NRAO NEWSLETTER

1 January 1993 No. 54

IN GENERAL

1993 OBSERVATORY BUDGET

The NRAO users are undoubtedly aware of the current budget problems at NSF. The 1993 budget appropriated by Congress for NSF research activities fell short of the 1992 level. Furthermore, interagency commitments for new initiatives, for example, high speed computing and materials research, and congressionally mandated increases for the Gemini and LIGO projects magnified the impact of no growth in research funds. NRAO, like all other elements of the NSF astronomy program, faces a very difficult year.

The amount requested by NSF for NRAO in the budget submitted to the Congress was $37.8M; the amount received in the approved Foundation operating plan is $28.9M. Although much of the difference in these figures was planned for improvements to observing facilities that must now be postponed, the cut does go well beyond those projects, cutting into the base program of operations. Preserving observing opportunities and user services is a high priority for 1993, but even these areas will be impacted by the imposed constraints of a very tight budget.

The principal consequences of the reduced budget given the Observatory:

- The program to rebuild the Observatory infrastructure is frozen at the 1992 level, less than half the size planned for 1993.
- The start of a multi-year project to upgrade VLA with new receiver systems, new correlator, and optic fiber replacement of the waveguide system must be postponed.
- The development of the MMA must be held to a minimal amount, largely that required for continued environmental study of potential sites.
- The instrumentation program must be reduced rather than increased; the same is true of software development.
- Except for VLBA operations, all other areas will be cut by at least five percent from last year.
- Bringing the VLBA into full operation remains a high priority, and this is the only area of operations scheduled for growth.

The Observatory is committed to providing the best possible facilities and service to its users within the resources available, and the continuing support and cooperation of the users is appreciated.

P. A. VANDEN BOUT

GREEN BANK SITE DIRECTOR

I am pleased to announce the appointment of Jay Lockman as NRAO Assistant Director for Green Bank Operations. Jay has a long involvement with the Green Bank site, both as a user and more recently as Project Scientist for the Green Bank Telescope. He is an ideal choice for site director particularly during the construction and beginning operations of the GBT. I want to thank Dave Hogg for the excellent job he has done while the search for a new site director was being conducted. Jay will begin his new duties on February 15.

P. A. VANDEN BOUT

VISITING COMMITTEE

The AUI Visiting Committee to NRAO will meet April 6-8 in Charlottesville. The Committee is chaired by F. J. Low (U. Arizona). The other members are: D. C. Backer (U. California), F. N. Bash (U. Texas), E. B. Churchwell (U. Wisconsin), J. N. Hewitt (MIT), R. Hills (Cavendish Lab), A. P. Marscher (Boston U.), A. I. Sargent (Caltech), P. Thaddeus (CFA), and J. A. Tyson (Bell Labs).

P. A. VANDEN BOUT

The NRAO Newsletter is published quarterly by the National Radio Astronomy Observatory, Edgemont Road, Charlottesville, VA 22903-2475 USA. NRAO is operated by Associated Universities, Inc., under cooperative agreement with the National Science Foundation. [Contact Joanne Nance (804) 296-0323 if you wish to receive mailings of the Newsletter.]

NEW GENERATION DIGITAL CORRELATORS WORKSHOP

NRAO is sponsoring the New Generation Digital Correlators Workshop, to be held in Tucson on February 25-26, 1993. It will be a fairly small meeting, but we anticipate that many of the experts in the field will take part. The meeting is expected to be very technical in nature.

There will be no conference fee, but participants will be expected to pay for their own travel, food, and lodging.

For more technical details of the meeting, you may contact Darrel Emerson at NRAO-Tucson (demerson@nrao.edu). If you wish to take part or need other details, please contact Jennifer Neighbours (jneighbo@nrao.edu).

D. T. EMERSON

THE FIRST SYMPOSIUM ON THE INFRARED CIRRUS AND DIFFUSE INTERSTELLAR CLOUDS

Steward Observatory and NRAO-Tucson are jointly sponsoring the First Symposium on the Infrared Cirrus and Diffuse Interstellar Clouds. The Symposium will be held in Tucson on April 7-9, 1993, at the Hotel Park Tucson (5151 E. Grant Road). The format of the meeting will include invited review talks on the major topics, along with contributed presentations describing current research in the field. Most of the contributed papers will be presented in poster format, and ample time during the meeting will be dedicated specifically for poster review. The proceedings of the Symposium will be published as part of the Astronomical Society of the Pacific Conference Series.

For technical information, please contact:

Roc Cutri	or	William Latter
Steward Observatory		NRAO, Campus Bldg. 65
University of Arizona		949 N. Cherry Ave.
Tucson, AZ 85721		Tucson, AZ 85721
(602) 621-3445		(602) 882-8250
rcutri@as.arizona.edu (I)		wlatter@nrao.edu (I)

For other details (fees, etc.), please contact Jennifer Neighbours (jneighbo@nrao.edu).

W. B. LATTER

SUMMARY OF USERS' COMMITTEE REPORT

The Users Committee met June 15 and 16, 1992, in Charlottesville, discussing topics of general interest as well as specific items for each telescope. The first topic of general interest was computing resources, and the Committee commended the Computing Division for putting in place Observatory-wide planning and for the goal of providing every visiting observer with a workstation. Concern was expressed over inadequate staffing of the AIPS++ project, the slower than desirable buildup of VLBA staff, and the under-representation of women on the scientific staff. The Committee encouraged the Observatory to advertise the availability of internal technical memoranda more widely and to continue summer schools for the training of students. The Committee noted the plans for new spectrometers at several sites and urged a coordinated effort for their development. Finally, noting the growing role of the NRAO in U.S. radio astronomy, the Committee urged that closer relationships with university groups be established.

The Central Development Laboratory was commended for their work in producing both transistor amplifiers and SIS mixers that define the state-of-the-art in low-noise receivers. NRAO was encouraged to protect and support its sources of SIS devices, most of which come from the University of Virginia. The Tucson staff were also commended for the many improvements associated with the 12 Meter Telescope operation and urged that clear priorities be established among the many projects in progress and planned.

The Committee supported continued development of the systems required to make the Green Bank Telescope operate through at least 45 GHz. A wide-band spectrometer with flexibility for both coarse and fine resolution is important, as is allowing for the analysis of pulsar data. The Committee stated the importance of remote observing. Broad user input is needed now as instrumentation for the GBT is being planned. Specific suggestions included S/X receivers, multi-feed L-band receivers, and provision for access to instrumentation near the telescope.

