# NRAO NEWSLETTER

1 January 1999 No. 78

http://www.cv.nrao.edu/html/newsletter/

## IN GENERAL

### Riccardo Giacconi to Become President of AUI

Riccardo Giacconi, currently the Director General of the European Southern Observatory (ESO), in Garching, Germany, will become the new President of Associated Universities, Inc., (AUI) on 1 July 1999. An internationally recognized and honored astronomer, Dr. Giacconi is no stranger to science management in the United States. His early career was spent at American Science and Engineering, Inc., in Cambridge, Massachusetts, where he was Executive Vice President and Senior Scientist. He then became head of the High Energy Astrophysics Division and Associate Director of the Harvard/Smithsonian Center for Astrophysics where he held a concurrent position as Professor of Astronomy at Harvard. From 1981 until 1993, he was Director of the Space Telescope Science Institute (STScI) in Baltimore Among other honors, he has been elected to the National Academy of Sciences and is the recipient of the Wolf Prize in physics.

Dr. Giacconi has extensive experience in science management, project management, and international scientific relations. At ESO, he has been responsible for seeing the first light of the Very Large Telescope at its newly developed site on Cerro Paranal in Chile. At STScI, Giacconi oversaw the first years of operations of the Hubble Space Telescope including the formulation and initial execution of the repair mission At both institutions, he stewarded both technical development and operations and the support of facility users.

A renowned scientist, Giacconi has received, among other awards, both the Warner Award and Heinemman Prize of the American Astronomical Society and the Gold Medal of the Royal Astronomical Society. Most of his career has been focused on the x-ray regime, beginning with his leadership of the team that discovered the first non-solar celestial x-ray source. He is the author of more than 200 scientific publications on explorations of x-ray universe from stellar black hole the candidates to distant clusters of galaxies.

The selection of Dr. Giacconi culminates an extensive search for a new president taking place over the last six months. The Search Committee was chaired by AUI Trustee Claude Canizares of MIT and included four other Trustees and two outside members. Ken Kellermann was the NRAO representative. The Search Committee solicited nominations and applications internationally and conducted numerous teleconferences and interviews in its deliberations. The Board of Trustees unanimously and enthusiastically endorsed the selection of Dr. Giacconi as the presidential candidate.

Dr. Giacconi will replace Martha Haynes, Professor of Astronomy at Cornell University and a member of the AUI Board, who has been serving as Interim President since April. AUI and the NRAO are pleased to give Dr. Giacconi the chance to extend his involvement in science planning and management to the longer wavelengths exploited by the NRAO, and we welcome him to our organization

*Martha Haynes*

### MAP Project Draws to an End

On October 23, there was a celebration at the Central Development Laboratory (CDL) as the last of the MAP flight amplifiers was shipped. A few more spares and extras remained to be finished, but Princeton University had everything they needed to build the flight hardware Congratulations are due to the MAP team and everyone else who worked on the project.

The MAP amplifiers represent another significant step in the evolution of the design of low-noise amplifiers from the CDL, and an additional step in refining and improving the assembly process. These factors have resulted in a level of consistency and repeatability of performance which is truly remarkable. They are also extremely rugged. At one point, a test bracket holding a flight radiometer disintegrated during a vibration test at Goddard Space Flight Center, allowing the amplifiers to be beaten severely before the apparatus shut down. The worst amplifier "looked like it had been beaten with a ball peen hammer," according to Dave Wilkinson at Princeton. Nevertheless, all four

The NRAO Newsletter is published quarterly by the National Radio Astronomy Observatory. 520 Edgemont Road, Charlottesville, VA 22903-2475, USA
The NRAO is a facility of the National Science Foundation operated under cooperative agreement by Associated Universities, Inc
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abused amplifiers still work perfectly. It seems likely that they will have no difficulty surviving the rigors of the launch on a Delta rocket in September 2000.

With the end of the MAP project at the NRAO, the CDL will turn its attention to internal needs which have suffered during MAP construction. New production batches of amplifiers for 18-26, 26-40, and 40-50 GHz are already under way. Over the next two years, the CDL anticipates building enough amplifiers to outfit all existing and new 22, 43, and 86 GHz receivers on the VLA and VLBA, and at least a 43 GHz receiver for the GBT, with modern indium phosphide amplifiers similar to the MAP units. Including spares, this is about 160 amplifiers—more than the MAP project.

Even during MAP, we have managed to complete the design and construction of a new series of low-frequency amplifiers for the GBT prime focus receivers. These cover 290-1230 MHz in several bands, with noise temperatures in the range 2-3K. At the high frequency end of this range, good gain and noise can be obtained in a single balanced amplifier covering the range 600-1200 MHz—a full octave.

*J C Webber*

## Observatory-Wide Computing Developments

During the last quarter of 1998, a number of purchases were made or completed which will have an impact on visitors to NRAO facilities. These include equipment for major networking upgrades in Charlottesville (see the article by P. Murphy) and in the original Jansky Lab at Green Bank, which, when fully implemented early next year, will result both in increased reliability and in higher bandwidth being available to many systems within the local networks. Upgrades for a number of key software packages were also purchased observatory-wide, including the major office suites from Microsoft and Corel, as well as the engineering program AutoCAD Consistent upgrades at all sites will result in fewer difficulties transferring files between sites. Any collaborators outside of NRAO who exchange files in these formats (e.g., Word, QuattroPro, etc.) with NRAO staff members will also need to be aware of the new versions.

A dedicated connection between the AOC and UIUC/NCSA was also brought into operation, which has greatly improved access to NCSA's computing facilities for the AIPS++ group working on the development of parallelization for astronomical data reduction techniques in the AIPS++ environment.

