball 20m	12-15-01		

Project Summary

Azimuth Track/Wheel Bearings

As last quarter's report was being written, we had just completed modification of the azimuth track wear strip, increasing the diameter and number of the retention bolts. We have also replaced a number of rusted azimuth wheel bearings. After these were completed, it was necessary to realign the wheels, since the new track configuration (with 1½ inch, protruding bolts) requires that the radius of travel of the wheels has much tighter tolerance than before. After the azimuth track was fully secured, we checked to see how much the wear strips and the base plates were moving when the antenna was rotated in azimuth. We also checked to see how much it would move during a hard stop. In all cases, the maximum movement we saw was no more than 0.002 inches. Before the track modification the movement was 0.140 inches. All this work was completed by mid July. Although the full report is not yet available, the detailed

review of the azimuth track design by the consulting engineer indicates that the modified design should be fully adequate.

Active Surface System

We took advantage of the track/wheel work to tackle a number of other projects. Extensive work has been done on the active surface system. Thorough tests of the over-temperature system have been performed, and all of the actuators are moved periodically to check for possible problems. So far, only three actuator motors, one LVDT and one cable have had to be replaced. Water leakage into the actuators has been a problem. There are two main areas where water appears to enter: at the top of the actuator where water tends to collect in the small opening in the hat bracket, and on those with half hat brackets, where water tends to run up under the open side of the bracket toward the piston. Masterbond low viscosity RTV sealant has been applied to the tops of all actuators except the ones blocked by the rope stanchions. Aluminum tape was applied to the open side of the half hat brackets, to create a "drip rail" for them. So far, these steps appear to be successful in preventing water ingress. The few remaining actuators inaccessible during the engineering period will be addressed during routine daytime maintenance periods. The photogrammetry adjustment of the surface actuators required a "second phase" of panel corner adjustments, as mentioned in the last report. This second phase adjustment took place during June and the first part of July.

Antenna Structure/Servo System

The main dish was balanced in mid 2000, but was rechecked in July after all the construction scaffolding was taken out of the backup structure. Removal of the scaffolding created a weight imbalance that exceeded specifications. Rebalancing, by moving trim weights, required about two weeks during mid July.

The NRAO performed "graduated" hard stop testing on both the azimuth and elevation axes during July and August. Tests show that hard stopping in azimuth at rates higher then 10 deg/min produced forces which exceed the design limits of the structure. Tests also show that hard stopping in elevation at rates higher than 10 deg/min could damage the bull-gear. Thus, we have currently reduced the maximum slew speeds of the telescope to 10 deg/min in azimuth and elevation. The cause of the problem (on both axes) is that in a hard stop the brakes apply too rapidly.

After performing additional tests to characterize how best to stop the antenna, the NRAO developed a new brake design. The new design utilizes brakes which apply "immediately," and brakes which apply gradually over roughly a 1.8 second period. The new system should safely stop the GBT in all hard stop scenarios, allowing each axis to operate at 40 deg/min and 20 deg/min in azimuth and elevation respectively. The new brake system is scheduled to be installed in early November. The estimated time to install the new system is one week. We reported in last quarter that none of the members in the structure were overstressed. Lee King has produced a list of critical members to inspect to verify this report.

HVAC System

After LMGT spent over $7,000 to upgrade controllers, valves, etc. on the HVAC system, it still failed to meet specification in the receiver room. While testing the system, another controller and a sequencer failed on the second chiller unit. LMGT has purchased a new controller and sequencer for the second chiller and the NRAO will install them when they come in. The representative from Trane will tune the new controller then the NRAO will test the system. We are hopeful the system will pass all tests when these items are installed.

Completion of the Project

Lockheed Martin vacated the site at the beginning August. The NRAO has received a GBT Closeout memo from LMGT which we intend to sign. If everything goes well then all should be closed out with LMGT by the end of October. Any additional work will now be performed as part of "antenna maintenance / upgrades project."

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 fourth 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 fourth 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 spring of 2002.

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.

Computing and Software Development

Essentially all of the efforts of the group during this quarter have gone into support of systems integration and commissioning of the GBT.

Commissioning of the GBT Spectrometer is now underway. Inspection of the switching signals revealed that the Spectrometer hardware was generating logical low levels when high levels were desired, and vice-versa. This has been cured by a modification to the firmware in the Spectrometer. We continue to be plagued by the fact that control of the hardware is via a serial line whose protocol does not provide confirmation that a command has been received. Further, if a command is sent while a micro controller is busy, that command is simply ignored. A number of intermittent errors suggest that such failures are occurring, including failure to start a scan, failure to change switching signal setups, and so on. We hope that these problems can be alleviated in the short term by selectively adding delays after each command (as was implemented for the 12 Meter MAC spectrometer). In the longer term, a more robust solution, involving some sort of upgrade to the Spectrometer firmware may well be required. An "expert user" GO interface for the Spectrometer has been completed, and a simpler alternative for less experienced users is under development. Apart from these items, the bulk of the work now remaining with the Spectrometer is support of end-to-end integration, including data processing in AIPS++.

Considerable work has been undertaken in support of pulsar observations. The Berkeley-Caltech Pulsar Backend (BCPM) "wrapper" Manager and GO interface have been completed. These allow the BCPM to be integrated into the standard GBT control system; this is especially useful when both BCPM 1 and 2 are in use simultaneously. Some minor problems with the wrapper manager have been identified, and these are being remedied. The Spectral Processor has also been used for "early science" pulsar observations. This revealed a number of (hardware and software) bugs, the majority of which have been resolved. The major remaining item is a problem with data acquisition, which causes scans to fail on an intermittent basis. This is caused by noise generated by an RF filter on the data lines.

Some progress has been made on antenna control. The bug that was causing impulsive accelerations at the start of some cross-scans has been found and fixed. Working with the engineering group, we identified the problem with transferring control between the NRAO antenna manager and the servo OCU/CCU, which turned out to be the result of a missing resistor pack on the SCU servo control board. This is required to ground unused inputs to the drive enable PAL. Without the ground the signals would often oscillate, causing the control problem. Work continues to upgrade the metrology control software.

Considerable time has been devoted to investigating a serious bug which occurs when using the CLEO engineering user interface to control device managers running on VxWorks based single board computers (SBC). The problem occurs when many parameters are being set (e.g., when loading a new configuration). This can cause the network stack in the SBC to freeze up, requiring a reboot. Although we can isolate the problem, we have not managed to determine the cause. Diagnosis is made extremely difficult by the fact that we do not have access to the VxWorks source code. Since it is possible to work around this problem by configuring devices in a less intense way, we have temporarily postponed further work on this problem. However, it will have to be resolved in the very near future.

GBT Development Projects

Although the bulk of our effort is still heavily committed to system integration and Phase I Commissioning, we are starting to refine the details of our future development plan. Three main items of this are rather well defined:

Precision Telescope Control System. This project has formerly been known by the rather unwieldy title of "M&C/Metrology Integration." The aim is to integrate the operation of the laser rangefinders, and other systems such as the quadrant detector, with antenna and surface control, to address the needs of Phase II/III commissioning. Little progress has been made in this area in the past quarter, but we hope to bring more resources to bear soon.

3 mm Receiver Module 1. This will be a dual-beam dual polarization receiver, capable of both continuum detection and spectroscopy in the 68-92GHz band. Design work on this project has been proceeding with some time, culminating in a Preliminary Design Review held on October 2. The plans successfully passed review, although some scientific and technical details need to be resolved; perhaps the main issue is the most appropriate method of performing the down-conversion. The intent is that this receiver will have a dedicated continuum back-end, built to a common design with the Ka-band receiver. Work will now proceed on the detailed design and prototyping of the RF section.

Beam Forming Array. This goal of this project is to build a 21 cm imaging spectrometer. It is a collaboration between NRAO Green Bank, the Central Development Laboratory, and the University of Virginia. The first formal meeting of the Beam Forming Array Group was held in Green Bank on August 2. Details of current work are provided in the CDL section of this report.

Other projects include a collaboration with Caltech to provide a Ka-band (26-40 GHz) receiver capable of both spectral line and continuum detection, and collaboration with the University of Pennsylvania to build a bolometer array receiver. Both of these possibilities are under active discussion. The development of the Q-band tertiary has been deferred in order to devote the maximum effort to these other projects.

Mechanical Engineering Development

During the third quarter, the Mechanical Engineering Division continued to support outfitting with a variety of fabrications including cryogenics compressor chassis, a Q-band receiver radome, and miscellaneous brackets, boxes, and frames.

Design has also begun on the weather covers for the feed arm lasers. A sound concept has been prepared and detailed design will begin following approval. Fabrication work on the weather covers is expected to start late in the fourth quarter and be completed in the following quarter. The design and fabrication of the quadrant detector mounting and access system is also expected to begin in the fourth quarter and be completed the following quarter. Work has begun on installing the mounting system for the PF-2 amplifier bodies next quarter for use in GBT receivers.

Operations Summary

Telescope Operations Personnel Changes

During the third quarter of 2001, one new GBT Operator and one new Telescope Mechanic were hired.

GBT Operations Documentation

Development and updating of operational procedures documentation continued into the third quarter of 2001. Areas of the documentation update include: electrical, CLEO startup and M&C reboot procedures, antenna control, power outages, maintenance log procedures, reference information, and various different job aids.

The current version of the GBT Operators Manual is available on line. The new Telescope Operations home page came on line during the third quarter. In addition, a daily report summarizing activities on the GBT was implemented. The current summary is e-mailed to staff

members and both the current and previous versions of these summaries are available from the Telescope Operations home page.

Monthly GBT observing schedules were routinely generated starting during the third quarter. These schedules and support reports are available from the GB home page, the GBT home page, and the Telescope Operations home page.

GBT Maintenance

The number of regular Preventative Maintenance duties continued to increase during the third quarter. Some of these included brake inspections, lubrication of elevators, random inspections of tach and drive brushes (to establish a baseline for determining brush life), and other smaller preventative maintenance task. The results of the azimuth wheel bearing grease tests were received during the third quarter. These results will serve as a starting point for a wear analysis monitoring of the bearings.

Construction of GBT hoist pads and sidewalks were begun during the third quarter and will be completed during the last quarter of 2001. Also completed during the third quarter were (a) installation and testing of spare subreflector and prime focus actuators were and (b) the azimuth track scrapers were modified to accommodate the additional track bolts. The new azimuth and elevation brakes will be installed and tested during the last quarter of 2001. A decision was made to contract out the development of a detailed plan for the inspection of the GBT structure and welds. The current goal is to have a completed plan by the end of the year.

GBT Operator Training

Additional operator training (both classroom and hands-on) was completed during the third quarter on the servo system including the use of CLEO screens and the M&C systems. Additional operator training will continue during the last part of 2001. The training of a new GBT operator was also started during the third quarter. A two-day (vendor provided) training session on use of the Mainsaver software program was held for all GB employees who will utilize this software.

GB Maintenance Bookkeeping

About 50 percent of the Mainsaver inventory was 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. The use of Mainsaver within the Operations division was delayed until the first part of next quarter because of limited Computer division resources.

GBT Operations

A preliminary version of the GBT operator logging program specifications and program were completed during the third quarter of 2001. Completion of the operator logging program is delayed due to limited Computer division resources. An interim GBT paper logging system was implemented and will probably continue until software is available.

The effort of converting the Operator Advancement Proposal into a plan continued during the third quarter. Further progress depends on the Observatory-wide personnel study (by an outside group).

Some operating procedures were developed and refined during the third quarter. Science observations were restarted and full time GBT operations of the GBT started during the third quarter.

NRAO Central Instrument Shop

Milestone	Original Deadline	Revised Deadline	Date Completed
Fab. dewars for Tucson	04-20-01	07-13-01	07-13-01
Fab. two WR-10 MMIC amplifier bodies	04-18-01	07-13-01	07-16-01
Fab. ten 510-690 MHz balanced amplifiers	04-30-01	09-12-01	
Fab. evaluation Rx flanges for ALMA	08-30-01		08-31-01
Fab. two K-band feeds for VLA	10-05-01		08-28-01
Fab. two K-band OMTs for VLA	08-24-01		08-28-01
Fab. L-band OMT for Arecibo (contract)	11-15-01		
Fab. dewar heat shields for ALMA	10-26-01		
Fab. dewar G-10 supports for ALMA	12-21-01		

Astronomy Education Center Project

Milestone	Original Deadline	Revised Deadline	Date Completed
AEC main bldg. contractor bids due	07-17-01		07-25-01
AEC main building contract awarded	08-13-01		09-30-01
AEC dormitory 90% design review	09-10-01	12-01-01	
AEC main building construction complete	10-15-02	12-15-02	

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

The work described in the previous report to upgrade our Solaris machines from 2.6 to 2.8 is largely complete. The only machines that have not been upgraded are those associated with the orbiting VLBI project. These are on hold pending the long-term future of that project. Upgrades of our Linux systems are on hold pending the release of Red Hat 7.2.