The Committee endorsed the policy giving the GBT priority over the 140 Foot Telescope. Improvements in computing hardware were noted. A desire to easily export data out of UNIPOPS was expressed. The Committee recognized the potential of the U.S. Naval Observatory, orbiting VLBI, and SETI projects to bolster the Green Bank site, but hoped that these projects would not draw resources away from the main mission of radio astronomy.

The Committee was pleased with progress on the repair and maintenance of the VLA. The L-band receiver project was enthusiastically endorsed, as was the potential project extending the VLA capability to 43 GHz. The general upgrade of the VLA by improving receivers, replacing the waveguide system with optic fibers, and building a new correlator was enthusiastically endorsed. The Committee gave strong support to the continued development of the real time data analysis system and urged completion of the standardization of archival data. A desire for earlier feedback on VLA proposals was expressed as well as more frequent rotation of the scheduling committee membership. Finally, the Committee endorsed the concept of comfortable, affordable visitors quarters in Socorro and urged a reduction in the notification rule for visitors to Socorro.

The Committee was pleased to see the construction of the VLBA nearing completion and urged a full effort of the two remaining hurdles—operation of the correlator and seeing an adequate supply of thin recording tape. There was a consensus that 327 MHz should take priority over 610 MHz in bringing receiver systems on-line. The Committee strongly urged that arrangements for correlation other than the VLBA correlator be made for an interim period to ensure that no loss in wideband correlation capacity occurs as the VLBA correlator comes on-line. It was felt that moving MkII recorders to Mauna Kea, Hancock, and St. Croix would be helpful during this interim period. The Committee also asked that experienced users be allowed access to the VLBA prior to routine operation, that the pulsar-gated correlator mode be rapidly implemented, and that a senior scientist be appointed in Socorro to look out for VLBA interests. The importance of maintaining close relations with the European VLBI network was reaffirmed. Finally, the need for VLBA documentation, analogous to the VLA Green Book, was stated, as was the interest in seeing an early version of an X-windows OBSERVE program for the VLBA.

The Committee was pleased with progress on the MMA proposal, but encouraged better communications with the user community. Further study of all potential MMA sites was encouraged, as was continued development by NRAO staff in conjunction with existing millimeter interferometers. The committee recommended that NRAO hire a scientist with expertise in, and a strong commitment to, millimeter wave research.

Data analysis software was discussed extensively by the Committee. Of prime concern to the Committee was adequate support of AIPS until AIPS++ becomes available. New releases of AIPS more frequently than once per year and better support of the VLBI tasks in AIPS were judged particularly important. In general, the Committee felt that AIPS at present should receive priority over AIPS++ in the assignment of personnel. With regard to AIPS++, the Committee hopes a working prototype will be available soon, that it will be easy to program within the new system, and that a workshop on object-oriented programming be hosted by NRAO.

Rachel Dewey will serve as the next chair of the Users Committee. Membership in sub-groups has been assigned as follows: VLBI—Dewey, Gwinn, Reid, Unwin, and Wehrle; MMA—Churchwell, Dewey, Duric, Gaume, Menten, Mundy, and Woody; and GBT—Briggs, Dewey, Fruchter, Menten, Mundy, Wehrle, and Woody. The Committee welcomes the input of the entire user community. Users who would like to have a copy of the more detailed report on which this summary is based should make a request to me at jhewitt@maggie.mit.edu or 617-253-3071.

J. HEWITT, CHAIR

U.S.-AUSTRALIA COLLABORATIVE RESEARCH GRANTS AWARDED

We are pleased to announce that the money allocated by the National Science Foundation for collaboration between U.S. and Australian researchers was awarded to four investigators following a competition last fall. The recipients were: Dr. Bernard Burke (MIT), Dr. John Dickey (U. of Minnesota), Ms. Victoria Kaspi (Princeton), and Dr. Stephen White (U. of Maryland).

R. L. BROWN AND H. S. LISZT

CD-ROM: "IMAGES FROM THE RADIO UNIVERSE"

The new NRAO CD-ROM "Images From the Radio Universe" contains over 2000 FITS-format digital images of extraterrestrial radio sources plus catalogs of radio sources written as ASCII text files. These images preserve the full accuracy and dynamic range of the original data, and they can be used for quantitative scientific analysis. The radio images were contributed by nearly 100 scientists from several countries, and they are based on observations made with a variety of radio telescopes operated by different institutions. Each image or group of images is accompanied by a text file with the name and address of the image donor, a description of the observation, a description of the image, and references to published papers based on that image. The cover booklet gives a detailed description of the CD-ROM and its contents. AIPS, IRAF, and other astronomical image analysis software running on a wide variety of computer systems will accept the FITS files on this ISO-9660 standard CD-ROM, and can be used to display and analyze the imagery. FITS-image support for DOS and Macintosh systems is currently somewhat limited; none is provided on this disk. Copies of this CD-ROM may be obtained for $10 from:

Pat Smiley
NRAO
520 Edgemont Road
Charlottesville, VA 22903-2475

We are now collecting digital images of radio sources to be archived and distributed on a new CD-ROM similar to the CD-ROM "Images From the Radio Universe" just released. A single CD-ROM can hold almost 700 Mbyte of data, a capacity sufficient for about 300, 16-bit maps 1024 pixels on a side, or about 5000, 256x256 maps. We hope to collect the best radio images and tabular data available, without restriction on source type (planets, radio stars, galaxies, etc.), radio telescope(s) used to obtain the data, or institutional affiliation of the image donors. The images and tables may be sent in any FITS format readable by AIPS (e.g., 2-dimensional continuum maps, 3-dimensional spectral line cubes, sets of 1-dimensional spectra, FITS extension tables listing source parameters) or as ASCII plain text files. Each must be accompanied by a copy of the NRAO CD-ROM submission form that describes the image (and will be included on the CD-ROM). TeX copies of the submission form may be obtained electronically as indicated below.

It is our expectation that the images appearing on this CD-ROM will be analyzed quantitatively and used for scientific research, so contributors should submit only those images that they are willing to release for use by the scientific community. Users of these images should give scientific credit to the donors in their publications, either by referencing the relevant paper listed on the image submission form or by referencing the CD-ROM itself and naming the image donor(s). Your generosity in donating your best images is necessary for the success of this project.

Fits tapes (9-track, Exabyte, or DAT) may be mailed to:

J. J. Condon
NRAO
520 Edgemont Road
Charlottesville, VA 22903-2475

Images may be sent electronically via FTP as follows:

```
% ftp 192.33.115.53
> login anonymous (or Name:  anonymous)
> Password: [your name]
> cd pub (directory for the CD-ROM)
> get cdform.tex (to get a TeX copy of the CD-ROM
  submission form)
> put imagename.tex (to return the renamed and
  completed form)
> binary
> put imagename (to submit the image itself)
> quit
```

If you have any questions, contact Jim Condon by phone (804-296-0322) or e-mail (jcondon@nrao.edu).