In addition, new tape drives were required at the 12 Meter Telescope to archive the drastically increased amount of data that is anticipated from the new correlator which was installed this past summer; currently high-density Exabyte is used, but this cannot keep up with the expected rates. After canvassing several institutions with similar requirements, we decided to order three DLT7000 drives, the same type that are in use at NOAO's facilities at Kitt Peak. One of these drives will be located at the NRAO office in Tucson for reading the new 12 Meter data tapes; the two on the mountain will be used for archiving and verification. There are still some concerns about the robustness of this medium, but our research suggests that this has improved for hardware produced during the past year.

The improvement of data loading and backup facilities by selecting a medium with significantly better capabilities than traditional Exabyte or DAT, which is also reliable, likely to be viable well into the future, and reasonably well-represented at the home sites of our user community, remains difficult. Optical storage still has not come of age for this purpose, and there are three serious contenders in tape technology: DLT, Exabyte Mammoth, and Sony AIT. We have now tested the first two, with one of each type of tape drive available in Socorro and Charlottesville for those who wish to use them, and we can see no reason why AIT would not also be able to meet our performance needs. However, it is far less clear what direction our users are taking in this respect. If you have requirements for capacity and data transfer rates that are greater than can conveniently be met by the commonly-used tape media, we would welcome your feedback. Please send any comments or queries to Ruth Milner, rmilner@nrao edu

*M R Milner*

## Charlottesville Computing Developments

A new pair of Ethernet switches were purchased and deployed in Charlottesville, replacing an aging and increasingly troublesome switch. At the same time, the entire network rack was overhauled, with an eye to getting ready for an upgrade from the old thin-wire Ethernet based network to 100 Mb/sec twisted-pair Ethernet (this or better is already deployed at most other NRAO sites). The increasing difficulty in obtaining thin-wire Ethernet devices means we have to move away from this old standard. Preliminary work on connecting up a subset of computer room and AIPS Caige systems with 100 Mb/sec wiring is progressing.

The deployment of the SPARC Ultra and Intel/Linux systems purchased earlier in the year has mostly been concluded. Charlottesville is now at the point of nearly eliminating the old SPARC IPC systems from our network. The remaining two IBM RS/6000 computers will be decommissioned in the coming year as their functionality is taken over by the new Linux systems.

As part of the Observatory-wide high-end tape drive initiative, Charlottesville Computing took delivery of an Exabyte 8900 "Mammoth" tape drive. These drives can write up to 20 Megabytes (uncompressed) on a single cartridge. When initially tested on a SPARC Ultra II running AIPS, the throughput with the FITTP task was an impressive 2.6 Megabytes per second data transfer rate (including time for file mark writing). This compares favorably with the 3 Megabytes per second rate achieved with DLT 7000 drives. The only concern with the Mammoth drive is its distaste for traditional 8200 and 8500 tapes; it requires cleaning after reading one of these. Thus, we have requested that only 8900 tapes be used in this drive.

*P P Murphy*

## AIPS++ News

The AIPS++ third beta was released on October 15, 1998. This is the culmination of a year-long period of development, for the most part along lines we had anticipated in our planning, and also partly in response to comments from testers of our previous beta releases. This release sees substantial improvements in all areas, most importantly in interfaces and in functionality. Details of the contents of the release are given in the November AIPS++ newsletter article. The newsletters are found at URL: http://aips2.nrao.edu/aips++/daily/docs/newsletters/.

We are nearing the first public release of AIPS++. The code freeze will occur on March 15, 1999, with a release occurring as soon as testing proves satisfactory. We are quite short of active beta testers so if you are willing to help out, please contact Tim Cornwell (tcornwel@nrao.edu) or Athol Kemball (akemball@nrao.edu). Our work at the moment consists mainly of integrating applications, improving interfaces, fixing bugs, and clarifying the documentation.

Other notable news in the project:

> Our parallelization collaboration with NCSA has resulted in a mosaic image of a M33 HI data set from the VLA, taken over 64 hours in three configurations. The final image has 6000 by 6000 pixels and emission in about 200 channels. Work continues on improving performance and also on parallelizing more parts of the imaging process.
>
> We gave presentations of AIPS++ at the ADASS meeting held at NCSA in Champaign-Urbana in early November and at the AAS meeting in Austin. We expect to announce the first release at the AAS meeting in Chicago this summer.

More information on recent progress and on AIPS++ in general can be found from the AIPS++ Newsletter and from the AIPS++ home page at: http://aips2.nrao.edu.

*T J Cornwell*

# GREEN BANK

## Green Bank Telescope

The photos at the top of Page 5 show the status of the construction of the Green Bank Telescope as of late October.

**Erecting the Backup Structure (BUS) upon the Box Girder**
With the completion, on the ground, of the BUS in July of 1998 the next task was the erection of the BUS on the box girder. Seventeen temporary support points were located atop the box, duplicating the 17 points used in building the BUS on the ground. The BUS was disassembled into its 22 modules and these units were sequentially repositioned so that they could be individually lifted and installed upon the box using highly qualified S70 tower derricks. With the BUS solidly in place on the box girder, installation of the permanent supports began. These members are made up of sixteen large weldments attached to the back of the BUS and a like number installed at various elevations on the top and sides of the box girder. Most of the two sets of weldments accommodate multiple beams as there are 30 large beams carrying structural loads from the BUS to the box. When the permanents are in place, the temporary supports on the top of the box will be removed.

