Quarterly Report
April - June 2002

National Radio
Astronomy
Observatory

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NRAO

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Executive Summary

ALMA

The Joint ALMA Office has been created as the central management structure for the construction phase, with Paul Vanden Bout serving as Interim Director. The first custom correlator chips have been received from the factory and all tests performed so far indicate that the chips and the associated board are working properly. All major parts of the prototype antenna have arrived at the ALMA Test Facility and installation of the antenna has begun.

EVLA

Hardware design and prototype construction are under way. Testing of modules will begin in the next quarter. The plan to install fiber optic cable along the array is complete. The project change control board is now in place and meets monthly to review and approve system requirements and budget changes.

Green Bank Telescope

The commissioning passed a major milestone with the successful execution of the first program in the 18-26 GHz (K-Band) range, a search for water maser emission in active galactic nuclei. The program requires the successful development of the active surface system. Other commissioning activities included the testing and debugging of correlator modes, the improvement of the observer interface to GBT control, and improvement of the control of the local oscillator. The fraction of the time allocated to scientific programs increased throughout the quarter.

Additional measurements have been made to investigate the stability and wear of the azimuth track. The antenna engineering group has examined the data and a finite element model and is formulating a plan for engineering modifications to strengthen the track, reduce the rate of wear, correct the existing worn areas, and reduce the rocking of the wheels at the joints.

The electronics effort included supporting the seven receivers which were deployed on the telescope this quarter, investigation of the reliability of the fiber optic IF transmission system, and the completion of the installation of the cryogenic compressor system on the telescope. The Quadrant Detector and laser were installed, debugged, and tested, and will provide new data on the position of the Feed Arm.

A separate Software Development Division (SDD) has been created to provide a more clearly defined focus to the activities in this area. During the quarter the SDD worked on the improvement of the robustness and reliability of the Local Oscillator control and of the network infrastructure that supports the M&C system, on the Observer's interface, and on the operating procedures for the division itself. The Computing Division deployed 14 new workstations, supported improvements in system security, and upgraded the GB web server.

In GBT development projects, the Quadrant Detector, a component of the Precision Telescope Control System, was installed and tested. In the next period, several critical experiments will be performed

to verify that the output signals correlate well with pointing changes inferred from half-power track data. Good progress was made in the development of both the 68-93 GHz receiver and the 26-40 GHz receiver. The basic design of the cryogenics of the Penn Array Bolometer Camera, a 64-pixel imaging system for the 3 mm band, is complete, and the work now has moved to the design of the overall system. Three pulsar spigot cards have now been built and the interfaces between the card and the GBT systems are being evaluated. The RFI suppression group has developed a system to suppress interference from the GBT feed arm servo, and is surveying the site to identify other sources of interference.

Very Large Array & Very Long Baseline Array

Following several years of preparation, and five years of in-flight support, VLBA participation in the VSOP Space VLBI Project ended this quarter. VLBA stations participated in 71% of all General Observing Time observations, and the VLBA correlator produced 87% of the ground-space baseline data from those peer-reviewed projects. Significant milestones achieved by the VLBA and its correlator included the first ground-space fringes using three of the four U.S.-operated tracking stations, the first VSOP image, the first fringes at 5 GHz, and the only fringes ever detected using the HALCA satellite's 22-GHz receiver, which had been damaged at launch.

Maintenance visits, azimuth rail repair, azimuth axle replacement, and painting were carried out at the St. Croix, North Liberty, Los Alamos, and Kitt Peak VLBA antennas, respectively. Panel adjustments were carried out on three VLA antennas as determined from 43-GHz holographic measurements.

Significant steps were taken in enhancing the ease-of-use of the VLA. There was a new release of Jobserve, the software used to prepare VLA observing schedules, which corrected a number of significant bugs. The first version of a new Jobserve Cookbook was released publicly at the same time. Finally, the web pages describing all aspects of VLA high-frequency proposing, observing, and data analysis have been overhauled. The update and consolidation of these pages address many questions and requests that have been made by observers using the 22- and 43-GHz systems on the VLA.

The VLA-Pie Town fiber optic link was used for its second operational session during the VLA's A configuration, from January through May. For the first time, a 74 MHz receiver was available at Pie Town, doubling the resolution of the lowest frequency band on the VLA. A total of 15 science projects were observed using the link, comprising 20 blocks of time and approximately 165 telescope hours.

VLA and VLBA scientific staff played the major role in organizing a day-long session on the "New Radio Universe" at the June meeting of the American Astronomical Society. Typical attendance at this topical session was about 200 astronomers. In late June, the Eighth Synthesis Imaging Summer School was hosted in Socorro by NRAO and New Mexico Tech. This week-long school has become a part of the traditional radio astronomy education for many students and young astronomy researchers. The 149 registrants attended lectures on basic and advanced interferometry topics, as well as touring the VLA and participating in various data-analysis tutorials.

Central Development Laboratory

Amplifier development made good progress on several fronts. Use of the TRW-JPL transistor resulted in record low-noise performance at 75 GHz, and good results are expected at 30 GHz. The 84-115 GHz mixers performed well in tests, and have been sent to Herzberg Institute for Astronomy(HIA) for integration. Two designs for a mixer for 211-275 GHz have been developed, and mixer blocks will be fabricated and tested. The effects of gain compression in mixers have been studied. Tests confirmed the expectation that the use of an isolator between the mixer and the amplifier increases the overall receiver noise.

Prototype samples of the ALMA correlator chip were received and tested successfully. The unit power dissipation is close to the predicted value, and there is a margin of 30% in the clock rate above the system requirements. Work continued on other cards for the correlator control and station control.

An initial design of a power amplifier in the range 91-124 GHz for use in the ALMA LO system has been completed, and tests have been made with triplers for the band at 200-300 GHz.

Major progress has been made in the design of the superstructure of the 21cm focal plane array for the GBT. Preliminary designs for the antenna, ground plane, dewar configuration, and support structure are being refined.

Data Management

The first development cycle of the e2e(End-to-End) project concluded on 15 July 2002. A central element in the cycle was the development of an interim archive system for VLA data. The server has been installed, a meta-data extractor has been tested, and an initial pipeline for reading data and returning derived results has been constructed. Work is continuing on the processing of synthesis observations and on the Calibration Source Toolkit.

The next release of AIPS++, the v1.7 release, was made in mid-July, and the attention has turned to the definition of the work breakdown structure for the v2.0 release scheduled for April 2003.

The effort to maintain a close collaboration with scientific testers continues, and includes presentations at the Synthesis Summer School and an exhibition booth at the AAS meeting in Albuquerque. Significant progress was made in the evaluation tests with data from the IRAM interferometer on Plateau de Bure. The ALMA project has formed a closer tie to AIPS++ and now has a representative on the AIPS++ Executive Committee.

Progress in enhancing the overall scientific capabilities in AIPS++ includes improved calibration routines and interactive cleaning in imaging problems. The GBT remains a strong priority, and direct support of commissioning activities and early scientific observations has been provided. The development of analysis and calibration routines for GBT data has continued.

A significant effort to improve the security environment at the NRAO has greatly reduced the incidence of successful incursions. The steps taken include the purchase of advanced anti-virus software,

an upgrade of the Linux-based gateway computers, and abandoning the use of connection protocols that are unable to encrypt sensitive information.

A sophisticated Web mirroring system has been established. Three new servers are now operating in Charlottesville, Green Bank, and Socorro, and a fourth server will be implemented for Tucson. The site webmasters met in Charlottesville to prepare, test, and deploy the system. The Common Computing Environment project is working on the standards for the Observatory UNIX systems, and will determine the set of core applications which will be installed on these systems. It is also working toward a common Operating System installation and application standards under Windows 2000. A Calendar/Scheduling tool is now available to schedule meetings and the use of the video-conferencing hardware.

Education and Public Outreach

Construction is proceeding on the Green Bank Astronomy Education and Visitor Center, currently more than one quarter complete, and expected to finish mid-December 2002. The accompanying dormitory has been put out for bid. A gift shop area for the VLA Visitor Center is under design. Both Visitor Centers have new video presentations about their respective research facilities in progress. Both sites are also surveying their visitors for demographic information.

The rich array of educational programming continues at Green Bank, and Socorro is broadening their offerings. Tours continue to prove very popular at both sites, with general public tours at the VLA being expanded beyond the summer season. An experimental project of translating selected NRAO web pages into Spanish, particularly appropriate for New Mexico and the growing Hispanic communities around the country, may also prove useful with the impending actuality of ALMA.

The image gallery development continued and should be staff tested in mid-summer and available to the public by late summer. The organization of the NRAO-EPO staff has been restructured and a new Head of Education and Public Outreach appointed. As usual this group provided strong support for NRAO presence at the spring AAS conference and for other NRAO research milestones.

Green Bank

Discrete HI Clouds in the Galactic Halo – GBT observations of the Galactic HI halo in the inner Galaxy show that in many directions the halo consists of previously-unresolved clouds, some of which are found more than 1 kpc from the Galactic plane, co-rotating with the disk below. In previous, lower-resolution 21 cm observations the cloud ensemble appeared nearly continuous, suggesting, incorrectly, that the HI halo was diffuse. It now appears that much, if not all, of the HI halo is concentrated into clouds with sizes of a few tens of parsecs.

Investigator: *F. J. Lockman.*

The Nature of the Faintest Galaxies – Surveys of the faintest radio objects (20 to 200 μJy at 1.4 GHz) using instruments such as the VLA, and optical images from HST, Keck and the Subaru telescopes show that most of these objects are galaxies with a redshift greater than one. The nature of their emission is important in determining the evolution and interaction of galaxies at early cosmological epochs. Two processes are believed to be important contributions to their radiative properties: massive star formation and active galactic nuclei (AGN). One of the best discriminators between these processes is the angular size of the emission regions. If the objects are located in a region less than about 0.1 arcsec (about 50 pc for an object at z=1), then their radiative temperature is greater than 10^6 degrees and the emission cannot be produced by star formation processes. However, the required resolution and sensitivity can only be obtained using VLBI techniques with at least one large telescope.

In March 2002, observations were conducted at 1.4 GHz with the VLBA + GBT + Effelsberg to image a 6'x6' region in the well-studied field SA13 with a resolution of 0.02". Within this region, about 100 objects above 50 μJy had already been detected with the VLA, and optical images down to 26-mag identified >90% of the objects. With the VLBA alone the rms image noise was 35 μJy, and very few of the objects could be detected. But with the addition of the large collecting area of the GBT and Effelsberg telescope, the rms noise decreased to 7 μJy. Preliminary analysis of the images suggest that less than 10% of the radio sources contain emission within 0.04 arcsec components - the size expected for AGN activity. Thus, the early evolution of galaxies appears to be driven mostly by starburst phenomenon rather than the AGN phenomenon.

Investigators: E. Fomalont and K.Kellermann, E. Richards (Univ of Alabama)

VLA

VLA Links High-Redshift Quasars to Ultraluminous Infrared Galaxies - High-resolution imaging of the CO (2-1) emission from two quasars at redshifts of z=4.4 and z=4.7 has been carried out using the VLA at 43 GHz. The CO emission shows substructure on scales of 0.2 to 0.5 arcseconds, corresponding to physical scales of about 1.5 to 4 kpc, much less than the typical size of a large galaxy. The combination of the VLA imaging with higher-order CO transitions seen by millimeter-wavelength interferometers indicates that the quasar host galaxies have very high excitation. The excitation is similar to nearby starburst galaxies such as M82, much higher than in the disks of normal spiral galaxies, and the column density of molecular hydrogen is an order of magnitude higher than M82. Therefore, it seems likely that the high-redshift

quasars, whose CO has been imaged with the VLA, are the ancient counterparts of the ultraluminous infrared galaxies, which are the most extreme star-forming galaxies in the nearby universe.

Investigators: *C. Carilli; K. Kohno (NRO); R. Kawabe (NAO); K. Ohta (University of Kyoto); C. Henkel, K.Menten (MPIfR); M. Yun (University of Massachusetts); A. Petric (Columbia); Y. Tutui (University of Tokyo)*

VLBA

VLBA Provides Clue to Planetary-Nebula Morphology - A longstanding question about planetary nebulae arose from the observation that, while the progenitor stars are spherical, many of the nebulae are not, often displaying a distinctly bipolar morphology. VLBA observations of W43A may have provided an important clue to resolving this question, by revealing water masers in what appears to be bipolar, precessing jets. While the origin of the jets is yet to be determined, their existence supports one model for the evolution of bipolar planetary nebulae.

Investigators: *H. Imai (NAOJ and JIVE), P Diamond (MERLIN) and K. Obara (Mizusawa Astrogeodynamics Observatory and Kagoshima University), T. Omodaka (Kagoshima University), and T. Sasao (NAOJ).*

VLBA Finds Link Between Quasars and Microquasars - A three-year joint monitoring program of the radio galaxy 3C 120 was carried out by the VLBA and NASA's Rossi X-ray Timing Explorer (RXTE). This program revealed that the relativistic radio jets from the galaxy generate new radio-emitting components shortly after the X rays from the accretion disk become dimmer. A similar phenomenon has been seen in microquasars in the Milky Way Galaxy, powered by black holes of about one solar mass, versus the hundreds of millions of solar masses likely for the black holes in radio galaxies. The interpretation is that the inner part of the accretion disk fueling the black hole becomes unstable and plunges into the black hole, with the X-ray flux from the accretion disk being reduced as some of its hot gas disappears within the event horizon and contributes to the generation of new radio components. The observation of the radio galaxy strongly supports the supposition that the same basic physical processes can account for black-hole accretion and radio-jet formation over a factor of more than a hundred million in physical scale.

Investigators: *A. Marscher, S. Jorstad (Boston University); J. Gomez (IAA, Granada); M. Aller (University of Michigan); H. Terasranta (Helsinki Institute of Technology); M. Lister (NRAO); A. Stirling (University of Central Lancashire)*

Atacama Large Millimeter Array

The official bimonthly reports to the NSF on the ALMA Project can be found on the NRAO web site at http://www.nrao.edu/almamirror/news/. A summary of significant items during the period of this report is given below.

At its April meeting in Venice, Italy, the ALMA Coordinating Committee (ACC) voted to create the Joint ALMA Office (JAO) as the central management structure for the construction phase. The JAO will ultimately have a key staff that will include the ALMA Director, ALMA Project Manager, ALMA Project Scientist, and ALMA Project Engineer. At a subsequent teleconference in May, the ACC made the following interim appointments for JAO staff:

ALMA Director	Paul Vanden Bout
ALMA Project Manager	Massimo Tarenghi
ALMA Project Scientist	Stephan Guilloteau

These interim appointees are expected to serve for approximately eight months until the ALMA Board can complete a search for permanent staff.

Immediately after the ACC meeting, the first "ALMA Week" was held in Granada, Spain. This meeting was an opportunity for all of the task leaders and senior design personnel across the ALMA project to meet. In addition to both plenary and parallel sessions, this was an excellent opportunity for informal and impromptu "hallway" discussions.

The first custom correlator chips were received from the foundry and tests were begun. The chips have been tested and function properly at frequencies up to 160 MHz. This is comfortably faster than the system requirement of 125 MHz providing adequate speed margin in the design. The power dissipation was measured at 2.1 watts at 125 MHz, just as predicted by the extensive modeling performed as part of the design process. Two chips that passed the test fixture evaluation were soldered to the prototype correlator board (which accommodates up to 64 chips), and testing in the correlator board environment is underway. All tests performed so far indicate that the chips and board are working properly. This is a major milestone for correlator development.

The installation of the prototype antenna has begun at the ALMA Test Facility (ATF) in New Mexico and all major parts of the antenna have arrived on site. Near real-time pictures of the assembly activities can be viewed on the web at http://www.tuc.nrao.edu/~jmangum/alma/atf/.

Expanded Very Large Array

Milestones	Original Deadline	Revised Deadline	Date Completed
M/C engineering requirements version 2	03-15-02	04-30-02	04-04-02
M/C operations requirements version 2	03-15-02	04-17-02	04-04-02
Start WIDAR correlator architecture training	04-15-02		04-15-02
M/C Software PDR	03-15-02	05-15-02	05-15-02
Build prototype Beowulf System	05-30-02		05-30-02
Start prototype testing of 8-bit sampler	06-17-02		06-10-02
Array fiber trenching plan complete	05-09-02		06-12-02
Fiber cable installation internal CDR	05-09-02		06-12-02
Rack/bin/module internal design review	06-04-02		06-17-02
Selection of RTOS	04-30-02		06-18-02
Bid award of array fiber cable	05-10-02		06-24-02
Build second "SOIDA" receiver test stand	12-31-02	07-15-02	06-21-02
Overall data processing architecture PDR	07-16-02	07-18-02	
Earn value baseline schedules complete	04-19-02	07-31-02	
Start testing of prototype MIB	07-31-02		
MIB communications protocol selection	07-31-02		
Preliminary antenna fiber wrap design complete	08-01-02		
Antenna MIB development environment	08-05-02		
512 MHz offset generator bench prototype complete	08-12-02		
Prototype testing of 4/P-band converters complete	08-16-02		
Monitor RFI environment at VLA 1-18 GHz	12-31-01	08-15-02	
Array fiber delivered	07-16-02	08-15-02	
Design for C&L - band OMT complete	05-17-02	08-16-02	
Hardware & software interface control documents complete	06-24-02	08-19-02	
RTP receiver & monitor bench prototype complete	08-23-02		
Feed cone prototype complete	06-28-02	08-30-02	
Test WVR on antenna	12-31-01	08-30-02	
128 MHz synthesizer bench prototype complete	08-30-02		
Update operational requirements	08-30-02		
12-20 GHz synthesizer prototype complete	09-03-02		
Correlator MIB RTOS selection	06-13-02	09-03-02	

Milestones	Original Deadline	Revised Deadline	Date Completed
Rack/bin/module prototype test complete	09-03-02		
Final module interface specifications complete	09-03-02		
Issue project plan & budget for FY2003	09-03-02		
Correlator M/C MIB selection	05-13-02	09-03-02	
Design for antenna utility module complete	09-13-02		
Design for F14 transition module complete	09-13-02		
Upgrade Beowulf cluster to more nodes	09-15-02		
MIB to screen initial implementation	09-20-02		
Antenna RTOS on development board	06-19-02	09-30-02	
Initial Backend prototype	09-30-02		
Backend Requirements update	09-30-02		
GBT M/C reuse for EVLA design study	09-30-02		
Backend functional design revision	09-30-02		
Overall EVLA M&C architecture/design	10-01-02		
Test antenna software plan	10-01-02		
Start trench fiber installation	08-01-02	10-01-02	
Array fiber termination panel installation	09-01-02	10-25-02	
EVLA network security	11-04-02		
Continue development of 10 Gbps fiber optic link for ALMA project; work may transfer to EVLA project	12-31-01	01-03-03	
Demonstrate RFI from 8-bit samplers and fiber optic transmitters can be reduced to acceptable levels	12-31-01	01-30-03	
Modify helium lines to facilitate testing new receivers (Cryo)	01-31-02	01-31-03	
Build and install five more 7mm receivers	01-31-02	01-30-03	
Test higher volume helium compressor (Cryo)	12-31-01	04-15-03	
Test vacuum pump upgrade (Cryo)	12-31-01	04-15-03	
MIB application software development	04-30-03		
Complete K-band build	12-31-02	06-30-03	
MIB RTOS on prototype MIB board	TBD		

Management

The EVLA External Advisory committee held its first meeting on 10-11 June. Membership of this committee is currently:

John Dreher - SETI

Mark Reid - CfA
Luis Rodriguez (Chair) - UNAM
Alan Rogers - Haystack Observatory
Stephen Scott - Caltech
Russ Taylor - University of Calgary
Steve Thorsett - University of California, Santa Cruz
Jacqueline Van Gorkom -Columbia University
Marco de Vos -NFRA
Sander Weinreb - JPL
Anthony G. Willis – DRAO

A number of Design Reviews were held during the quarter, including:
Servo Internal Review
Monitor & Control System Software Review
Fiber Installation Internal Critical Design Review
Racks Bins and Modules Design Review

The only Preliminary Design Review remaining is the Overall Data Processing Architecture Review scheduled for July. An update to the WBS budget was done to project year end spending and start the 2003 fiscal year allocation process. Detail scheduling of level 2 tasks is continuing.