J. J. CONDON

MILLIMETER ARRAY

In the last quarter we provided to the Foundation, at their request, a plan for the four-year development phase of the MMA. The plan describes all aspects of the technical and site/environmental work that needs to be accomplished to put us in a position to begin construction of the array. We have attempted to be comprehensive: the plan incorporates not only the work that must be done to develop the hardware needed by the array but it also highlights the need for us to develop techniques for hardware fabrication and testing that will enable us to produce multiple copies of the various components that have identical performance characteristics. We hope that the MMA Design and Development Plan will provide the Foundation with the guidance they need to begin funding this R&D phase of the MMA in FY 1994.

Meanwhile, in 1992 considerable progress was made in refining some of the design parameters of the array and in understanding the criteria by which choices among alternatives can be made in the future. Many of the issues are explored in the MMA memo series. A list of the 22 MMA memos issued in the last twelve months is included on the next page. Copies of the memos are available on request from Betty Trujillo in Socorro.

Evaluation of the feasible sites for the MMA continues to occupy a significant fraction of our attention and resources. The atmospheric opacity and stability data for the site in the Magdalena Mountains, the site near Springerville, and for the summit of Mauna Kea as determined from our 225 GHz tipping radiometers was published in MMA Memo 79. Analysis of these data suggest that for the long MMA configuration it is highly desirable to calibrate rapidly or continuously. Several techniques are being investigated that will make this possible either by rapid physical motion of the antennas, a technique that impacts the antenna design, or by pairing antennas in close proximity, a technique that impacts the long baseline configuration. Meanwhile, atmospheric tests have begun near the one site on Mauna Kea that is high enough, and large enough, for the MMA. It will be very interesting to compare these data with the corresponding information on the continental sites.

Design work with the MMA Joint Development Group universities began in 1992. Substantial progress was made by the participation of individuals from Illinois and Maryland in the design of AIPS++. Here the goal is to assure that AIPS++ includes at a fundamental level all the facilities for millimeter-wave synthesis astronomy. Early tests with BIMA data in 1993 will provide a useful demonstration. Analysis of the thermal characteristics of the BIMA antennas is underway in a collaboration between the Hat Creek staff and the MMA antenna design team in Tucson. We hope to learn whether, or under what circumstances, an antenna of steel backing structure and machined aluminum panels, would be suitable for the MMA. Finally, the Central Development Laboratory is collaborating with OVRO on the feasibility of sideband separating mixers, with UVa and Illinois on SIS device fabrication techniques, and with industrial partners on millimeter-wave HFET development. The JDG activities will continue in 1993.

R. L. BROWN

VLBA

VLBA CONSTRUCTION STATUS

St. Croix, VI - The site is operational and lacks only a 43 GHz receiver, a second tape recorder, and a connection to Internet. The Internet connection, which will be through CRACIN, the Caribbean regional network in San Juan, Puerto Rico, has been delayed by telephone cable installation problems in San Juan. Until the connection is complete the site is being operated using a dial-up telephone line from Socorro.

Mauna Kea, HI - The antenna and site construction are complete, and the outfitting of the site with all of the equipment supplied by NRAO is 50 percent complete. The site should be ready for testing in March, 1993.

Receivers - The program to install at all VLBA antennas their full complement of receivers is complete except for St. Croix's 43 GHz receiver, scheduled for installation in January, 1993. The Mauna Kea antenna will come on-line equipped with all receivers.

Tape Recorders - All but four sites now have two tape recorders, and the correlator has eleven of its eventual twenty-four playback drives. All recorders and playback drives will be installed in the first quarter of 1993 except for four playback drives on loan to the Haystack correlator, where they will remain until needed on the VLBA correlator.

Tape - Purchase orders for approximately one-half (about 450) of the production VLBA thin tape and glass reel inventory were placed in December, with deliveries scheduled for February.

P. J. NAPIER

1992 MMA MEMOS

No.	Title	Author
72	Circular Polarization and Multi-Band Operation: Implications for MMA Receiver Design	A. R. Kerr
73	Mosaicing with Even Higher Dynamic Range	M. Holdaway
74	Surface Accuracy Requirements for Mosaicing at Millimeter Wavelengths	M. Holdaway
75	Lower Tropospheric Wind Speed Statistics from Rawinsonde Observations at Albuquerque, New Mexico; Winslow, Arizona; and Hilo, Hawaii	F. Schwab
76	Radio Frequency Interference and the MMA	P. Crane
77	Road Feasibility Study for MMA Sites in the Magdalena Mountains	P. J. Napier
78	Report on Visit to Hat Creek	J. Lamb and J. Payne
79	A Summary of the Data Obtained During the MMA Site Survey	D. E. Hogg
80	Further Simulation of (Possible) MMA Configurations	Jing-Ping Ge
81	Evaluating the MMA Compact Configuration Designs	M. A. Holdaway
82	List of Millimeter Array Memoranda	P. Crane
83	Thermal Considerations for MMA Antennas	J. W. Lamb
84	Possible Phase Calibration of the MMA	M. Holdaway
85	Some Remarks on the MMA System Design	B. Clark
86	Possibilities for Wide-Angle Beam Switching	J. W. Lamb
87	Progress on Tunerless SIS Mixers for the 200-300 GHz Band	A. R. Kerr
88	Paired Antenna Phase Calibration: Residual Phase Errors & Configuration Study	M. Holdaway
89	MMA Downconversion to Baseband Sampling	A. Dowd
90	A Study of Materials for a Broadband Millimeter-Wave Quasi-Optical Vacuum Window	A. R. Kerr, N. Bailey, D. Boyd, N. Horner
91	More Remarks on MMA System Design	J. Granlund
92	Timber Ridge: A Configuration Out on Limb	M. A. Holdaway
93	Springerville/Eager Trip	D. A. Webb
94	Discussion of Slant Axis Antenna Concept	J. Cheng

Copies of MMA memos on request from Betty Trujillo (Phone: 505-835-7231; Fax: 505-835-7027; E-mail: btrujillo@nrao.edu.)

VLBA CORRELATOR CONSTRUCTION STATUS AND OPERATIONS OUTLOOK

As the VLBA construction project ends, the correlator too is nearing completion. Checkout of the playback interface's operating modes—a set described by an irregular four-dimensional volume containing 332 cells, each with as many as 32 sub-cells—continues as the primary remaining hardware task. Some effort is also being turned toward optional features such as the fractional-sample corrector, the self-test facility, and the pulsar gate.