Support of visitors continued throughout the quarter, as well as support for two visiting pulsar back-ends with associated Sun control computers. We have specified and ordered three dual-processor Linux workstations, which will be made available to visiting observers. These are part of a larger order which includes identical machines for Socorro and Charlottesville. We have also ordered an eight processor Linux SMP system with 8 Gb memory, 800 Gb disk space and associated tape backup. This will be used for intensive pulsar and spectral line on-the-fly data analysis tasks.

Little other progress was made during the quarter, primarily due to vacancies in the Unix System Administrator and Head of Computing positions. The latter remains unfilled. However our new Unix System Administrator, Wolfgang Baudler, joined us at the start of September. Wolfgang has already made a significant contribution in the area of general user and system support.

Mechanical Engineering and the NRAO Central Instrument Shop

The Central Instrument Shop completed two large single-piece receiver flanges for the ALMA evaluation receivers during the third quarter. The Shop has also begun work in the heat shields for the evaluation Dewars. Planned work for ALMA in the next quarter includes dewar G-10 support parts and an anticipated nutator assembly.

The Shop delivered number 3 and number 4 in a run of eight K-band feeds and OMT's for the VLA. Work has begun on the L-band orthomode transducer for Arecibo and will be proceeding through the fourth quarter. Completion is expected before the new year but could be delayed due to CNC availability.

Operations - Other Telescopes

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

The 20 Meter will be moth-balled after VLBI tests supporting the GBT have been completed, during the last quarter of 2001. The two GBI telescopes were moth-balled 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. A part-time OVLBI operator was hired during the third quarter and will continue training during the last quarter of 2001. The 85-3 (Pulsar Monitoring) telescope had both routine maintenance and repairs as needed. Receiver removal and reinstallation as well as work on the elevator were completed on the 40 foot telescope during the third quarter. Inspection of the 140 Foot telescope and maintenance of the 140 Foot building elevator were completed during the third 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 contract was awarded to Multiplex, Inc. Construction will begin on October 15, 2001, and should be completed 14 months later (December 15, 2002).

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	08-31-01
Reduce fiber use to single fiber	11-30-01	12-30-02	
Increase dynamic range	11-30-01		
Use spare VLA antennas in VLBI	06-30-02		
Receivers (FE)			
Complete solar calibration work	12-31-00	12-31-01	
Build and install three more W-band receivers	10-31-01		
Replace Y-coupler on W-band receivers #2 to #4	08-30-01	10-15-01	
Build second "SOIDA" receiver test stand	12-31-01		
Test and begin replacement of new material for Dewar windows on L-band receivers (FE)	12-31-01		
Identify and correct moisture buildup problem in new VLA K-band feeds (FE)	12-31-01		
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	08-30-01
Checkout of VME timing card & multi A/D FADC	01-31-01	07-31-01	09-15-01
Checkout of full FADC	09-30-01	11-15-01	
Other VLA			
Modify helium lines to facilitate testing new receivers (Cryo)	01-31-01	12-31-01	

Milestone	Original Deadline	Revised Deadline	Date Completed
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	12-31-01	
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)			
Change FE filters to 3 MHz	12-31-01		
Iridium Filters (FE)			
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	09-15-01
VLBA Hydrogen Maser #11, replace (LO/IF)	12-31-00	06-30-01	09-15-01

PT Link

Although a scheme to measure round trip phase was tested, the current plan is not to implement round trip measurement or single fiber operation until 2002 to avoid interruptions to the A configuration run starting January 7, 2002. Instead, the so-called "Y1" project to use the antenna spared by link use, is scheduled for tests.

Receivers

W-band receiver #2 was successfully modified to reduce system noise temperature; #4 is scheduled for October, a delay driven in part by the delay in receiving components.

FADC

The FADC system has been used for observing in limited modes and so the targets for FADC and VME are considered complete. Additional revisions will be necessary to achieve full functionality. Delays in the project stem primarily from the need to verify each hardware change with software tests.

VLBA Improvements

Although successful holographic measurements were performed at VLBAPT, additional modifications and tests are desired to improve accuracy. The delay in completing the project is largely the result of having to schedule test time on the antenna.

Engineering Services

Milestones	Original Date	Revised Date	Date Completed
Brewster maintenance visit	07-24-01	07-24-01	07-23-01
Complete DnC Array reconfiguration	09-21-01		09-20-01
Complete D Array reconfiguration	10-12-01		
Mechanical Group			
Assemble three spare Dichroic panels for VLBA	05-31-01	09-31-01	11-30-01
Replace Vicker 90 gpm pumps on Transporter 1 with newer model pumps	11-15-01		09-07-01
Antenna 7 overhaul	05-29-01	07-31-01	07-31-01
Prep and paint Antenna 5	05-28-01	07-15-01	07-15-01
Dish panel adjustments on Antenna 21	07-13-01		07-10-01
Install W-band mount on Hancock VLBA Antenna	07-26-01		07-26-01
Prep and paint Antenna 28	07-31-01		08-16-01
Complete VLA fall arrest installation	08-31-01	11-30-01	

Milestones	Original Date	Revised Date	Date Completed
Dish panel adjustments on Antenna 10	08-03-01		08-07-01
Replace azimuth bearing on Antenna 17	08-31-01		08-22-01
Dish panel adjustments on Antenna 17	09-06-01		08-22-01
Dish panel adjustments on Antenna 19	10-12-01		
Dish panel adjustments on Antenna 26	10-26-01		
Prep and paint Antenna 1	09-12-01		09-12-01
Prep and paint Antenna 25	10-18-01		
Dish panel adjustments on Antenna 11	09-21-01	10-08-01	
Electrical Group			
Begin installation of new encoders	06-29-01	10-26-01	
Tech Services UPS installation	07-31-01	08-10-01	08-10-01
Fort Davis HVAC Retrofit complete	10-30-01		
Cryo Air Conditioner installation	10-30-01		
Upgrade fire alarms	11-30-01		09-25-01
Radio upgrade	12-28-01		
Site & Wye Group			
ALMA base course application	06-29-01		
Redo Visitor Center parapet stucco	06-29-01	07-20-01	07-13-01
Repair Manhole at CE6	07-31-01	08-31-01	10-19-01
Install 5,000 crossties on East Arm	09-30-01	10-21-01	
HAZMAT /waste oil storage	09-30-01		09-14-01
ES Engineering Group			
Start construction of ALMA antenna foundation	05-07-01	07-09-01	07-09-01
Complete ALMA antenna foundation construction	08-06-01		08-16-01

Milestones	Original Date	Revised Date	Date Completed
Administrative (Scheduling-Safety)			
National Electrical Code Updates	10-30-01		
Crane Inspection Recertifications	10-30-01		
Removal of sludge from used oil tanks	03-30-01	08-30-01	08-01-01

The installation of the new encoders was postponed in order to resolve integration problems. The Tech Services UPS installation was delayed because the parts were late to arrive. The ALMA base course application delay was due to project delays in Europe. Tamper repairs interrupted crosstie installation. The CE6 manhole repair was postponed due to changing priorities and manpower shortage. Two antennas have prototype fall arrest systems and need to be retrofitted with the final fall arrest system.

Computer Division

Systems Support Group

Milestone	Original Deadline	Revised Deadline	Date Completed
Arana Removal	09-30-00	12-30-01	
Video conferencing	01-31-01	12-30-01	
Solaris 2.8 installation	07-31-01	11-30-01	
RedHat 7.1 installation	07-31-01	12-31-01	
Web/ftp server	08-31-01	11-30-01	
Replacement public machines	09-30-01	10-31-01	
Off-load zia server	09-30-01	12-31-01	
Expand filehost file-server	06-30-01	06-30-01	07-15-01
Build 2+ Terabyte SAN	11-30-01		
Release Jobserve 1.6.4	12-31-01		
Move AIPS to Socorro	12-31-01		
Upgrade Ingres to version 2.5	08-01-01	10-31-01	
Convert monitor data loader program	08-01-01	10-01-01	
Convert AOC Library Software to Java	09-01-01	On hold	
Correlator controller in continuum	05-31-01	10-28-01	
VLBA station computers upgrade	07-30-01		08-31-01

Milestone	Original Deadline	Revised Deadline	Date Completed
Real time VLBA fringe searching	09-01-01	03-31-02	
VLBA Distribution system upgrade	09-01-01		09-01-01
Complete installation of CMP	09-30-01	On hold	
CMP/SLC interface software testing	09-30-01	On hold	
CVS Version Management Installation	12-31-01		
Integrate distribution archive in OMS	08-31-01	09-24-01	09-24-01
Ancillary data procedures -> VLA Ops	05-30-01	12-30-01	
OMS Performance enhancements	12-31-01		
Alternative to 9-track at VLA site	03-31-02		
Simplify observe file submission	12-31-01		
Modcomp replacement	10-31-01	12-17-01	
WBS EVLA M&C system	06-30-01		06-30-01
ASG recruitment	08-31-01	12-31-01	
Second new PC Order/installation	06-30-01	06-30-01	06-30-01

Arana Removal

Until now, removal of the arana file server has been waiting for the conclusion of the VLA scheduling software rewrite, over which the Computer Division has no control. The old scheduling software uses DBase IV, an obsolete product which uses arana as a license server. Since new plans require use of the space currently taken up by arana, we are investigating moving the license to another server.

Solaris 2.8 Installation

The Solaris 2.8 installation is mostly complete; only central servers, VLA systems, and some VLBA systems remain to be upgraded. Temporary loss of personnel over the summer and the upcoming Modcomp replacement will cause the final completion to be delayed to late November.

RedHat 7.1 Installation

The RedHat upgrade was halted in favor of waiting for RedHat version 7.2, which automatically fixes some known bugs we would have had to apply patches for in 7.1. We expect to resume this project mid to late October, and complete it by the end of the year.

Web/ftp servers

New Web/ftp servers have been ordered for all major NRAO sites, and are now in CV being installed. There is still no firm date as to when they will arrive in Socorro.

Replacement Public Machines

Eight new public PCs running Linux have been ordered and should be in service by the end of October. These machines come with dual 1.7GHz Xeon processors and an unprecedented amount of disk space. Our currently fastest two Sun machines will continue to serve as public machines for visiting scientists requiring a Sun platform; all other public Suns will be used to replace obsolete machines which could not be upgraded to Solaris 2.8.

Expand filehost File-server

The available disk space on our general file server *filehost* was doubled with the addition of new disks. This increased storage benefits space for personal accounts, storage areas for the VLBA, and development areas for the EVLA and ALMA projects.

Off-load zia Server

No work has been done here. We plan no further effort in this area until the Web/ftp servers are functional (see above). Web services are currently handled by zia.

Implement 2+ Terabyte SAN

In cooperation with Data Management, the Computer Division plans to build a 2+ Terabyte Storage Area Network (SAN). This new storage will allow the AOC to move the entire VLA archive online. The system can be expanded at a later date to include storage for the current

VLBA archive. The SAN will also improve the AOC's centralized backup completion times and backup storage capacity. In addition the SAN will allow us to begin examining many centralized storage issues that had originally been slated for 2002, and are prompted by the need to handle the expected EVLA data volume.

Jobserve

No new releases took during the third quarter. For the fourth quarter we plan to release 1.6.4, which includes updated calibrator positions, fixes to a number of reported bugs, and increased stability.

NRAO-GB Systems Support

The NRAO-NM computer division assisted the NRAO GB site during their search for a new systems administrator. James Robnett spent an initial two weeks there, followed by Stephan Witz who assisted them for six weeks.

AIPS Support

The master installation of (classic) AIPS, and the basis for serving the AIPS midnight job, will be moved from Charlottesville to Socorro during the final quarter of 2001.

Ingres Upgrade

Ingres is our database engine on which many vital applications are based (VLA archive, VLBA operations). Ingres 2.5 has been installed on a test machine and all appropriate software successfully tested. Pending the move of a few Ingres-based Web applications to the new Web server, the production machine is now ready for this Ingres upgrade.

Convert Monitor Data Loader Program

Porting the monitor data to Java serialized objects proved not to be efficient. Instead, the current C++ code was modified to work with Ingres 2.5. This project is being reviewed with the Recorder and Correlator Groups to determine their needs and how to best fulfill them. The database design is also being reviewed and will be modified to fit the Recorder/Correlator needs.

AOC Library Software Conversion to Java

A review of the Library software in Charlottesville by the Observatory librarian determined that the AOC Librarian can use this software to meet requirements. Replacement software should be available by the end of this year. The conversion to Java will not be needed.