Electronics

The procurement process for the fiber optic cable is complete and approved by the NSF. A Purchase Order will be issued in early July with delivery scheduled for August. The design for installation appears to be thorough and complete as a result of the CDR held this quarter.

The 10 Gbps link is defined more specifically to include all electronics to get the data stream on and off the fiber. Jodrell Bank will provide the optical receivers and transmitters required for the link; delivery is planned for later this calendar year. Delays in the digital design are attributed to learning curves with the AMCC, Giga, and Xilinx chips used in the design; for example, the Xilinx FPGA engineering sample used in the original design proved too slow and was recently replaced with a faster version not available initially. The digital transmitter board (formatter) will be redesigned to a new form factor compatible with both EVLA and ALMA by the ALMA LO/IF Division with completion scheduled for January 2003. Equipment to solder ball grid array (BGA) chips to circuit boards has been procured. BGA chips are required for the design.

A preliminary RFI hardware plan was prepared. Installation of the new shielded chamber was completed and it is currently being used to measure radiated power from new equipment, such as network modules planned for the Ethernet monitor and control design. RF testing of the 8-bit sampler and 10 Gps formatter, however, is delayed until January 2003, since operation of one depends on the other and both will

be co-located in the same box. RF testing of the "French" sampler will be scheduled after a delivery date for that equipment is better known.

Calibrated monitoring of the RFI environment is now being performed routinely at the VLA from 1 to 8 GHz, including the notorious DME emissions in the FAA band at 1 - 1.2 GHz. Software and hardware to monitor to 18 GHz are nearly complete. The EMI/RFI engineer position was frozen earlier in the year which contributed to delays in RFI testing and monitoring.

Selected parts for the new K-band feed are being fabricated in Ensenada, Mexico, machine shop to establish a Mexican "connection" for use of the Mexican EVLA funds. A similar effort for fabricating an electronic circuit board is being organized.

Installation of the Real Time Operating System (RTOS) selected for the Module Interface Board (MIB) requires a special communication interface, which was designed and released for fabrication. Progress was delayed when delivery of an evaluation sample of the Infineon MIB chip was 2 months late.

Electromagnetic design software, Ansoft HFSS, was procured and is being used to develop orthomode transducer (OMT) designs for the feed polarizers.

Water Vapor Radiometer (WVR)

The WVR test is expanded to include two units and so the completion date is moved out 2 months to provide observing test time. One unit was installed on antenna 26 in June and has been tested satisfactorily as a stand-alone instrument.

Significant design issues still being resolved include implementation of RTP (Round Trip Phase), sufficiency and practicality of 20 dB of headroom, data quality from transition equipment, and wideband performance of the feeds, synthesizers, and frequency converters.

Computing

The microprocessor chip and the RTOS for the MIB were selected and orders placed for their procurement.

The PDR for the Monitor and Control (M/C) software subsystem was completed. The primary concerns raised at the review were the difficulty of recruiting software engineers for this work and the need for a more detailed overall design for the M/C software. This design has been delayed by the need to concentrate available manpower on the MIB work so that hardware design could continue.

Significant effort was expended during the quarter on personnel recruiting. In order to fill the four open software engineer positions, six interviews were held, three offers were made and two acceptances were obtained.

The 4-node Linux cluster which forms the prototype Beowulf system for the correlator backend was completed. The system currently resides in Arana's old rack. The responsible software engineer has begun prototyping software on the cluster. Next quarter we will examine expanding the cluster by an additional 4 to 12 nodes.

Engineering Services

Fabrication of the K-band feed prototype was begun in the Green Bank machine shop. Materials for the prototype feed cone panels and laminated horn ring machine were ordered and are being received. The fabrication and assembly area for feed cone work was prepared. The preliminary design of the antenna fiber cable wrap was completed. A mockup of this design is now being assembled.

The manhole distributing fiber to the array arms was installed and covered. Fiber conduit has been installed between the Control Building and manhole as well. The trencher and backhoe purchased to trench fiber cable along the array arms were received. The grader is expected to arrive in August; another grader, on loan, is being used in the meantime. The trencher is undergoing modifications to enclose its cab and add an overhead chute to guide fiber cable into trenches.

Correlator (Report from Canadian Partner)

Development of the correlator is well under way. We have now filled the position of the second senior engineer. We are pleased to announce that Dr. Dave Fort from JPL has decided to join us, starting in September. Dave's wealth of experience in development of correlators and space communications instrumentation is a significant asset to the project.

Meanwhile, development of the correlator has proceeded at an auspicious rate with the existing senior engineer and two new digital engineers. Modern digital "HDL" design techniques and tools are proving their worth with a demonstrably significant speedup in development of digital chips compared to using older schematic-based entry techniques. The correlator chip FPGA design is complete and a sophisticated test-suite has been developed. The FPGA will be a scaled-down version of the final correlator chip that will be used for initial prototype testing. Porting of the FPGA design to a full-size custom chip is quite simply a matter of changing a few lines of code, and "re-synthesizing" to the new technology (along with paying more dollars!). The "Coarse Delay Module" that will allow the correlator to eventually handle (real-time) continental and even space baselines is near completion and looks like it will be within budget. Finally, good progress is being made on the correlator's time and frequency distribution system.

GBT Antenna

Milestone	Original Deadline	Revised Deadline	Date Completed
Install lower feed arm lasers	09-15-00	09-01-02	postponed
Measure az track profile	09-15-99	06-01-02	postponed
Install optical guide scope	04-30-01	06-01-02	06-01-02

GBT Mechanical Engineering and Central Instrument Shop Work

Milestone	Original Deadline	Revised Deadline	Date Completed
Design & fab. feed arm laser rangefinder	09-28-01	Deferred	
GBT Access Ladder Modification	01-30-02	04-15-02	04-15-02
Servo RFI Box	02-28-02	06-20-02	06-15-02
Servo RFI Panel	08-31-02		
Ka-band OMT's (3)	04-30-02	--	06-28-02
Ka-band Phase Shifter (4) Mandrel	05-30-02	--	06-14-02
Ka-band Transition Mandrel	05-15-02	--	06-14-02
Penn Array Cryostat	08-15-02		
K-band OMT's for VLA (2)	08-30-02		
K-band Feeds for VLA (2)	04-19-02	--	04-19-02
EVLA L-band Feed	08-30-02		
EVLA K-band Prototype	07-31-02		

GBT Software and Computing

Milestone	Original Deadline	Revised Deadline	Date Completed
Configuration through Observer's Interface	03-23-01	09-30-02	
Prepare for visiting observers	06-30-01	10-01-02	
LO Phase 0 improvements	07-15-02		
LO Phase 1 improvements	08-19-02		
Spectrometer Phase 0 improvements	08-19-02		
Spectrometer Phase 1 improvements	09-16-02		
Antenna Test Range Phase 0 functionality	08-16-02		

GBT Operations

Milestone	Original Deadline	Revised Deadline	Date Completed
Six-month structural inspection plan for GBT	07-30-01	09-01-02	
Decision on date of 20m Mothball	03-30-02	deferred	
Six month Inspection of GBT welds /structure	06-30-02	11-01-02	
Implementation of calc of monthly stats in Ops Log	06-30-02		06-30-02
Expansion of Cable Building complete	07-01-02	09-01-02	
Begin three maintenance days per week	07-01-02	10-01-02	
Refinement of GBT painting plan	07-01-02	08-01-02	
Repair bowed GBT BUS member	09-01-02		
Complete implementation of maj tasks in Ops Log pgrm	10-01-02		
Continued site access improvements	12-31-02		

Astronomy Education Center Project

Milestone	Original Deadline	Revised Deadline	Date Completed
AEC dormitory 90% design review	09-10-01	04-15-02	05-15-02
AEC dormitory pre-bid conference	05-03-02		06-24-02
AEC dormitory bid due date	05-24-02	07-12-02	
AEC dormitory start of construction	07-01-02	07-31-02	
AEC main building construction complete	10-15-02	12-15-02	

The Green Bank Telescope

Commissioning and Observing Activities

As reported last quarter, the major activity during the winter and early spring was developing observing capability in the 18-26 GHz range (K-Band). Early in the second quarter, this initiative culminated in the successful execution of the first K-Band observing program, a search for water maser emission in active galactic nuclei (Braatz, et al.). The K-Band initiative was of strategic importance to the GBT as it included the successful development of the active surface system and a number of other enhancements necessary for observations at high frequencies. Based on the success of this initiative, we expect to begin 40-50 GHz (Q-Band) commissioning in the 4th Quarter.

In the second quarter, commissioning activities have emphasized operational readiness. These efforts are oriented toward achieving routine operations for all major observing modes at frequencies up to 26.5 GHz, including a robust and easy to support system that will allow scientific observing programs to be scheduled for a majority of available time. Specific activities in this initiative include improvement of local oscillator control, continued development and testing of Spectrometer modes, improvement of the observer interface to GBT control, particularly in respect to observing configuration and execution, and resolution of issues concerning network operations. Further description of the software development projects appears in the software and computing section below.

Efforts on the Spectrometer have focused on testing and debugging auto-correlation modes. About 55 auto-correlation modes are needed for basic GBT spectral line observing. These modes are based on the four, primary bandwidth modes (12.5, 50, 200, and 800 MHz) and a large number of permutations involving the sampling levels, inputs (samplers required), and the Spectrometer digital quadrants utilized. At the end of the quarter, 26 of the 55 modes were tested and released for use. In addition to the auto-correlation modes, the Spectrometer also has a considerable number of cross-correlation modes that were being addressed toward the end of the quarter.

Observations for approved scientific programs continue to share time with commissioning activities. The GBT routinely runs programs for pulsar observing, VLBI, bi-static radar, and an increasing number of spectral line programs. The first refereed journal paper from GBT data appeared in May (Camilo et al., 2002 ApJ, 571, L41). During the month of June, observing programs were run on 15 of 30 days, and are scheduled to increase to 26 of 31 days in July.

Azimuth Track

As described in previous quarters, some issues of stability and wear of the azimuth track have arisen and are being investigated. Early this year, it was found that the upper plate (wear plate) of the azimuth track was undergoing noticeable wear, that there was evidence of some deterioration of the underlying grout, and that the azimuth wheels were undergoing a larger than expected rocking motion as they passed over track joints. The GBT antenna engineering group has invested considerable effort in analyzing the issues. In early May, a test was performed in which the grout was replaced below one joint section of the track. This replacement went quite smoothly and reduced the vertical displacement of the track, but did not reduce the rocking motion of the wheels. After further investigation, it was found that the interior surface of the wear plate and underlying base plate were undergoing fretting wear, and had opened up a gap between the plates near the joint. This wear is responsible for the rocking motion of the wheels. A finite element model of the joint has been developed, and the analysis of the model is in progress.

We are examining several options that may include welding the base plates at the joint gaps, shimming the worn areas, and inserting an anti-fretting material between the wear plates and base plates. Other, more extensive options are also under consideration. The details and schedule for this work are not yet set, but some part of this work will be undertaken in the third quarter.

GBT Operations/Maintenance

This past quarter, GBT Operations supported observing, commissioning, and maintenance activities. The telescope ran several observing programs during this quarter, while Commissioning activities occupied much of the remaining time. Maintenance was performed four days per week.

Operator Activities

The telescope operators supported all observing, commissioning, and maintenance activities. Operators continued developing documentation and operating procedures.

Maintenance

Construction began on the shop expansion for the telescope mechanics. The contractor is scheduled to complete this work by September. This shop expansion will allow the mechanics to work from a common area.

Inspections and scheduled maintenance was performed as usual, but much time and effort went into assisting the Antenna Engineering Group with investigations, repairs, and tests on the azimuth track. This work continues to occupy the maintenance staff. Many servo system issues are being addressed in a systematic manner in cooperation with the Electronics Division.

The contract to develop the structural inspection plan was let this quarter. The contractor is scheduled to deliver the plan during the third quarter. Once the plan is delivered, the inspection work will begin as prescribed by the plan.

Work continues on developing spare parts lists for all subsystems on the GBT.

Electronics Development

GBT Spectrometer Hardware

Detailed testing, debugging, and repair of the spectrometer continues. To date, one 50 MHz, fifteen 12.5 MHz, one 200 MHz, and nine 800 MHz modes have been certified correct. Modifications to the 1600 MHz phase-locked loops in the high speed samplers were designed and tested more than a year ago. Designing a PC board and implementing these fixes remains as a task to be done. Final measurements and modifications to all High-Speed Samplers remain to be done. All the chip capacitors on the LTA's have been replaced.

Front-ends

The C band receiver was first installed and commissioned this quarter. The Prime Focus, L-band, S-band, X-band, Ku-band, and K-band receivers all were used, and several problems with them were addressed. The L-band receiver's room temperature plate was removed and repaired. The C-band receiver

has some instabilities that are being investigated. The K-band receiver was removed from the antenna to allow it to be reworked so that both beams in a pair switch at the same elevation on the sky when beam switching. It will be ready to be reinstalled before good K-band weather returns. The Tipper was taken into the shop for repair of a 48 volt power supply and a motor controller.

LO/IF Systems

On several occasions this quarter, a channel of the fiber IF system failed, with all of the failures in supporting components rather than the fiber transmitter/receiver links themselves. Work continues on a MMIC amplifier to replace the unreliable, unobtainable, and expensive commercial units currently used.

Cryogenics

The sixth compressor was finished in the last quarter. All the helium compressor lines on the GBT are now capable of supporting receivers. Support to the CDL was also provided, and training was obtained at the VLA and Tucson sites.

Active Surface

The active surface was brought on-line and tested last quarter. The surface is being maintained through the summer to allow us to return to high frequency observing immediately in the fall when the weather is suitable. All our spare actuator motors have been used. We are taking motors from complete spare actuators and using them. To date, all the problems with the actuators have been motor, wiring, or electronics problems.

Quadrant Detector

The Quadrant Detector and the laser were installed, debugged, and tested. The system is running and collecting data. Several enhancements to the electronics are planned over the next few months to increase the stability and accuracy of the device.

Weather Stations

Our RFI-proofed ultrasonic anemometer was repaired. The power supply would fail when the ambient temperature dropped below freezing. The power supply was replaced with another one, and it passed the freezer test. A temperature sensor was added to this device as well.

Weather Stations 1 and 2 were both damaged by lightning several times this quarter. We have developed a surge suppressor system for the leads going up the tower to try and prevent recurrence of this. Tower grounding is also being checked.

GBT Computing and Software Development

In April 2002, the software development activities of the then Green Bank Computing Division have been split out to a separate Software Development Division (SDD) with a new Division Head (Nicole Radziwill). This change has given each division a more clearly defined focus, while the presence of the additional Division Head provides an increased level of managerial and high-level technical expertise. In addition to the new Software Development Division Head, one Software Engineer vacancy was filled by Melinda Mello. The second vacancy is being actively recruited for. The new Computing Division Head, Chris Clark, started work at the beginning of June.

During the second quarter, the SDD focused on improving the robustness and reliability of the LO1, the network infrastructure that supports the M&C system, the Observer's Interface, and operating procedures for the division itself.

The first round of improvements to the LO1 was designed and developed during this quarter, and is scheduled for testing and release during early next quarter. These include: improved accuracy in Doppler frequency calculations, usability enhancements, synthesizer control optimizations, the addition of two new reference frames, and proper enabling/disabling of interrupts. These changes should improve our ability to handle frequency switching; pre-release tests will provide confirmation.

A major accomplishment during this quarter was the resolution of underlying network issues which were requiring observers and commissioners to frequently reboot single board computers during observing runs. During a three-week investigation the SDD eliminated this problem and optimized other key components of the M&C base system, allowing observers to work without experiencing frequent, critical systems failures.

The legacy Observer's Interface (GO), though targeted for completion by the first quarter of last year, remained unfinished at the end of the first quarter of 2002. Early in this quarter, the SDD evaluated the barriers that have had impacts on this project over the past year and a half. In order to achieve a more reliable means for observers to interact with the GBT, as well as to support remote observing and flexible scheduling in the future, a new direction was chosen. The SDD drew from lessons learned throughout the development of GO to construct a new solution that will scale to meet NRAO's longer term goals. Whenever possible, code already in place will be used for rapid time-to-production. Although this new direction may initially slow down the delivery of new functionality, the SDD is confident that over time its ability to deliver new features quickly will be greatly enhanced. Additionally, the choice of development environment (Java using Jbuilder v7) supports the efforts of the Data Management Division e2e project, and this project will serve as the SDD contribution to that initiative.

In the second quarter, the primary focus in support of the Observer's Interface was configuring the telescope in a simplified manner to reduce the time it takes for pre-observation setup. A database driven method for configuring M&C based on select astronomical meta keywords, incorporating cabling and other logic, was explored. Prototyping exercises were initiated in earnest during this quarter, and by the close of the period, the SDD had determined that M&C could be configured in 12-15 seconds. Much more work is required before releasing this capability to observers, particularly in the development of configuration mappings between astronomical keywords and M&C parameters. Configuration functionality will be provided to the community as soon as a collection of scenarios is available; this may be integrated into the current GO application in the next quarter for public use prior to the release of a new graphical interface.

The SDD also provided systems support throughout the initial K-Band observing program in April by validating the software that had been developed during last quarter for the active surface, and by providing additional enhancements based on feedback from that campaign.

Additional progress was made in support of the Precision Telescope Control System, the Beam Forming Array, and the Pulsar Spigot Card. These efforts are detailed in the project-specific sections that follow.

Turning to the Computing Division, 14 desktop workstations were purchased, configured and installed for summer visitors. These will be re-deployed to NRAO staff members at the end of the summer, allowing obsolete systems to be replaced. Considerable support was given to the NRAO-wide initiative to develop a Windows 2000 domain. A number of security improvements have been made, including blocking external telnet and rsh connections, as well as installing new sftp and anonymous ftp servers. As part of the NRAO web upgrade, the new GB web server has been installed and configured. Considerable progress has been made on performing a much needed overhaul of the user accounts and backup systems.