As reported earlier, it was discovered that problems in the design and fabrication of the permanents required that they be reworked. Most of the rework has now been completed. A significant milestone was achieved during the week of December 6, 1998, when the rework of the large permanent supports attached to the BUS was completed. In the middle of December the work on the permanents attached to the box was estimated to be 88 percent complete. Fourteen of the 30 supporting beams have been installed between the permanent supports. The installation of the remaining beams will be completed by February

**Installation of the Vertical Feed Arm & Upper Feed Arm**

The Vertical Feed Arm (VFA) rises from the end of the Horizontal Feed Arm, the installation of which was completed in June 1997, past the vertex of the dish, and on past the prime focal point to the region of the secondary focus. The tip of the VFA, the Upper Feed Arm, carries the Gregorian mirror. When the secondary optics is in use, the radio signal, at frequencies above approximately 1 GHz, is reflected into a suitable feed on the roof of the Feed/Receiver Room mounted on the VFA. When the GBT operates at lower frequencies the signal is received by a prime focus radiometer mounted on a movable boom which is raised into a position in front of the Gregorian mirror. The boom is also carried by the Upper Feed Arm.

The Upper Feed Arm has been fully assembled for some time, and extensive field tests of the Upper Feed Arm servo systems have been performed. On November 16 an intensive 30-day test began, in which the servos that control the position of the Gregorian subreflector were exercised around the clock in a simulation of actual observing modes. The test was completed successfully with no mechanical failures. The position transducers occasionally gave erroneous outputs, and this situation will be examined. Tests of the Prime Focus system were not possible, because of failures in the original motors. Tests will be made of the Prime Focus servos in January after new motors have been installed. The goal is to complete all testing of the Upper Feed Arm by the beginning of February, at which time the Upper Feed Arm assembly will be moved from its current location near the road to a position adjacent to the large derrick crane. The VFA consists of 12 modules, six on each of the two arms, and the Upper Feed Arm The lower module's G & H left and G & H right are now in position and the welding of the structures is in progress. Next, modules K-L left and right will be lifted into place and modules J left and right will be created by welding interconnecting members into place. Then the Upper Feed Arm will be raised and attached. The installation of the Upper Feed Arm is currently scheduled to begin in April 1999.

**The Panel Actuators and the Associated Cabling**

One of the important features of the GBT is that it will have an active primary surface. The telescope structure is so large that gravitational deflections will cause the primary mirror to deviate from the desired parabolic shape. To compensate, the surface panels will be mounted on a total of 2,209 remotely controlled actuators, so that the shape can be altered to improve the efficiency with which the telescope focuses radiation, especially at the higher frequencies where surface irregularities are more important

All of the actuators are now mounted on the BUS. In order to gain time in the schedule, a program was started to align the actuators using a total station theodolite. As of November 15, 1998, 849 actuators had been set in this way. This program will be suspended for the winter, in part because of the difficulty in doing this precision work during winter weather and in part because of concern that the outlying actuators, those lying well beyond the Box, might shift when the load of the BUS is transferred from the temporary to the permanent supports. Such a shift would require a more extensive second stage of alignment than is anticipated for those over the Box.

It was originally planned to install the actuator cable in the spring of 1999, in order that the cabling not be in the way of actuator installation and welding. However, COMSAT developed an ingenious procedure for installing the actuator cables in cable trays in such a way that the cable is out of the way and protected until it is needed, at which time it can be spooled out and connected to the appropriate actuator. All of the cable is now in place, and one end of each cable has been passed through the bulkhead in the Actuator Control Room. In the Room the cables have been cut to approximate length, and work will soon begin to prepare the cable ends for connection to the controllers.

**The Surface Panels**

The primary reflector is made up of 2,004 panels, the largest of which are approximately 2.5 meters on a side. In order that the GBT be effective at high frequencies the panels themselves must be precise, with a smoothness of a surface of 5 mils, and they must be carefully installed and aligned. The status of the panels is unchanged from the previous reports; approximately 1,400 have been manufactured, and installation tests involving several panels were made in the summer of 1998. The actual panel installation will occur after the Upper Feed Arm is in place, in the late spring of 1999, and will continue through September. The accurate alignment will employ photogrammetry, and will begin late in 1999.