BARS Replacement

Our current reservation and billing system (BARS) was analyzed for possible upgrade and it was determined that it is technically feasible to do so. In addition, six off-the-shelf packages have been identified which could replace BARS. Skip Lagoyda is reviewing the packages and will determine if he wishes to purchase one of them or simply upgrade BARS.

VLA Correlator Controller

Progress on verifying continuum data was slower than expected. We are currently dealing with a number of integrator memory timing issues and schedule conflicts. Data communication with the online systems has been established.

VLBA Station Computers

The MVME050 VME board functionality has been transferred to the CPU board, removing the system's dependence on the 050 (the number of spares for which was becoming dangerously low). The operating system was updated to version 5.4 and driver support was added for the latest generation of Sigma Tau masers.

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 correlator code is complete, but is not part of the production environment yet. Some testing and refinement of the user interface needs to be performed before making this tool generally available. Since this item is regarded as rather low priority, system integration will most likely be concurrent with the next routine correlator code update in 2002.

VLBA Distribution System Upgrade

The VLBA archive and distribution drives have been upgraded to DDS-4 compatibility and archiving media upgraded from DDS to DDS-3.

Control and Monitor Processor (CMP) Related Goals

Work on the CMP has been indefinitely suspended while preliminary EVLA Monitor & Control design is taking place.

ASG Software Area/Version Control

A design for an Array Support Group software area was developed and implemented. Next step is to install the CVS version management system.

Integrate the Distribution Archive into OMS

This item has been in a parallel testing phase since September 10 and is considered complete as of September 24. The addition of this to OMS removes the necessity for paper 'Distribution Request' forms and the use of the archinfo tool.

OMS Performance Enhancements

This is a low priority item that aims at improving the overall usability of OMS. Its primary focus will be those tasks within OMS that are done most often and currently take a long time to finish.

Turn Over Ancillary Data Procedures to VLA Operations

Turnover of processing and delivery of reference pointing data has been completed and seems to be completely successful. The turnover of processing and delivery of tipping data and VLBI/VLA data have not yet been completed. The necessary instructions for tipping data are approximately three quarters complete. The materials needed to turnover VLBI/VLA data are approximately half complete.

Modcomp Replacement

After long delays during the shipment, the Modcomps finally arrived on September 28. The loss of two weeks time requires a rescheduling of the date for the switch-over to the new CPUs. While a definite date is still being discussed, it is likely that the switch-over to the new Modcomp 9250 CPUs will take place sometime during the week of December 10.

Recruitment

Currently we have three unfilled vacancies in the Array Support Group. Job descriptions have been written, and the vacancies have been widely posted and advertised.

Simplify Observe File Submission

Through the years, the path observe files take from submission to their final destination on the Modcomps has become more convoluted. An initiative has begun to simplify this path, which hopefully will lead to fewer problems.

AIPS

Distribution

The 31DEC01 version of AIPS, updated daily, has now been distributed 387 times, to 325 sites, since December 2000. A total of 43 sites have retrieved multiple copies of 31DEC01, for an average of 2.5 retrievals each. Among the 73 registered users of 31DEC01 (most users fail to register), the number of machines is split almost evenly between Linux and various versions of Sun/Solaris operating systems, but two-thirds of the registrants have Linux as their primary architecture.

Key Developments

1. The AIPS group is working toward moving the *midnight job* and the master version of AIPS to NRAO-Socorro, since there are no longer any programmers in the AIPS group in Charlottesville. It is anticipated that these moves will be complete, and formally implemented, at the time of the frozen release of 31DEC01 in December 2001.

2. In response to reports of anomalous source counts in the NRAO VLA Sky Survey, Eric Greisen has undertaken a review of the Gaussian fitting in AIPS, including a series of Monte Carlo runs to determine errors in fitted parameters for a variety of source models. Results will be presented in an AIPS memo, and are being presented at the ADASS (Astronomical Data Analysis and Software Systems) meeting in early October. The investigation also has resulted in changes to the fitting routines IMFIT and JMFIT as well as the combined source-finding/fitting task SAD.
3. Data reduction utilities have been cleaned up in several instances. The VLBA utilities have had minor improvements made to permit use for spectral line data and to improve their use in polarization calibration. The VLAPROCS procedures (including VLACALIB) underwent a significant housecleaning in order to remove hidden inputs.
4. The precession subroutines had several errors fixed to enable correct precession as well as interpolation between the input and output precession dates. Calculation of the relativistic light-bending and aberration have been modified. Correct matrices for inverse precession were developed and implemented.
5. Testing of FRING and KRING has shown no significant differences between the two fringe-fitting programs for sources of high signal/noise; preliminary results show differences, but no systematic trends, in cases with low signal/noise or resolved sources. Tests are continuing, and are expected to be completed in the fourth quarter.
6. FILLM was modified to improve the handling of frequency and source parameters. In addition, the capability to load and use VLA weather data has been added.
7. FITLD was modified to improve the handling of CQ tables, and to apply (or not apply) the correction for delay quantization in the correlator, depending on the correlator identity.
8. UVPLT was modified to add the option of plotting quantities vs. the projected (u,v) distance in any position angle, not just along the axes.

Goals for Q4 2001

1. Continuing maintenance and user support.
2. Freeze and release 31DEC01 version, with primary copy and midnight job moved to Socorro.
3. Complete comparison of FRING and KRING for fringe-fitting under various conditions.
4. Develop and test task to separate primary and subreflector effects in VLBA holography.
5. Modify TECOR to permit use of ionosphere observations across UT midnight.
6. Develop a data-editing task to use the VLA weather information now provided by FILLM.

Major Developments

Milestone	Original Date	Revised Date	Date Completed
Design L-band amp using InP devices.	03-16-01	04-30-02	
Complete study of overmoded waveguide in LO transmission	03-16-01	11-30-01	
Demonstrate 211-275 GHz balanced SIS mixer with integrated 4-12 GHz IF preamp.	06-29-01	10-31-01	10-15-01
Demonstrate 211-275 GHz balanced sideband-separating SIS mixer with integrated 4-12 GHz IF preamps.	07-31-01	12-31-01	
Construct second test receiver	12-31-01	4-1-02	
Fabricate Band 3 windows.	09-30-01		09-30-01
Design GBT Q-band optics.	09-30-01	06-30-02	
Evaluate final design of K_a-band feed.	12-31-01		
Finish detailed design of W-band feed.	12-31-01		
Evaluate performance and finalize design of L-band feed	12-31-01		
Complete preliminary design of EVLA L-band feed.	09-30-01		09-30-01
Construct 80/240 GHz frequency tripler.	03-30-01	09-30-01	09-30-01
Design MMIC doubler chips for ALMA Band 7.	06-01-01	12-31-01	
Beam-forming array WBS completion	08-31-01		09-30-01
ALMA Correlator:			
Upgrade station card to final configuration	9-30-01		9-30-01
Write and release memo on filter card performance	9-30-01	12-30-01	
Complete testing LTA prototype card	9-30-01		9-30-01
Start design of adder tree & correlator card test fixture	9-30-01		9-30-01
Start correlator card and chip test fixture PCB fabrication	9-30-01		9-30-01
Complete preliminary design of power supply card	9-30-01	11-30-01	
Final test of station card using test fixture	6-30-01	8-31-01	8-30-01
Approve correlator chip design for fabrication	6-30-01	7-30-01	8-30-01
Initial test of complete prototype correlator	12-21-02		
Initial test of prototype ALMA correlator.	12-21-02		

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. The chemistry lab

contributed with electroformed waveguide components for the K- and W-band receiver projects in Socorro, a large feed horn electroform for NRAO/ Tucson, and numerous plating operations related to ALMA development.

Amplifier Production

A total of 16 amplifiers was completed during the quarter. Production included: seven K-band amplifiers used for receiver construction at the VLA, five K_a-band units as spares and for use outside of the NRAO, and four W-band amplifiers for VLBA use. An additional three W-band units are near completion; these units will be used in ALMA test receiver construction. Production of K-, K_a-, and W-band LNAs is ongoing, and a build of Q-band LNAs was begun at the end of the last quarter.

Superconducting (SIS) Millimeter-Wave Mixer Development

SIS Mixer Development

Band 3 (84-116 GHz) SIS mixer: The choice between SIS and HFET receivers for ALMA Band 3 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. The design and optimization of the mixer circuit were completed this quarter. In the absence of ALMA funding to complete this work, we are hoping for funding from an aerospace company for the mixer block design and fabrication, mask layout, and production of a prototype wafer.

Band 6 (211-275 GHz) balanced single-chip SIS mixer: A balanced SIS mixer is the Band 6 fallback design if neither of the sideband-separating designs (described below) is found to be suitable for ALMA production. There are two balanced mixer designs, one using the UVA single-chip balanced mixer described in ALMA Memo 308 but with a 4-12 GHz IF preamplifier, and the other using two single-ended SIS mixers of the type described in ALMA Memo 205, also with a 4-12 GHz IF preamplifier. At the time of writing, the first mixer block and 4-12 GHz IF preamplifier are assembled and initial tests show good results.

Band 6 (211-275 GHz) balanced sideband-separating SIS 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 have been fabricated at UVA. The mixer block and 4-12 GHz IF preamplifiers are being made in the CDL shop.

Band 6 (211-275 GHz) balanced sideband-separating SIS mixer – B. Multi-chip design: This

design uses four separate SIS mixers of established design (ALMA Memo 205), mounted in a block containing three waveguide quadrature hybrids and an in-phase power divider. The design of the mixer block, compatible with the 4-12 GHz IF preamplifiers, was completed this quarter and the block is in the CDL shop.

Band 9 (602-720 GHz) SIS mixer: SUNY/Stony Brook is still having a problem with junction quality, which is far below that obtained for similar junctions two years ago. At the time of writing, they believe they have solved the problem. In the interim, they delivered a wafer for Band 9 which, despite the poor junction quality, can be used for evaluating the RF tuning characteristics of the circuit. Although the receiver noise temperature (~ 1200 K) was high due to the poor junction characteristics and Josephson noise, the mixer had good pumped I(V) steps from 600 to 680 GHz and the correct SQUID LC resonant frequency (~ 660 GHz)—a good indication that the RF tuning circuit of the mixer is working as designed.

4-12 GHz IF Preamplifier Development

In an earlier report, we found that after installing InP transistors from the latest batch into the preamp, the gain dropped off above 10.5 GHz. We have constructed and tested a new version of the preamplifier designed to mate with the balanced and sideband separating mixers described above. In this amplifier, we shortened the gate bond wire between the first and second stages, which increased the gain up to 11.5 GHz. With additional adjustments to the gate bond wires, it is expected that we will be able to increase the gain roll-off frequency to above 12 GHz.

To accommodate balanced SIS mixers, the new preamplifier incorporates two mixer bias-T circuits. It is found that when these are connected to the input lines, there is a small penalty in noise temperature at the low end of the band. Increasing the bond-wire length to the input substrate should improve this.

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. This quarter, we have continued exploring the use of an overmoded stainless-steel waveguide between the LO multiplier on the 70 K stage and the SIS mixer at 4 K. Simulations are being done using both QuickWave and CST Microwave Studio. In the absence of a vector network analyzer for Band 6, W-band scale models are being fabricated in the shop. Compact, multi-conductor heat sinks are required for the many bias and monitor wires in the test receiver.

We continue to evaluate a compact design using Nanonics miniature connectors. The goal is to derive a thermal π equivalent circuit of the heatsink which can be used in thermal analysis.

Receiver Optics

In planing to incorporate the planned ALMA Band 6 optics into the mixer production test sets, two potential problems were found with the optics. A physical optics analysis by S. Srikanth indicated an undesirably low edge taper on the subreflector of the ALMA telescope, lower than expected from the (less accurate) Gaussian beam analysis used in designing the optics (ALMA Memo 362). This is being discussed with the other ALMA engineers. The size of the Band 6 cartridge will not accommodate the proposed optics if a waveguide orthomode transducer turns out to be impractical for Band 6. The same concern applies to Band 5.

We have confirmed the low insertion loss of the vacuum windows made in the CDL for the Band 6 test interferometer receivers. In the absence of a vector network analyzer for Band 6, the measurements were made by moving the window in and out in front of a Band 6 SIS receiver as it was tuned across the band—a time-consuming measurement, not suitable for testing production windows.

Automatic SIS Mixer Testing

The new mixer bias supply breadboard described last quarter was modified to include protection circuits with solid-state switching and reed-relay switching. Testing of this enhanced breadboard will be completed in the third quarter.

Construction of the dewar-based receiver for the second mixer measurement system is proceeding according to our work schedule. Construction of two new HFET amplifier bias supplies is complete.

Gain stability measurements of mixers and preamplifiers continued during the quarter and a memo written on the preliminary results. Additional work is planned to reduce data contamination from power line harmonics.