Major progress has been achieved in the correlator control software during the last several months. The tasks which supervise the flow of data through the digital output filter and into FITS-formatted disk files were completed, opening the wideband backend output port for the first time. This access to adequate test results, as well as the increased availability of the correlator for tests, accelerated software progress in all areas.

Control of tape motion on the playback drives has been solidified, in part by starting to exploit some of the features incorporated into the VLBA tape format. Data-validity results are now available with the cross-spectral output, and the association of system-noise measurements and gain curves with the corresponding output data has been started. The archive subsystem is substantially complete. Software which optimizes the mix of multiple correlation jobs has been installed. The operator interface has been developed substantially, and now provides most of the information necessary to monitor the system's performance.

At the end of 1992, the correlator was able to process observations end-to-end through the entire data path, across as many as 11 station inputs, limited only by the number of playback drives. Because there are only nine operational VLBA stations, demonstrations of this capability had to be performed by running two correlator jobs (of 8 and 3 stations) simultaneously. This minor milestone marked the effective change from a debugging phase to an astronomical test and validation phase. We are now able to make some predictions of correlator operations development for the guidance of VLBA users, refining the schedule presented previously in Section 7.1 of the VLBA Observational Status Summary.

Astronomical testing will become the main correlator activity in January 1993, using data both from test observations and from selected VLBA scientific programs already completed or specifically scheduled for this purpose. This phase will continue through the end of the February/March Network session. We will not attempt to correlate the Network observations immediately, however, primarily because the non-VLBA telescopes involved in these programs cannot be rescheduled easily if errors in correlation are discovered after tapes are released. We also cannot confirm the performance of these telescopes through near-real-time fringe checks, and our capability to fill our database from SNAP-type logs is still incomplete.

Following the Network session, already approved internal VLBA observations will be scheduled, to be recorded on the first increment of the VLBA's main procurement of thin tape. The correlator's playback drive complement is planned to reach 18 and to be upgraded for thin-tape operation by that time. We will attempt to correlate all these observations as the tapes are received. The programs will be restricted to the simplest and best-established modes; at a minimum, this should include continuum and wideband spectroscopy (channel bandwidths of 4 MHz and greater) in single or parallel polarizations. Additional modes such as narrowband spectroscopy, cross-polarization, and pulsar gating will be added as they become available. Experience in this phase will determine the rate at which internal VLBA observing can be expanded.

By the end of the May/June Network session, we hope to have developed enough confidence in the correlator's performance, and to have advanced its support for non-VLBA logs and recordings sufficiently, that we can start processing the observations made in these two Network sessions—along with the expanding load of internal VLBA observations. The transition plan from U.S. Network operations to the VLBA calls for the transfer of correlation responsibilities from Haystack Observatory to be complete by the end of June.

J. D. ROMNEY

GREEN BANK

GREEN BANK TELESCOPE CONSTRUCTION

Structural Design

During the last several weeks an intensive study of the Loral/RSi model of the tipping structure has been made by the NRAO structural engineers. The method of calculation, including the treatment of the joints, has been agreed upon, and the analysis of the predicted performance of the structure is in progress. At this time the design effort is concentrated on a few members which show overstress under the maximum wind loading, and under the maximum snow load. When these members have been strengthened, an analysis will be made to confirm that no overstress has been introduced elsewhere in the structure and that the structure continues to meet the performance specifications for pointing and surface accuracies. Some iteration between stress analysis and performance analysis may be required. It is expected that this process will be completed late in January, at which point the design of the tipping structure will be accepted.

The design of the focus and rotation mounts for the prime focus system and for the Gregorian mirror have been completed and are being reviewed by NRAO. Work is in progress on the design of the molds for the surface panels.

Work at the Site

Good progress has been made with the construction at the site. The track has been assembled, and levelled to within 0.015 inches. The track is now being grouted in place, using special grout that cures to a strength of 10,000 psi. The grouting process requires that the concrete and steel be at a temperature of at least 50°F, so that RSi has enclosed the area of the track being grouted with heated tents, which are moved to the next track section when the grout has set. The grouting is now 75 percent complete, and the tents have been moved to cover the final sections of track. The grouting task will be finished in January.

Assembly of the derrick crane was delayed somewhat by holdups in the delivery of key components, but recent progress has been rapid. The 180-foot tower is complete, as is the temporary crane to be used in the erection of the large derrick crane. All parts of the crane are on the site, and it is expected that this unit will be ready for check-out by mid-January.

Approximately 90 percent of the lower three levels of the alidade structure are now in storage at the site. Work will begin in January on the construction of temporary shoring towers inside the track ring. Early in February the first pieces of the alidade will be placed on the shoring towers, and erection of the telescope structure itself will have begun.

The photograph on the next page shows the telescope site as it was on December 22, 1992. The skyline is dominated by the derrick crane. Near the crane are the two crawler cranes used in the erection of the derrick. In the foreground is the ring foundation, with the tents sheltering the back left portion of the track.

D. E. HOGG

PRIME FOCUS RECEIVER

Block diagrams for the first prime focus receiving system have been finalized and include four operating frequency bands (290-395 MHz, 375-520 MHz, 510-690 MHz and 680-920 MHz). The user will have a choice of either dual linear or dual circular polarization which is selected from the receiver monitor and control system. Two polarization modules will also be incorporated which will allow the measurement of the I, Q, and U Stokes parameters to be made at 610 MHz and 405 MHz.