GBT Mechanical Engineering Development

During the second quarter in the Mechanical Engineering Division the major portion of engineering and design effort went into the quadrant detector mounting and the azimuth track problems. The Quadrant Detector mounting and alignment hardware were fabricated and successfully installed. The track study efforts have generated some viable alternatives.

GBT Development Projects

Precision Telescope Control System (PTCS)

During the past quarter, the GBT Quadrant Detector (a PTCS component) was calibrated, installed on the telescope, tested, and has been used to help diagnose several pointing related issues. The measurement data flow through standard M&C components to a custom analysis application. This instrument infers feedarm position via angular measurements, and was designed to measure feedarm motion at rates high enough to help compensate for feedarm motion due to structural vibration as well as thermal, gravitational, and wind loading distortions.

The Quadrant Detector has been in nearly continuous operation for six weeks, has proven to be quite reliable and the accuracy of inferred relative feedarm position is nominally around 200 μm (1σ), and shows long-term instabilities (over weeks) of a few millimeters. This level of accuracy should be adequate for improving GBT pointing stability at millimeter wavelengths. Over the next quarter we will be performing several critical experiments to verify that Quadrant Detector signals correlate well with half-power track inferred pointing changes, and formulate approaches for using the data in future M&C implementations.

A significant campaign was conducted to align all ground laser rangefinder instruments, upgrade the software to automate tweaking the pointing, and fix the known bugs. Alignment problems with ZY108 and ZY109 monuments were identified and corrected. All instruments should now point nominally. The ground survey coordinates were updated and put in a true Cartesian coordinate system, i.e., corrections were made for the curvature of the earth. A field test to confirm the instrument calibrations, and establish a

refractometer base line path, was initiated by making differential measurements between two monuments and using a laser tracker to measure the distance between two additional monuments.

3 mm Receiver Module 1

A dual-beam, dual-polarization, psuedo-correlation receiver front-end covering 68-93 GHz is under development. Good progress was made in the second quarter on several aspects of the receiver. The feedhorn design and fabrication drawings were completed, and fabrication nears completion. The broadband OMT fabrication at an outside shop was completed in conjunction with an ALMA order. OMT microwave testing will begin this month, and a test dewar is being outfitted for cold testing of the OMT and other subsystems.

Detailing for the system design, mechanical layout, and drafting continues. Several of the purchased microwave components have arrived, and subassembly testing is underway. Acceptance testing of the dual-channel frequency converter assembly is in progress. Purchase of a second assembly is pending the test outcome, as do certain aspects of the receiver filtering design. The initial magic-T vendor was not able to meet specifications, so that order was cancelled. Units from a second vendor have now been received but are not yet tested. The bi-phase switches have been received, tested, and accepted.

1 cm Receiver

A dual-beam, dual-polarization, psuedo-correlation receiver front-end covering 26-40 GHz is under development. Good progress was made in the second quarter on several critical components. The feedhorn design was completed and fabrication drawings are nearing completion. The corrugated waveguide polarizer mandrel fabrication was completed and sent to be electroformed. The broadband OMT split-blocks were made and sent to an outside shop for an EDM fabrication step. However, a drafting error discovered during the EDM process made it necessary to remake one-half of the blocks. This was completed and the corrected parts sent for EDM. Fabrication and testing of the cross-guide cal couplers were completed. Detailing for the system design continues. Mechanical layout and drafting work continues. Initial design of a microstrip bandpass filter multiplexer, which will subdivide the receiver passband into four contiguous segments for continuum detection, was completed and artwork sent out for board fabrication. A housing design for the multiplexer was completed and fabrication began. Several of the purchased microwave components have arrived, and preparations for subassembly testing are underway.

Beam-Forming Array

This is a research and development project that will result in a 7-19 beam receiver for the 18-21 cm wavelength band. The receiver uses a packed array of planar feeds that sample the electric field in the focal plane. The beams on the sky are formed electronically and can be configured for full sampling. Work on this project is being done in Green Bank, the Central Development Laboratory and the University of Virginia. Details of current work are provided in the CDL section of this report

Penn Array Bolometer Camera

The Penn Array Bolometer Camera is a 64-pixel continuum imaging system for the 3 mm band. The project is a collaboration of the University of Pennsylvania, NASA-Goddard Space Flight Center, and the NRAO. The project is being funded through NRAO's university-built instrumentation program. The project was formally initiated in the first quarter of 2002 with the signing of a memorandum of agreement between NRAO and UPenn. The project team has been making excellent progress. The basic cryogenic design, which consists of a 3-stage system consisting of a pulse tube cooler, and closed, recyclable ^{4}He cooler and a closed, recyclable ^{3}He cooler with a final stage temperature of 300 mK, is complete. The commercial pulse tube cooler has been procured. Work on the detectors and readout electronics at NASA Goddard is proceeding very well. Optics design, cryostat layout, and other system elements are also progressing well. The NRAO is providing instrument machining services, control software and the interface to GBT systems, and data analysis software. Work on overall system design and the development of scientific requirements will be underway in the third quarter. The Penn Array Camera will be designed as a facility instrument, accessible to all GBT users.

Pulsar Spigot Card

Three spigot cards have been built and successfully tested electrically. This quantity allows for two in the system and one spare. The data interface between the two cards, internal to the spectrometer has been successfully tested. Serial interfaces between the spigot card and the spectrometer terminal port, the spectrometer VME port and the Sun serial port have all been shown to work. Some commands do not work as advertised. Fixing these involves spigot firmware changes in some cases and Sun programming changes in others. The high speed data interface between the spigot card and the Sun's EDT card has also been successfully tested.

At the end of this quarter, the combined Caltech/GB team had determined data transfer and format requirements between M&C and systems developed at Caltech. Negotiating the design of the Pulsar Spigot Card's complete integration with M&C is planned for next quarter.

Caltech Continuum Backend

The Caltech Continuum Backend is a fast sampling, multi-input backend that is anticipated to be built under the university-built instrumentation initiative funded by NRAO. The backend will be used with both the 1 cm and 3 mm Receivers and will provide a highly precise backend for continuum radiometry in these bands. The backend has been under conceptual design by Caltech during this quarter. The conceptual design will be formally reviewed in the third quarter. If the review is successful, a Memorandum of Agreement with Caltech will be executed, and funding of the project will begin.

RFI Suppression

The Green Bank RFI group has worked actively in several areas in the past quarter. Work on suppressing interference from the GBT feedarm servo has proceeded very well. Filters and bulkhead

connectors have been prototyped and have passed initial testing in the anechoic chamber. Final systems are being procured or fabricated. Installation should be complete in the third quarter and should greatly reduce a source of RFI on the GBT. The group is also aggressively pursuing other sources of RFI around the site through a program of surveys. Extensive measurements of 70 points around the shielded GBT Control and Equipment revealed RF leakage around the windows, but showed that the walls largely met the 60 dB suppression specification. The window leakage is believed to be the result of dissimilar metal corrosion. A program is underway to send the window frames out for nickel plating. The RFI group participated in the IUCAF Spectrum Management Summer School in June and gave a number of demonstrations.

Other Site Activities

NRAO Central Instrument Shop

In April, the Central Instrument Shop completed the fabrication of the Quadrant Detector mount and adjustment hardware. Since then the Shop has been spent a good deal of its efforts on receiver parts, including some challenging Ka and W band close- tolerance parts. The shop has also fabricated two S-band transition mandrels which are considerably larger than any electroform mandrels fabricated here to date. The Shop has also begun work to be completed next quarter on a cryostat for the Penn Array. In support of the ongoing RFI mitigation projects the shop has fabricated various special purpose RFI boxes and feed-throughs.

Next quarter work will continue on the W- and Ka-band receivers and the Penn Array. Additional work will be performed on the ongoing project to supply K-band Feeds and OMT's for the VLA as well as the prototype feeds for the EVLA.

Infrastructure Improvements

A number of projects were underway as part of the Green Bank infrastructure renewal program funded by the one-time augmentation in FY2001. Efforts have focused on basic plant infrastructure as well as strategic initiatives. A redundant chiller for the GBT Control and Equipment rooms in the Jansky Laboratory was recently installed. This eliminates a point of failure that could have taken the GBT offline for an extended period. A new wastewater treatment facility was begun in the past quarter. This facility will have the capacity to serve the existing site, the new Astronomy Education and Visitor Center, and will meet all environmental requirements. Site housing for professional staff and REU students was also improved in the last quarter: five new, 2-bedroom apartments were recently completed for professional staff and the Hannah House was restored for use by REU students. Both facilities are already fully occupied.

Management and Scientific Services

Milestones	Original Date	Revised Date	Date Completed
Teacher Workshop at VLA	04-19-02		04-19-02
Last of 4 VLA Public Tours	04-21-02		04-21-02
Update VLA High-Frequency Web Pages	04-30-02		04-30-02
Release Jobserve Cookbook	09-30-01	05-29-02	05-06-02
Complete VSOP Support	05-15-02		05-07-02
VLBA Calibration Service Prototype Testing Complete	05-29-02		05-15-02
VLA/VLBA Proposal Deadline	06-03-02		06-03-02
"New Radio Universe Session" at AAS	06-05-02		06-05-02
Hold Synthesis Imaging Summer School	06-24-02		06-24-02
VLBA Calibration Pipeline Released Publicly	08-30-02		
Automated Monitoring of AIPS Software Downloads	06-30-02	09-30-02	
Update Astronomer Information on Web	09-30-02		
VLA/VLBA Proposal Deadline	10-01-02		
EVLA Completion Plan Science Case-Version 1	10-31-02		
Debut New VLA Visitor Center Film	10-31-02		
18th Annual New Mexico Symposium	11-01-02		
Jobserve Cookbook Revision	11-23-02		
First Fringes on Mark 5 Recorder Prototypes	11-30-02		
AIPS++ VLA Data Reduction Cookbook-Version 2	12-20-02		
VLA Visitor Center Gift Shop Opening	02-28-03		
VLBA 10th Anniversary Symposium	06-30-03		

Electronics

Milestones	Original Deadline	Revised Deadline	Date Completed
VLA/VLBA Pie Town Link (LO/IF)			
Complete construction & checkout of spares	01-31-01	05-30-03	
Receivers (FE)			
Build and install three more 86 GHz receivers	10-31-01	08-30-02	
Identify and correct moisture buildup problem in new VLA 22 GHz feeds	12-31-01	09-30-02	
Build and install one more 86 GHz receiver for a total of 9	12-30-02		
Install new 1.4 GHz receiver windows as the old ones fail	Open ended		
VLBA Improvements			
Multi-speed recording	06-15-02		06-15-02
Test new Metrum heads	06-30-02		06-30-02
Head pre-amp boards	As needed		
VLA Improvements			
Install Iridium Filters at 1.6 GHz	12-31-01	09-27-02	

Engineering Services

Milestones	Original Date	Revised Date	Date Completed
Complete BnA reconfiguration	05-17-02		05-16-02
Complete B array configuration	06-07-02		06-07-02
Complete CnB reconfiguration	09-13-02		
Mechanical Group			
Dish Panel adjustments Antenna #5	05-30-02		04-22-02
Maintenance visit to St. Croix VLBA	04-08-02		04-24-02
Dish panel adjustments on Antenna #23	04-30-02		04-30-02
Dish Panel adjustments Antenna #15	05-15-02		05-22-02
Wheel & axle replacement Los Alamos VLBA	06-09-02		06-09-02
Paint Kitt Peak VLBA	07-22-02		06-10-02
North Liberty AZ rail repair	06-15-02		06-11-02
Paint Antenna #24	07-15-02		06-14-02
Paint Antenna #21	06-15-02	07-15-02	

Milestones	Original Date	Revised Date	Date Completed
Grout Los Alamos VLBA	08-17-02		
Maintenance visit to Mauna Kea VLBA	08-20-02		
Paint St. Croix VLBA	08-21-02		
Paint Antenna #27	08-24-02		
Antenna #7 Azimuth Bearing change	07-15-02	09-15-02	
Paint Antenna #26	09-30-02		
VLBA Subreflector re-work	12-31-02		
Install Hasps in all antennas Az & EL cabinets	12-31-02		
Electrical Group			
UPS PM	05-07-02		05-07-02
ALMA Elec./HVAC	06-30-02		06-13-02
Power protection circuit	06-30-02		06-24-02
Jackson tamper retrofit	06-30-02		06-25-02
Radio upgrade	12-28-01	06-30-02	06-30-02
Warehouse HVAC	07-30-02		
ES Engineering Group			
Feed cone prototype design complete	06-30-02		06-13-02
VLBA Improvements			
Modification to encoder electronics	12-30-02		06-15-02

The painting schedules for Antenna #24 and Antenna #21 were swapped due to array configuration logistics.

Computing Division

Milestones	Original Date	Revised Date	Date Completed
Release JObserve 1.6.5	02-28-02	04-01-02	04-01-02
Ancillary data procedures-> VLA ops	05-30-01	04-01-02	04-01-02
Upgrade Ingres User Access	04-01-02		04-01-02
Atmospheric Phase Interferometer	05-01-02		05-01-02
Future of Mainsaver/Sybase	05-01-02		05-01-02

Milestones	Original Date	Revised Date	Date Completed
Build 2+Terabyte SAN	11-30-01	05-01-02	05-15-02
Database modifications for Mark 5	06-01-02		06-01-02
NRAO DNS/DDNS implementation	05-30-02	07-15-02	
Establish NRAO-NM laptop policy	02-28-02	07-31-02	
VLBA Recorder Test Software	01-31-02	08-01-02	
Ingres Conversion to Oracle	08-13-02		
Finalize AOC rewire proposal	08-15-02		
Correlator Controller in Continuum	05-01-01	08-31-02	
Upgrade Web/ftp servers	08-31-01	09-01-02	
True replacement boards Modcomps	09-02-02		
Foreign Monitor Data Loading	09-30-02		
Streamline VLA observe file submission	12-31-01	10-01-02	
Alternative to 9 track tape at VLA Site	03-31-02	12-31-02	

JObserve 1.6.5

The release took place on April 1, 2002. It contains a large number of bug fixes. Work on a next release is not expected to start before August 2002.

Upgrade Ingres User Access

Knowledge Management has been installed and groups set up within the Ingres database for data access. It has been determined that Knowledge Management does not work well with Java, so does not give us the full functionality we expected.

Atmospheric Phase Interferometer (API)

The system has been documented and an alert system put into place and tested. This system was proven effective on 6/5/02 when the API lost satellite link and the astronomers and support personnel were notified by the alert system.

Implement 2+ Terabyte SAN

The SAN is now fully functional. The migration of the VLA tape archive onto the SAN has begun. All centralized backups are now done over the SAN to the AIT-3 tape loader.

Mark 5 Support

Haystack has decided to retain the eight character VSN and to not bundle disks in groups. Therefore, no changes are required in the Ingres database for Mark 5. During the investigation of the changes required for Mark 5, it was found that there were problems with the tape tracking system which had resulted in tapes being erased before correlation. The tracking system was modified to prevent this from occurring in the future.

Ingres Conversion to Oracle

We are researching the feasibility of moving the Ingres data to Oracle and dropping the Ingres database. This would add functionality to the systems using these data, save annual maintenance costs and centralize AOC database functions. The decision must be made by October 2002, when our Ingres maintenance contract expires.

Finalize AOC Rewire Proposal

We will begin rewiring the AOC with multimode fiber near the end of the '02 fiscal year. Designs, plans and purchase lists should be finalized by mid August. The actual rewiring will take place over the following two years at the end of which all connections in the AOC should be fiber based.

Web/ftp Servers

The arrival of the new web/ftp server was delayed until the end of June; configuration of the machine and the migration of the existing AOC web and ftp content is expected to take until the end of the summer. This will also result in off-loading tasks from the zia server.

Development True Replacement Boards for the Boss/Monty Modcomps

Boss/Monty are a load-sharing Modcomp 9250-based system while Bacchus is a standalone system. After installation of the 9250 systems it was discovered that 1) the Boss/Monty system contains a unique memory board for which we have no replacement board, and 2) that the IOS & CPU boards in Bacchus are not true replacements for the IOS & CPU boards in Boss & Monty. To rectify this problem we must 1) have a memory board from the old 32/85 system converted to be a replacement board for the unique memory board in Boss, and 2) convert the IOS & CPU boards from Bacchus to be true replacements boards for the Boss & Monty systems.

Foreign Monitor Data Loading

VLBA Monitor Data for stations other than the original 10 VLBA sites is now manually downloaded by the analysts. The process is tedious and time-consuming. We are looking into methods for automating the capture of these data. Data for GBT are now semi-automated; other stations will follow.

AIPS

Distribution and Versions

The 31DEC02 version of AIPS now has been in routine operation for six months, under the new CVS configuration for the midnight jobs. Unfortunately, counts of "fetches" of the AIPS versions still are disabled due to complexities associated with local cgi scripts and a lack of resources to fix the problems.

Key Developments

1. A memo comparing the results of the KRING and FRING tasks for fringe-fitting has been released as AIPS memo No. 107. The two tasks give similar results on both high- and low-signal/noise cases. In many instances, it appears that KRING runs faster, typically by factors of 1.5 to 4.
2. The VLBA data-calibration utilities have been improved and debugged further. In particular, VLBALOAD and VLBAFIX include many more of the bookkeeping tasks necessary to deal with various peculiarities of correlator output data.
3. The VLBA data-calibration pipeline has been completed for basic VLBA data between 1 and 15 GHz observation frequency. It was demonstrated successfully at the Synthesis Imaging Summer School, and is intended to be incorporated into AIPS releases later this year. Future developments will focus on more complex observations, such as polarization, high frequency, and those with some "extra" antennas such as the VLA, GBT, and Effelsberg.
4. A variety of adjustments have been made to IMAGR and related tasks, largely in order to make wide-field imaging and multi-resolution Cleaning more robust. Included are better handling of boxfiles, a bug fix in steering the multi-resolution algorithm, better defense against selection of a field with inadequate flux or bad window parameters, and an increase in the size of the Clean box arrays.
5. FILLM and WETHR were modified to provide more control and insight into opacity corrections that were made to the data. A seasonal opacity model was added to the one that is derived based on the actual surface weather data, and the user given the capability of combining the two with any relative weighting (default is 0.5 each). INDXR also was changed to make use of the weather information in computing CL tables.
6. An "adverb pass back" capability was added in order to permit adverbs to be passed back to AIPS from the outputs of running various tasks.
7. UVCON was modified to allow a source model for simulations to be multiplied by various types of antenna primary beam, and to use different coordinate systems for the antenna positions.

Goals for Third Quarter 2002

1. Continuing maintenance and user support, including systems support.
2. Resurrect the monitoring of fetching of copies of 31DEC01 and 31DEC02.
3. Add a guide to low-frequency, wide-field imaging as a Cookbook appendix.
4. Improve interactive editing capabilities.
5. Incorporate VLBA calibration pipeline into AIPS midnight job release.