Electromagnetic Support

GBT

The design of a wideband feed to cover the 26.5-40.0 GHz range was completed. This feed is a linear taper corrugated horn with an aperture inside diameter of 10.5 wavelengths at the center frequency. With two such feeds placed next to each other, the beam separation is 4.8 beamwidths at 33 GHz.

Two preliminary designs of a W-band feed to cover 68-92 GHz were completed. One design uses a linear taper horn with an aperture diameter of 10 wavelengths at 80 GHz. The other design uses a profile compact horn with an aperture diameter of 5.5 wavelengths. A detailed design of one of these feeds will be undertaken once the requirement on beam separation is finalized.

EVLA

The preliminary design of the L-band feed (1-2 GHz) has an aperture of 75 inches and length of 192 inches. A feed of this length would extend through the floor of the feed room of the VLA antenna. A study to develop a shorter L-band feed has begun.

Spectrometers/Correlators

Work on the baseline ALMA correlator during the last quarter concentrated on the design of the correlator card, the design of the final adder card and testing of the station card, the digital filter card, and the LTA.

The correlator card was released for PCB fabrication, and the design of a correlator card/LTA test fixture was started. A preliminary design for this test fixture was completed by the end of the quarter.

A preliminary design for the final adder card was also finished. Testing of the prototype LTA continued as minor changes to card interfaces were made.

The prototype station card was modified to install recently available full-size RAM chips. This card is now in its final configuration. Extensive software to test the upgraded station card was written and, by the end of the quarter, all modes of the station card had been successfully tested.

Testing of the prototype digital filter card continued at a low level.

A preliminary design study of the signal interface paddle boards was made, and a single board design that could meet all requirements both for the station bin and the correlator bin and for both the prototype and final correlator systems was described.

Design of the station bin motherboard was begun during the quarter.

The preliminary design of a power supply card for developing 1.8 VDC and 3.3 VDC power for both station and correlator bins from the system 48 VDC was made during the quarter.

Final approval of the ALMA correlator chip design was given and a purchase order for a prototype wafer run was issued. (The prototype run is currently being held pending clarification of next year's budget.)

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 sent out for PCB fabrication.

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

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 completing prototypes of the LO driver components. The phase-locked loop surface mount board was finished and tested successfully. The AMBSI interface card was received and partially integrated into the subsystem. Power combining of two WR-10 power amplifiers was successfully demonstrated using waveguide quadrature hybrids designed and fabricated at the CDL. A MMIC tripler with W-band output was packaged and tested. The possibility of contracting for more of these MMICs designed especially for the ALMA drivers has been investigated. Work continues on integrating the remainder of the driver components. Wideband WR-10 and WR-8 MMIC power amplifiers have been received and will be packaged and tested next quarter with a tripler to drive Band 6 and a quintupler to drive Band 9.

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 is being developed.

80/240 GHz Frequency Tripler: The fabrication of the improved/modified quartz-backed GaAs devices for the tripler was completed. Subsequently, the tripler was assembled and is being debugged. Several details of the block and assembly process, not available at the time of initial modeling and design, are being incorporated at this time.

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 was done to develop a working knowledge of Michigan fabrication processes, and to set up design/data transfer protocols with the group. A trial fabrication run has been completed thus far. Inspection of the resulting diodes revealed a need to modify the mask set to accommodate a specific University of Michigan process. (Original mask sets were designed with clearances based on the UVA process.) This has been done and another fabrication run is under way at this time. Finished devices are expected to be delivered in the third week of October 2001.

Concurrently, work is in progress to develop viable substrates for MMIC work for ALMA Band 7 doublers. As a part of this effort, test circuits were fabricated on thinned down GaAs membranes. However, these were found to be very fragile and susceptible to breakage despite careful handling. This was not altogether unexpected, so the next option (of the four outlined in the previous quarterly report) is being explored. This involves coating the circuit with layers of polyamide (3 microns at a time) until the thickness is sufficient for mechanical support, and then thinning the backside. Earlier, a single layer polyamide deposition process had been developed and calibrated for obtaining the desired layer thickness. Currently, efforts are ongoing to work out multi-layer deposition techniques (higher viscosity polyamides are required) to obtain the desired mechanical strength for the polyamide backing. The test circuits fabricated on this kind of substrate will be available in the subsequent quarter.

Fully-Sampled, Focal Plane Array Feed

The purpose of this long-term project is to develop a 21 cm imaging spectrometer for the Green Bank Telescope (GBT) within a period of five years. The instrument consists of a two-dimensional array of at least thirty-seven electromagnetic sampling elements located in the telescope's focal plane and is capable of synthesizing up to seven independent beams. Each element of the array consists of the dual polarized antenna, low noise electronics, analog down converter, and a digital sampler. The digital data streams are sent via optical fibers to a specially designed signal processor for beam-forming and spectral analysis. The physical size of the 21 cm

feeds on the GBT makes it impossible to support a system with more than three beams if they are formed in the traditional manner. The beam-forming array is the most natural, efficient, and logical way to gain the advantage and would represent a major breakthrough in technology applicable to all radio telescopes.

The Beam-Forming Array (BFA) Project Group was created in July, and the first official group meeting was held in Green Bank on August 2, 2001. Work throughout this quarter was focused on addressing project planning issues and detailing preliminary designs. A Work Breakdown Structure (WBS) was created. Six core technical documents were outlined with two completed and a third currently under way. A web page devoted exclusively to this project was created and can be found at URL http://www.gb.nrao.edu/BFA. Preparations are under way for the Conceptual Design Review (CoDR) which is scheduled to take place next quarter.

Technical activities related to Development Phase A have already begun. In Green Bank, planning is under way to upgrade the outdoor antenna test range for array feed measurements. Xilinx digital development tools for designing an FPGA-based array signal processor have been purchased and an approach for implementing the BFA process flow is being studied. The state-of-the-art in A/D converters is being investigated for comparison with BFA requirements. A state-of-the-art receiver for the RFI monitoring system in Green Bank is being developed which is directly applicable to the BFA receiver. Various cryogenic cooling options are being examined in preparation for constructing BFA prototype dewars next year. All of this work will continue into next quarter.

The CDL and the UVA radio astronomy instrumentation laboratory are also involved in this project. A parameter study of several electromagnetic sampling elements is being planned. Materials have been purchased for a small anechoic chamber that was designed specifically for accurate antenna impedance measurements. To complement the study, advanced electromagnetic simulation software has been purchased to aid in modeling antenna performance. The folded dipole and sinuous antenna will be studied next quarter.

Several approaches to integrating graduate students into project activities are currently being explored.

e2e Project

Milestone	Original Deadline	Revised Deadline	Date Completed
e2e project initiated	07-01-01		07-01-01
DM WBS out to 2006	02-01-01		12-01-01
First version e2e project book	08-01-01	11-01-01	
Submit revised COBRA proposal	08-01-01		08-15-01
DM review	09-17-01	11-14-01	
Install interim VLA archive server	12-01-01		
Internal tests of VLA interim archive	01-15-02		
External tests of VLA interim archive	03-15-02		
Announce VLA interim archive server	06-01-02		
Archive RFP issued	10-01-01	06-01-02	

Definition of the e2e (End-to-End) project continues. In collaboration with the AOC scientific staff, we have filled out the scientific requirements for e2e processing. In the next quarter, we will conclude this phase and move on to discuss the requirements with telescope operations. Project documentation is available at http://www.nrao.edu/e2e.

Much of the funding for e2e activities comes from internal contracts with other projects (e.g., ALMA, EVLA, GBT). 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 received funding for a downsized proposal: this provides $520K to last two years. In addition, we have received funding for one position for five years as part of the NRAO collaboration in an NVO proposal to NSF/ITR.

An e2e scientist with deep knowledge of and experience in synthesis processing has been appointed (John Benson transferred from VLA/VLBA Scientific Support). A position for a C++/Java developer is currently being advertized.

Sufficient definition of scientific requirements is available to allow us to proceed with some prototyping work. We plan to deploy rapidly interim archive and pipeline servers for the VLA, with a goal of providing interim archive and pipeline capabilities by the middle of 2002. While these will not be the final systems to be deployed, we expect to gather experience from these efforts and to provide some useful interim capabilities for VLA observers. The deployment of the interim archive is being pursued in collaboration with the VLA/VLBA Computing Division.

An external, AUI-sponsored review of DM activities and management planned for September 19-20, 2001, was re-scheduled following the September 11 attacks. The review committee is now scheduled to meet November 14-15, 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
AIPS++ Developer's Pre-release	09-24-00	12-01-01	
AIPS++ Release v1.5	04-30-01	05-15-01	06-03-01
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	12-01-01	
AIPS++ workshop in Washington D.C.	09-06-01		09-06-01
GBT science observing	10-01-01	12-15-01	
AIPS++ Release v1.6	10-15-01	11-15-01	
WBS for AIPS++ Release v1.7	10-20-01	11-20-01	
Formalize AIPS++ user support and operations division	11-01-01		
Form AIPS++ Technical Advisory Group	11-15-01		
AIPS++ booth at AAS, Washington D.C.	01-10-02		

During this quarter, effort in DM Technology Development has remained focused primarily on AIPS++, as it has in recent quarters. 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. This effort also includes public outreach to the user community as an important component.

AIPS++ is in a regular six-month release cycle at present. The fifth public release of AIPS++ (v1.6) is scheduled for November 2001. Each development cycle proceeds by phases of planning, WBS definition, code development, implementation, and release preparation. This quarter has fallen within the second half of the development cycle for v1.6, and code development has proceeded during the quarter in line with the development plan defined in May 2001 for this release. The development focus for v1.6 follows closely the overall objective of scientific integration described above. This includes continued work on end-to-end reduction for the VLA as a primary NRAO goal. Similar efforts are underway by AIPS++ consortium partners for the BIMA and ATCA telescopes. Other targets addressed during this cycle include improvements in visibility and image visualization, calibration capabilities, single-dish integration and scientific user documentation, amongst others. Code development efforts have proceeded in concert with

regular work in defect identification and correction, and performance monitoring and enhancement.

The previous release has been distributed in CD-ROM form to approximately 750 users thus far. This has included distribution at public meetings and by mailings in response to user requests. A binary patch was published this quarter on the AIPS++ web page to allow users to update the v1.5 release of June 2001. A professional brochure and poster were also developed for AIPS++ during the quarter, consistent with the layout and format of other NRAO promotional materials.

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 user groups, both in the area of synthesis testing (Socorro and Charlottesville) and single-dish testing (Green Bank). We conducted an external AIPS++ tutorial at U. Maryland during this quarter which was attended by a total of approximately 25-30 people drawn from U. Maryland, NRL, USNO, GSFC, and other local institutes. This was followed by a visit to NRL dedicated to further AIPS++ data reduction tutorials and discussions. We also plan a demonstration and CD-ROM distribution at the Astronomical Data Analysis and Software Systems meeting scheduled for early October this year.

The ALMA AIPS++ test, initiated over the summer, has proceeded during this quarter. The working group, comprising ALMA and AIPS++ personnel, has met by teleconference on an approximate monthly schedule. Dominique Broguiere (IRAM) spent two weeks in Socorro during this quarter to become more familiar with AIPS++ development and the overall system architecture. In return, Dominique helped local AIPS++ personnel become more expert in CLIC/GILDAS reduction, programming and architecture. A reciprocal visit by AIPS++ personnel to IRAM is scheduled for November this year. Code development for the IRAM test has commenced and an initial framework for the ALMA-TI data filler has been added to the system. Negotiations were initiated during this quarter for a closer formal coordination tie between the ALMA and AIPS++ projects.

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 a pipeline server system was specified and procured for the VLA and will be deployed in Socorro. This system will be used for pipeline development. In personnel matters, Joe McMullin became Deputy Project Manager for AIPS++ in August 2001. In addition, efforts are continuing to fill vacancies in the parallelization and visualization NSF 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

Milestone	Original Deadline	Revised Deadline	Date Completed
Revise Security Policy	02-15-01	01-31-02	
Upgrade SSH in GB, NM	03-01-01	08-31-01	08-15-01
Testbed VPN	09-30-01	12-31-01	
Mail gateway and IDS purchases	12-31-01		
Web-server deployment in GB, NM, TU	07-31-01	12-31-01	
Complete CCE-compliant UNIX OS upgrades	10-15-01	12-31-01	
CCE design (to infrastructure level)	10-31-01	11-30-01	
CCE design (core applications)	03-31-02		
DHCP/DDNS integration decision	11-30-01		
W2K Active Directory testing	08-15-01	11-30-01	
Final W2K domain design	09-01-01	12-31-01	
Begin W2K domain deployment	10-15-01	01-31-02	

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. Despite frequent receipt of virus-carrying email attachments and occasional situations where desktop anti-virus definitions or software security patches were out of date, viruses have rarely managed to infect NRAO systems; even the CodeRed and NIMDA worms which inflicted considerable damage worldwide this past quarter were unable to get more than a toehold thanks to our other precautions. Our multi-faceted approach to security continues to prove its value.