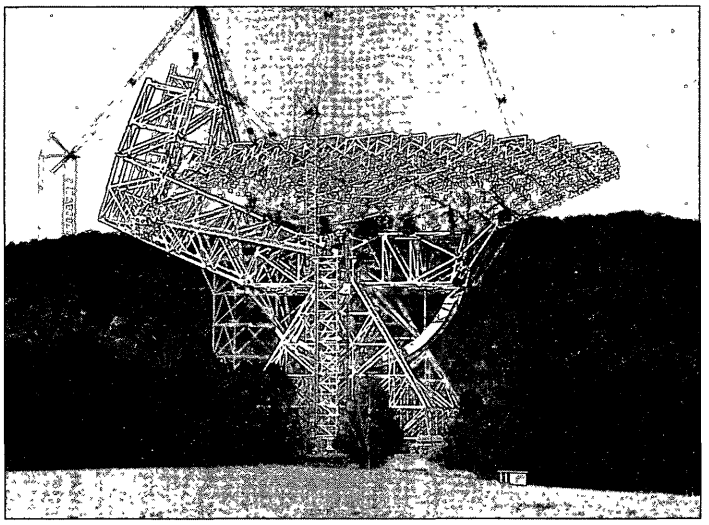
*R D Hall and D E Hogg*

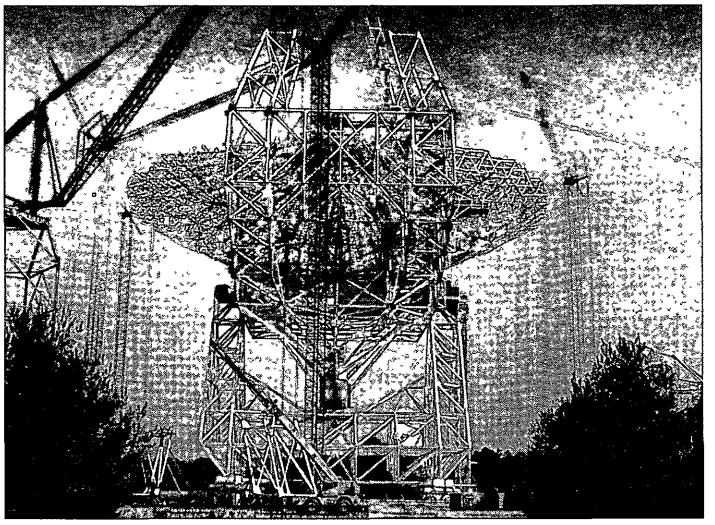
# Final Call for 140 Foot Proposals

The 140 Foot Telescope is scheduled to be closed in the early summer of 1999. Proposals will be accepted until 15 January 1999. It is expected that the current group of receivers and backends will be available for use until the telescope closes

More detailed information is available on the Green Bank web site at: http://www.gb.nrao.edu/.

*F. J Lockman*





## Green Bank Operations Move into the Jansky Lab

The shielded rooms in the top floor of the new addition to the Jansky Lab were completed at the end of 1997. At that time plans were immediately formulated to move the Operators and control of the antennas into their new home in the Lab. There is a total of five shielded rooms in the upper floor. Their use includes: GBT Equipment, GBT Control, Tape Room, (which will house all the instrumentation tape drives on site), USNO/OVLBI Control, and USNO/GBI Equipment.

The first major piece of equipment to be moved into the Lab was the Timing Center (USNO Hydrogen Maser). It was moved into the GBT Equipment Room from the Interferometer building on October 29. The move went very smoothly with very few problems and little interruption in the distribution of the timing signals around the site.

The move of the control of the USNO 20 Meter antenna was completed on October 31. Again the move went very smoothly with minimal downtime. The pulsar backend was successfully moved the following week. Operation of the pulsar backend and control of 85-3 from the Lab were in place by November 9.

The USNO Operators moved into their Control Room on October 29. The OVLBI Operators had moved into the Control Room during the last few weeks of September. The OVLBI move will be complete when their two VLBA tape drives are moved into the Tape Room during the first quarter of 1999.

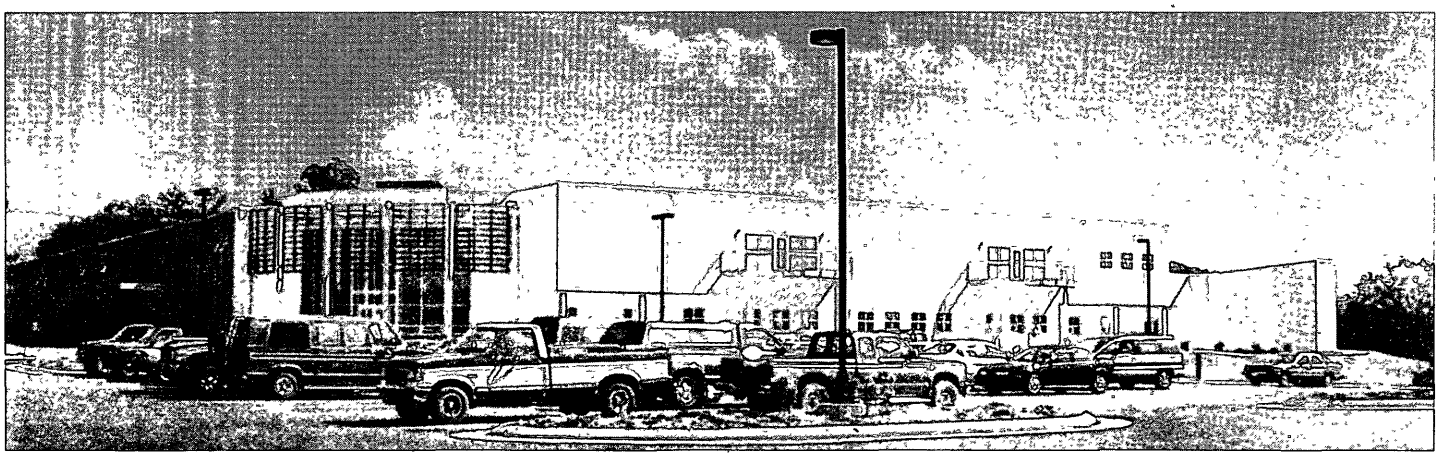
The Lab Tape Room currently houses two USNO VLBA Tape Drives, and one OVLBI S2 Recorder. It will eventually house a total of five VLBA Tape Drives, two S2 Recorders and one VSOP Recorder.

Plans are underway to move control of the Green Bank Interferometer into Jansky Lab during 1999.

The GBT Electronics room contains the GBT Mock Up and the control work stations are located in the GBT Control Room. The GBT Control Room will be outfitted during 1999 in preparation for the completion of construction of the GBT.

The success of the Operations move to date is due to the cooperation of many individuals from many groups in the Electronics, Plant Maintenance, Scientific Services, and Telescope Services Divisions.

*R. C. Bignell*



# MILLIMETER ARRAY

## Status of the Millimeter Array

In the past three months the MMA Project team has focused its efforts on addressing the principal concerns voiced by the NSF MMA Oversight Committee at their August 1998 meeting. These concerns included recommendations that the project management tools, the Project Book and the Management Plan, be developed quickly to a more mature state and the concern that the potential partnership with the European Large Southern Array (LSA) project be secured.