Major Developments

Milestone	Original Date	Revised Date	Date Completed
Design L-band amp using InP devices.	03-16-01	09-30-02	
Study use of overmoded w/g in LO transmission	03-16-01	08-31-02	
Demonstrate 211-275 GHz balanced sideband-separating SIS mixer with integrated 4-12 GHz IF preamps.	07-31-01	09-30-02	
Construct second test receiver	12-31-01	09-30-02	
Design GBT Q-band optics.	09-30-01	09-30-02	
G/T optimization of feed taper at 10 and 30 GHz	03-31-02	09-30-02	
Feed pointing optimization of the VLA antenna	06-30-02	09-30-02	
ALMA Correlator: 1) Start and complete PCB layout of interface boards. 2) Develop FPGA designs for and test interface boards. 3) Start PCB layout of station motherboard. 4) Order parts for 2-antenna prototype correlator. 5) Assemble station and correlator bins in prototype correlator rack and start design of rack plenum. 6) Complete design of and start PCB layout of quadrant control card.	 09-30-02 09-30-02 09-30-02 09-30-02 09-30-02 09-30-02		
1) Complete design of FPGA chip for the ALMA correlator chip test fixture card. 2) Complete testing of the prototype ALMA correlator chip using both the chip test fixture and the prototype correlator card. 3) Perform design reviews and start PCB layout of the two ALMA correlator motherboards, the paddler board, and the quadrant control card. 4) Complete mechanical design of the correlator bin. 5) Complete testing of the GBT spigot card. 6) Finish design of system interface paddle boards.	06-30-02 06-30-02 06-30-02 06-30-02 06-30-02 03-31-02	 09-30-02 05-15-02	06-30-02 06-30-02 06-30-02 06-30-02 06-30-02 06-30-02
Initial test of prototype ALMA correlator.	12-21-02		
Design MMIC doubler chips for ALMA Band 7.	06-01-01	09-30-02	

Amplifier Design and Development

The amplifier group was focused on development activities during the second quarter. Significantly, modified versions of the W-band (70-110 GHz) amplifiers were built and tested, with measured noise performance of 32 K at 75 GHz. This NRAO record low-noise performance results from the use of TRW-JPL

"Cryo-3" transistors, and negotiations are under way to secure a long-term supply of these devices from JPL. A "Cryo-3" version of the Ka-band (26-36 GHz) LNA is in assembly and is expected to achieve 8-9 K performance at 30 GHz.

Additional activities included the assembly of a modern, PC-based noise measurement system to eventually replace the Apple IIs, which have been used for such measurements for nearly 20 years. The new system employs commercial data acquisition hardware and instrumentation to replace aging, NRAO-built equipment, and will support modern data formats and eventually network-based presentation of test results.

Amplifier Production

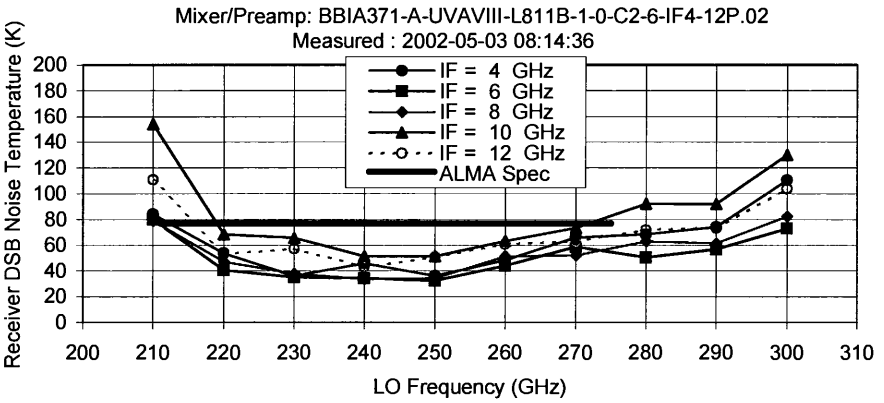
Production amplifiers completed during this quarter were three K-band, two W-band, six 8-18 GHz, and two sis-mixer integrated IF amplifiers. Five Ka-band amplifiers were finished to 80% completion, and a production run of 8-18 GHz LNAs was started. Other work included the assembly of 20 bias cards and cables for the LNAs, maintenance of test dewars and equipment, and repairs to a valuable frequency synthesizer obtained from government surplus.

Superconducting (SIS) Millimeter-Wave Mixer Development

ALMA SIS Mixer Development

Band 3 (84-116 GHz) SIS mixer: Last year we completed the design of a tunerless DSB SIS mixer for Band 3 capable of operation with a 4-12 GHz IF. Funding for wafer fabrication at UVA was provided by the Herzberg Institute as part of the Canadian contribution to ALMA. Engineers from HIA visited the CDL this quarter to learn how to assemble these mixers and to participate in the first tests. Two mixers were successfully tested, and initial results are very encouraging. In our test dewar, which has a room temperature feed horn and an L-band IF amplifier with 5 K noise temperature, we measured DSB receiver noise temperatures less than 50 K across Band 3. Based on earlier calibration, this corresponds to a receiver noise temperature at the input of the mixer of about 10 K (*i.e.*, < 2hf/k) which is well within the ALMA specifications. Mixers have been shipped to HIA and will be tested with the proper input optics and a 4-12 GHz IF.

Band 6 (211-275 GHz) balanced SIS mixer-preamp: A single-chip balanced SIS mixer-preamp has been tested with a 4-12 GHz IF using several IF coupling circuits — the best measured noise temperatures are shown in the figure below. (Earlier measurements on this mixer (ALMA Memo 308) were made with an L-band IF.) The single-chip balanced and sideband-separating designs will not be pursued further for ALMA as the multi-chip approach uses much smaller SIS chips and requires fewer wafers.



Band 6 (211-275 GHz) balanced sideband-separating SIS mixer-preamp — multi-chip design: This design uses four separate building-block SIS mixers of established design (ALMA Memo 205), mounted in a block containing three waveguide quadrature hybrids and an in-phase power divider. The wafers were fabricated at UVA, and have given good performance as single-ended mixers with L-band and 4-12 GHz IFs. The first unit is complete and awaiting testing.

Band 6 (211-275 GHz) new elemental SIS mixer: A new elemental (single-ended) mixer has been designed to take advantage of the new UVA niobium circuit fabrication process which uses a sputtered SiO_2 insulator in place of SiO. This should give fewer pinhole short-circuits and more consistent results. At the same time, the mixer was reoptimized for the actual ALMA band (211-275 GHz), narrower than the original design band, and uses a quasi-lumped element RF tuning circuit which increases the inherent bandwidth. The RF choke was redesigned to present less capacitance to the 4-12 GHz IF amplifier. Mask layout has been completed, and the masks are being fabricated. A single-ended mixer block has been designed to evaluate these mixers and is now awaiting fabrication in the shop.

Saturation in SIS mixers: ALMA Memo 401 has been revised (5 April 2002) to include a simple procedure for measuring the degree of gain compression caused by high-level signals or noise (*e.g.*, 300 K thermal noise). The revised version emphasizes the fact that a mixer can have substantial gain compression from broadband noise but still be linear to a small CW test signal, the small signal gain depending therefore on the broadband noise power.

ALMA 4-12 GHz IF Preamplifier Development

Isolators vs. integration of mixer and preamplifier: Opinions have differed on whether an SIS mixer is best operated with an IF isolator or with the amplifier closely integrated with the mixer. While the isolator provides a more benign IF impedance for both mixer and amplifier, it also adds noise from the (4 K) termination on its third port. For some time we have believed, based on simulations, that integrating the mixer and amplifier would result in superior overall performance. Recently, SRON received a prototype 4-12 GHz isolator from Pamtech which they lent to us for comparative testing. Using the same mixer and amplifier, first connected directly together, and then with the isolator, we found the overall receiver noise temperature to be higher by 10-20%

(5-10 K DSB) when the isolator was used, thus verifying the results of our simulations. (Note that the amplifier itself was optimized for operation from a 50-ohm source.)

Balanced SIS mixer-preamp: Important to a successful balanced mixer is the design of the 3-port IF combining circuit between the two component mixers and the preamplifier. This circuit connects the IF signals from the component mixers to the preamplifier while providing DC bias separately to the two component mixers from bias-T's built into the preamplifier housing. Its design is critical in ensuring resonance-free operation when the component mixers are not identical and stability of the mixer-preamp under operating conditions in which the output conductance of one or both component mixers may be slightly negative — which may occur outside the nominal IF band. Results of this work are described above.

ALMA Band-6 Cartridge Development

Much time was spent this quarter on budget revisions and de-scoping in an attempt to fit the Band-6 cartridge production to the allocated ALMA budget. Detailed costing has been generated for the four different combinations of DSB or sideband-separating mixers with either single- or dual-polarization.

We continued work on magnetic circuit design for the SIS mixers. After modifying the old magnetic circuit to eliminate local saturation, we are able to operate the circuit at a substantially reduced coil current. There is still concern that the large hysteresis loops observed in samples of magnetic materials will make automated adjustment of the magnetic field difficult. The test samples are being sent out for annealing (in a hydrogen atmosphere) which is expected to reduce the hysteresis considerably in some of the materials.

Work also continues on design of a resonance-free thermal isolator for coupling LO power from the 80 K stage to 4 K. Studies show that it is not practical to make a highly overmoded waveguide circuit free of suck-outs over such a wide frequency range. Present work is on less highly overmoded circuits.

In collaboration with IRAM, work has begun on a new feed horn and optics design for Band 6.

Components for ALMA Band-6 Mixer Production Test Set

Connectorized wiring heatsinks have been developed for use in the ALMA test dewars and possibly, in a modified form, in the Band-6 cartridges. Thermal equivalent circuits have been determined at several temperatures between 4 and 300 K. This work will be published in a memo.

Automatic SIS Mixer Testing

The programmable Band-6 LO was completed during this quarter and is currently being tested. The software includes routines to plot output power vs. frequency and to use a millimeter-wave spectrum analyzer to find and log all spurious outputs. Testing in a real mixer test system will begin shortly.

Vacuum Windows

The CDL has been commissioned by IRAM to produce prototype crystal quartz-based multi-layer vacuum windows for loss measurements and comparison with commercial windows. The Band-9 windows are now being completed.

Publications & Memos this Quarter

A. R. Kerr, "Saturation by Noise and CW Signals in SIS Mixers," ALMA Memo 401, revised 5 April 2002.

Electromagnetic Support

EVLA

Analysis of gain/system temperature (G/T_{sys}), as a function of the feed taper at the edge of the subreflector, was carried out at 3 GHz. The patterns used were for a corrugated horn with a sinusoidal inside profile. The G/T peaks at a feed taper of -17 dB compared to -18 dB for a linear taper horn.

A detailed design of the C-band feed (4-8 GHz) was completed. The mechanical drawings are being drafted.

A detailed design of the L-band feed (1-2 GHz), scaled to C-band (4-8 GHz), was completed. Mechanical drawings have been completed, and machining of the feed is scheduled to begin in July.

GBT

Transitions from the feed to the orthomode transducer were designed for the Ka-band (26.5 to 40.0 GHz) receiver.

Spectrometers/Correlators

ALMA Correlator

During the second quarter, prototype samples of the 4096-lag ALMA correlator chip were received and successfully tested. Testing was performed on a dedicated test fixture and also by using the ALMA correlator card.

Initial hardware testing of the chip test fixture itself, as well as software development for the fixture, was performed in the process of chip testing. Tests of the prototype chips in the correlator card were performed using the correlator card/LTA test fixture with operational correlator software.

All tests that were performed indicate a successful design for the chip with a unit power dissipation very close to the predicted value and at least a 30% maximum operating clock rate margin above system requirements.

A design review of the station motherboard was conducted during the quarter. PCB layout will begin upon completion of the PCB layout of the two interface boards (previously called paddle boards). A detailed design of these two interface boards was completed during the quarter, but a design review is needed before start of PCB layout.

Software for the operational LTA/correlator control card was written and documented during the quarter. Some of this software was used in the ALMA correlator chip testing. Communication within the ALMA correlator via CAN bus was tested, and some support software was written for the bus.

The mezzanine power board for the correlator card was received, assembled and successfully tested. The correlator card was sent out for full population with prototype correlator chips.

Three station control cards were built and partially tested. A prototype 6U power card was received, assembled and partially tested.

A test fixture for the station control card, 6U power card, and the interface boards was designed and constructed during the quarter. The test fixture was used to test the station control cards and the 6U power card.

The correlator bin hardware design was completed, and drawings were submitted to the shop for construction of a bin.

Design of the quadrant control card was started, but not completed because of the effort of testing the prototype correlator chips.

Other Projects

Some support of mode checkout for the GBT spectrometer was provided. A few modes were found to have incorrect FPGA personalities, and these problems were corrected.

The GBT pulsar spigot card was successfully tested in the GBT spectrometer. Raw lags from the spectrometer were streamed correctly onto a RAID disk system.

Layout of a printed circuit board for a project to stream VLBA recorder data onto a RAID disk was completed and sent out for bid.

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.

An initial design of a 91-124 GHz InP power amplifier MMIC has been completed. Work on remaining MMIC designs for ALMA is under way. Programmable surface-mount bias cards for the power amplifier and active multiplier chain (AMC) bodies have been designed. A prototype monitor/control box has been assembled for the LO driver using the AMBSI-1 card and two inputs: the CAN bus and dc power.

Ordering has begun for parts for pre-prototype LOs to be delivered to the cartridge sites this fall. The Band- 6 LO pre-prototype driver was tested with a Virginia Diodes tripler showing power greater than 200 μW from 200-300 GHz. Noise measurements using this LO with a SIS mixer should be under way shortly. A more advanced version of the AMC for this band is currently being assembled.

Testing of commercial MMIC solutions for both the Q- and Ka-band EVLA postamps will begin soon.

ALMA Frequency Multipliers

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

80/240 GHz Frequency Tripler: Subsequent to the receipt of the mask set for the redesigned quartz circuits, the fabrication of circuits was completed in the earlier part of this quarter.

The fabrication of the modified block posed some machining issues that had to be resolved by making several trial runs and fine-tuning the program sequence. Problem areas included meeting the required tolerance on the depth of the channel (to house the 1-mil thick quartz circuit) and obtaining acceptable surface finish on the waveguide walls in the split block. These problems have been addressed and fabrication is under way. The next step is the assembly and testing of the 80/240 GHz frequency tripler.

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 physical size of conventional 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.

Major progress continues in the design of the array superstructure. Preliminary designs for the antenna, ground plane, dewar configuration, and support structure are being refined. The antenna impedance test setup was completed. The dielectric constant and loss factor for more than twenty samples of rigid foam have been measured, and suitable foam material has been chosen for further characterization. The fabrication and use of test fixtures for measuring the vacuum seal, outgassing, and thermal conductivity of these materials are currently under way. Low-noise amplifier designs are being refined. The downconverter and LO distribution have been prototyped.

Major progress has been made on the enhancements to the Outdoor Antenna Test Range that are required for the beam-forming array measurements. Prototyping of the proposed phase-locking system is under way with preliminary results supporting the conceptual design. An REU student began work mid-quarter on the software components of the upgrade needed to enable testing of the array and other upcoming GBT development projects. In addition to establishing a technical vision for the Test Range, software was designed and developed to support monitor and control of a new lock-in amplifier and synthesizer with some data visualization capabilities.

Meetings

NRAO Visiting Committee Meeting, Socorro, NM, April 4-6, 2002 (Webber).
ALMA Week meetings, Granada, Spain, April 23-27, 2002 (Bryerton, Ediss, Effland, Lauria, Pan, Thacker, Webber).
NRAO Users Committee Meeting, Green Bank, WV, May 20-21 (Webber).
NRAO FASR meeting, Green Bank, WV, May 23-24 (Bradley, Escoffier).
IEEE IMS 2002, Seattle, WA, June 2-7, 2002 (Bryerton, Kerr, Pan, Pospieszalski).
ALMA Band-3 Internal Review, HIA, Victoria, BC, June 6-7, 2002 (Kerr, Pan).

e2e Project

Milestone	Original Deadline	Revised Deadline	Date Completed
Install interim VLA archive server	12-01-01	04-15-02	04-01-02
Internal tests of VLA interim archive	01-15-02	08-01-02	
External tests of VLA interim archive	03-15-02	10-01-02	
Announce VLA interim archive server	06-01-02	12-01-02	
End of e2e phase 1	07-01-02		07-15-02
EVLA e2e PDR	07-15-02		07-18-02
Purchase GBT archive hardware	09-15-01	09-01-02	

The first development cycle of the e2e (End-to-End) project concluded on 15 July 2002. All major goals of the development cycle were met.

- To get expertise in dealing with large volumes of data, we have started the process of moving the VLA archive onto disk. Highest priority has been given to a contiguous block of tapes from the late nineties. We have loaded 67 VLA XH* tapes (equivalent to roughly 700 VLA 9 track tapes), and four VLBA distribution tapes.
- We developed a meta-data extractor in AIPS++ and tested it on various forms of MeasurementSet.
- A catalog of original data and derived results has been constructed from the meta-data.
- Interfaces to the catalog have been provided from AIPS++ and the web. The web interface has been tested "by hand," and the AIPS++ interface by the pipeline.
- An initial pipeline has been constructed to read data from the archive and put derived results back into the catalog. The final step of inserting results into the catalog has not been done but everything else has.
- Data of a simple class (*e.g.* A configuration, 8 GHz, continuum) has been processed into images, and the results inserted back into the catalog. In addition, we did some work on processing an HI synthesis observation.
- In addition, the preliminary work done on the Calibration Source Toolkit has been completed. A working version is being tested internally with deployment outside the Observatory to follow shortly.

Because of the excellent progress made on the last item, we did the following unplanned work:

- We performed analysis and design of the proposal submission and proposal management toolkits. As a result, we can implement a prototype in the next development cycle.

Our major misestimate was in the amount of time needed to procure and deploy the archive server. Since this depended on heavily-overloaded AOC Computing Staff, it took roughly 4 months longer than expected. Fortunately, much of the associated archive implementation could be done independently. The net result is that we are behind on tape copying.

The next cycle is due to start once the goals and deliverables have been defined. Our expectation is that by the end of the second development cycle, architecture and designs will be sufficient to allow establishment of a project plan, including deliverables, costs, schedule, *etc.*

Technology Development

Milestone	Original Deadline	Revised Deadline	Date Completed
AIPS++ Developers Release	09-24-00	09-01-02	06-14-02
ALMA AIPS++ tests	08-15-01	08-30-02	
Form AIPS++ Technical Advisory Group	11-15-01	08-01-02	
Port to Solaris NTV	04-12-02		04-12-02
AIPS++ developer conference	05-28-02		05-31-02
AIPS++ booth at AAS, Albuquerque	06-02-02		06-06-02
AIPS++ release v1.7	06-15-02	07-30-02	07-19-02
AIPS++ WBS for v2.0	06-15-02	07-30-02	
AIPS++ tutorial at NRAO Synthesis Imaging Summer School	06-18-02		06-23-02
AIPS++ booth at AAS, Seattle, WA	01-06-03		
AIPS++ external users' workshop	01-15-03		
AIPS++ release v2.0	04-01-03		

The primary current responsibility of DM Technology Development is management of the AIPS++ project. The AIPS++ project is in an integration phase at present, with a priority focus on scientific completeness, usability improvements and enhancements in performance and robustness. All release planning during the integration phase reflects these priorities. The package is in a regular 6-month development and release cycle, and this quarter covers the second half of the v1.7 development cycle. The v1.7 release was issued in early July 2002. The work breakdown structure for the next release, v2.0, is scheduled for the end of July 2002.