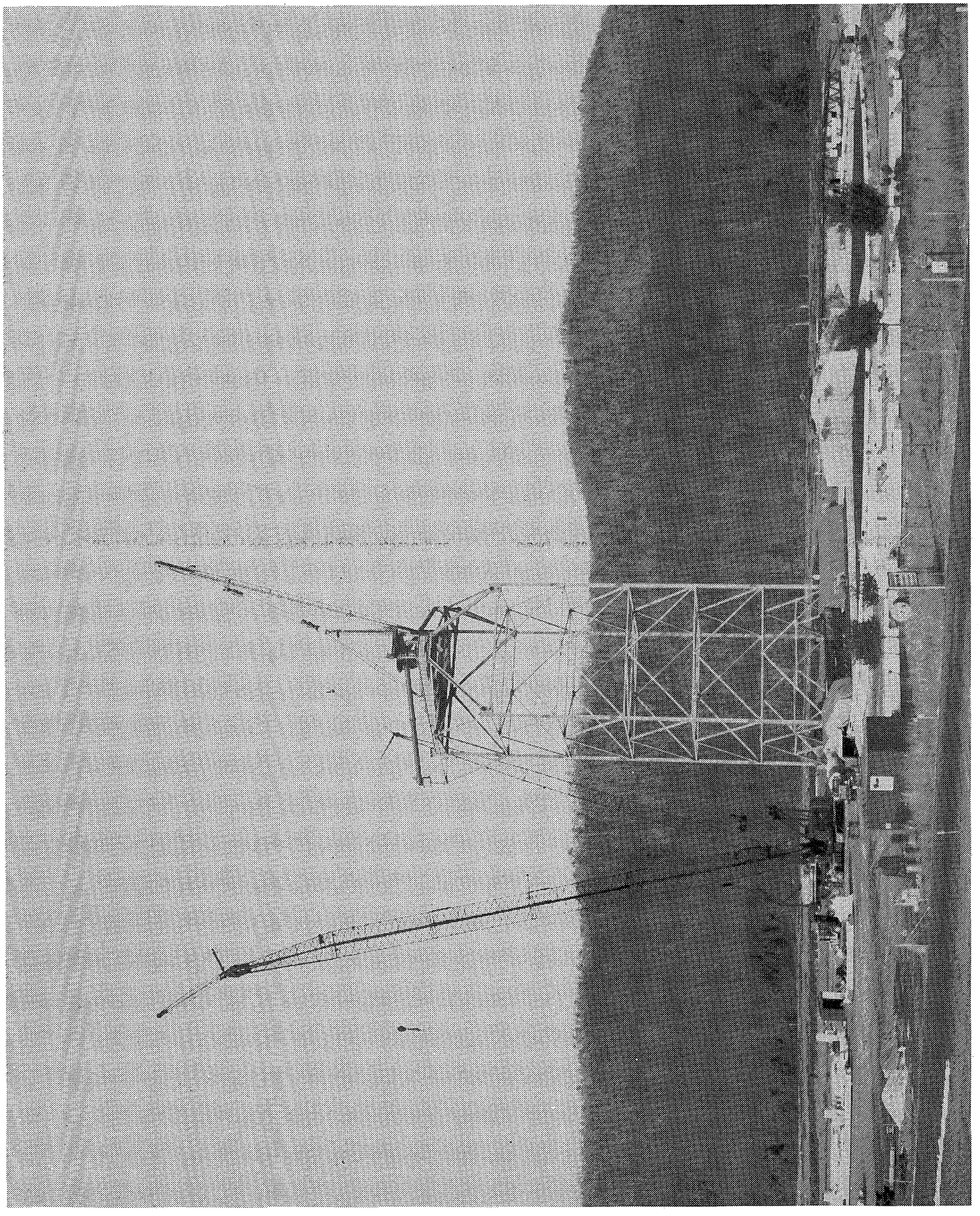
Orders for several of the components of the system have been placed. Orders for the remaining items are pending the final system analysis and component specification process which is now in progress.

The vacuum dewar assembly design was completed and the construction phase is now underway. The dewar cylinder has been fabricated, electropolished, vacuum tested, and found free of leaks. The 680-920 MHz orthomode transducer was received from the manufacturer and is now being installed in the dewar assembly. Other components such as the radiation shield that comprise the dewar assembly are now being fabricated.

The standard NRAO front end box that will house the receiving system has been modified and fitted with the necessary hardware to accept the unusually large dewar assembly and the other components which must go into the package.

G. H. BEHRENS

Newsletter No. 54
1 January 93



ACTIVE SURFACE AND POINTING

Development of the laser ranging system for measuring the surface and pointing continues to progress at a steady pace. A full-scale active surface model consisting of three rangers (two ground based units and one tower mounted unit), a two x two panel active surface 80 meters away, and associated computer hardware and software has been demonstrated in closed-loop mode. This demonstrates the successful integration of seven computers into a system, in addition to the physics of the measurement method.

A perturbation injected into the panel backup structure is measured by the laser system and communicated to the active surface computer, which commands the active surface actuators to a corrected position. This model will be used for hardware and software testing as well as mechanical refinement of the actuator mounting and associated hardware.

Final design for production laser mirror systems is underway with production of complete units scheduled to begin in mid 1993. Space in the 300 foot control building basement is being renovated for a metrology lab to be built in early 1993 to calibrate the pointing, linearity, and zero point of the instruments.

D. H. PARKER

INTERFERENCE AT LOW FREQUENCIES

An unhappy consequence of the progress in the GBT construction is that the likelihood of experiencing problems with interference at low frequencies will be greater, at least during the day. It is expected that the welding of the alidade will begin in late February, and that as the daytime lengthens and the rate of construction picks up, the welding will be done over two shifts. We have already had one program that has been affected by the interference produced in the course of welding.

We will make tests over the next several weeks to explore how high in frequency the interference may extend. Every effort will be made to fit programs in when the interference will be at a minimum, but in general the welding must be allowed to proceed in order that the construction schedule is maintained.

D. E. HOGG

12-METER

DATA ARCHIVING AND EXPORT AT THE 12 METER TELESCOPE

The conversion to Unix-based workstations and the UniPops data analysis system have necessitated some changes in data export procedures at the 12 Meter Telescope. We will continue to make an archival image of the complete contents of each observing directory, including data files, source catalogs, analysis procedures, and any other auxiliary files created during a run. We will keep this archive for at least two years following the run. An observer can request that a copy of his data be retrieved at any time during the life of the archive tape.

Observers will have two options for data export format: FITS or Unix "tar" binary format. The FITS files follow the binary tables format. FITS writers exist for converting raw data files or for converting UniPops-processed data. We will include a sample program for reading a FITS tape as the first file on the export tape. We can create export tapes and mail them following a run, or the observer can create them himself at the conclusion of the run.

Several options for the export medium will soon be available. We currently support 6250 BPI, half-inch reel tape and are acquiring Exabyte and DAT cartridge tape drives, as well. Alternatively, observers can ftp their data via Internet and avoid tapes altogether.

P. R. JEWELL

SUMMER SHUTDOWN FOLLOW-UP

Two of the projects mentioned in the last Newsletter as in progress were completed before the conclusion of summer shutdown. We are pleased to report that the remounting of the azimuth inductosyn has largely removed both the hysteresis in azimuth pointing and some other systematic residuals. In addition, the major repair work on the dome door drive track and mechanism has resulted in significant improvements in its operation. As described previously, the drive sprockets and the connecting telescoping axle were replaced and the drive track was repaired. The door now opens and closes more smoothly. We will continue to inspect and evaluate the performance of the dome.