The MMA Project Book, which is available on-line from the MMA web page at http://www.mma.nrao.edu is a complete summary of all the tasks planned for the design and development phase of the project. In separate chapters it includes the requirements for each major subsystem of the array, a description of the steps to be taken to design and fabricate the instruments to meet those requirements, a summary of the key development milestones and deliverables, and options to be evaluated with decision points noted. The Project Book is a web document presented in PDF format; it will evolve continually to reflect progress and decisions with a clear audit trail. The version now on-line is the second major release. Akin to the system used by AIPS, we will keep on-line the last complete revision together with the version currently being updated with recent material.

The Project Book is the fundamental reference for the MMA project. It is useful to the MMA staff as a way of assessing how their individual efforts fit into the whole of the project. It is useful to those outside the project as a way to answer any questions as to what is, or is not, planned to be part of the MMA. The MMA System Engineer, Darrel Emerson, is the editor of the Project Book.

Prospects for joining the MMA project to the LSA project are becoming increasingly likely. Many people in Europe are working to define a comprehensive project team that can interact with the MMA project in an effective way, beginning with the design and development efforts. An MOU has recently been signed in Europe that firmly establishes the commitment of several countries and institutes to realize the joint project, and which can serve as a vehicle for discussion with the NSF and AUI. Such discussions will take place early in 1999.

The Millimeter Array Advisory Committee (MAC) met in Chicago on November 21; the report of this meeting is available via the MMA web page. Once again this year the MAC gave strong support to efforts directed toward achieving a European collaboration that would greatly increase the scientific capabilities of the MMA. They recommended that the issue of a common antenna diameter be resolved, so that a joint homogeneous array could be built. They went further and endorsed the conclusions of an ad hoc MDC/MAC/NRAO committee whose report was presented orally and as a written draft to the committee. Specifically, they noted that the science goals would not be seriously affected by the choice of antenna size if the antenna diameter is in the range 10-12 meters, so long as that antenna meets the specifications set for the MMA antenna.

In December, the NSF MMA Oversight Committee (MMAOC) met to review project development. This committee also urged that the European collaboration issue be resolved in a way that would not slow the momentum of the MMA project. Since the major near-term milestone of the MMA project is the issuance of the Request for Proposals (RFP) for a prototype antenna, the MMAOC endorsed a plan to issue that RFP for design and fabrication of a 12 meter antenna prototype. This approach allows the MMA project to proceed with the antenna procurement on the same schedule that has been built-in to the US-only project, it eliminates a potential obstacle to collaboration without compromise to the science goals, and yet it provides the time needed for NSF/AUI and the European Negotiating Team to forge a satisfactory agreement for design and development of the common array project

The first quarter of 1999 promises to be an eventful period for the MMA project, a time for definition of the structure of the US—European partnership together with an opportunity to initiate the personal interactions between the MMA and LSA groups that will become the basis for success of the joint project.

*R L. Brown*

# VLBA/VLBI

## VLBI Network Call for Proposals

Proposals for VLBI Global Network observing are handled by the NRAO. There are usually four Global Network sessions per year, with up to three weeks allowed per session. The Global Network sessions currently planned are:

| Date | Bands | Proposals Due |
|---|---|---|
| 11 Feb to 04 Mar 1999 | 6 cm, 18 cm, 0.7 cm | 01 Oct 1998 |
| 27 May to 17 Jun 1999 | 6 cm, 18 cm, 3.6 cm? | 01 Oct 1998 |
| 09 Sep to 30 Sep 1999 | 6 cm, 18 cm, UHF? | 01 Feb 1999 |
| 12 Nov to 03 Dec 1999 | 6 cm, 18 cm, 5 cm? | 01 Jun 1999 |

Each session will probably comprise observations at three bands. First priority will be HALCA observations in the 6 cm and 18 cm bands. The third band for each session has not been finally chosen; the band above marked with a question mark has been suggested, but the final choice of bands for sessions in 1999 has not yet been made.

It is recommended that proposers use a standard cover sheet for their VLBI proposals. Fill-in-the-blanks TeX files are available by anonymous ftp from ftp.cv.nrao.edu, directory proposal or via the VLBA home page on the web. Printed forms, for filling in by typewriter, are available on request from Lori Appel, AOC, Socorro.

Any proposal requesting NRAO antennas and antennas from two or more institutions in the European VLBI network constitutes a Global proposal. Global proposals MUST reach BOTH Network's Schedulers on or before the proposal deadline date; allow sufficient time for mailing. In general, fax submissions of Global proposals will not be accepted. The Socorro correlator will be used for some EVN-only observations unsuitable for the Bonn correlator until such time that they can be processed with the JIVE correlator. Other proposals, not in EVN sessions, requesting use of the Socorro correlator must be sent to NRAO even if they do not request the use of NRAO antennas; proposals for the use of the Bonn correlator must be sent to the MPIfR if they do not request the use of any EVN antennas. For Global proposals, or those to the EVN alone, send proposals to:

R. Schwartz
Max Planck Institut fur Radioastronomie
Auf dem Hugel 69
D 53121 Bonn, Germany

For proposals to the VLBA, or Global network proposals, send proposals to:

Director, National Radio Astronomy Observatory
520 Edgemont Road
Charlottesville, VA 22903-2475
USA

Proposals may also be submitted electronically, in Adobe Postscript format, to proposevn@hp.mpifr-bonn.mpg.de or to propsoc@nrao.edu, respectively. Care should be taken to ensure that your Postscript files request the proper paper size.