During the last quarter, the SSH upgrade in Socorro and Green Bank was completed. Due to limited staff time, however, the Computing Security Policy revisions and VPN (Virtual Private Networking) tests have yet to be done. VPN is needed for employees who are required to work frequently or for extended periods of time at non-NRAO locations, and to support telecommuters during construction at Edgemont Road in Charlottesville. The Policy must be revised to accommodate these issues as well as special-purpose Web servers.

As planned, we have now begun examination of techniques to make enhanced monitoring and intrusion detection manageable with the current staff. One-time supplemental funding resulting from the change in fiscal year-end will allow us to purchase software and/or hardware

which, after initial deployment, should improve these capabilities and reduce the staff time that would otherwise be needed to perform them. We will also be able to supplement desktop anti-virus detection, which relies on every single system to be effective, with software to detect and handle viruses at our email delivery gateways. These purchases will be made during the coming quarter.

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

1. ***Improving Web services***: Our recently-implemented Web services support emerging standards for Web development and dynamic content (such as PHP) that were not previously available at the NRAO. Identical mirroring servers for all four sites have been delivered and are being configured in Charlottesville before deployment 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. This effort is somewhat behind schedule due to demands on Charlottesville staff time, but is expected to be complete by the end of 2001.
2. ***The Common Computing Environment project, or CCE (UNIX)***: CCE-compliant Solaris 8 upgrades are complete in Green Bank and Tucson, and are close to completion in Socorro and Charlottesville. Due to the imminent release of RedHat Linux 7.2, which incorporates a number of patches and is expected to be more stable than 7.1, the group decided to postpone Linux upgrades until 7.2 is available. This should occur in October, and most upgrades should be complete by the end of 2001. During this time, the group will also finish the definition of standards in the most important remaining infrastructure areas, such as electronic mail delivery. By the end of the coming quarter, we will begin the next step: determining the set of core UNIX applications that will be installed on all desktop and public NRAO systems.
3. ***CCE (Windows)***: This group is developing an NRAO-wide Active Directory (AD) design and migration plan for the new Windows 2000 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. At the end of this quarter we purchased enough Windows 2000 licenses (325) to allow us to upgrade all Windows desktops at the Observatory. The week of NRAO-wide AD design testing scheduled for early August was only partially successful due to conflicting demands on staff time and test systems, and has been rescheduled for late October. Before the AD design can be completed, we must also decide how deeply to integrate Dynamic DNS and DHCP, which control the assignment of network names and addresses to computers and other network devices, with the existing network infrastructure. A larger group including our senior UNIX, Windows, and network administrators will be

involved in this discussion, since it has implications for the long-term future of all NRAO networking.

Observatory-wide Communications

Milestone	Original Deadline	Revised Deadline	Date Completed
Chg long distance service in Green Bank	05-31-01	10-31-01	
Chg long distance service in Tucson	05-31-01	10-31-01	
Deploy most new video conferencing services	11-30-01		
Decision on intranet contract for next years	12-31-01		

The use of video conferencing between the major NRAO sites has reached a point where more than 50 percent of the overlapping work hours between the NRAO sites in the Mountain and Eastern time zones have regularly scheduled conferences. We also continue to support video conferences between the NRAO sites and with other organizations, such as the Max Planck Institut fuer Radioastronomie (MPIfR) and the European Southern Observatory (ESO). Last quarter, we proposed significant enhancement to the video services at the major NRAO sites, particularly to allow much easier access to scientific colloquia between sites. With additional funds unexpectedly available this quarter, we were able to bring these plans to fruition and to enhance the scope.

When all equipment is installed, we will be able to support three simultaneous video conferences. We will have permanently installed, and therefore immediately available, video conferencing equipment in eight different facilities. In Socorro, Green Bank, and Charlottesville we will have equipment in both the local auditorium and the main conference room; we will also have equipment in the conference rooms in Tucson and at the VLA site. We will also have a more limited installation in a small conference room in Green Bank. This will enable us to test the usefulness of smaller installations, with an eye to making these available at the other sites. In Socorro, we are also planning for permanently mounted microphone arrays and video projectors. The latter will be in ceiling mounts and will also be available for use in local meetings.

We were able to obtain equipment on loan to help us prepare purchase requisitions for equipment that will function well with our existing equipment. Purchase orders for much of the equipment were placed this quarter. The remaining orders will be placed in October. We presently plan to have most of the new equipment deployed by the end of November. Because of manpower limitations, the new services in New Mexico may be deployed later than this.

Due to the lack of availability of manpower earlier in the year, we made the decision to delay the change of long distance phone service at Green Bank and Tucson. This is now progressing, and the changes should be in place early next quarter.

We will need to work on the renewal of our inter-site communications (intranet) contract during the coming quarter.

Telescope Usage

The following telescopes have been scheduled for research and maintenance in the following manner during the third quarter of 2001.

	VLA	VLBA	GBT
Scheduled Observing (hrs)	1652.9	1007.5	
Scheduled Maintenance and Equipment Changes	232.3	161.5	
Scheduled Tests and Calibration	255.8	386.0	
Time Lost	73.1	33.7	
Actual Observing	1579.8	973.8	160.0

VLA Observing Programs

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

No.	Observer(s)	Programs
AA259	Alexander, P. (Cambridge) Clemens, M. (Cambridge)	Star formation in galaxies undergoing tidal interaction. 20 cm
AB956	Benz, A. (SFIT, ETH) Bastian, T. Mann, G. (Ondrejov Obs) Klein, K. (Paris Obs) Gary, D. (NJIT)	Electron beam emission in the solar corona. 20 cm
AB982	Blundell, K. (Oxford) Dubner, G. (IAFE) Mioduszewski, A. Kassim, N. (NRL)	Imaging the W50-SS433 system at 74 MHz. 400 cm
AB994	Berger, E. (Caltech)	Multi-frequency monitoring of the Brown Dwarf LP944-20. 1.3, 3.6, 6, 20 cm
AB995	Brogan, C. Goss, W. M. Claussen, M. Hoffman, I.	OH Maser search toward supernova remnant HB21. 20 cm
AB996	Bowen, D. (Princeton) Brinks, E. (Guanajuato U.) Tripp, T. (Princeton) Jenkins, E. (Princeton) Huchtmeier, W. (MPIR, Bonn)	LSB Galaxy SBS 1543+593: a nearby damped Lyman absorber. 20 cm
AB998	Bower, G. (UC, Berkeley) Falcke, H. (MPIR, Bonn) Brunthaler, A. (MPIR, Bonn) Mellon, R. (Penn State)	Linear and circular polarization of M81. 1.3, 2, 3.6, 6 cm

AB999	Beck, R. (MPIR, Bonn) Berkhuijsen, E. (MPIR, Bonn) Horellou, C. (Chalmers, Onsala) Fletcher, A. (Newcastle) Shukurov, A. (Newcastle)	Coupling of gas and magnetic fields in M51. 6 cm
AB1000	Brosius, J. (NASA/GSFC) Thompson, B. (NASA/GSFC) White, S. (Maryland) Gallagher, P. (NJIT) Gary, D. (NJIT)	Coronal magnetography using radio and EUV data. 2, 3.6, 6, 20 cm
AB1001	Bergman, P. (Chalmers, Onsala) Kerschbaum, F. (Vienna Univ.) Olofsson, H. (Stockholm Obs)	Circumstellar envelope of AGB Star RV Boo. 0.7 cm
AB1002	Boboltz, D. (USNO) Claussen, M.	SiO thermal and maser emission in long period variables. 0.7 cm
AB1003	Beck, R. (MPIR, Bonn) Laine, S. (STScI) Shukurov, A. (Newcastle) Sokoloff, D. (Moscow/SSAI)	Kiloparsec scale jet in the barred spiral NGC 7479. 3.6, 6 cm
AB1004	Blundell, K. (Oxford) Perley, R. Rawlings, S. (Oxford) Kassim, N. (NRL) Lazio, T. (NRL) Owen, F.	The very large, steep spectrum outer structure of a FR II radiogalaxy. 90 cm
AB1006	Berger, E. (Caltech) Rutledge, R. (Caltech) Bildsten, L. (UC, Santa Barbara) Martin, E. (Hawaii) Gizis, J. (IPAC) Basri, G. (UC, Berkeley)	Search for emission from L and late M stars. 3.6 cm
AB1013	Braatz, J.	Water maser in Mk 1419. 1.3 cm

AB995	Brogan, C. Claussen, M. Goss, W. M. Hoffman, I.	OH Maser search toward supernova remnant HB21. 18 cm
AC524	Cartwright, J. (Caltech) Taylor, G. Readhead, A. (Caltech) Pearson, T. (Caltech)	Polarization monitoring observations of 3C273. 0.7, 1.3 cm
AC582	Clarke, T.	Faraday study of galaxy cluster core sources. 6 cm
AC583	Clarke, T. Enslin, T. (MPIAP, Munich) Kassim, N. (NRL) Neumann, D. (CNRS, France)	Low frequency observations of diffuse emission in Abell 2256. 90 cm
AC589	Clarke, T. Cohen, A. (NRL) Kassim, N. (NRL) Enslin, T. (MPIAP, Munich) Neumann, D. (CNRS, France)	Diffuse emission in galaxy cluster Abell 754. 90 cm
AC592	Condon, J. Jarrett, T. (IPAC) Helou, G. (IPAC)	The second "taffy" galaxy pair. 6, 20 cm
AC598	Cohen, A. (NRL) Enslin, T. (MPIAP, Munich) Kassim, N. (NRL)	Possible relic in galaxy cluster AWM 4. 90 cm
AC599	Clarke, T. Owen, F.	Search for halo or relics in Butcher-Oemler Cluster Abell 2125. 90 cm
AC600	Clarke, T.	Faraday study of galaxy cluster core sources. 6 cm
AC601	Chandler, C. Low, F. (Arizona)	Nature of dust in the debris around HD 98800. 0.7 cm

AC603	Coziol, R. (Guanajuato U.) Brinks, E. (Guanajuato U.) Bravo-Alfaro, H. (Guanajuato U.) Lopez-Cruz, O. (Guanajuato U.) Iovino, A. (Brera Obs) de Carvalho, R. (Obs. Nat. Brasil)	Gas in compact galaxy groups. 20 cm line
AC605	Claussen, M. Wilner, D. (CfA)	Monitoring continuum emission from TW Hya. 2, 3.6, 6, 20 cm
AC606	Cappa, C. (IAR) Goss, W. M. van der Hucht, K. (Utrecht)	Survey of radio continuum emission from Wolf-Rayet stars. 3.6 cm
AD441	Dwarakanath, K. (Raman Institute) Kassim, N. (NRL) Owen, F. Perley, R.	The radio halo of Virgo A at 74 MHz.
AD452	Dahlem, M. (ESO) Ehle, M. (ESA, Spain)	HI observations of galaxies with radio halos. 20 cm
AD456	Doi, A. (NAO, Japan) Kameno, S. (NAO, Japan) Kohno, K. (NAO, Japan)	Radio quiet AGN. 1.3 cm
AE145	Eyres, S. (Lancashire) Zijlstra, A. (Manchester) Kurtz, D. (Lancashire) Tyne, V. (Keele) Evans, A. (Keele) Smalley, B. (Keele)	Planetary nebula around V4334 Sgr. 2, 6 cm
AF370	Falcke, H. (MPIR, Bonn) Brunthaler, A. (MPIR, 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

AF383	Fomalont, E. Kellermann, K. Rossi, P. (MPIfEP, Garching) Shaver, P. (ESO)	Chandra deep field south. 6, 20 cm
AF386	Fish, V. (CfA) Reid, M. (CfA)	Ammonia absorption in H II regions. 1.3 cm line
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. (Wisconsin)	HI survey of clusters in the local universe. 20 cm
AG594	Gary, D. (NJIT) Lee, J. (NJIT) Gallagher, P. (NJIT) Bastian, T.	Solar active regions with VLA, OVSA, and HESSI. 2, 3.6, 6, 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. 90 cm