P. R. JEWELL

IMPROVED SYSTEM TEMPERATURES

The staff made two changes to the telescope during the summer that have resulted in improved system temperatures for 12 Meter receivers. First a spillover shield was installed around the edge of the subreflector. This shield captures stray radiation that otherwise would have been terminated at ambient temperature on the subreflector support structure, and instead reflects it back onto the dish where it then terminates on the cold sky. The shield does not produce any change in the overall efficiency of the dish, but rather transfers losses from rear (warm) spillover to forward (cold) spillover. In addition to the spillover shield, the bulky insulation around the feedlegs was removed, which resulted in lower blockage. The function of the insulation is being replaced by a foil covering and by increased air circulation through the interior of the legs. The changes to spillover and blockage have resulted in improved system temperatures for all receivers. For example, with the 3 mm receiver operating near 98 GHz, observers have measured system temperatures as low as 133 K on the T_R^* scale.

THE TUCSON RECEIVER GROUP

PROPOSAL PRESSURE

For the last two trimesters, proposal pressure has run well above a 2:1 oversubscription rate. The unsuccessful proposals included many well-rated ones that might have been scheduled in other times. Part of the oversubscription results from transient events that will even out over time. However, much of the observing demand is for use of the stable of high-quality SIS receivers that now provide nearly continuous coverage of frequencies between 68 and 300 GHz. In addition, the coming year should see the return of the revamped 8-beam SIS receiver, which will likely add to the proposal pressure.

The high demand for time should not deter anyone from applying for time; we do schedule ~90-100 proposals in a typical year. Clearly, observers should take care in the preparation and justification of their requests. In addition, observers who are initially unsuccessful but modify and resubmit their proposals in accordance with the referees' comments are often awarded time ultimately. The 12 Meter staff and scheduling committee will make every effort to provide advice and to accommodate as many observers as possible.

P. R. JEWELL AND D. T. EMERSON

VLA

VLA CONFIGURATION SCHEDULE

Configuration	Starting date	Ending date	Proposal Deadline
BnA	29 Jan 1993	16 Feb 1993	01 Oct 1992
B	19 Feb 1993	10 May 1993	01 Oct 1992
CnB	21 May 1993	07 Jun 1993	01 Feb 1993
C	11 Jun 1993	30 Aug 1993	01 Feb 1993
DnC	10 Sep 1993	04 Oct 1993	01 Jun 1993
D	08 Oct 1993	17 Jan 1994	01 Jun 1993
A	11 Feb 1994	18 Apr 1994	01 Oct 1993

The maximum antenna separations for the four VLA configurations are: A-36 km, B-11 km, C-3 km, D-1 km. The BnA, CnB, and DnC configurations are the hybrid configurations with the long north arm, which produce a round beam for southern sources (south of about -15 degrees declination).

APPROXIMATE LONG-TERM SCHEDULE

	Q1	Q2	Q3	Q4
1993	B	B,C	C	D
1994	A	B	B,C	C
1995	D	A	B	B,C
1996	C	D	A	B
1997	B,C	C	D	A

Observers should note that some types of observations are significantly more difficult in daytime than at night. These include observations at 327 MHz (solar and other interference; disturbed ionosphere, especially at dawn), line observations at 18 and 21 cm (solar interference), polarization measurements at L-band (uncertainty in ionospheric rotation measure), and observations at 2 cm and shorter wavelengths in B- and A-configurations (tropospheric phase variations, especially in summer). Observers should defer such observations for a configuration cycle to avoid such problems. The upcoming B-configuration daytime will occur at about 23^h RA, and the C-configuration daytime will be about 8^h RA.

Time will be allocated for the VLBA on intervals approximately corresponding to the VLA configurations from those proposals in hand at the corresponding VLA proposal deadline.

B. G. CLARK

OBSERVE

L- and U-band defaults have been changed in OBSERVE: L-band to reflect the new Modcomp defaults and U-band because of an error. Users relying on NRAO defaults to set their observing frequencies should be aware that old OBSERVE workspaces (not files) read in will use the new default frequencies and not the old frequencies.

A keypad mapping for SUN type 5 keyboards is available via anonymous ftp from zia.aoc.nrao.edu (146.88.1.4), cd pub/observe, get Xdefaults-keymap.type5.

The most current version of OBSERVE is 3.1.14, dated 1992.12.29.

W. K. YOUNG

REAL TIME IMAGING AT THE VLA

The VLA now has a workstation dedicated to real time data examination and imaging. A SPARC2 (called miranda) at the VLA is connected to the Modcomp on-line computers by an Ethernet link. AIPS is available on this machine and provides all the usual capabilities for data editing, calibration, and imaging. The observed visibility data is available to AIPS via a pseudo-tape drive (INTAPE=2) in AIPS which is read by FILLM. At the moment, the data must be read in increments of scans, and successive scans must be DBCONed together to produce a full data set. Soon this will be circumvented by using a modified version of FILLM with an APPEND option. Moderate processing is possible in real-time, ranging from an initial editing and calibration to imaging of continuum data and single position spectra (using the AIPS task POSSM) for spectral line observations. The data can be exported via an attached Exabyte drive. The system has been in widespread use for a few months now, and we would especially like to encourage visitors to make full use of it. Please contact Tim Cornwell (505-835-7333 or tcornwel@nrao.edu) for further details and advice.

T. J. CORNWELL

PROGRESS IN 327 MHZ CONTINUUM IMAGING

There has been substantial progress in improving the continuum imaging capability of the VLA at 327 MHz. In all configurations, wide-field imaging is nearly always required to reach noise levels below a few mJy/beam. Sidelobes from the typically 12-15 Jy of confusing sources in the primary beam must be largely removed in order for the thermal noise to be important. This is possible only if a field of view spanning many degrees is CLEANed. A "polyhedron" algorithm which allows correction of the w-term for such large fields of view has been developed by Tim Cornwell and Rick Perley over the last few years. Recent enhancements to the polyhedron algorithm incorporate self-calibration into the deconvolution with the result that a long B-configuration observation can be processed in about real-time (8-12 hours) on an IBM RS/6000-560. This is an improvement in processing speed of about a factor of five. More importantly, an increase in the allowed field of view and a number of other enhancements have improved the limiting sensitivity obtained by a factor of about two or three. In the best cases away from the Galactic plane, B-configuration images have a noise level of about 300 microJy/beam. This is only about two to three times the thermal noise level and is at a level roughly consistent with the amplification of noise expected in self-calibration of a confused field of view. Currently the polyhedron algorithm is available only in the experimental SDE package. It is planned for AIPS++. At the AOC, there is an IBM RS/6000-560 especially configured for wide-field imaging (which principally requires lots of physical memory). This is well-matched to B-configuration 327 MHz imaging requirements. With the improved software, the smaller VLA configurations can be processed on a SPARC 2 class machine. Recent development has focused on using coarse-grained parallel processing (via the PVM package) to allow A-configuration imaging using parallel processing. Anyone wishing further details about the polyhedron software or about 327 MHZ continuum imaging in general should contact Tim Cornwell (505-835-7333).