*B G Clark*

## VLBA Dynamic Scheduling

The VLBA will shortly go to a dynamic scheduling model. Observers with proposals that require no non-VLBA resources will be asked to provide observe files without knowing the date that the observation will be scheduled. The proposals will be placed in a queue, and the most suitable proposal will be selected from the queue very shortly before the actual observation. Not all proposals in the queue will actually be observed, but those that are will be done at a time when all required VLBA antennas are functioning. This mode of observing is done to improve the quality of high priority observations, to improve utilization of the array when not all antennas are available by scheduling proposals which do not require all antennas, and to preserve flexibility for target of opportunity observations

Proposals which require outside resources will continue to be scheduled in fixed-date slots. The main needs for outside resources are for outside antennas, including VLA antennas, and for VLA observations to determine absolute E-vector position angles for 7 mm polarization. An additional impetus for dynamic scheduling in the spring term is the unstable state of the HALCA VLBI satellite. We want to be in a position to be able to take advantage of time freed by short notice cancellation of HALCA observations In the extreme case, if HALCA does not resume normal operation this term, more than half of the time will be scheduled dynamically.

*B G Clark*

## VLBA Improvements for Users

Summarized below are some major VLBA developments, during the second half of 1998, of potential interest to array and correlator users. These developments are aimed at making the VLBA more user-friendly, so that it is simpler and easier for non-experts to propose, schedule, and analyze VLBA observations. For further information, please contact the undersigned or those identified with specific topics. Other major VLBA developments are described in accompanying articles.

AUTOMATIC TAPE CONTROL: July saw the advent of automatic tape control at the VLBA and VLA for all observations to be correlated in Socorro. This frees the user from needing to worry about tape control. Tape changes are no longer synchronous across the VLBA, but occur during normal working hours, and thus at different times depending on time zones. Automatic tape control on the VLBA has led to an increase in the amount of time scheduled and was a prerequisite to dynamic scheduling (see previous article by B. Clark).

SOURCES AND STATIONS UPDATE: Major portions of the sources and stations catalogs used by the correlator and the NRAO program SCHED were supplied to us in 1995 by the U.S. Naval Observatory (USNO). The USNO is continually improving its catalogs, and their 1998-6 reference frame, including station velocities, was adopted by the correlator in August and by SCHED in December. [Contact - J. Benson]

TRACK STATISTICS: When tapes exhibit poor recording and/or playback quality, the correlator operators generate plots of track statistics. These plots can aid those diagnosing recording problems. Since November the VLBA home page has provided access to such plots for some EVN stations. An explanatory narrative accompanies the plots. [Contact - G. Peck]

SCHED RELEASE: In addition to the catalog updates mentioned above, the December SCHED release includes basic support for the VLA-PT link; improvements in plotting, B1950-J2000 conversions, and Doppler calculations; enhancements in writing VEX files for more complicated schedules; and the ability to set a correlation integration time on space baselines. [Contact - C. Walker]

VLBA FRINGE-FINDER SURVEY: VLBA Test Memorandum 60, issued in December, presents visibility plots for eight strong continuum sources observed with the VLBA at frequencies ranging from 1.7 to 43.2 GHz. These plots will be useful to VLBI observers seeking fringe finders and/or bandpass calibrators. Both the visibility plots and the images are posted on the VLBA home page. [Contact - J. Wurnig]

IN PROGRESS. Efforts continue on 3 mm, 512 Mbps, phase referencing improvements, and the rewrite of the operations software.

*J. M Wrobel and J S Ulvestad*

# VLA

## VLA Upgrade Project Status

The past month has seen considerable activity by NRAO scientific staff as we prepare for the upcoming decadal review process. A series of meetings focusing on the considerable new science that an upgraded VLA will enable were held at the AOC in November and December. Written summaries of these meetings can be found on the VLA Upgrade web page, which is accessed from the NRAO home page. Newsletter readers are encouraged to submit contributions on VLA Upgrade science to Michael Rupen (mrupen@nrao.edu), who is coordinating the Upgrade science case, and is managing the Upgrade web page.

An up-to-date ten-page document summarizing the design performance of the upgraded VLA is also available from the web page, and should be consulted by readers who want detailed information on planned observational characteristics.

*R A Perley*

## OBSERVE Bug

We have found a bug in OBSERVE 4.0.3, released on December 23, 1997. This bug only affects spectral line observers attempting to use the "no change" option to keep the LO settings the same as those in the immediately preceding scan. If you don't know what this means, you haven't done it! The bug was as follows Choosing the "no change" option on the Local Oscillator page should lead to a //FIN card in the resulting OBS. file; unfortunately, OBSERVE 4.0.3 instead produces no //FI card at all. We are in the process of checking the past year's OBSERVE files, and will contact those we think may have been affected. OBSERVE itself, is currently being fixed, the new version (4:0 4) will be available shortly, and will be announced both on the web page and via the VLA exploder. Please check with Michael Rupen (mrupen@nrao.edu) if you have any further questions.

*M P Rupen, G A van Moorsel, W K Young*

# VLA Configuration Schedule

| Configuration | Starting date | Ending date | Proposal Deadline |
|---|---|---|---|
| C | 20 Nov 1998 | 01 Feb 1999 | 1 Jun 1998 |
| DnC | 12 Feb 1999 | 01 Mar 1999 | 1 Oct 1998 |
| D | 05 Mar 1999 | 01 Jun 1999 | 1 Oct 1998 |
| A | 18 Jun 1999 | 27 Sep 1999 | 1 Feb 1999 |
| BnA | 08 Oct 1999 | 25 Oct 1999 | 1 Jun 1999 |
| B | 29 Oct 1999 | 14 Feb 2000 | 1 Jun 1999 |
| CnB | 25 Feb 2000 | 14 Mar 2000 | 1 Oct 1999 |

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) and extreme northern sources (north of about 80 degrees declination).