A close collaboration with scientific testers remains an important component of the integration phase efforts. Within NRAO this proceeds in partnership with the NRAO AIPS++ Users Group (NAUG), which is coordinated from the AIPS++ Operations Division. This quarter the NAUG collaboration culminated in participation in the NRAO 8th Synthesis Imaging Summer School in June 2002. Approximately 55 international students were trained in the use of AIPS++ for synthesis analysis by AIPS++ staff and NAUG members. Response to the training was very favorable and highlights the continued effort in user outreach as an integral part of package deployment. In keeping with past practice, we staffed an exhibition booth at the AAS meeting in Albuquerque, NM in June 2002 and conducted tutorials for attendees on request. This activity continues next quarter with participation in the SPIE and ADASS meetings. In the area of user documentation, the instrument-specific chapters (particularly VLA, BIMA, and the GBT) were heavily used and were correspondingly revised and improved.

This quarter has seen continued progress in the overall scientific capabilities and performance of existing tools. Improved calibration routines support greater flexibility in the selection and application of solutions. Imager now supports an interactive cleaning mode. The viewer is more tightly coupled to the image analysis tools and supports new histogram range setting and annotation capabilities. Spectral plotting and scan selection are more generally supported for data displays.

Significant progress was made in the evaluation tests of AIPS++ with data from the IRAM Interferometer on Plateau de Bure. These tests were agreed upon in the fall of 2001 and good progress has been made in reducing the designated IRAM dataset in AIPS++ and in migrating CLIC/GILDAS algorithms into the package. The ALMA project has also formed a closer tie to AIPS++. By mutual agreement between the ALMA project and the AIPS++ Executive Committee, ALMA is directly represented on the AIPS++ Executive Committee in order to conduct discussion on future reciprocal resource obligations related to ALMA support within AIPS++.

The GBT remains a strong priority for AIPS++, and this focus has continued during this quarter. This has included direct support of GBT commissioning activities and early scientific observations. The development of analysis and calibration routines for GBT supported observing modes has continued throughout the quarter enabling a wide variety of spectral line and continuum data to be obtained. User support now consumes a significant fraction of time for GB personnel.

Central Computing Services

Milestone	Original Deadline	Revised Deadline	Date Completed
Revise Security Policy	02-15-01	09-30-02	
Testbed VPN	09-30-01	12-31-02	
Anti-virus email gateway purchases	12-31-01	08-15-02	
Turn off telnet/rlogin/rsh/rcp into NRAO	07-01-02		07-01-02
Web-server deployment in GB, NM, TU	07-31-01		07-15-02
Complete CCE-complaint UNIX upgrades (CV)	10-15-01	08-31-02	
CCE design (to infrastructure level)	10-31-01	07-31-02	
CCE design (core applications)	03-31-02	12-31-02	
Final W2K domain design	09-01-01	08-31-02	
Begin W2K domain deployment	10-15-01	09-30-02	
Complete W2K Active Directory testing	03-31-02	07-31-02	
Complete deployment of shared calendar software	05-31-02	07-08-02	

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 intrusions that occurred before the Computing Security Policy was issued. Near the end of the previous quarter we experienced a Distributed Denial-of-Service (DDOS) attack against the Charlottesville *ftp* server. It is impossible to entirely prevent such attacks since they require no penetration of our own network, and nearly impossible to stop them because they involve hundreds of remote systems (more than 450 in this case). Steps were taken to deflect the attack, and in mid-April, about three weeks after the attack began, normal service was restored. No other successful attacks occurred in the past quarter.

Evaluation of software to detect and handle viruses and other malicious attachments at our email delivery gateways, to supplement desktop anti-virus detection, was completed in late June 2002; purchase of the commercial software component (Sophos Anti-Virus) and of the Linux-based computers which will function as the gateways at each major NRAO site should be complete by the end of August 2002. The commercial package will be used as the core anti-virus detection technology, and will be controlled by an open-source package called MailScanner, which allows more flexibility and has better content- and attachment-filtering capabilities than the vendor offering.

For some time we have been concerned about the continuing use of protocols which cannot encrypt account password and other sensitive information, thus exposing them to monitoring anywhere along the connection path. Following the lead of other institutions similar to the NRAO (such as Jodrell Bank and NOAO), at the beginning of 2002 we announced our intention to block several of these protocols for connections from non-NRAO sites to NRAO systems, and instead require the use of Secure Shell. Training and documentation were provided to NRAO staff affected by the change, which took effect for *telnet*, *rlogin*, *rsh*, and *rcp* on July 1, 2002.

Due to limited staff time, 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 and wireless networking security requirements.

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

- *Mirrored Web Servers*: All four of the new Web servers have now been shipped, delivered, and installed at each of the four main NRAO sites. The Charlottesville server supplies the main NRAO Web pages, he ALMA Web pages, and local site pages as well as mailing list management software and local ftp service. A sophisticated mirroring system has been established and is already running to the Green Bank and Socorro servers, providing a complete mirror of the main www.nrao.edu content; the addition of the Tucson mirror, and final tests will precede the actual rollout of mirrored service to www.nrao.edu. Not only does the mirroring system provide redundancy and improved service, but it also permits hiding of the technical details of the revision control system (CVS) used to keep track of changes to files on the web server. This, along with the fact that merely creating, editing, or deleting a file in the "sandbox" area on any one of the four web servers will cause those changes to be visible on the other three within two hours during working hours, is expected to vastly improve the ability of NRAO staff to leverage these new web servers to their advantage. The work to complete this stage of the infrastructure project was made possible by a Configuration Workshop ("configfest") in June 2002. The de facto webmasters from all four sites met in Charlottesville for a week to nail down, test, and deploy the actual mirroring system. The configfest was extremely productive and successful as evidenced by the subsequent shipping of the servers and the deployment of the mirroring scheme.
- *Calendar/Scheduling tool:* As promised in the previous report, the WebEvent tool has been deployed, and is now used by staff at all four sites to schedule meetings and events. It covers both the actual conference and meeting rooms and auditoria at all sites, and the use of the video-conferencing hardware.
- *The Common Computing Environment project, or CCE (UNIX)*: NRAO-wide, more than 300 systems were affected by the recent round of CCE-compliant UNIX upgrades. Solaris 8 and RedHat Linux 7.2 upgrades were completed in Green Bank, Tucson, and Socorro in early 2002, and should be complete in Charlottesville by the end of August 2002. The CCE group continues to work on the definition of standards in the most important remaining infrastructure services, although some delays were experienced during the past quarter due to conflicting demands for staff time. Before the end of the coming quarter, we expect to be ready to begin the next step: determining the set of core UNIX applications that will be installed on all desktop and public NRAO systems.
- *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. Tests for this design continued this part quarter, including a detailed analysis of the numerous security-related settings that must be configured in the Windows 2000 environment. In addition, Dynamic DNS (DDNS) has been enabled in some NRAO DNS zones, and is expected to be supported in all forward-lookup zones by the end of the summer.

Charlottesville

The NRAO scientific and professional staff, continuing on the project started last quarter, did extensive work on researching, designing, and testing a new image gallery for the website. The gallery will be launched internally in mid-July for testing and further refinement. The public version is scheduled for launch in August. Key features of this gallery include a versatile search engine, multiple resolutions of images, detailed observational information, links to other information sites such as NED & SIMBAD, and descriptive information on the astronomical objects featured in the gallery. Concurrently, a web-based submission form is being developed so astronomers can upload images onto the gallery database.

In April, the nationally syndicated children's newspaper supplement The Mini Page ran a 3-page feature on NRAO and radio astronomy. This publication is carried in nearly 600 newspapers, including The Washington Post, the Richmond Times, and the Boston Globe. NRAO continues to update its marketing materials in line with overarching themes and designs. A new tour brochure for Green Bank was designed and printed and a tour brochure for the VLA is in development. New meeting displays for the Robert C. Byrd Green Bank Telescope, and the Atacama Large Millimeter Array were produced, making NRAO's suite of six displays current and consistent.

In May, the hiring of a central coordinator for all of NRAO's EPO efforts fulfilled last year's EPO Workshop's highest recommendation. The EPO staff is now meeting on a regular basis, via email and video conferencing, to coordinate efforts and discuss facility-wide issues, strategies, and efforts.

Green Bank

The Green Bank Astronomy Education and Visitor Center construction is on schedule and expected to be finished by mid-December 2003. At the June 7 project meeting, the project was deemed 25% complete in terms of submitted pay estimates by the contractor. The pre-bid conference for construction of the dormitory/bunkhouse facility that will accompany the new visitor center was held on June 24. Construction bids are due on July 12 and construction should begin by the end of July. A new video presentation is in production and should be ready for the opening of the new center. Visitors to the current tour center are being surveyed to gather data about demographics and desires. The data will be used in future planning for exhibits and facilities and in promotion of the new center and the Green Bank telescopes to prospective visitors.

Visitation at Green Bank remains popular. There are three levels of tour: self-guided, guided, and high-tech tours. The self-guides tours can be on foot or via bicycles and can be taken at anytime during the year. Guided public tours, currently offered during the summer months and weekends in September and October, include exhibits and educational demonstrations in the tour center, an audiovisual show on radio astronomy, and a guided bus tour through the research area past more than a half-dozen radio telescopes. Guided tours may be scheduled, by groups or schools, at any time of the year. High-tech tours, scheduled at ten times during the summer, include visits through parts of NRAO normally off limits to visitors, such as lab areas where sensitive receivers are designed and built. Other visitor activities include Star lab programs presented at specified times, solar observing sessions, and the NRAO-Green Bank gift shop is open during summer. Star parties are scheduled on specified nights, with a Star Lab program substituted in event of cloudy weather.

This year Green Bank has nine co-op and REUs (Research Experience for Undergraduates) students plus three RETs (Research Experience for Teachers). Other formal education programs include Chautauqua workshops, Hands-On-Universe workshops, and Rarecats, a teacher enhancement program for K-12 teachers. There are less formal extended-stay programs for fifth grade through college students, in which the group has a workshop on radio/astronomy, using radio astronomy data. Then they receive a lesson on the 40 Foot telescope accompanied by a research project. They may also have a behind-the-scenes tour of lab and control room, and a general tour. In addition to those educational programs, Green Bank hosted a workshop for the Frequency Agile Solar Radiotelescope (FASR) in late May and the IUCAF Spectrum Management Summer School in early June.

Socorro

In May, the film crew from ESI traveled to the VLA and spent three days shooting footage for the new 10-minute presentation for the Visitor Center. They are now putting the finishing touches on animations and editing, with an expected completion date of September 2002. An architect is currently working on plans for a gift shop for the Visitor Center and, like Green Bank, visitors to the VLA are being surveyed to gather data about demographics and desires. The data will be used in future planning for exhibits, facilities, and in promotion of the Visitor Center and the VLA to prospective visitors.

In April, the pilot program of monthly tours for the general public (more than 2,100 attendees reported last quarter) was completed and based on that success it was decided to continue them on a quarterly basis. Since the approximately 15 summer students (co-op students, REUs, returning students, and graduating seniors) and 2 RETs host public tours of the VLA on weekends during summer, the next general public tour is not scheduled until October. The VLA also played host to tours from the High Energy Astrophysics Division meeting held in Albuquerque in April, approximately 150 attendees from the AAS meeting in June, and 150 students from the NRAO Synthesis Imaging Summer School also in June.

NRAO hosted a reception for the press at the June AAS meeting in Albuquerque, well attended by media people and by NRAO scientists attending the meeting. The press reception provided an excellent informal gathering to foster communication between NRAO scientists and the astronomical science-reporting community. This was followed the next day by a special VLA visit for the press. After lunch on site with lectures about the VLA, a detailed tour was given, including an antenna climb and a visit to the control room. The press tour received compliments from the media people and from the AAS Press Officer. Tour press participants wrote stories about the VLA Expansion that appeared in the New York Times and on the Reuters news wire. The Reuters story was also featured in the science section of CNN.com.

The Southwestern Consortium of Observatories for Public Education (SCOPE) met at NRAO-Socorro the day after the AAS conference ended. At the meeting, agreement was reached to prepare plans for a "Tour of the Southwestern Observatories," to be conducted by a commercial tour company. Tour operators appear to be enthusiastic about offering such a tour, and further plans and negotiations will ensue with possible inauguration for the 2004 summer season. NRAO EPO staff arranged for shuttle astronaut Dr. John Grunsfeld to attend this year's New Mexico State Science Fair in Socorro. As part of the visit, the astronaut returned the NRAO-emblazoned flag, which he had carried aboard the recent Shuttle mission to upgrade the Hubble Space Telescope. Grunsfeld was the keynote speaker for the fair and helped hand out awards at which hundreds of middle and high school visitors were in attendance.

Socorro's first RET arrived during June and was quickly at work with the new Small Radio Telescope (SRT) at the Visitor Center to get it in exhibit working order. The intent is to create a display that allows visitors to point the SRT to a source (the Sun, Cas A or Cygnus A) and observe the incoming signal. In another special project, six high school students and a professional translator were hired to spend seven weeks this summer translating some NRAO web pages into Spanish. This is occurring under the auspices of a NASA Ideas grant procured by an NSF postdoctoral fellow.

Telescope Usage

The following telescopes have been scheduled for research and maintenance in the following manner during the first quarter of 2002. Note that time lost and actual observing for the arrays are computed at fractions of the total antenna arrays. For example, losing 27 VLA antennas for one hour counts as 1.0 hours of time lost, while losing one out of 10 VLBA antennas for one hour counts as 0.1 hours of time lost. The VLA downtime was larger than usual due to an early onset of the spring windy season in March.

	VLA	VLBA	GBT
Scheduled Observing (hrs)	1651.20	1131.50	434.00
Scheduled Maintenance and Equipment Changes	225.30	337.75	456.00
Scheduled Tests and Calibration	313.50	292.20	1113.00
Time Lost	79.70	66.60	54.55
Actual Observing	1571.50	1064.90	550.85

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

No.	Observer(s)	Programs
BL106	Lazio, T. J. W. (NRL) Goss, W. M. Brogan, C. Faison, M. (Beloit College) Zauderer, A. (Agnes Scott College) De Pree, (Agnes Scott College)	AU scale HI opacity variations 21 cm
BP100	Perez-Torres, M. (Bologna) Mantovani, F. (Bologna) Marcaide, J. M. (Valencia) Guirado, J. C. (Valencia) Alberdi, A. (IAA, Andalucia) Lara, L. (IAA, Andalucia) Ros, E. (MPIfR) Panagia, N. (STScI) Shapiro, I. (CfA) Sramek, R. Stockdale, C. (Oklahoma) Weiler, K. W. (NRL) Van Dyk, S. (IPAC/Caltech) Lundqvist, P. (Stockhom U.)	VLBI observations of SN2001gd in NGC5033 3.5 cm
BU022	Ulvestad, J. Wong, (Cornell) Taylor, G. Mundell, C. (Liverpool JMU)	NGC 4151: Where is the nucleus, and how fast is the jet? 2, 3.5, 6 cm
BU024	Ulvestad, J. Teng, S. (U. of Maryland) Neff, S. G. (GSFC/NASA)	The possible AGN in NGC 3690 system 2, 11 cm
GBT 01A-011	Dickey, J. (Minnesota) Lockman, F. J. McClure-Griffiths, N. (CSIRO)	Low latitude galactic HI mapping with the GBT 21 cm
GBT 01A-014	Braatz, J. Greenhill, L. (CfA)	Detecting high-velocity masers to reveal nuclear disks in nearby AGNs. 1.3 cm

GBT 01A-017	Ransom, S. (McGill University) Backer, D. (UC, Berkeley) Beasley, A. (OVRO) Greenhill, L. (CfA)	A search for binary and millisecond pulsars in globular clusters. 21 cm
GBT 01A-040	Lockman, F. J	Corotation of the HI halo in the inner Galaxy 21 cm
GBT 01A-078	Stairs, I. Kaspi, V. (McGill University)	A 20 cm search for pulsars in globular clusters 21 cm
GBT 01A-079	Thorsett, S. (UC, Santa Cruz) Stairs, I. Arzoumanian, Z. (NASA/GSFC)	Timing fast pulsars at the GBT 21 cm
GBT 02A-012	Minter, A. Balser, D.	Probing HI structure on sub-AU - AU scales: Hydrodynamical or MHD turbulence? 21 cm
GBT 02A-016	Benner, (JPL) Black, G. Ostro, S. (JPL) Nolan, M (Arecibo Observatory) Margot, J. (Caltech) Giorgini, J (JPL) Jurgens, R. (JPL) Hudson, R (Washington State) Pravec, P (AIAS))	Bistatic radar imaging of slowly rotating asteroid 1999 GU3. 3.5, 11 cm
GBT 02A-021	Lockman, F. J Roshi, A.D. Balser, D.	A search for recombination lines from diffuse gas in the Galactic Center region 6, 11, 21 cm
GBT 02A-022	Allen, R. J. (STScI) Rajagopal, J. (Raman) Panagia, N. (STScI)	Search for formaldehyde absorption of the CMB by cold molecular gas in M31. 6 cm

GBT 02A-039	Camilo, F. (Columbia) Klein, B. (MPIfR, Bonn) Mueller, (MPIfR, Bonn) Wielebinski, R. (MPIfR, Bonn) Kramer, M. (NRAL) Lorimer, D. (Manchester) McLaughlin, M. (Manchester) Stairs, I. Backer, D. (UC, Berkley)	Searching for radio pulsations from the (X-ray) pulsar J0205+6449 in SNR 3C58. 21 cm
GBT 02A-042	Margot, J. (Caltech) Peale, S. (UC, Santa Barbara) Slade, M. (JPL)	Radar measurements of Mercury's obliquity and librations. 3.5 cm
GBT 02A-049	Backer, D. (UC, Berkley) Stairs, I. Nice, D. (Princeton) Lommen, (UC, Berkeley)	Exploration of millisecond pulsar timing stability. 11, 21, 38 cm
GBT 02A-052	Stairs, I. Manchester, R. (Australia) Lyne, A. G. (NRAL)	Continued multifrequency monitoring of a massive pulsar system. 1, 21, 38 cm
GBT 02A-062	Camilo, F. (Columbia) Halpern, J. P. (Columbia) Stairs, I. Backer, D. (UC, Berkley) Arzoumanian, Z. (NASA/GSFC)	Studying PSR J2229+6114: an energetic gamma-ray emitting young pulsar. 11, 21, 38 cm
GBT 02B-009	Roshi, A. Deshpande, A. (Raman)	AU scale HI structures: a probe using scattering of pulsar signals. 21 cm
GBT 02B-019	Stairs, I. Ransom, S. (McGill University) Kaspi, V. (McGill University) Hessels, (McGill University) Backer, D. (UC, Berkeley) Lorimer, D. (Manchester)	Timing of newly discovered globular cluster pulsars. 21 cm