T. J. CORNWELL

VLA L-BAND DEFAULT FREQUENCY IS CHANGED

We have experienced an increasing amount of radio frequency interference (RFI) at the L-band "BD" default frequency of 1515 MHz (passband of 1490-1540 MHz). The interference comes from satellite transmissions in the 1520-1540 MHz band, and we do not expect these transmissions to decrease. After performing some tests, we have chosen a new default frequency of 1385 MHz, with a passband of 1360-1410 MHz. While our tests indicate that the severity and frequency of occurrence of RFI in this passband are significantly reduced, there are occasional satellite test transmissions at 1381 MHz. However, these transmissions are logged by NRAO-Green Bank.

The OBSERVE program has been modified to default to the new frequency of 1385 MHz. If you wish to observe at the previous default frequency, you must specifically request the observing frequency of 1515 MHz within OBSERVE. Observers planning L-band runs at non-default frequencies should consult our most recent plots of interference, which are available by fax. You may obtain these by sending e-mail to analysts@aoc.nrao.edu or vdhawan@aoc.nrao.edu, providing your fax number. As always, if you experience RFI, you should complete the interference report form provided to all observers and return it to the AOC.

V. DHAWAN AND W. D. BRUNDAGE

VLA SKY SURVEY

With the increasing importance of multiwavelength astronomy and large astronomical databases, the NRAO has decided that it is time for an all-sky VLA continuum survey at 20 cm. The scientific demands of completeness and positional accuracy make it difficult to choose a single array configuration for the survey. Therefore, we are commissioning the survey in two parts. In the D configuration all of the sky north of -42 degrees will be observed by a team led by Jim Condon (NRAO-Charlottesville). In addition, a region of the north galactic cap will be surveyed in B configuration by a team led by Robert Becker (UC Davis and IGPP at Livermore Lab). The goal of both surveys is to provide a resource to the entire astronomical community which can be used like the IRAS survey or the Palomar Sky Survey for a myriad of projects for years to come.

The D configuration survey is currently planned to take place during the next three D sessions and to be completed in the summer of 1996. All the observations will take place at night to avoid interference caused by the Sun in the antenna sidelobes. The final survey will have a resolution of about 54 arcsec FWHM and a 5 sigma completeness limit of about 2 mJy. The positional accuracy will be $\leq$ 1 arcsec for sources stronger than 10 mJy, but will degrade to 5 arcsec rms in each coordinate at 2 mJy. It is estimated that about 2,000,000 sources will be found in this survey.

The B configuration survey will have a resolution of $\sim$ 6 arcseconds and a positional uncertainty of better than 1 arcsecond for the faintest point sources. This survey will use the spectral line system to minimize bandwidth smearing and thus will need more integration time per field if it is to reach the same flux density limit. This survey will use the same pointing centers as the D-array. The region for study is being chosen to coincide with the Sloan Digital Sky Survey Project, a CCD survey being carried out by a consortium including the University of Chicago, FermiLab, the Institute for Advanced Study, and Princeton. The Sloan survey will be done in four colors and is projected to have a limiting magnitude of 23.1 in the red. It is planned to be completed in 2000 or 2001 and to cover the north galactic cap north of 30 degrees galactic latitude. The B configuration survey observing is expected to be complete in 1998.

Both surveys will produce several data products which will be available to the community. First, the uv data will be available immediately after the observing sessions for anyone in the astronomical community. Second, fully calibrated and mosaiced D-configuration sky maps will be produced and distributed. Preliminary versions will be distributed on tape and as complete parts of the sky become available the images will be distributed on CD-ROMs. Third, catalogs of the discrete sources will be constructed.

An Oversight Committee has been created to monitor the progress of both surveys toward these goals. Members are: Kenneth Chambers (U. Hawaii), Barry Clark (NRAO), Eric Feigelson (Penn State U.), Jacqueline Hewitt (MIT), Gillian Knapp (Princeton U.), Frazer Owen (NRAO), and Rogier Windhorst (Arizona State U.). Advice from users should be directed to members of the Committee, particularly Frazer Owen, who will chair the Committee.

P. A. VANDEN BOUT AND W. M. GOSS

IMPACT OF THE VLA SURVEYS ON VLA OBSERVING TIME

These two surveys will require about 15 percent of all the scheduled VLA time over three years, with a smaller impact for two more years to complete the B-configuration portion. The detailed allocation of time will be an issue the oversight committee will consider and the NRAO management will ultimately decide. Because of the requirements of the surveys for night observing time for the D-array and for the region between 7^h and 17^h30^m for the B-array, some projects will be affected more than others. Also, we believe the VLA users do not want us to deviate very much from the current cycle of going through the four configurations in 1.3 years. One possible result of these constraints over the next three years is outlined below.

A-configuration: An evenly distributed reduction of observing time of about 25 percent.

B-configuration: A reduction of time in the survey right ascension (7^h - 17^h30^m) of 75 percent coupled with an increase in time at other RAs of about 30 percent.

C-configuration: An evenly distributed reduction of observing time of about 25 percent.

D-configuration: A nighttime reduction of about 50 percent and a daytime increase of about 25 percent.

The above is only an outline. The actual impact will depend on the details of the final decisions about the total time and sky coverage of each survey.

W. M. GOSS AND B. G. CLARK

VLA WILL GET RECEIVERS FOR 43 GHZ BAND (Q-BAND)

A set of nine receivers for the 43 GHz band will be installed on the VLA, with the first one arriving in the middle of 1993. The Q-band receivers represent a cooperative project between NRAO and the Instituto de Astronomia, Universidad Nacional Autonoma de Mexico (UNAM), in Mexico City. The receivers, to be built by NRAO, will be funded by UNAM in support of an observing program led by Luis Rodriguez that seeks to produce VLA images of dust emission from protoplanetary disks.

The specifications for these receivers have not yet been finalized, but they will be as broadband as possible without significantly compromising the system temperature. Their addition to the VLA will expand the capabilities of the Array in a number of areas, including the study of SiO masers, radio recombination lines from ultracompact H II regions, and free-free emission from active galactic nuclei. Initial tests by D. Wood with a spare VLBA receiver have shown that the best VLA antennas provide about 15 percent aperture efficiency at 7 mm, the Q-band wavelength.

Once installed and tested, these receivers will be available to all VLA observers. It is expected that all nine Q-band receivers will be completed by April, 1994, and that a sufficient number of them will be on the Array to allow their use for observations during the A-configuration of 1994.