**Approximate Long-Term Schedule**

| | Q1 | Q2 | Q3 | Q4 |
|---|---|---|---|---|
| 1999 | C,D | D | A | B |
| 2000 | C | C,D | D | A |
| 2001 | B | B,C | C | D |
| 2002 | A | A,B | B | C |
| 2003 | D | D,A | A,B | B |

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). They should defer such observations for a configuration cycle to avoid such problems. In 1999, the A configuration daytime will be about $9^h$ RA and the B configuration daytime (late 1999, early 2000) will be about $18^h$ 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. The VLBA spends about half of available observing time in coordinated observations with other networks, with the scheduling dictated by those networks. In decreasing order of the time devoted to the observations, these are HALCA space VLBI, Combined Millimeter VLBI Array, Global astronomical VLBI with the EVN, and geodetic arrays coordinated by GSFC.

Any proposal requesting NRAO antennas and antennas from two or more institutions affiliated with the European VLBI network is a Global proposal, and must be sent to the EVN scheduler as well as to the NRAO. VLBA proposals requesting only one EVN antenna, or requesting unaffiliated antennas, are handled on a bilateral basis; the proposal should be sent both to NRAO and to the operating institution of the other antenna requested. Coordination of observations with non-NRAO antennas, other than members of the EVN and the DSN, is the responsibility of the proposer.

*B G Clark*

# AOC Tenth Anniversary Celebration

The tenth anniversary of the Array Operations Center in Socorro, New Mexico, was celebrated on December 15, 1998. The keynote speaker was U.S. Senator Pete Domenici, who was instrumental in obtaining funding for the building. Also on hand were state officials, New Mexico Tech officials, and representatives of the architectural firm that designed the AOC.

In addition to marking the anniversary, the event also saw the official announcement of first fringes between the VLA and the Pie Town VLBA antenna via a fiber optic link. This success had been obtained just a few days before the ceremony.

*D G Finley*

# First Fringes on VLA Pie Town Real-Time Link

The first real-time interference fringes between the Pie Town VLBA telescope and five antennas of the VLA were acquired on December 3, 1998. The antennas were observing the quasar 3C 345 at 6 cm wavelength (5 GHz frequency). The result marks a major milestone in this project, slightly more than one year after the project was begun under the National Science Foundation's Major Research Instrumentation program, with funding supplied by NSF and by Associated Universities, Inc. Congratulations are due to the many engineers and technicians who contributed to this achievement. Special recognition should go to the Project Engineer, Ron Beresford, responsible for much of the design and implementation of the fiber optic connection, to Ken Sowinski, for the required modifications to the VLA software, and to Chuck Broadwell, for leading the group responsible for the prototype boards that provide the required extra delay at the VLA correlator.

During November 1998, a series of tests was performed with the stand-alone VLA in which progressively more complex parts of the VLA Pie Town link equipment were tested out, with a VLA antenna playing the role of Pie Town. These tests included sending the signal from the "donor antenna" through a 105 km spool of fiber in the VLA electronics room, and the various frequency conversions necessary to make a VLBA intermediate-frequency signal look like the signal from a VLA antenna as it comes off the VLA waveguide transmission system.

Following the success of all the planned tests, the rack of signal-conversion equipment was moved out to Pie Town on December 1. The first fringe-finding observation was attempted on December 3, with the rack controlled over 105 km of commercial telephone company fiber installed by the Western New Mexico Telephone Company, and with the analog signal from the Pie Town antenna transmitted back to the VLA via the same fiber. First fringes were seen within a few minutes of the time when all antennas were pointing at the source, while fine-tuning of the delay took another 30 minutes. The actual delay over the fiber optic link was approximately 1.5 microseconds different from the predicted delay.

Since December 3, we have successfully demonstrated fringes at all wavebands in common between the VLA and the VLBA from 1.5 to 43 GHz. Most major bugs have been tracked down during a series of three test observations. Delay offsets of 10 to 30 nanoseconds have been measured as a function of observing band, due to the different signal paths at the VLBA antenna relative to the VLA antennas. A more detailed test report will be available on the VLA Pie Town Connection home page, at http://www.nrao.edu/~julvesta/vla_pt.html.

Over the next two years, we will concentrate on converting the current prototype into a real operational system that can be controlled routinely by observers. This process will include (1) production of operational software for scheduling and controlling all aspects of observations with the link; (2) construction and installation of more than 200 piggyback delay cards for the correlator; (3) production of operational hardware for the signal conversion system; (4) further testing of the link characteristics; (5) characterization of all aspects of a data calibration, including system temperature and delay measurements; and (6) development of an overall operational system to support the link. We anticipate a few limited scientific observations with fewer than 27 antennas in the next A configuration (June-October 1999), and full operation of the link in the succeeding A configuration, now scheduled to begin in September 2000.

*J S Ulvestad*

# New Mexico Computing Developments

OBSERVE, the software currently used for detailed scheduling of VLA observations, is built around a VT100 terminal interface. The archaic nature of this interface is causing a growing number of portability and maintenance problems. A replacement, JObserve, has been written by Bill Cotton (NRAO-CV), using the Java language for portability and a modern GUI interface. JObserve supports essentially all features of OBSERVE. JObserve Version 1.0 is now available in Socorro and Charlottesville, and release to the user community is expected in first quarter of 1999.