GBT 02B-021	Chandler, A. (Caltech Physics) Jacoby, B. (Caltech Astronomy) Anderson, (Caltech Physics) Kulkarni, S. R. (Caltech) Prince, T. A. (Caltech) Backer, D. C. (UC, Berkeley)	Timing the six millisecond pulsars in M62. 21 cm
GBT 02B-026	Ransom, S. (McGill University) Stairs, I. Camilo, F. (Columbia)	Radio detection of the millisecond X-ray pulsar XTE J1751-305. 11, 21 cm
GBT 02B-027	Rupen, M. Stairs, I. Brisken, W. (Princeton)	Observations of X-ray transient XTE J0929-314. 11, 21 cm
W405	Reid, M. (CfA)	HALCA observations of J1230+12 (M87). 21 cm
W406	Junor, W. (UNM)	HALCA observations of J1230+12 (M87). 6 cm
W421	Lobanov, A. (MPIfR)	HALCA observations of J1229+02 (3C273) 6 cm

No.	Observer(s)	Programs
AA269	Anglada, G. (IAA, Andalucia) Rodriguez, L. (Mexico/UNAM) Torrelles, J. (IAA, Andalucia) Ho, P. (CfA)	Young close binary SVS 13, 1.3 cm
AA270	Anderson, J. (NMIMT) Ulvestad, J. Ho, L. (Carnegie Obs.)	Spectral energy distributions of low-luminosity AGNs. 0.7, 1.3, 2, 3.6, 6 cm
AA271	Armstrong, E. (Columbia) Helfand, D. (Columbia)	Stellar radio candidates from the FIRST survey. 3.6, 20 cm
AB0950	Becker, R. (UC, Davis) White, R. (STScI) Helfand, D. (Columbia)	The FIRST survey. 20 cm
AB1014	Bains, I. (Herfordshire) Thomasson, P. (Manchester) Bryce, M. (Manchester)	Angular expansion measurement of NGC 7027. 6 cm
AB1016	van Breugel, W. (LLNL) Reuland, M. (LLNL) deVries, W. (LLNL) DeBreuck, C. (IAP, Paris) Rottgering, H. (Leiden) Carilli, C. Rottgering, H. (Leiden)	High resolution imaging of Z>3 radio galaxies. 3.6, 6 cm
AB1018	Black, G. Campbell, D. (Cornell) Nicholson, P. (Cornell)	Radio source occultation by the Saturnian ring system. 20, 90 cm
AB1019	Brunthaler, A. (MPIR, Bonn) Falcke, H. (MPIR, Bonn) Aller, M. (Michigan) Aller, H. (Michigan) Terasranta, H. (Helsinki) Bower, G. (UC, Berkeley)	Monitoring the radio-intermediate quasar PG2209+184. 1.3, 2, 3.6, 6, 20, 90 cm
AB1024	Blundell, K. (Oxford) Perley, R. Greisen, E.	Brightest low-frequency sources - a calibration resource. 90, 400 cm

AB1026	Blundell, K. (Oxford) Fabian, A. (Cambridge) Perley, R.	Low frequency probe of Chandra cavities. 90, 400 cm
AB1029	Brisken, W. Thorsett, S. (UC, Santa Cruz) Goss, W. M.	Proper motion of the Duck pulsar: B1757-24. 20 cm
AB1031	Brogan, C. Kassim, N. (NRL) Lazio, T. J. W. (NRL)	Low frequency observations of the W51 Complex. 90, 400 cm
AB1033	Blundell, K. (Oxford) Rawlings, S. (Oxford)	E1821+643 - is the jet axis precessing? 20 cm
AB1036	Best, P. (Royal Obs)	SCUBA sources in z~1 clusters: confirmation of cluster membership. 20 cm
AB1039	Bignall, H. (Adelaide) Jauncey, D. (CSIRO) Lovell, J. (CSIRO) Kedziora-Chudczer, L. (CSIRO) Tzioumis, T. (CSIRO) Macquart, J-P. (Groningen/Kapteyn)	ISM properties toward the Intraday variable PKS 1257-326. 3.6 cm
AB1043	Blundell, K. (Oxford) Cruz, M. (Oxford) Peck, A. (CfA)	Search for HI absorption in radiogalaxies at z~3.5. 90 cm
AB1049	Berger, E. (Caltech) Martin, E. (Hawaii) Rutledge, R. (Caltech) Bildsten, L. (UC, Santa Barbara) Gizis, J. (IPAC) Basri, G. (UC, Berkeley)	VLA, Chandra, UH 2.3 m observations of brown dwarf 2MASSW1507-16. 3.6 cm
AB1050	Bartel, N. (York U.) Bietenholz, M. (York U.)	Flux of SNN 1986J. 0.7, 1.3, 2, 3.6, 6, 18, 90 cm
AB1051	Berger, E. (Caltech) Kulkarni, S. (Caltech) Frail, D.	Type Ib/c SN2002cj and SN2002cp. 3.6 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, 400 cm
AC599	Clarke, T. Owen, F.	Search for halo or relics in Butcher-Oemler Cluster Abell 2125. 90 cm
AC605	Claussen, M. Wilner, D. (CfA)	Monitoring continuum emission from TW Hya. 2, 3.6, 6, 20 cm
AC614	Cotter, G. (Cambridge) Bolton, R. (Cambridge) Jones, M. (Cambridge) Grainge, K. (Cambridge) Pooley, G. (Cambridge) Waldran, E. (Cambridge) Taylor, A. (Cambridge) Saunders, R. (Cambridge)	Followup of the Cambridge 15 GHz survey. 0.7, 1.3, 6, 20 cm
AC618	Chandler, C. Low, F. (Arizona)	The flat spectrum dust disk around HD 98800. 0.7 cm
AC622	Carilli, C. Petric, A. (Columbia) Omont, A. (IAP, Paris) Cox, P. (IAP, Paris) Beelen, A. (IAP, Paris) McMahon, R. (Cambridge) Isaak, K. (Cambridge) Priddey, R. (Cambridge) Bertoldi, F. (MPIR, Bonn) Menten, K. (MPIR, Bonn)	Radio continuum properties of far-IR luminous QSOs at z~2. 20 cm
AC624	Clemens, M. (Cambridge) Alexander, P. (Cambridge) Cotter, G. (Cambridge) Longair, M. (Cambridge) Nikolic, B. (Cambridge)	Comparison of thermal continuum emmission with mid-IR PAH features. 6, 20 cm
AC628	Castelletti, G. (IAFE) Kassim, N. (NRL) Dubner, G. (IAFE)	Supernova remnant W44 at low frequency. 90, 400 cm

AC629	Chatterjee, S. (Cornell) Cordes, J. (Cornell) Wong, D. (Cornell) Brisken, W. Goss, W. M. Fomalont, E. Benson, J. McKinnon, M. Thorsett, S. (UC, Santa Cruz) Kramer, M. (Manchester) Lyne, A. (Manchester) Lazio, T. J. W. (NRL) Backer, D. (UC, Berkeley) Golden, A. (Ireland)	VLA survey for pulsar astrometry with the VLBA. 3.6, 20 cm
AC630	Curiel, S. (Mexico/UNAM) Trinidad, M. (Mexico/UNAM) Canto, J. (Mexico/UNAM) Hernandez, L. (Mexico/UNAM) Torrelles, J. (IAA, Andalucia) Gomez, J. (IAA, Andalucia) Anglada, G. (IAA, Andalucia) Ho, P. (CfA) Patel, N. (CfA) Greenhill, L. (CfA) Rodriguez, L. (Mexico/UNAM) Garay, G. (Chile)	Powering source of the water maser bubble in Cepheus A. 3.6 cm
AC633	Cohen, A. (NRL) Rottgering, H. (Leiden) Kassim, N. (NRL) Jarvis, M. (Leiden)	Search for ultrasteep spectrum objects. 20 cm
AC640	Ciliegi, P. (Bologna) Comastri, A. (Bologna) Brusa, M. (Bologna) Baldi, A. (Hawaii) Perola, C. (Rome) Severgnini, P. (Florence) Vignali, C. (Penn State)	Radio nature of XMM X-ray sources. 20 cm

AC641	Cheung, C. (Brandeis) Roberts, D. (Brandeis) Wardle, J. (Brandeis) Sambruna, R. (George Mason) Maraschi, L. (Brera Obs) Tavecchio, F. (Brera Obs) Urry, C. (Yale) Scarpa, R. (ESO)	Deep 22 GHz imaging of new X-ray/optical jets in AGN. 1.3 cm
AC647	Clarke, T. Neumann, D. (CNRS, France) Kassim, N. (NRL)	Low frequency observations of cooling flow clusters. 90 cm
AC648	Cohen, A. (NRL) Israel, F. (Leiden) Kassim, N. (NRL)	Searching for free-free absorption in normal spiral galaxies. 90, 400 cm
AC650	Chandler, A. (Caltech) Kaplan, D. (Caltech) Jacoby, B. (Caltech)	Pulsar positions in M62. 20 cm
AC651	Cheung, T. (Brandeis) Schwartz, D. (CfA) Wardle, J. (Brandeis)	Jet in z=5.99 quasar SDSS J1306+0356. 6, 20 cm
AD458	Dickey, J. (Minnesota) Heiles, C. (UC, Berkeley)	Variations in the HI optical depth toward compact continuum sources. 20 cm
AD462	Darling, J. (Cornell) Giovanelli, R. (Cornell)	Locations of OH megamasers in their host galaxy. 20 cm
AD463	DeBreuck, C. (IAP, Paris) Carilli, C. Rottgering, H. (Leiden) Miley, G. (Leiden) Kurk, J. (Leiden) Pentericci, L. (MPIA, Heidelberg)	High redshift radio galaxies in proto clusters. 20 cm
AD467	Drake, S. (NASA/GSFC) Linsky, J. (Colorado/JILA) Wade, G (RMCC).	Magnetic CP stars: radio vs. X-ray properties. 3.6, 6, 20 cm

AD468	Diamond, P. (Manchester) Hagiwara, Y. (MPIR, Bonn) Miyoshi, M. (NAO, Japan)	Flaring water maser in NGC 4051. 1.3 cm
AE146	Exter, K. (Queens U, Belfast) Davis, R. (Manchester) Barlow, M. (U. College London) Watson, S. (Manchester)	P Cygni's variable wind. 0.7, 1.3, 6 cm
AF387	Feretti, L. (Bologna) Kassim, N. (NRL) Perley, R. Giovannini, G. (Bologna)	FRI radio galaxy 3C 449 at 74 MHz. 400 cm
AF388	Farrell, B. (NASA/GSFC) Lazio, T. J. W. (NRL) Desch, M. (NASA/GSFC) Bastian, T. Zarka, P. (Paris Obs)	Search for low frequency radio emission from the planet orbiting Tau Boo. 400 cm
AF390	Ferrari, C. (Cote d'Azur) Feretti, L. (Bologna) Giovannini, G. (Bologna) Maurogordato, S. (Cote d'Azur)	Radio galaxies and diffuse emission in the merging cluster A521. 20 cm
AF391	Feretti, L. (Bologna) Brunetti, G. (Bologna) Giovannini, G. (Bologna) Govoni, F. (Bologna) Kassim, N. (NRL) Cotton, W.	74 MHz observations of the radio halo in A2163. 400 cm
AG618	Giroletti, M. (Bologna) Giovannini, G. (Bologna) Treves, A. (Milano Obs) Falomo, R. (Padova) Dallacasa, D. (Bologna)	A sample of nearby BL lac objects. 3.6, 20 cm
AG623	Gizani, N. (Lisbon) Cohen, A. (NRL) Kassim, N. (NRL)	Spectral aging in Hercules A. 90, 400 cm

AG627	Gaensler, B. (CfA) Pooley, D. (MIT) Lewin, W. (MIT) D'Amico, N. (Bologna) Kaspi, V. (McGill)	Globular clusters NGC 6266 and 6366. 20 cm
AH763	Hagiwara, Y. (MPIR, Bonn) Diamond, P. (Manchester)	The water maser region/IXO in M82. 1.3 cm
AH766	Hardcastle, M. (Bristol, UK) Worrall, D. (Bristol, UK) Birkinshaw, M. (Bristol, UK)	Jets in a Chandra sample of B2 radio galaxies. 6 cm
AH769	Hardcastle, M. (Bristol, UK)	X-ray cavities in HCG 62. 90 cm
AH775	Hyman, S. (Sweet Briar) Lazio, T. J. W. (NRL) Denn, G. (Sweet Briar) Kassim, N. (NRL)	Monitoring the galactic center for transient detection. 90 cm
AH777	Hofstadter, M. (JPL) Butler, B.	Seasonal variations in the atmosphere of Uranus. 2, 6 cm
AH778	Harper, G. (Colorado/JILA) Brown, A. (Colorado/JILA) Guinan, E. (Villanova)	Extended atmosphere of Alpha Orionis. 1.3, 2, 3.6, 6, 20 cm
AH780	Hagiwara, Y. (MPIR, Bonn) Diamond, P. (Manchester) Miyoshi, M. (NAO, Japan)	Water emission in NGC 6240. 1.3 cm
AH781	Hota, A. (TIFR) Saikia, D. (TIFR)	Ultra luminous infrared galaxies with galactic-scale outflows. 3.6, 20 cm
AH784	Harris, D. (CfA) Vrtilek, J. (CfA) Ponman, T. (Birmingham) Kassim, N. (NRL) Lane, W. (NRL)	The X-ray cavities in HCG 62. 90 cm
AH786	Hoare, M. (Leeds) Lumsden, S. (Leeds) King, T. (Leeds)	Survey of red MSX sources in the outer galaxy. 6 cm

AH787	Harris, D. (CfA) Kim, D. (CfA) Fomalont, E.	X-ray - radio comparison in Fornax A. 6, 20 cm
AH791	Hofner, P. (Puerto Rico)	A variable source in a star formation region. 2, 3.6, 6, 18 cm
AI096	Ivison, R. (Royal Obs) Townsend, R. (U. College London) Blain, A. (Caltech) Smail, I. (Durham) Frayer, D. (Caltech)	Search for water and OH masers in BAL quasar APM 08279+5255. 90 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. 0.7, 1.3, 2, 3.6, 6, 20 cm
AK543	Koopmans, L. (Caltech) deBruyn, A. (NFRA) Fassnacht, C. (STScI) Wambsganss, J. (API, Potsdam) Blandford, R. (Caltech)	Radio micro lensing in B1600+434. 2, 3.6, 6, 20 cm
AK544	Kassim, N. (NRL) Lazio, T. J. W. (NRL) Cohen, A. (NRL) Perley, R. Cotton, B. Owen, F. Carilli, C. Harris, D. (CfA) Dwarakanath, K. Erickson, W. (Maryland)	Highest resolution, low frequency imaging of Cygnus A and Virgo A. 400 cm
AL550	Lestrade, J. (Paris Obs) Taylor, G.	Detection of the photosphere of Sirius and Procyon at 43 GHz. 0.7 cm

AL557	Lovell, J. (CSIRO) Bignall, H. (Adelaide) Jauncey, D. (CSIRO) Tzioumis, A. (CSIRO) Kedziora-Chudczer, L. (CSIRO) Reynolds, J. (CSIRO) Rickett, B. (UC, San Diego) Marcquart, J. (Groningen/Kapteyn)	Northern hemisphere intra-day variable survey. 3.6, 6 cm
AL564	Landt, H. (STScI) Perlman, E. (Maryland) Padovani, P. (STScI)	Faint sample of BL lacertae objects. 20 cm
AL566	Lonsdale, C. (Haystack) Kassim, N. (NRL) Lane, W. (NRL)	Relic radio lobes in 3C249.1. 90, 400 cm
AL568	Leto, P. (Bologna) Trigilio, C. (Bologna) Buemi, C. (Bologna) Umana, G. (Bologna) Leone, F. (Catania)	High frequencies search for coherent emission from HD 37479. 2, 3.6 cm
AL569	Loinard, L. (Mexico/UNAM) Rodriguez, L. F. (Mexico/UNAM)	Proper motions in the protostellar system IRAS 16293-2422. 0.7, 3.6 cm
AL570	Lang, C. (Massachusetts) Johnson, K. Goss, W. M. Rodriguez, L. (Mexico/UNAM)	Stellar winds in the galactic center quintuplet cluster. 3.6, 6 cm
AL573	Lazio, T. J. W. (NRL) Lang, C. (Massachusetts) Gotthelf, E. (Columbia) Cordes, J. (Cornell) Wang, D. (Massachusetts)	Radio counterparts to Chandra sources toward the galactic center. 3.6 cm

AL574	Linz, H. (Puerto Rico) Hofner, P. (Puerto Rico) Araya, E. (Puerto Rico) Stecklum, B. (Thuringian) Kurtz, S. (Mexico/UNAM) Rodriguez, L. (Mexico/UNAM) Marti, J. (U. Jaen) Henning, T. (MPIA, Heidelberg)	Structure of the driving source of HH80/81. 0.7 cm
AL575	Lee, J. (Arizona) Impey, C. (Arizona) van Zee, L. (Indiana)	Kinematics of low surface brightness galaxies. 20 cm
AM684	Maccorone, T. (Yale) Nowak, M. (Yale) Bailyn, C. (Yale) Brisken, W. Jain, R. (Yale)	Searching for outflows in Aql X-1. 1.3, 3.6 cm
AM708	Murgia, M. (Bologna) Parma, P. (Bologna) Mack, K. (NFRA) deRuiter, H. (Bologna)	Dying radio galaxy candidates. 20 cm
AM710	Markovic, T. (NMIMT) Owen, F. Eilek, J. (NMIMT)	Central radio sources in cooling core clusters. 90, 400 cm
AM714	Mack, K. (NFRA) Prieto, A. (ESO) Brunetti, G. (Bologna)	Resolving radio hot spots. 3.6, 6, 20 cm
AM726	Martin, E. (Hawaii) Berger, E. (Caltech) Rutledge, R. (Caltech)	Survey of radio-emission in ultra cool dwarfs. 3.6 cm
AM727	Monnier, J. (CfA) Greenhill, L. (CfA) Tuthill, P. (Sydney) Danchi, W. (NASA/GSFC)	Colliding wind binary WR 112. 3.6 cm