Proposals to use the VLA 43 GHz system should be submitted before the 01 October 1993 proposal deadline.

R. A. SRAMEK

COMPUTING AT NRAO-NM

The installation of new equipment at the AOC as a result of the VLBA computing procurement is essentially complete. AOC visitors can choose from among seven Sun SPARCstation IPXs with 2 gigabytes of data space each, an IBM RS/6000-320H with 2GB of data space, and five IBM RS/6000-560s with a minimum of 3GB of data space each, depending on the size of the observing project. Two of the IBMs are being upgraded to a total data capacity of 8GB and 15GB respectively, with VLBA spectral line data requirements in mind. All of these workstations are equipped with Exabyte drives, and most with DAT drives as well. Reservation procedures for these systems have been described in previous newsletters.

A Tektronix Phaser II color PostScript printer was also purchased recently, which provides color hardcopy and is particularly good for overhead transparencies. Like the high-capacity QMS PostScript printer, it is directly attached to the Ethernet network, allowing very quick data transfer.

The e-mail delivery of VLA OBSERVE files has been moved to the VLA operators' Sun workstation. The e-mail address remains the same, however. This computer should be considerably more reliable than the old VAX 11/750, OUTBAX, that has been used for this purpose since 1988. We continue to have backup procedures in place in case of problems; these are transparent to observers submitting files.

Current plans for the AOC Convexes are to turn one off around mid-February 1993, and keep the other running until at least the middle of 1993. Maintenance prices on these machines are very high, and the C1 models installed at the AOC are no longer powerful enough to compare favorably with the newer machines in terms of processing capacity and the perceived response time.

R. MILNER

VLA AND VLBA MEMORANDA

Up-to-date listings of VLA and VLBA memoranda are available electronically. The listings reside in the VLAIS public area under the GEN heading of the main menu. Each listing has a contact name as well as an e-mail address and phone number to be used in requesting a specific memo. To see these listings, telnet to zia, then log on by typing <vlais>. The logon should be in lower case letters.

T. ROMERO

TRANSPORT OPTIONS TO/FROM THE ALBUQUERQUE AIRPORT

1) The Socorro Roadrunner Shuttle service operates on a schedule as listed below and the rate is $25.00 each way. (See note below.)

2) Dollar-Rent-A-Car has agreed to provide NRAO with Government rates of $26.00/day or $136.50/weekly as long as the reservation is made through the NRAO reservation system.

Note: If you plan to use the shuttle as transport, please review the schedule below and make your travel plans accordingly, to avoid a long wait at the airport.

Socorro Roadrunner Shuttle Service Schedule
(Travel time ~1-1/2 hours each way)

Albuquerque to Socorro	Socorro to Albuquerque
0900	0600
1400	1100
1900	1600
2400	2100

T. ROMERO

USER INFORMATION

Visitors coming to the NRAO-New Mexico may find it useful to fill out the reservation form on the next page prior to contacting the AOC reservationist. Some of the questions may require a bit of research, and having a copy of the form should save you time while making your reservations. The information requested is used to plan a productive and pleasant visit for you.

A copy of this form is in the public area of the VLAIS. To get to this area, telnet to zia, then type <vlais> in lower case. The menu will have a listing called Visitors, where the form is located. Alternatively, you can request this form via e-mail from Eileen Latasa.

T. ROMERO

LATE BREAKING NEWS

VLBA - EFFELSBURG 100 M TIME AVAILABLE

VLBI observers wishing to propose programs involving the VLBA and Effelsburg 100 m telescope, but not the other telescopes that normally make up the European VLBI Network, may do so by simply submitting their proposals both to the NRAO and to the Max-Planck-Institut für Radioastronomie (MPIfR). Approximately twenty days of additional 100 m observing time per year has been reserved for such programs under the terms of an agreement between NRAO and the MPIfR. Inclusion of additional NRAO telescopes or telescopes outside of Europe is not precluded by this agreement; proposals including such telescopes should be submitted to those observatories as well as to the NRAO and MPIfR.

P. A. VANDEN BOUT

VISITOR RESERVATION FORM

TRAVEL AND LODGING

FULL NAME_____ DATE_____

INSTITUTION_____ PHONE_____ E-MAIL ADDRESS_____

STUDENT? Y N FIRST VISIT? Y N (FIRST TIME STUDENT SHOULD BE ACCOMPANIED BY AN ADVISOR)

DATE OF ARRIVAL_____ DATE OF DEPARTURE_____

AIRLINE AND FLIGHT #_____ AIRLINE AND FLIGHT #_____

ARRIVAL TIME_____ DEPARTURE TIME_____

GROUND TRANSPORTATION: RENTAL_____ OWN_____ SHUTTLE: In_____ Out_____

LODGING REQUIREMENTS: VLA_____ FITCH_____ APARTMENT_____ MOTEL_____ OTHER_____

CURRENT OBSERVATION and/or DATA REDUCTION

1. Program:

Code	Date of Observation
_____	_____
_____	_____
_____	_____
_____	_____

2. Data Type:
   - VLA Continuum _____
   - VLA Spectral Line _____
   - VLA HTRP _____
   - VLBI or VLBA _____
   - Other (Specify) _____

3. Last VLA, VLBI or VLBA Observing Date: _____
4. Last NRAO-NM Post-Processing Visit: _____
5. Post-Processing System:
   - ___ AIPS
   - ___ SDE
   - ___ Caltech VLBI Package
6. Do you wish to have (old) VLA data filled before you arrive? Y N If yes:
   - a. Observing Time _____ (hours)
   - b. Filling Integration Time _____ (seconds)
   - c. Do you want all frequencies in the same FQ table? (Spectral Line only) Y N If no, please specify.
7. Do you want to use the real-time imaging system at the VLA Site? Y N
8. NRAO-NM Collaborator(s): _____

   Accompanying Collaborator(s): _____

MISCELLANEOUS

1. Type of Assistance Required: Observing File Preparation _____ Consultation _____

   Friend (Extensive Help) _____ None _____
2. Miscellaneous:_____

_____

_____

Reservations: Eileen Latasa
Telephone: 505-835-7357
Fax: 505-835-7027
E-mail: elatasa@nrao.edu

EDITOR NRAO NEWSLETTER
NATIONAL RADIO ASTRONOMY OBSERVATORY
520 EDGEMONT ROAD
CHARLOTTESVILLE, VA 22903-2475 USA

NON - PROFIT ORG
U S POSTAGE PAID
PERMIT # 373
CHARLOTTESVILLE, VA

FORWARDING AND RETURN
POSTAGE GUARANTEED,
ADDRESS CORRECTION REQUESTED

To:

DATED MATERIAL - DO NOT DELAY