A major milestone in the VLA rearchiving project was reached on October 1. The last old data (from 1987) still residing on 9-track tape, were reformatted and transferred to Exabyte tape. This concludes a project which was started at the beginning of this decade. This also means that the catalog of VLA data, which is accessible from the NRAO home page, is finally complete. We are currently in the process of redoing a small fraction of the older spectral line data in which we discovered a problem for some correlator modes. We expect to finish this in the course of 1999.

After gaining experience with a small number of 400 MHz PCs running Linux, we have ordered and received 14 more systems. We expect to install these in the course of January 1999. Readers interested in issues concerning centralized administration of Linux PCs should contact James Robnett, jrobnett@nrao edu.

Those who are familiar with the AOC will find the computer floor greatly changed. A large portion has been vacated to create new office space. The various computing servers, which

formerly were spread out across the computer floor, have now been concentrated on several racks in the rear area adjacent to the VLBA correlator. Several old pieces of hardware, which were not on maintenance any more but still saw occasional use, had to be removed in the process. These include the line printer, the microvax, and the IBM RS6000 workstations. The laser printers are now located in the area where the line printer used to be located.

The AOC's new file server, a Network Appliance Filer720, has arrived and has been installed. This new server, *filehost*, will be taking over file service from both Arana and Zia. Arana will be retired later next year after its functions have been allocated to the new server. Filehost is currently serving a handful of accounts as well as binaries for the Linux systems.

The AOC is completing testing of the printing system. The new printing system is based on an older BSD style printing system instead of the newer Says-V printing system. Both systems were developed by Sun for Solaris. Sun decided to revert to the older system due to problems with the newer Says-V release. When completed, the new printing system should provide greater flexibility in file types sent to the printer as well as a wider range in printing options. Most importantly, the new system should prove more stable than the current one. Transfer to the new system should occur soon after the new year.

*G A van Moorsel*

# 12 METER

## 1 mm Array Receiver Status

The 8-beam 1 mm array receiver has been in routine use on the telescope since mid-November. The 4X2 beam cluster can map in both (RA,Dec) and (lII,bII) coordinates while tracking a parallactic angle with an arbitrary position angle offset. The current performance of the receiver represents a substantial gain over the existing dual-beam system for making maps of extended regions. During this past summer and fall, work on this receiver concentrated on solving problems with optical alignment of the eight beams and mixer system temperature uniformity. These efforts by the Tucson electronics group have resulted in vastly improved optical coupling to the telescope and better mixer system temperature uniformity across the eight receiver channels. We anticipate demand for this improved instrument to increase for the coming winter quarter.

*J G. Mangum for the Tucson Staff*

## Note to 12 Meter Observers

In order to make the best use of the telescope, prospective and scheduled observers are strongly encouraged to contact the Friend of the Telescope, Jeff Mangum, for advice regarding their proposed experiments. This is of particular importance for observers conducting 1 mm array and on-the-fly experiments given the complexity of these observing modes. Send any questions via e-mail to jmangum@nrao.edu or by voice to (520) 882-8250, x113.

*J G Mangum*

## Laser Local Oscillator Development in Tucson

Progress continues on the development of a photonic local oscillator for the MMA. The high speed photomixer contract with UCLA has five months remaining at which point a 100 GHz photomixer will be delivered to the NRAO. A critical parameter for the use of a photomixer in an SIS receiver is the amount of output power that the device will yield, so perhaps we'll have an answer to that in the next newsletter. Other aspects of the photonic LO are being addressed in Tucson. Initial tests of local oscillator phase noise and wideband noise indicate that the phase-locked lasers could provide a suitable phase reference for the MMA. Ongoing work is addressing the distribution of laser tones over long lengths of fiber without appreciable loss of phase coherence, the phase-locking of different frequencies in the millimeter-wave range, tests of cooled photomixers, and an all optical round trip phase correction scheme.

*W P Shillue*

# On-The-Fly Analysis at NRAO Tucson

In order for us to provide assistance with the analysis of OTF data, visiting observers can make arrangements to use the NRAO Tucson downtown computing services for their OTF analysis. Observers who might benefit particularly from the use of the NRAO-Tucson computing system are those with limited OTF analysis experience, or those whose home computing resources are strained in handling the quantity and processing needs of OTF data. In particular, on-site assistance from the Tucson 12 Meter scientific staff in the analysis of OTF data may prove helpful. If you are interested in visiting NRAO-Tucson to analyze 12 Meter OTF data, contact Jeff Mangum (jmangum@nrao.edu, 520-882-8250 x113).

*J G Mangum*

# 12mnews E-Mail List Server

In order to improve our ability to disseminate information regarding new features, changes, and other notes of interest to the 12 Meter Telescope user community, we have enabled an e-mail list server called "12mnews." Notes sent to 12mnews subscribers will contain short articles which will usually contain links to web page documents containing further information. We anticipate that 12mnews notices will be distributed approximately every couple of months.

We invite all 12 Meter Telescope users to subscribe to this list server. To subscribe to 12mnews, send the following in the body (not the subject line) of an e-mail message to "Majordomo@majordomo.cv.nrao.edu": subscribe 12mnews. This will subscribe the account from which you send the message to the 12mnews list.

If you wish to subscribe another address instead (such as a local redistribution list), you can use a command of the form: subscribe 12mnews other-address@your_site.your_net.

If you have questions or comments about 12mnews, please let me know.

*J G Mangum*

Newsletter No. 78
1 January 1999

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520 EDGEMONT ROAD
CHARLOTTESVILLE, VA 22903-2475

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