AM728	Massimiliano, B. (Bologna) Feretti, L. (Bologna) Giovannini, G. (Bologna) Govoni, F. (Bologna)	Relics of a possible giant radio galaxy in A548. 3.6, 6, 20 cm
AM729	Murgia, M. (Bologna) Parma, P. (Bologna) Mack, C. (NFRA) de Ruiter, H. (Bologna)	Ultra steep spectrum radio galaxies. 20 cm
AM732	Morganti, R. (NFRA)	Radio galaxy B2 0648+20. 3.6 cm
AM733	Marscher, A. (Boston) Krawczynski, H. (Yale) Falcone, A. (New Hampshire)	TEV detected BL Lacs. 0.7, 1.3, 2, 3.6, 6 cm
AN103	Neff, S. (NASA/GSFC) Ulvestad, J. Champion, S. (Maryland)	High resolution imaging of NGC 3256. 3.6, 6 cm
AN109	Nakanishi, K. (NAO, Japan) Takata, T. (NAO, Japan) Kashikawa, N. (NAO, Japan)	An extended SCUBA source in a cluster of galaxies. 6, 20 cm
AO168	O'Brien, J. (Mt. Stromlo) Bosma, A. (Marseille Obs) Freeman, K. (Mt. Stromlo) Staveley-Smith, L. (CSIRO)	Thin edge-on galaxies. 20 cm
AP429	Pedlar, A. (Manchester) Wills, K. (Sheffield) Muxlow, T. (Manchester) Booth, R. (Chalmers, Onsala) Aalto, S. (Chalmers, Onsala) Conway, J. (Chalmers, Onsala)	OH absorption study of the M82 starburst. 20 cm
AP432	Palmer, P. (Chicago) Goss, W. M. Devine, K. (Carleton College)	The OH lines in W49. 6 cm

AP434	Petric, A. (Columbia) Bertoldi, F. (MPIR, Bonn) Carilli, C. Cox, P. (IAP, Bonn) Fan, X. (Princeton) Menten, K. (MPIR, Bonn) Omont, A. (IAP, Bonn) Rupen, M. Strauss, M. (Princeton)	Sensitive search for radio emission from the highest redshift QSOs. 20 cm
AP435	Polatidis, A. (MPIR, Bonn) Marcha, M. (Lisbon) Caccianiga, A. (Brera Obs) Bondi, M. (Bologna) Pihlstrom, Y. Marr, J. (Union College)	HI absorption in nearby compact symmetric objects. 20 cm
AP437	Punsly, B. (Hughes) Tingay, S. (CSIRO) Rodriguez, L. (Mexico/UNAM)	High quality images of the EGRET source PKS 1622-253. 3.6, 6 cm
AP439	Perlman, E. (Maryland) Biretta, J. (STScI) Baum, S. (STScI) O'Dea, C. (STScI) Harris, D. (CfA) Martel, A. (Johns Hopkins)	Structure and physics of extra galactic jets. 1.3, 3.6 cm
AP441	Perley, R. Condon, J. Cotton, W. Cohen, A. (NRL) Lane, W. (NRL) Kassim, N. (NRL) Lazio, T. J. W. (NRL) Erickson, W. (Maryland) Wall, J. (Oxford)	4 Meter All-Sky Survey (4MASS); mini-survey. 400 cm
AR463	Roberts, M. (McGill) Kaspi, V. (McGill)	Expansion of the shell and pulsar wind nebula of SNR G11.23. 6, 20, 90 cm
AR464	Reynoso, E. (IAFE) Hughes, J. (Rutgers) Moffett, D. (Furman)	Expansion of Tycho's supernova remnant, 3C10. 20 cm

AR474	Rodriguez, L. (Mexico/UNAM) Canto, J. (Mexico/UNAM) Carral, P. (Guanajuato) Kurtz, S. (Mexico/UNAM)	Exciting sources of the shell HII regions NGC 6334A and NGC 6334E. 0.7, 2, 3.5 cm
AR476	Rupen, M. Mioduszewski, A. Dhawan, V.	Galactic X-ray binaries and transients. 0.7, 1.3, 2, 3.6, 20, 90 cm
AR477	Rawlings, S. (Oxford) Willott, C. (Oxford) McLure, R. (Oxford) Mitchell, E. (Oxford) Dunlop, J. (Edinburgh) Jarvis, M. (Leiden) Hill, G. (Texas)	Radio structures over a wide range of luminosities. 3.6, 6, 20 cm
AR478	Roberts, D. (Northwestern) Yusef-Zadeh, F. (Northwestern)	Measurement of radial acceleration of ionized gas in Sag A. 3.6 cm
AR479	Rusin, D. (CfA) Biggs, A. (Manchester) Fassnacht, C. (STScI) Koopmans, L. (Caltech) Lovell, J. (CSIRO) Winn, J. (CfA)	Which new radio lenses are variable? 3.6 cm
AR481	Rawlings, S. (Oxford) Dalton, G. (Oxford) MacDonald, E. (Oxford) Wegner, G. (Dartmouth)	Radio imaging of the Oxford-Dartmouth thirty degree survey. 20 cm
AR483	Roy, A. (MPIR, Bonn) Slee, O. (CSIRO) Feretti, L. (Bologna) Andernach, H. (Guanajuato U.) Ehle, M. (ESA, Spain) Murgia, M. (Bologna)	Structure in the cluster radio relic in Abell 1664. 20 cm
AR486	Romano, R. (INAOE, Mexico) Mayya, D. (INAOE, Mexico) Garcia-Barreto, J. (Mexico/UNAM) Vorobyov, E. (Rostov)	Star formation history of the Cartwheel galaxy. 2, 6, 20 cm

AR488	Reid, M. (McMaster U.) Wilson, C. (McMaster U.)	Ammonia (1,1) and (2,2) in star-forming cloud cores. 1.3 cm
AR489	Rottgering, H. (Leiden) Cohen, A. (NRL) Best, P. (Royal Obs) Kassim, N. (NRL) Perley, R. Pierre, M. (CNRS, France) Refregier, A. (CNRS, France) Rengelink, R. (Leiden) Birkinshaw, M. (Bristol, UK) Bremer, M. (Bristol, UK) Liang, H. (Bristol, UK) Zanichelli, A. (Milano Obs)	Radio source population and XMM large scale structure survey. 90, 400 cm
AR490	Roberts, M. (McGill) Tam, C. (McGill) Gaensler, B. (CfA)	Pulsar wind nebula of gamma-ray source GeV J1809-2327. 20, 90 cm
AR493	Rusin, D. (CfA) Winn, J. (CfA) Wythe, S. (CfA)	SDSS J083643.85+005453.3, a radio loud quasar at z=5.8. 6 cm
AS687	Soifer, B. (Caltech) Helou, G. (IPAC) Werner, M. (JPL) Shupe, D. (Caltech) Storrie-Lombardi, L. Condon, J. Cotton, W.	The SIRTF first-look survey. 20 cm
AS719	Snellen, I. (Royal Obs) Best, P. (Royal Obs)	Distant FR I radio galaxies. 20 cm
AS721	Schmidt, H. Calzetti, D. (STScI) Armus, L. (Caltech)	Star formation of local starbursts. 20 cm
AS722	Sarma, A. (Illinois) Crutcher, R. (Illinois) Troland, T. (Kentucky) Momjian, E. (Kentucky)	HI Zeeman observations of NGC 1275 (Perseus A). 20 cm

AS723	Stockdale, C. (NRL) Cowan, J. (Oklahoma) Maddox, L. (Oklahoma) Prestwich, A. (CfA) Primmi, F. (CfA) Zezas, A. (CfA)	SNRs in nearby spiral galaxies. 20 cm
AS729	Subrahmanyan, R. (CSIRO) Saripalli, L. (CSIRO)	Restarting beams in the giant radio galaxy B11545-321. 6, 20 cm
AS732	Sjouwerman, L.	OH masers in GMC −0.13-0.08. 20 cm
AT274	Torrelles, J. (IAA, Andalucia) Gomez, Y. (Mexico/UNAM) Miranda, L. (IAA, Andalucia) Anglada, G. (IAA, Andalucia)	Search for water maser emission in planetary nebulae. 1.3 cm
AU091	Umana, G. (Bologna) Trigilio, C. (Bologna) Leone, F. (Catania)	The inner core of the bipolar nebula M2-9. 1.3, 2, 3.6, 6, 20 cm
AV256	Venturi, T. (Bologna) Bardelli, S. (Bologna) Dallacasa, D. (Bologna)	Radio galaxies in A3562, a duster with a halo. 20, 90 cm
AW563	Williams, P. (Edinburgh) Dougherty, S. (DRAO)	Continuing monitoring of WR 125. 3.6, 6, 20 cm
AW574	Wrobel, J. Taylor, G. Myers, S. Gregory, P. (British Columbia)	Phase calibration sources at low galactic latitudes. 3.6 cm
AW575	Wiedner, M. (CfA) Reid, M. (CfA) Menten, K. (MPIR, Bonn)	Extended emission around the double nuclei of Arp 200. 2, 3.6 cm
AW576	Winn, J. (CfA) Biggs, A. (Manchester) Fassnacht, C. (STScI) Koopmans, L. (Caltech) Lovell, J. (CSIRO) Rusin, D. (CfA)	Time delays in gravitational lenses. 3.6 cm

AW579	Weiler, K. (NRL) Stockdale, C. (NRL) Sramek, R. Van Dyk, S. (IPAC) Panagia, N. (STScI) Marcaide, J. (Valencia) Lewin, W. (MIT) Pooley, D. (MIT) Immler, S. (Massachusetts)	Properties of radio supernovae. 2, 3.6, 6, 20, 90 cm
AW582	Webster, Z. (UC, Berkeley) DiFranceso, J. (UC, Berkeley) Anglada, G. (IAA, Andalucia) Welch, W. (UC, Berkeley) Wilner, D. (CfA) Rodriguez, L. (Mexico/UNAM)	The embedded protostars in NGC 1333. 0.7 cm
AY132	Young, L. (NMIMT) Rundle, D. (NMIMT)	Elliptical galaxies: radio continuum and star formation. 20 cm
AZ134	van Zee, L. (Indiana) Salzer, J. (Wesleyan U.) Skillman, E. (Minnesota)	Kinematics of gas rich blue compact dwarf galaxies. 20 cm
AZ136	Zhao, J-H. (CfA) McGary, R. (CfA) Goss, W. M. Bower, G. (UC, Berkeley)	VLA monitoring the 106-day cycle of Sgr A. 0.7, 1.3, 2 cm
BD080	Diamond, P. (Manchester), et al. *See VLBA Program List*	TX CAM. 0.7 cm
BG118	Greenhill, L. (CfA), et al. *See VLBA Program List*	SiO maser motions in Orion BN/KL. 0.7 cm
BH097	Hoffman, I. (New Mexico), et al. *See VLBA Program List*	Full stokes observations of the 1720 MHz OH masers in W28. 18 cm
BL106	Lazio, T. J. W. (NRL), et al. *See VLBA Program List*	AU scale HI opacity variations. 18 cm
BP091	Peck, A. (CfA), et al. *See VLBA Program List*	Spare Change - collecting the last few COINS from the bottom of the VCS. 2, 6 cm

BR080	Ratner, M. (CfA), et al. *See VLBA Program List*	Astrometry of HR 8703 in 2002 for gravity Probe-B mission. 3.6 cm,
BS102	Sahai, R. (JPL), et al. *See VLBA Program List*	The water masers in the "water-fountain" proto planetary IRAS 16342-3814. 1.3 cm
BS113	Stairs, I., et al. *See VLBA Program List*	Precise position for a massive binary pulsar. 18 cm
BU022	Ulvestad, J., et al. *See VLBA Program List*	NGC 4151: where is the nucleus, and how fast is the jet? 2, 3.6, 6 cm
GB042	Bartel, N. (York U.), et al. *See VLBA Program List*	SN 1993J and the core jet counterjet in M81. 6 cm

VLBA Observing Programs

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

No.	Observer(s)	Programs
BA047	Asaki, Y. (ISAS) Deguchi, S. (Nobeyama) Honma, M. (Mizusawa) Imai, H. (Mizusawa) Miyoshi, M. (Mizusawa)	Determination of positions of a galactic evolved star with a distance of 2.3 kpc. 1 cm
BA049	Attridge, J. (Haystack) Doeleman, S. (Haystack) Homan, D. (Brandeis) Phillips, R. (Haystack) Wardle, J. (Brandeis)	Linear polarization observations of AGN. 0.3, 0.7 cm
BA053	Attridge, J. (Haystack) Homan, D. (Brandeis) Phillips, R. (Haystack) Wardle, J. (Brandeis)	86 and 43 GHz linear polarization of five AGN. 0.3, 0.7 cm
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*. 0.7 cm
BB140	Bujarrabal, V. (OAN) Alcolea, J. (OAN) Colomer, F. (OAN) Desmurs, D. (OAN) Sanchez-Contreras, C. (JPL)	86 GHz SiO masers from the proto planetary nebula OH231.8+4.2. 0.3, 0.7 cm
BB142	Brunthaler, A. (MPIR, Bonn) Falcke, H. (UC, Berkeley) Greenhill, L. (CfA) Henkel, C. (MPIR, Bonn) Reid, M. (CfA)	Second epoch obs. for extra galactic proper motions in the local group with the VLBA. 1 cm

BB144	Brunthaler, A. (UC, Berkeley) Aller, H. (Michigan) Aller, M. (Michigan) Bower, G. (UC, Berkeley) Terasranta, H. (Metsahovi)	Search for super-luminal motion in the radio-intermediate quasar PG2209+184. 0.7, 1, 2 cm
BB148	Baganoff, F. (MIT) Taylor, G. Morris, M. (UCLA)	Simultaneous Chandra/VLBA observations of Sagitarrius A*. 0.7 cm
BB149	Baan, W. (Westerbork) Garrett, M. (JIVE) Hofner, P. (Univ. Puerto Rico) Klockner, H-R. (Kapteyn) Pihlstroem, Y.	Torus/Disk structures in powerful OH mega masers. 20 cm
BB152	Bach, U. (MPIR, Bonn) Alef, W. (MPIR, Bonn) Graham, D. (MPIR, Bonn) Greve, A. (IRAM) Krichbaum, T. (MPIR, Bonn) Terasranta, H. (Metsahovi) Witzel, A. (MPIR, Bonn) Zensus, J. A. (MPIR, Bonn)	Precessing or helical jet in NRAO 150? 0.7, 1.3, 3.6 cm
BC113	Chatterjee, S. (Cornell) Cordes, J. (Cornell) McLaughlin, M. (Manchester) Lazio, T. J. W.(NRL) Arzoumanian, Z. (NASA/GSFC)	A very high proper motion pulsar. 18 cm

BC123	Chatterjee, S. (Cornell) Backer, D. (UC, Berkeley) Benson, J. Brisken, W. Cordes, J. (Cornell) Ellis, R. (UC, Santa Cruz) Fomalont, E. Golden, A. (Ireland) Goss, W. M. Kramer, M. (Jodrell Bank) Lazio, T. J. W. (NRL) Lyne, A. (Jodrell Bank) McKinnon, M. Thorsett, S. (UC, Santa Cruz) Wong, D. (Cornell)	First-epoch pulsar astrometry with the VLBA. 20 cm
BC125	Clarke, T. Punsly, B. (Boeing Satellite Systems)	Observations to determine the structure of an IXO in the Halo. 4, 20 cm
BD077	Dallacasa, D. (Bologna) Fanti, R. (Bologna) Stanghellini, C. (Noto) Tinti, S. (Bologna)	High frequency peakers. 0.7, 1, 2, 4, 6, cm
BD078	Dhawan, V. Kellermann, K. Romney, J.	Monitoring the accelerating, bent jet in 3C84. 0.7 cm
BD080	Diamond, P. (Manchester) Kemball, A.	TX Cam. 0.7 cm
BE023	Edwards, P. (ISAS) Piner, G. (Whittier College)	Markarian 421-Monitoring after a TeV outburst. 1 cm
BF070	Falcke, H. (MPIR, Bonn) Backer, D. (UC, Berkeley) Bower, G. (UC, Berkeley) Doeleman, S. (Haystack) Krichbaum, T. (MPIR, Bonn) Rogers, A. (Haystack) Wright, M. (UC, Berkeley) Zhao, J-H. (CfA)	Detecting internal structure at 3mm in Sagittarius A* during a flare. 0.3, 0.7 cm

BF071	Fomalont, E. Benson, J. Taylor, G. Walker, R. C. Wrobel, J. Beasley, A.J. (OVRO) Peck, A. (CfA) Ma, C. (NASA/GSFC) Gordon, D. (NASA/GSFC) Petrov, L. (NASA/GSFC)	VLBA Calibrator survey: filling the holes. 3.6 cm
BG116	Geldzahler, B. (George Mason) Bradshaw, C. (George Mason) Fomalont, E.	Astrometric observations of the compact radio source G120.11+0.54. 4 cm
BG118	Greenhill, L. (CfA) Chandler, C. Diamond, P. (Manchester) Moran, J. (CfA) Reid, M. (CfA)	SiO maser motions in Orion BN/KL. 0.7 cm
BG121	Gabuzda, D. (JIVE) Cawthorne, T. (Lancashire) Pashchenko, I. (Moscow State) Pushkarev, A. (ASC, Lebedev)	High frequency polarization observations of a complete sample of BL Lac objects. 0.7, 1, 2 cm
BH069	Hachisuka, K. (Graduated Univ.) Fujisawa, K. (NAO) Honma, M. (NAO) Imai, H. (NAO) Kameya, O. (NAO) Kawaguchi, N. (NAO) Manabe, S. (NAO) Miyoshi, M. (NAO) Nishio, M. (Kagoshima) Omodaka, T. (Kagoshima) Sasao, T. (NAO) Sawada-Satoh, S (NAO).	Determination of the velocity of Galactic rotation at IRAS 21008+700. 1 cm

BH077	Hachisuka, K. (Graduate University) Fujisawa, K. (NAO) Honma, M. (NAO) Imai, H. (NAO) Kameya, K. (NAO) Manabe, S. (NAO) Miyoshi, M. (NAO) Mochizuki, N. (Graduate University) Nisio, M. (Kagoshima) Omodaka, T. (Kagoshima) Sasao, T. (NAO) Sawada-Satoh, S. (NAO)	Detection of an annual parallax of water masers in W3 (OH). 1 cm
BH083	Hachisuka, K. (Graduate University) Hirota, T. (Kagoshima) Imai, H. (NAO) Sasao, T. (NAO)	Measurements of proper motion of the Orion-Monoceros molecular cloud complex. 1 cm
BH084	Hirotani, K. (NAO) Kameno, S. (NAO) Marcaide, J. (Valencia) Perez-Torres, M. (Bologna)	Pair plasma dominance in the pc-scale jets of B1150+812 and B1213+350? 1, 2, 4, 6, 13 cm
BH097	Hoffman, I. (New Mexico) Goss, W. M. Brogan, C. Claussen, M.	Full stokes observations of the 1720 MHz OH masers in W28. 18 cm
BI024	Imai, H. (NAO) Diamond, P. (Jodrell Bank)	Collimated molecular jet in W43A traced by water maser emission. 1 cm
BJ042	Johnston, K. (USNO) Fey, A. (USNO) Boboltz, D. (USNO) Ma, C. (NASA/GSFC) Gordon, D. (NASA/GSFC) Gaume, R. (USNO) Kingham, K. (USNO) Vandenberg, N. (Interferometrics) Himwich, E. (Interferometrics) Shaffer, D. (Radiometrics) Fomalont, E. Walker, R. C.	VLBA geodesy/sstrometry observations for 2002. 3.6 cm