AG609	Giovanelli, R. (Cornell) Haynes, M. (Cornell) Spekkens, K. (Cornell) Valotto, C. (Cornell)	Fast rotators - dark matter or compact massive nuclei? 20 cm line
AG611	Gentile, G. (Bonn U.) Kalberla, P. (Bonn U.) Klein, U. (Bonn U.) Salucci, P. (Trieste Obs) Borriello, A. (Trieste Obs)	HI rotation curves of galaxies with optical rotation curves. 20 cm line
AG612	Guedel, M. (Paul Scherrer) Smith, K. (SFIT, ETH) Beasley, A. (OVRO) Audard, M. (SFIT, ETH) Benz, A. (SFIT, ETH) Mewe, R. (Utrecht) Brinkman, A. (Utrecht) Savin, D. (Columbia)	X-ray and radio emission from stellar coronae. 3.6, 6 cm
AG613	Gao, Y. (IPAC) Hibbard, J. Xu, C. (IPAC) Wang, W-H. (Hawaii) Lo, K.-Y. (SA/IAA, Taiwan)	HI in gas rich LIRGs. 20 cm line
AG617	Guerra, E. (Rowan University) Myers, S. Partridge, R. (Haverford College)	Single epoch radio spectral energy distributions from 1.4 GHz to 23 GHz. 1.3, 3.6, 6, 20 cm
AH685	Haarsma, D. (Haverford) 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 line

AH717	Hardcastle, M. (Bristol, UK) Sakelliou, I. (Mullard Space Lab)	Jets and their termination in wide angle tail radio galaxies. 3.6 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 line
AH744	Harris, D. (CfA) Krawczynski, H. (Yale) Kassim, N. (NRL) Katz-Stone, D. (USNA) Lane, W. (Groningen/Kapteyn)	Jet-intracluster medium interactions of radio galaxy 3C 129. 20 cm
AH745	Hofner, P. (Puerto Rico) Kurtz, S. (Mexico/UNAM) Araya, E. (Puerto Rico)	Dust continuum distribution in hot molecular cores. 0.7 cm
AH746	Healy, K. (Arizona State) Claussen, M. Hester, J. (Arizona State)	Observations of protostellar envelopes in M16. 0.7 cm
AH747	Helfand, D. (Columbia) Becker, R. (UC, Davis) White, R. (STScI)	A P-band galactic plane survey. 90 cm
AH751	Hollis, J. (NASA/GSFC) Jewell, P. Palmer, P. (Chicago) Pedelty, J. (NASA/GSFC) Snyder, L. (Illinois) Lovas, F. (Illinois)	Search for interstellar glycine. 0.7 cm
AH754	Henkel, C. (MPIR, Bonn) Peck, A. (MPIR, Bonn) Menten, K. (MPIR, Bonn) Neininger, N. (Bonn U.) Weiss, A. (Bonn U.) Mauersberger, R. (IRAM) Hagiwara, Y. (MPIR, Bonn)	Ammonia in nearby galaxies. 1.3 cm

AH759	Hagiwara, Y. (MPIR, Bonn) Diamond, P. (Manchester)	Water maser in NGC 6240. 400 cm
AI088	Ivison, R. (U. College London) Papadopoulos, P. (Leiden) Carilli, C. Barvainis, R. (NSF) Lewis, G. (AAO)	CO J=1-0 and J=2-1 mapping of the z=3.9 quasar APM 08279+5255. 1.3 cm
AI092	Irwin, J. (Queens) English, J. (Manitoba) Saikia, D. (TIFR) Spekkens, K. (Cornell)	HI observations of NGC 2683 and NGC 5433. 20 cm
AI093	Ivison, R. (U. College London) Greve, T. (Edinburgh) Carilli, C. Papadopoulos, P. (Leiden) Lewis, G. (AAO)	Mapping high z gas rich mergers via CO J=1-0. 0.7, 1.3 cm
AJ282	Jamrozy, M. (Jagellonian) Machalski, J. (Jagellonian)	Detection of radio core in giant radiosource candidates. 6 cm
AJ283	Johnston-Hollitt, M. (CSIRO) Clarke, T.	High resolution observations of the radio relic in 0917+75. 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.
AK532	Kobulnicky, C. (Wisconsin) Martin, C. (Caltech)	NGC 1569, the nearest starburst with a galactic wind. 2, 6, 20 cm
AK533	Kempner, J. (Virginia) Sarazin, C. (Virginia) Rudnick, L. (Minnesota)	Cluster radio relics discovered in WENSS. 20, 90 cm

AK534	Kassim, N. (NRL) Lazio, T. J. W. (NRL) Anantharamaiah, K.(Raman Institute) Nord, M. (New Mexico)	74 MHz imaging of the Galactic center. 400 cm
AK536	Kern, J. (NMIMT) Hankins, T. (NMIMT) Dickerson, J. (NMIMT)	Dual frequency observations of the Vela pulsar. 2, 3.6, 6 cm
AK539	Kern, J. (NMIMT) Hankins, T. (NMIMT) Dickerson, J. (NMIMT)	Notches in the average profile of pulsar PSR 1919+21. 400 cm
AL529	Lacey, C. (NRL) Kassim, N. (NRL) Dyer, K. Brogan, C. Dwarakanath, K. (Raman Institute) Anantharamaiah, K. (Raman Institute) Bhatnagar, S. (NCRA, India)	Low frequency observations of galactic SNRs. 90 cm
AL535	Lim, J. (SA/IAA, Taiwan) Ho, P. (CfA)	HI environment of low redshift QSOs. 20 cm
AL538	Laing, R. (Oxford) Canvin, J. (Oxford) Bridle, A. Cotton, W. Giovannini, G. (Bologna)	Rotation measure of the jets in NGC 315. 20 cm
AL541	Lim, J. (SA/IAA, Taiwan) Ho, P. (CfA)	HI imaging of low redshift QSO hosts and their environments. 20 cm
AL542	Lim, J. (SA/IAA, Taiwan) Ho, P. (CfA)	HI imaging of Seyfert galaxies. 20 cm
AL544	Lim, J. (SA/IAA, Taiwan) Heidt, J. (Heidelberg Obs) Nilsson, K. (Turku) Ho, P. (CfA)	HI imaging of BL Lac 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
AL549	Lim, J. (SA/IAA, Taiwan) Liang, M-C. (SA/IAA, Taiwan) Choi, M. (SA/IAA, Taiwan) Su, Y-N. (SA/IAA, Taiwan)	Imaging the dust disks of Vega type stars. 0.7 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
AM674	Mohan, N. (Raman Institute) Kurtz, S. (Mexico/UNAM) Anantharamaiah, K. (Raman Institute)	Extended emission around ultracompact HII regions. 1.3, 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
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
AM693	Myers, S. Becker, R. (UC, Davis)	C-band mini-survey of NOAO deep wide field. 6, 20 cm

AM694	Muhle, S. (Bonn U.) Klein, U. (Bonn U.) Wilcots, E. (Wisconsin) Duric, N. (New Mexico) Huttenmeister, S. (Bochum)	Polarization study of the post starburst dwarf galaxy NGC 1569. 6 cm
AM701	McKean, J. (Manchester) Browne, I. (Manchester) Jackson, N. (Manchester) Rusin, D. (Pennsylvania)	Spectral energy distributions of faint flat-spectrum radio galaxies. 1.3, 2, 3.6, 6 cm
AM703	Muno, M. (MIT) Belloni, T. (Brera Obs) Dhawan, V. Rupen, M.	Searching for compact jets in neutron star X-ray binaries. 1.3, 3.6, 6, 20 cm
AN095	Neff, S. (NASA/GSFC) Ulvestad, J.	Star formation in merging galaxies: an age-ordered sequence. 3.6, 6 cm
AN099	Natta, A. (Arcetri) Testi, L. (Arcetri) Wilner, D. (CfA) Shepherd, D.	Structure of protoplanetary disk around CQ Tau. 0.7 cm
AN102	Nord, M. (New Mexico) Kassim, N. (NRL) Lazio, T. J. W. (NRL) Duric, N. (New Mexico) Falcke, H. (MPIR, Bonn)	HII regions in absorption. 400 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

AO160	Osten, R. (Colorado/JILA) Brown, A. (Colorado/JILA) Ambruster, C. (Villanova) Linsky, J. (Colorado/JILA) Rector, T. (KPNO-NOAO) Drake, S. (NASA/GSFC)	X-ray and radio observations of the red dwarf flare star EV Lac. 2, 3.6, 6 cm
AO162	O'Neill, K. (NAIC) van Gorkom, J. (Columbia)	Extended HI envelopes around low surface brightness galaxies. 20 cm
AP428	Pratap, P. (Haystack)	44 GHz methanol masers in NGC 7538. 0.7 cm
AQ014	Qi, C. (CfA) Zhang, Q. (CfA) Blake, G. (Caltech)	Ammonia in protoplanetary disks. 1.3 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. (MPIR, Bonn)	Cluster "relic" physics - spectral and X-ray studies. 6, 20, 90 cm
AR458	Rupen, M. Mioduszewski, A. (Sydney) Dhawan, V.	Radio and X-ray activity in Galactic black hole X-ray transients. 0.7, 1.3, 2, 3.6, 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, 90 cm

AR464	Reynoso, E. (IAFE) Hughes, J. (Rutgers) Moffett, D. (Furman)	Expansion of Tycho's supernova remnant, 3C10. 20 cm
AR471	Ramesh, B. (Raman Institute) Mohan, N. (Raman Institute) Anantharamaiah, K. (Raman Institute)	Mapping the molecular density structure in NGC 253: HC3N. 0.7 cm
AS701	Sokoloski, J. (Southampton) Kaiser, C. (MPIfEP, Garching) Charles, P. (Southampton)	Symbiotic binaries during outburst. 3.6, 6, 20 cm
AS708	Sridharan, T. (CfA) Wyrowski, F. (Maryland) Zhang, Q. (CfA) Hunter, T. (CfA) Beuther, H. (MPIR, Bonn) Menten, K. (MPIR, Bonn) Schilke, P. (MPIR, Bonn)	Ammonia disks around high mass young stars. 1.3 cm
AS711	Saito, M. (CfA) Kawabe, R. (NAC, Japan) Beltran, M. (CfA)	Continuum observations of low-mass protostars in Taurus. 3.6 cm
AS712	Sewilo, M. (Wisconsin) Watson, C. (Wisconsin) Churchwell, E. (Wisconsin) Goss, W. M. Kurtz, S. (Mexico/UNAM) Hofner, P. (Puerto Rico)	Search for broad line HII regions. 0.7 cm
AS713	Schmitt, H. Calzetti, D. (STScI) Armus, L. (Caltech)	Local starbursts galaxies. 2, 3.6 cm

AS714	Schindler, S. (Liverpool JMU) Feretti, L. (Bologna) Wambsganss, J. (API, Potsdam) Schwope, A. (API, Potsdam) de Filippis, B. (Liverpool JMU) Castillo-Morales, A. (Liverpool JMU)	Distant galaxy cluster RBS 797. 3.6, 20 cm
AT258	Thilker, D. Elmegreen, B. (IBM) Efremov, Y. (Moscow/SSAI) Larsen, S. (Potsdam)	HI imaging of giant bubbles and arcs in NGC 6946. 20 cm
AT259	Thomas, H. (Cambridge) Clemens, M. (Cambridge) Alexander, P. (Cambridge) Green, D. (Cambridge) Eales, S. (Wales) Dunne, L. (Wales)	HI observations of galaxies in the JCMT/SCUBA survey. 20 cm
AT261	van der Tak, F. (MPIR, Bonn) Menten, K. (MPIR, Bonn)	Small scale distribution of dust around massive protostars. 7 cm
AU072	Uson, J. van Gorkom, J. (Columbia) Shambrook, A. (UC, Santa Cruz)	HI mapping of Abell 2029. 20 cm line
AW362	White, S. (Maryland)	The stellar activity cycle on active stars. 3.6, 6, 20 cm
AW559	White, S. (Maryland) Kundu, M. (Maryland) Garaimov, V. (Maryland)	Microwave, millimeter and hard X-ray observations of solar flares. 2, 6 cm
AW560	Willson, R. (Tufts)	Trans-equatorial loops on the sun. 20, 90 cm
AW561	Willson, R. (Tufts)	Solar flares and microflares. 1.3, 3.6, 6 cm
AW566	Wu, Y. (Beijing Obs) Zhang, Q. (CfA) Huang, M. (CfA) Wang, J. (Beijing Obs) Wu, J. (Beijing Obs)	Structures in protoplanetary disks. 0.7, 3.6, 6 cm

AY123	Young, L. (NMIMT)	Elliptical galaxies: radio continuum and star formation. 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
AZ133	van Zee, L. (Indiana University) Schade, D. (DAO) Cote, S. (NRC, Herzberg)	HI in galaxies with deep Hα imaging. 20 cm
AZ134	van Zee, L. (Indiana University) Salzer, J. (Wesleyan U.) Skillman, E. (Minnesota)	Kinematics of gas rich blue compact dwarf galaxies. 20 cm
BB129	Brogan, C., et al. *See VLBA Program list*	Zeeman observations of OH masers associated with SNRs. 18 cm
BC111	Cotton, W., et al. *See VLBA Program list*	Bright O-rich Mira stars. 0.7 cm
BD069	Diamond, P. (Manchester), et al. *See VLBA Program list*	TX Cam: the final curtain. 0.7 cm
BD079	Diamond, P. (Manchester), et al. *See VLBA Program list*	TX Cam returns. 0.7cm
BG113	Gomez, J-L. (IAA), et al. *See VLBA Program list*	Monitoring superluminal componenets in 3C120. 0.7, 1.3, 2 cm
BG118	Greenhill, L. (CfA), et al. *See VLBA Program list*	SiO maser motions in Orion BN/KL. 0.7 cm
BH086	Homan, D. (Brandeis), et al. *See VLBA Program list*	Misaligned jet in PKS 1510-089. 6 cm
BM126	Mutoh, M. (NAO), et al. *See VLBA Program list*	Target of Opportunity observations of the X-ray binary Cygnus X-3
BM157	Mantovani, F. (Bologna), et al. *See VLBA Program list*	Polarization and rotation measaure in CSS QSOs. 3.6, 6 cm

BM159	Momjian, E. , et al. *See VLBA Program list*	Observations of the ultra luminous infrared galaxies.
V069	Zensus, J. A. (MPIR, Bonn), et al. *See VLBA Program list*	Jet in quasar 3C345.
W418	Gurvits, L. (JIVE), et al *See VLBA Program list*	Extremely variable IDV source J1819+3845
W420	Asada, K. (NAO), et al. *See VLBA Program list*	Third epoch observation of 3C84.

VLBA Observing Programs

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

No.	Observer(s)	Programs
BA045	Alberdi, A. (IAA) Gomez, J. (IAA) Marcaide, J. (Valencia) Marscher, A. (Boston University) Perez-Torres, M. (IRA)	Interaction of moving and standing components in 4C39.25. 0.7, 1, 2 cm
BA051	Aller, H. (Michigan) Aller, M. (Michigan) Homan, D. (Brandeis) Hughes, P. (Michigan) Roberts, D. (Brandeis) Wardle, J. (Brandeis)	Oblique shocks in jets: evolution of Parsec-scale structures of sources with rapidly variable polarization. 0.7, 1, 4 cm
BB129	Brogan, C. Claussen, M. Goss, W.M.	VLBA Zeeman observations of OH masers associated with SNRs. 20 cm with VLA
BB130	Bower, G. (UC,Berkeley) Backer, D. (UC, Berkeley) Falcke, H. (MPIR, Bonn) Goss, W. M. McGary, R. (CfA) Zhao, J-H. (CfA)	Detecting outflow and expansion in Sagittarius A*. 1, 0.7 cm
BB136	Brisken, W. (Princeton) Golden, A. (NUI) 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
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, C.	Geodesy/astrometry observations for 2001. 3.6 cm
BC115	Chatterjee, S. (Cornell) Cordes, J. (Cornell) Goss, W.M. Fomalont, E. Beasley, A. (Caltech) Benson, J. Lazio, T. J. W. (NRL) Arzoumanian, Z. (NASA/GSFC)	Neutron star kinematics: gated VLBA pulsar astrometry. 18 cm

BC116	Chatterjee, S. (Cornell) Cordes, J. (Cornell) Goss, W. M. Fomalont, E. Benson, J. Lazio, T. J. W. (NRL) Arzoumanian, Z. (NASA/GSFC)	High frequency VLBA astrometry of pulsars. 6 cm
BD069	Diamond, P. (Manchester) Kemball, A.	TX Cam: the final curtain. 0.7 cm with VLA
BD079	Diamond, P. (Manchester) Kemball, A.	TX Cam returns. 0.7 cm with VLA
BE023	Edwards, P. (ISAS) Piner, B. (Whittier College)	Markarian 421-monitoring after a TeV outburst. 1 cm
BE024	Edwards, P. (ISAS) Horan, D. (Whipple Obs.) Piner, G. (Whittier College)	New TeV gamma-ray source H1426+428. 4 cm
BF068	Barthel, P. (Kapteyn) Filho, M. (Kapteyn) Ho, L. (OCIW) Nagar, N. (Arcetri)	Parsec scale radio cores in transition LINERs. 2, 6, 13 cm
BG113	Gomez, J. (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 superluminal components in 3C120. 1.3, 2, 7 cm with VLA
BG114	Gabuzda, D. (JIVE) Cawthorne, T. (Lancashire) Pushkarev, A. (ASC)	Toroidal B fields in BL Lac objects. 1, 2, 4, 6, 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 with VLA
BH077	Hachisuka, K. (Graduated Univ.) Fujisawa, K. (NAO) Honma, M. (NAO) Imai, H. (NAO) Kameya, K. (NAO) Manabe, S. (NAO) Miyoshi, M. (NAO) Mochizuki, N. (Graduated Univ.) Nisio, M. (Kagoshima) Omodaka, T. (NAO) 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
BH083	Hirota, T. (Kagoshima) Hachisuka, K. (Graduate Univ.) Imai, H. (NAO) Omodaka, T. (Kagoshima) Sasao, T. (NAO)	Measurements of proper motion of the Orion-Monoceros molecular cloud complex. 1 cm
BH085	Hoffman, I. Brogan, C. Claussen, M. Goss, W. M.	VLBA + VLA1 imaging of the 1720 MHz OH masaers in SNR IC 443. 20 cm
BH086	Homan, D. (Brandeis) Wardle, J. (Brandeis) Roberts, D. (Brandeis) Attridge, J. (Haystack)	The misaligned jet in PKS 1510-089. 6 cm with VLA

BH087	Ho, P. (CfA) Anglada, G. (IAA) Canto, J. (UNAM) Curiel, S. (UNAM) Garay, G. (UNAM) Gomez, J. (IAA) Greenhill, L. (CfA) Ho, P. (CfA) Patel, N. (CfA) Rodriguez, L. (UNAM) Sollins, P. (CfA) Torrelles, J. (IAA)	Tracking a puff of spherically symmetric ejection Cepheus A. 1 cm
BH088	Hagiwara, Y. (MPIR, Bonn) Diamond, P. (Manchester) Miyoshi, M. (NAO)	Single black hole formation in an on-going merger? 1 cm
BI018	Iguchi, S. (NAO) Fujisawa, K. (NAO) Inoue, M. (NAO) Kameno, S. (NAO)	An extremely Doppler-boosting source: OTO81. 0.7, 1, 2, 4 cm
BK076	Kurayama, T. (NAO) Sasao, T. (NAO)	Parallax measurment of Miras for Period-luminosity relation. 1 cm
BK084	Kameno, S. (NAO) Inoue, M. (NAO) Sawada-Satoh, S. (ISAS) Wajima, K. (ISAS) Zhi-Qiang, S. (ISAS)	Free-free absorption towards an active galaxy NGC 1052. 2, 4, 13 cm
BL086	Lobanov, A. (MPIR, Bonn) Ros, E. (MPIR, Bonn) Zensus, J. A. (MPIR, Bonn)	Monitoring of the ongoing flare in the VLBI core of 3C345. 0.7, 1, 2 cm
BL102	Lara, L. (IAA) Alberdi, A. (IAA) Guirado, J. (Valencia) Marcaide, J. (Valencia) Perez-Torres, M. (IRA) Ros, E. (MPIR, Bonn)	Kinematics and rotation measure in the inner jet of 3C395. 1, 2 cm

BL104	Lobanov, A. (MPIR, Bonn) Roland, J. (IAP) Ros, E. (MPIR, Bonn) Zensus, J. A. (MPIR, Bonn)	Cross-band monitoring of a flare in the VLBI core of 3C345. 0.7, 1, 2 cm
BM126	Mioduszewski, A. Rupen, M.	Target of opportunity observations of the X-ray binary Cygnus X-3 during and after a large flare. 1, 2, 6, 20 cm with VLA
BM140	Massi, M. (MPIR, Bonn) Franciosini, E. (Palermo) Ros, E. (MPIR, Bonn)	The corona of UX Arietis. 3.6 cm
BM142	Marcaide, J. (Valencia) Guirado, J. (Valencia) Perez-Torres, M. (Bologna) Ros, E. (MPIR, Bonn)	Multi-wavelength absolute kinematics in the S5 polar cap sample. 0.7, 2, 3.6 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*. 0.7 cm
BM155	Mutel, R. (Iowa) Helton, A. (Iowa) Su, B. (Yunnan Observatory)	Structure of magnetic fields in AGN Jets: testing the shock model. 0.7, 1, 2 cm
BM156	Mutoh, M. (NAO) Asada, K. (NAO) Fujisawa, K. (NAO) Inoue, M. (NAO) Kameno, S. (NAO)	Test of 90 degrees jump of the polarization position angle in GPS sources. 1, 2, 4, 6, 13, 20 cm
BM157	Mantovani, F. (Bologna) Junor, W. (New Mexico) Saikia, D. (TIFR) Salter, C. (NAIC)	Polarization and rotation measure in CSS QSOs. 3.6, 6 cm with VLA
BM158	Muno, M. (MIT) Dhawan, V. Mirabel, I. (Saclay) Rodriguez, L. (UNAM)	Jet evolution in GRS 1915+105 with VLBA and RXTE. 2, 4, 13 cm

BM159	Mon.jian, E. (Kentucky) Romney, J. Carilli, C. Troland, T. (Kentucky)	Observations of the ultra luminous infrared galaxies. 18 cm with VLA
BM162	Aller, M. (Michigan) Jorstad, S. (Boston) McHardy, I. (Southampton)	Relationship between X-ray flares and superluminal ejections in blazars. 1, 2, 4, 6, 13 cm
BP082	Pyatunia, T. (Applied Research) Aller, M. (Michigan) Aller, H. (Michigan) Gabuzda, D. (JIVE) Jorstad, S. (Boston) Terasranta, H. (Metsahovi)	Multi-frequency polarization of imaging of blazars wich cyclic activity. 0.7, 1, 2, 4 cm
BP083	Polatidis, A. (Onsala) Bondi, M. (IRA) Dallacasa, D. (IRA) Marcha, M. (Lisbon)	Estimating kinematical ages of compact symmetric objects from the 200 mJy flat spectrum radio source sample. 6 cm
BR078	Rupen, M. Dhawan, V.	Target of Opportunity - V445Pup. 4, 13 cm
BS090	Shepherd, D. Claussen, M. Kurtz, S. (UNAM)	Water masers in the massive accretion disk of G192.16. 1 cm
BS092	Shen, Z. (Shanghai Obs.) Chen, Y. (Shanghai Obs) Hirabayashi, H. (ISAS) Jiang, D. (Shanghai Obs) Kameno, S. (NAOJ) Liu, X. (Urumqi Obs)	Probing the center of activity in a CSS superluminal quasar 3C138. 1, 2, 4, 6, 13 cm
BS093	Smith, K. (Zurich) Benz, A. (Zurich) Conway, J. (Onsala) Guedel, M. (PSI Villigen) Montmerle, T. (Saclay) Pestalozzi, M. (Onsala)	Resolving the radio jet of the X-ray emitting protostar YLW15. 4, 6 cm

BS104	Schmitt, H. Antonucci, R. (UC, Santa Barbara) Kinney, A. (NASA) Pringle, J. (IoA) Ulvestad, J.	Parsec-scale jets and the inner structure of Seyfert galaxies. 6 cm
BW054	Walker, R. C. Wrobel, J.	Jet collimation regions. 0.7 cm
BZ027	Zhang, H. (Beijing) Gabuzda, D. (JIVE) Jin, C. (Beijing) Nan, R. (Beijing)	Polarimetric studies of the extended VLBI structures of four CSS sources. 20 cm
BZ028	Zhang, H. (Beijing) Gabuzda, D. (JIVE) Jin, C. (Beijing)) Nan, R. (Beijing)	Parsec-scale rotation measure distributions of three compact CSS sources. 4, 6 cm
V050	Kollgaard, R. (Fermi)	Subparsec scale structure of X-ray selected BL Lacertae objects. 18 cm
W018	Snellen, I. (Cambridge) Tschager, W. (Leiden) Schilizzi, R. (NFRA) de Bruyn, A. G. (NFRA) Miley, G. (Leiden) Rottgering, H. (Leiden) van Langevelde, H. Fanti, C. (Bologna) Fanti, R. (Bologna)	GPS galaxies and quasars. 18 cm
W069	Zensus, J. A. (MPIR, Bonn) Lobanov, A. (MPIR, Bonn) Unwin, S. (JPL) Cohen, M. (Caltech)	Jet in quasar 3C345. 6, 18 cm