BK076	Kurayama, T. (NAO) Sasao, T. (NAO)	Parallax measurement of Miras for period-luminosity relation. 1 cm
BK081	Kemball, A. Diamond, P. (Jodrell Bank)	TX Cam and S Per: complementary observations of 3 mm v=1,2, J=2-1 SiO. 0.3, 0.7 cm
BK084	Kameno, S. (NAO) Inoue, M. (NAO) Sawada-Satoh, S. (ISAS) Wajima, K. (ISAS) Zhi-Qiang, S. (ISAS)	Free-free absorption toward an active galaxy NGC 1052. 2, 4, 13 cm
BK085	Kopeikin, S. (Missouri) Fomalont, E. Gwinn, C. (UC, Santa Barbara)	Measuring the propagation of gravity by VLBI. 3.6 cm
BK092	Krichbaum, T. (MPIR, Bonn) Bach, U. (MPIR, Bonn) Ros, E. (MPIR, Bonn) Polatidis, A. (MPIR, Bonn) Witzel, A. (MPIR, Bonn) Zensus, J. A. (MPIR, Bonn) Ungerechts, H. (IRAM) Terasranta, H. (Helsinki) Aller, H. (Michigan) Aller, M. (Michigan)	VLBA monitoring of 1633+382 during a major millimeter-flare. 0.7, 1.3 cm
BL106	Lazio, T. J. W. (NRL) Goss, W. M. Brogan, C. Faison, M. (Northwestern) Zauderer, A. (Agnes Scott College) DePree, C. (Agnes Scott College)	AU scale HI opacity variations. 18 cm
BL108	Lazio, J. (NRL) Chatterjee, S. (Cornell) Cordes, J. (Cornell) Fey, A. (USNO)	Dection of intergalactic radio-wave scattering. 90 cm

BL111	Lister, M. Aller, H. (Michigan) Aller, M. (Michigan) Cohen, M. (Caltech) Homan, D. Kadler, M. (MPIR, Bonn) Kellermann, K. Kovalev, Y. (Lebedev) Lobanov, A. (MPIR, Bonn) Ros, E. (MPIR, Bonn) Vermeulen, R. (NFRA) Zensus, J. A. (MPIR, Bonn)	MOJAVE program. 2 cm
BM162	Marscher, A.(Boston) Minier, V. (UNSW) Aller, M. (Michigan) Balasubramanyam, R. (UNSW) Burton, M. (UNSW) Jorstad, S. (Boston) McHardy, I. (Southampton) Walsh, A. (CfA)	Relationship between X-ray flares and super luminal ejections in blazers. 0.7, 1 cm
BM165	Minier, V. (UNSW) Balasubramanyam, R. (UNSW) Burton, M. (UNSW) Walsh, A. (CfA)	Search for protostellar disks in hot cores. 2 cm
BM171	Marscher, A. (Boston) Aller, M. (Michigan) Gomez, J. (IAA, Granada) McHardy, I.M. (Southampton) Jorstad, S. (Boston University)	Relationship between X-ray events and superluminal ejections in blazers. 0.7, 1 cm
BM173	Momjian, E. Carilli, C. Romney, J. Troland, T. (Kentucky)	VLBA observations on two possible in-beam calibrators for low frequency observations on the target source IRAS 17208-0014. 90 cm
BP089	Piner, B. (Whittier College) Edwards, P. (ISAS) Jones, D. (JPL)	Monitoring of ultra-fast blazers. 0.7, 1, 2 cm
BP091	Peck, A. (CfA) Taylor, G.	Spare Change - collecting the last few COINS from the bottom of the VCS. 2, 6 cm

BP100	Perez-Torres, M. (Bologna) Mantovani, F. (Bologna) Marcaide, J. (Valencia) Guirado, J. (Valencia) Alberdi, A. (IAA, Andalucia) Lara, L. (IAA, Andalucia) Ros, E. (MPIR, Bonn) Panagia, N. (STScI) Shapiro, I. (CfA) Sramek, R. Stockdale, C. (NRL) Weiler, K. (NRL) Van Dyk, S. (IPAC) Lundqvist, P. (Stockholm)	SN2001 GD in NGC 5033. 3.6 cm
BR077	Ros, E. (MPIR, Bonn) Cohen, M. (Caltech) Kadler, M. (MPIR, Bonn) Kellermann, K. Lister, M. Vermeulen, R. (Dwingeloo) Zensus, J. A. (MPIR, Bonn)	Kinematics of parsec-scale structure in AGN: a survey. 2 cm
BR079	Resch, G. (JPL) Boboltz, D. (USNO) Fey, A. (USNO) Gordon, D. (GSFC) Ma, C. (GSFC) Sovers, O. (RSAS) Taylor, G. Ulvestad, J.	Extending the international celestial reference frame to multiple wavelengths. 0.7, 1 cm
BR080	Ratner, M. (CfA) Bartel, N. (York U.) Bietenholz, M. (York U.) Lebach, D. (CfA) Lestrade, J. (Paris Obs) Ranson, R. (York U.) Shapiro, I. (CfA)	Astrometry of HR 8703 in 2002 for gravity Probe-B mission. 3.6 cm
BS084	Sarma, A. (Kentucky) Romney, J. Troland, T.	VLBA Zeeman measurement of the magnetic field in 22 GHz H_20 masers. 1.3 cm

BS087	Sudou, H. (Tohoku) Iguchi, S. (NAO) Murata, Y. (ISAS) Taniguchi, Y. (Tohoku)	Phase referencing VLBI observations of 3C 66B. 1, 4, 13 cm
BS100	Sanchez-Contreras, C. (JPL) Alcolea, J. (OAN) Bujarrabal, V. (OAN) Colomer, F. (OAN) Desmurs, J. (OAN)	Phase referencing mapping of 43 GHz SiO masers in the PPN OH231.8+4.2. 0.7 cm
BS102	Sahai, R. (JPL) Claussen, M. Morris, M. (UCLA)	The water masers in the "water-fountain" protoplanetary IRAS 16342-3814. 1.3 cm
BS108	Shen, Z-Q. (ISAS) Kellermann, K. Moran, J. (CfA)	Central parsec of the quasar PKS 1921-293. 0.7, 6 cm
BS111	Storchi-Bergmann, T. (UFRGS) Schmidt, H. Wilson, A. (Maryland)	Connection between the accretion disk and radio jet in NGC 1097. 6 cm
BS113	Stairs, I. Brisken, W. Manchester, D. (CSIRO) Lyne, A. (Manchester)	Precise position for a massive binary pulsar. 18 cm
BU021	Ulvestad, J. Ho, L. (Carnegie Obs. Obs.)	ADAFs or jets in low-luminosity active galaxies? 0.7, 1, 2, 4 cm
BU022	Ulvestad, J. Wong, D. (Cornell) Taylor, G. Mundell, C. (Liverpool JMU)	NGC 4151: where is the nucleus, and how fast is the jet? 2, 3.6, 6 cm
BU024	Ulvestad, J. Teng, S. (Maryland) Neff, S. (NASA/GSFC)	Possible AGN in the NGC 3690 system. 13 cm
BV043	Vlemmings, W. (Leiden) Diamond, P. (Manchester) Habing, H. (Leiden) van Langevelde, H. (JIVE)	Monitoring the stellar image of enshrouded AGB stars. 20 cm

BV044	Vlemmings, W. (Leiden) Diamond, P. (Manchester) van Langevelde, H. (JIVE)	Polarization of circumstellar H20 masers. 1 cm
BW061	Wrobel, J. Fassnacht, C. (STScI) Myers, S. Taylor, G.	AGN content of the Bootes field of the NOAO deep wide field survey. 6 cm
BW062	Wehrle, A (JPL) Boboltz, D. (USNO) Fey, A. (USNO) Johnston, K. (USNO) Jones, D. (JPL) Unwin, S. (JPL)	How far do radio cores wander: multi-epoch astrometry. 2, 4 cm
BY013	York, T. (Manchester) Blandford, R. (Caltech) Browne, I. (Manchester) Fassnacht, C. (STScI) Jackson, N. (Manchester) Koopmans, L. (Caltech) McKean, J. (Manchester) Myers, S. Pearson, T. (Caltech) Readhead, T. (Caltech) Wilkinson, P. (STScI)	VLBA observations of the most recent CLASS gravitational lens candidates. 20 cm
GB042	Bartel, N. (York U.) Rupen, M. Bietenholz, M. (York U.) Beasley, A. (Caltech) Graham, D. (MPIR, Bonn) Altunin, V. (JPL) Venturi, T. (Bologna) Umana, G. (Bologna) Cannon, W. (York U.) Conway, J. (Chalmers, Onsala)	SN 1993J and the core jet counter-jet in M81. 6 cm

GF010	Frey, S. (FOMISGO) Mosoni, L. (FOMISGO) Gurvits, L. (NFRA) Garrett, M. (NFRA) Garrington, S. (Manchester) Tsvetanov, Z. (Johns Hopkins)	Deep extra galactic VLBI/optical survey (DEVOS). 6 cm
W405	Argon, A. (CfA) Reid, M. (CfA) Greenhill, L. (CfA) Moran, J. (CfA)	Nuclear jet in M87. 18 cm
W406	Junor, W. (New Mexico) Biretta, J. (STScI)	Following evolution of the Vir A jet. 6 cm
W421	Lobanov, A. (MPIR, Bonn) Zensus, J. A. (MPIR, Bonn) Abraham, Z. (Sao Paulo) Carrara, E. (Sao Paulo)	Parsec scale jet in superluminal quasar 3C 273. 6 cm

New Hires

Albanna, Sarmad	Electronics Engineer II	06/03/02
Caviggia, Kurt	Engineering Associate, Junior	05/20/02
Clark, Christopher	Division Head	06/01/02
Cutshall, Ryan*	Engineering Associate, Junior	06/17/02
Dwarakanath, K.S.	Visiting Scientist	05/15/02
Emerson, Nicholas	Mechanical Engineer III	04/23/02
Fugate, David	Scientific Programmer, Senior	05/22/02
Lacasse, Michael*	Engineering Associate, Junior	05/15/02
Masney, Brian	Scientific Programming Analyst	04/01/02
Mason, Brian	Assistant Scientist	06/10/02
Mello, Melinda	Scientific Programming Analyst	04/15/02
Perez, Jesus	Software Engineer II	06/17/02
Sarkar, Bikramjit	Engineering Associate, Junior	06/03/02
Sessoms, Eric	Scientific Programming Analyst	05/15/02
Shapiro, Lee	Head of EPO	05/13/02
Thomas, James	Electronics Engineer I	06/03/02
Vahle, Herald	Electronics Engineer III	06/05/02

Terminations

Masney, Brian	Scientific Programming Analyst	04/04/02

Promotions

Carilli, Christopher	Scientist	04/01/02

*Rehires

Publications

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

PREPRINTS RECEIVED, APRIL-JUNE 2002

BECK, R.; SHOUTENKOV, V.; EHLE, M.; HARNETT, J.I.; HAYNES, R.F.; SHUKUROV, A.; SOKOLOFF, D.D.; THIERBACH, M. Magnetic Fields in Barred Galaxies I. The Atlas.

BERGER, E.; KULKARNI, S.R.; CHEVALIER, R.A. The Radio Evolution of the Ordinary Type IC SN 2002AP.

BOOGERT, A.C.A.; HOGERHEIJDE, M.R.; CECCARELLI, C.; TIELENS, A.G.G.M.; VAN DISHOECK, E.F.; BLAKE, G.A.; LATTER, W.B.; MOTTE, F. The Environment and Nature of the Class I Protostar Elias 29: Molecular Gas Observations and the Location of Ices.

CAMILO, F.; STAIRS, I.H.; LORIMER, D.R.; BACKER, D.C.; RANSOM, S.M.; KLEIN, B.; WIELEBINSKI, R.; KRAMER, M.; MCLAUGHLIN, M.A.; ARZOUMANIAN, Z.; MULLER, P. Discovery of Radio Pulsations from the X-ray Pulsar J0205+6449 in Supernova Remnant 3C 58 with the Green Bank Telescope.

CAPPA, C.E.; GOSS, W.M.; PINEAULT, S. VLA Radio Continuum and IRAS Observations of the Ring Nebulae Around WR 101 and WR 113.

CARILLI, C.L.; COX, P.; BERTOLDI, F.; MENTEN, K.M.; OMONT, A.; DJORGOVSKI, S.G.; PETRIC, A.; BEELEN, A.; ISAAK, K.G.; MCMAHON, R.G. Imaging Low Order CO Emission from the z = 4.12 QSO PSS 2322+1944.

CONDON, J.J.; COTTON, W.D.; BRODERICK, J.J. Radio Sources and Star Formation in the Local Universe.

CROSTHWAITE, L.P. The Large Scale Distribution and Properties of Carbon Monoxide in a Sample of Nearby Spiral Galaxies.

DE PATER, I.; BUTLER, B.; GREEN, D.A.; STROM, R.; MILLAN, R.; KLEIN, M.J.; BIRD, M.K.; FUNKE, O.; NEIDHOFER, J.; MADDALENA, R.; SAULT, R.J.; KESTEVEN, M.; SMITS, D.P.; HUNSTEAD, R. Jupiter's Radio Spectrum from 74 MHz up to 8 GHz.

DE PATER, I.; BUTLER, B.J. Low Frequency VLA Observations of Jupiter.

DE PATER, I.; DUNN, D.E. VLA Observations of Jupiter's Synchrotron Radiation at 15 and 22 GHz.

EMERSON, D.T.; THOMPSON, A.R. The Relative Sensitivity of Full-Wave and Half-Wave Detectors in Radiometry.

FILHO, M.E.; BARTHEL, P.D.; HO, L.C. The Radio Properties of Composite LINER/H II Galaxies.

FINLEY, D.G. Public Relations for a National Observatory.

FRATERNALI, F.; VAN MOORSEL, G.; SANCISI, R.; OOSTERLOO, T. Deep H I Survey of the Spiral Galaxy NGC 2403.

HOBBS, G.; LYNE, A.G.; JOSHI, B.C.; KRAMER, M.; STAIRS, I.H.; CAMILO, F.; MANCHESTER, R.N.; D'AMICO, N.; POSSENTI, A.; KASPI, V.M. A Very Large Glitch in PSR J1806-2125.

HOLLIS, J.M.; LOVAS, F.J.; JEWELL, P.R.; COUDERT, L.H. Interstellar Antifreeze: Ethylene Glycol.

IMAI, H.; SASAO, T.; OBARA, K.; OMODAKA, T.; DIAMOND, P.J. A Collimated Molecular Jet in W 43A Traced by Water Maser Emission.

JESTER, S.; ROSER, H.-J.; MEISENHEIMER, K.; PERLEY, R. X-rays from the Jet in 3C 273: Clues from the Radio-Optical Spectra.

KERR, A.R. Saturation by Noise and CW Signals in SIS Mixers.

LAING, R.A.; BRIDLE, A.H. Relativistic Models and the Jet Velocity Field in the Radio Galaxy 3C31.

LISZT, H.; LUCAS, R. Comparative Chemistry of Diffuse Clouds IV: CH.

LISZT, H.S. Two-Phase Equilibrium and Molecular Hydrogen Formation in Damped Lyman-alpha Systems.

MARSCHER, A.P.; JORSTAD, S.G.; GOMEZ, J.-L.; ALLER, M.F.; TERASRANTA, H.; LISTER, M.L.; STIRLING, A.M. Observational Evidence for the Accretion-Disk Origin for a Radio Jet in an Active Galaxy.

MILLER, N.A.; LEDLOW, M.J.; OWEN, F.N.; HILL, J.M. Redshifts for a Sample of Radio-Selected Poor Clusters.

PREPRINTS RECEIVED, APRIL-JUNE 2002

MOHAN, N.R.; ANANTHARAMAIAH, K.R.; GOSS, W.M. VLA Detection of RRLs from the Radio Nucleus of NGC 253: Ionization by a Weak AGN, an Obscured SSC or a Compact SNR?

MORRIS, D.J.; HOBBS, G.; LYNE, A.G.; STAIRS, I.H.; CAMILO, F.; MANCHESTER, R.N.; POSSENTI, A.; BELL, J.F.; KASPI, V.M.; D'AMICO, N.D.; MCKAY, N.P.F.; CRAWFORD, F.; KRAMER, M. The Parkes Multibeam Pulsar Survey - II. Discovery and Timing of 120 Pulsars.

PISANO, D.J.; WILCOTS, E.M.; LIU, C.T. An H I/Optical Atlas of Isolated Galaxies.

RANSOM, R.R.; BARTEL, N.; BIETENHOLZ, M.F.; LEBACH, D.E.; RATNER, M.I.; SHAPIRO, I.I.; LESTRADE, J.-F. Possible Corotation of the Milliarcsecond Radio Structure of the Close Binary HR 1099.

REIPURTH, B.; RODRIGUEZ, L.F.; ANGLADA, G.; BALLY, J. Radio Continuum Maps of Deeply Embedded Protostars: Thermal Jets, Multiplicity and Variability.

RODRIGUEZ, L.F.; GOSS, W.M.; WILLIAMS, R. VLA Observations of H I in the Helix Nebula (NGC 7293)

ROSHI, D.A. Cancellation of TV Interference.

ROSHI, D.A.; KANTHARIA, N.G.; ANANTHARAMAIAH, K.R. Carbon Recombination Lines near 327 MHz I: "Diffuse" C II Regions in the Galactic Disk.

SCHMITT, H.R.; PRINGLE, J.E.; CLARKE, C.J.; KINNEY, A.L. The Orientation of Jets Relative to Dust Disks in Radio Galaxies.

STAIRS, I.H. Pulsar Observations II. - Coherent Dedispersion, Polarimetry, and Timing.

TARCHI, A.; HENKEL, C.; PECK, A.B.; MENTEN, K.M. Water Maser Emission in IC 342.

TAYLOR, G.B.; FABIAN, A.C.; ALLEN, S.W. Magnetic Fields in the Centaurus Cluster.

TAYLOR, G.B.; PECK, A.B.; HENKEL, C.; FALCKE, H.; MUNDELL, C.G.; O'DEA, C.P.; BAUM, S.A.; GALLIMORE, J.F. H I Absorption in the Gigamaser Galaxy TXS 2226-184 and the Relation Between H I Absorption and Water Emission.

WINDHORST, R.A.; TAYLOR, V.A.; JANSEN, R.A.; ODEWAHN, S.C.; CHIARENZA, C.A.T.; CONSELICE, C.J.; DE GRIJS, R.; DE JONG, R.S.; MACKENTY, J.W.; ESKRIDGE, P.; FROGEL, J.A.; GALLAGHER, J.S. III; HIBBARD, J.E.; MATTHEWS, L.D.; O'CONNELL, R.W. An HST Survey of the Mid-UV Morphology of Nearby Galaxies.

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