W312	Preston, R. (JPL) Pearson, T. (Caltech) Readhead, A. (Caltech) Lister, M. Piner, B. (JPL) Tingay, S. (CSIRO) Hirabayashi, H. (ISAS, Japan) Kobayashi, H. (NAO, Japan) Inoue, M. (NAO, Japan)	0Completing the Pearson-Readhead survey from space. 6 cm
W314	Murphy, D. (JPL) Conway, J. (Chalmers, Onsala) Polatidis, A. (NFRA) Preston, R. (JPL) Hirabayashi, H. (ISAS, Japan) Murata, Y. (ISAS, Japan) Kobayashi, H. (NAO, Japan)	Regular monitoring of 1928+738. 6 cm
W401	Frey, S. (FOMISGO) Gurvits, L. (NFRA) Gabuzda, D. (NFRA) Altschuler, D. (NAIC) Salter, C. (NAIC) Perillat, P. (NAIC) Aller, H. (Michigan) Aller, M. (Michigan) Hirabayashi, H. (ISAS, Japan) Davis, M. (SETI)	Structural variability in the brightest AGN: AO 0235+164. 6, 18 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
W418	Gurvits, L. (NFRA) Dennett-Thorp, J. (Groningen) de Bruyn, A. G. (NFRA)	Extremely variable IDV source J1819+3845. 6 cm with VLA

W420	Asada, K. (NAO, Japan) Kameno, S. (NAO, Japan) Inoue, M. (NAO, Japan) Horiuchi, S. (NAO, Japan) Shen, Z. (ISAS, Japan) Gabuzda, D. (NFRA)	Third epoch observation of 3C84. 6 cm with VLA
W425	Lister, M. Murphy, D. (JPL) Preston, R. (JPL)	High fidelity VSOP imaging of GPS sources. 6 cm
W513	Kameno, S. (NAO, Japan) Sawada-Satoh, S. (ISAS, Japan) Inoue, M. (NAO, Japan) Shen, Z. (ISAS, Japan) Wajima, K. (ISAS, Japan)	FF absorption in NGC 1052. 6 cm
W603	Tingay, S. (CSIRO) Edwards, P. (ISAS, Japan) Reynolds, J. (CSIRO) Tornikoski, M. (Helsinki)	PKS 0521-365. 6 cm

NEW HIRES

Banda, Juana	Jr. Research Associate	7/26/01
Bania, Thomas	Visiting Scientist	8/05/01
Dyer, Kristy	Research Associate	7/26/01
Hankins, Timothy	Visiting Scientist	9/24/01
Hoffman, Ian	Jr. Eng. Associate	9/04/01
Homan, Daniel	Research Associate	8/27/01
McCullough, Randy	Electronics Engineer I	7/02/01
Palmer, Patrick	Visiting Scientist	7/01/01
Rachnev, Miroslav	Research Associate	7/03/01
Reynolds, Eric	Jr. Eng. Associate	8/01/01
Zavala, Robert	Jr Research Associate	9/04/01

TERMINATIONS

Matthew, Lynn	Research Associate	8/31/01
Palmer, Patrick	Visiting Scientist	7/31/01
Rachnev, Miroslav	Research Associate	8/20/01
Schiebel, Dwayne	Electronics Engineer I	7/31/01 (*Retired*)
Thomas, Nathan	Jr. Eng. Associate	7/31/01

PROMOTIONS

Claussen, Mark	to Scientist	7/01/01
Dhawan, Vivek	to Scientist	7/01/01
Glendenning, Brian	to Scientist (Continuing)	7/01/01
Holdaway, Mark	to Scientist	7/01/01
Kingsley, Jeffrey	to Dep Assist Director, ALMA	8/01/01
McMullin, Joe	to Dep Proj Manager, AIPS++	9/01/01
Minter, Anthony	to Associate Scientist	7/01/01
Taylor, Gregory	to Scientist	7/01/01
Ulvestad, James	to Scientist (Continuing)	7/01/01
Webber, John	to Scientist (Continuing)	7/01/01

OTHER

Black, Gregory	to CV from GB	9/01/01
Zensus, J. Anton	to Adjunct Scientist	8/07/01

Publications

You will find attached 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, JULY - SEPTEMBER 2001

AUGUSTO, P.; BROWNE, I.W.A.; WILKINSON, P.N.; JACKSON, N.J.; FASSNACHT, C.D.; MUXLOW, T.W.B.; HJORTH, J.; JAUNSEN, A.O.; KOOPMANS, L.V.; PATNAIK, A.R.; TAYLOR, G.B. B2114+022: A Distant Radio Source Gravitationally Lensed by a Starburst Galaxy.

BALCELS, M.; VAN GORKOM, J.H.; SANCISI, R.; DEL BURGO, C. H I in the Shell Elliptical Galaxy NGC 3656.

BASTIAN, T.S.; PICK, M.; KERDRAON, A.; MAIA, D.; VOURLIDAS, A. The Coronal Mass Ejection of 1998 April 20: Direct Imaging at Radio Wavelengths.

BERGER, E.; KULKARNI, S.R.; FRAIL, D.A. The Host Galaxy of GRB 980703 at Radio Wavelengths - A Nuclear Starburst in a ULIRG.

BIETENHOLZ, M.F.; FRAIL, D.A.; HESTER, J.J. The Crab Nebula's Moving Wisps in Radio.

BIETENHOLZ, M.F.; KASSIM, N.E.; WEILER, K.W. The Radio Spectral Index and Expansion of 3C58.

CAMILO, F.; BELL, J.F.; MANCHESTER, R.N.; LYNE, A.G.; POSSENTI, A.; KRAMER, M.; KASPI, V.M.; STAIRS, I.H.; D'AMICO, N.; HOBBS, G.; GOTTHELF, E.V.; GAENSLER, B.M. PSR J1016-5857: A Young Radio Pulsar with Possible Supernova Remnant, X-ray, and Gamma-ray Associations.

CICHOWOLSKI, S.; PINEAULT, S.; ARMAL, E.M.; TESTORI, J.C.; GOSS, W.M.; CAPPA, C.E. A DRAO and VLA Investigation of the Environment of WR130.

CID FERNANDES, R.; HECKMAN, T.; SCHMITT, H.; GONZALEZ DELGADO, R.; STORCHI-BERGMANN, T. Diagnostics of Composite Starburst + Seyfert 2 Nuclei: Hints on the Starburst-AGN Connection.

DALE, D.A.; HELOU, G.; NEUGEBAUER, G.; SOIFER, B.T.; FRAYER, D.T.; CONDON, J.J. Multiwavelength Observations of the Low Metallicity Blue Compact Dwarf Galaxy SBS 0335-052.

FURUYA, R.S.; KITAMURA, Y.; WOOTTEN, H.A.; CLAUSSEN, M.J.; KAWABE, R. Water Maser Survey Toward Low-Mass Young Stellar Objects in the Northern Sky: Observational Constraints on Maser Excitation Conditions.

HAGIWARA, Y.; DIAMOND, P.J.; NAKAI, N.; KAWABE, R. VLBI Study of Water Maser Emission in the Seyfert 2 Galaxy NGC 5793. I. Imaging Blueshifted Emission and the Parsec-Scale Jet.

HIGHBERGER, J.L.; SAVAGE, C.; BIEGING, J.H.; ZIURYS, L.M. Heavy Metal Chemistry in Proto-planetary Nebulae: Detection of MgNC, NaCN, and AlF Towards CRL 2688.

HOFFMAN, G.L.; SALPETER, E.E.; CARLE, N.J. The Fine Structure and Outskirts of DDO 154.

KELLERMANN, K.I.; MORAN, J.M. The Development of High-Resolution Imaging in Radio Astronomy.

KEMBALL, A.J.; PATNAIK, A.R.; PORCAS, R.W. Polarization VLBI Observations of the Gravitational Lens System B0218+357 at 8.4 GHz.

LACEY, C.K.; DURIC, N. Cosmic Ray Production and the Role of SNe in NGC 6946.

LAROSA, T.N.; LAZIO, T.J.W.; KASSIM, N.E. A New System of Parallel Isolated Nonthermal Filaments Near the Galactic Center: Evidence for a Local Magnetic Field Gradient.

LAZIO, T.J.W.; FEY, A.L. Multi-frequency VLBA Observations of the Compact Double B2 2050+36: Constraints on Interstellar Scattering Revisited.

LISTER, M.L. Parsec-Scale Jet Polarization Properties of a Complete Sample of Active Galactic Nuclei at 43 GHz.

LISTER, M.L. Relativistic Beaming and Flux Variability in Active Galactic Nuclei.

LOCKMAN, F.J. Stray Radiation: Causes, Curses, and Cures.

MANCHESTER, R.N.; LYNE, A.G.; CAMILO, F.; BELL, J.F.; KASPI, V.M.; D'AMICO, N.; MCKAY, N.P.F.; CRAWFORD, F.; STAIRS, I.H.; POSSENTI, A.; KRAMER, M.; SHEPPARD, D.C. The Parkes Multibeam Pulsar Survey - I. Observing and Data Analysis Systems, Discovery and Timing of 100 Pulsars.

MIODUSZEWSKI, A.J.; DWARKADAS, V.V.; BALL, L. Simulated Radio Images and Light Curves of Young Supernovae.

PREPRINTS RECEIVED, JULY - SEPTEMBER 2001

OLBERT, C.M.; CLEARFIELD, C.R.; WILLIAMS, N.E.; KEOHANE, J.W.; FRAIL, D.A. A Bow Shock Nebula Around a Compact X-ray Source in the Supernova Remnant IC 443.

OSTEN, R.A.; BROWN, A.; WOOD, B.E.; BRADY, P. Multi-Wavelength Observations of Three Short Period Active Binary Systems: ER Vulpeculae, CC Eridani, and EI Eridani.

PHILLIPS, R.B.; SIVAKOFF, G.R.; LONSDALE, C.J.; DOELEMAN, S.S. CMVA Observations of R Cassiopeiae: 86 GHz SiO Masers and Envelope Dynamics.

RUSIN, D.; KOCHANEK, C.S.; NORBURY, M.; FALCO, E.E.; IMPEY, C.D.; LEHAR, J.; MCLEOD, B.A.; RIX, H.-W.; KEETON, C.R.; MUNOZ, J.A.; PENG, C.Y. B1359+154: A Six-Image Lens Produced by a z ~= 1 Compact Group of Galaxies.

SCHMITT, H.R. The Frequency of Active and Quiescent Galaxies with Companions: Implications for the Feeding of the Nucleus.

SCHMITT, H.R.; KINNEY, A.L.; HUTCHINGS, J.B.; ULVESTAD, J.S.; ANTONUCCI, R.R.J. The Importance of Shocks in the Ionization of the Narrow Line Region of Seyferts.

SCHMITT, H.R.; ULVESTAD, J.S.; ANTONUCCI, R.R.J.; CLARKE, C.J.; PRINGLE, J.E.; KINNEY, A.L. Testing the Unified Model with an Infrared Selected Sample of Seyferts.

SCHMITT, H.R.; ULVESTAD, J.S.; KINNEY, A.L.; PRINGLE, J.E.; CLARKE, C.J.; ANTONUCCI, R.R.J. Jet Directions in Active Galaxies.

STIRLING, A.M.; SPENCER, R.E.; DE LA FORCE, C.J.; GARRETT, M.A.; FENDER, R.P.; OGLEY, R.N. A Relativistic Jet from Cygnus X-1 in the Low-Hard X-ray State.

STOCKDALE, C.J.; GOSS, W.M.; COWAN, J.J.; SRAMEK, R.A. The Continuing Radio Evolution of SN 1970G.

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STORCHI-BERGMANN, T.; GONZALEZ DELGADO, R.M.; SCHMITT, H.R.; CID FERNANDES, R.; HECKMAN, T. An Evolutionary Scenario for Seyfert 2 Galaxies.

TORRELLES, J.M.; PATEL, N.A.; GOMEZ, J.F.; HO, P.T.P.; RODRIGUEZ, L.F.; ANGLADA, G.; GARAY, G.; GREENHILL, L.; CURIEL, S.; CANTO, J. Discovery of Linear 'Building-Blocks' of Water Masers Shaping Linear/Arcuate Microstructures in Cepheus A.

TREICHEL, K.; RUDNICK, L.; HARDCASTLE, M.J.; LEAHY, J.P. Spectral Structure in FRII Radio Galaxies and Jets.

TURNER, B.E.; APPONI, A.J. Microwave Detection of Interstellar Vinyl Alcohol, CH2CHOH.

VERDES-MONTENEGRO, L.; YUN, M.S.; WILLIAMS, B.A.; HUCHTMEIER, W.K.; DEL OLMO, A.; PEREA, J. Where is the Neutral Atomic Gas in Hickson Groups?

WILCOTS, E.M.; TURNBULL, M.C.; BRINKS, E. H I Gas in the Environment of the Seyfert Galaxies NGC 6764 and Mrk 1126.

YI, J.; BOOTH, R.S.; CONWAY, J.; WINNBERG, A.; DIAMOND, P.J. VLBA Observations of the 7mm SiO Masers in TX Cam and R Cas.