



# NRAO NEWSLETTER

1 July 1999

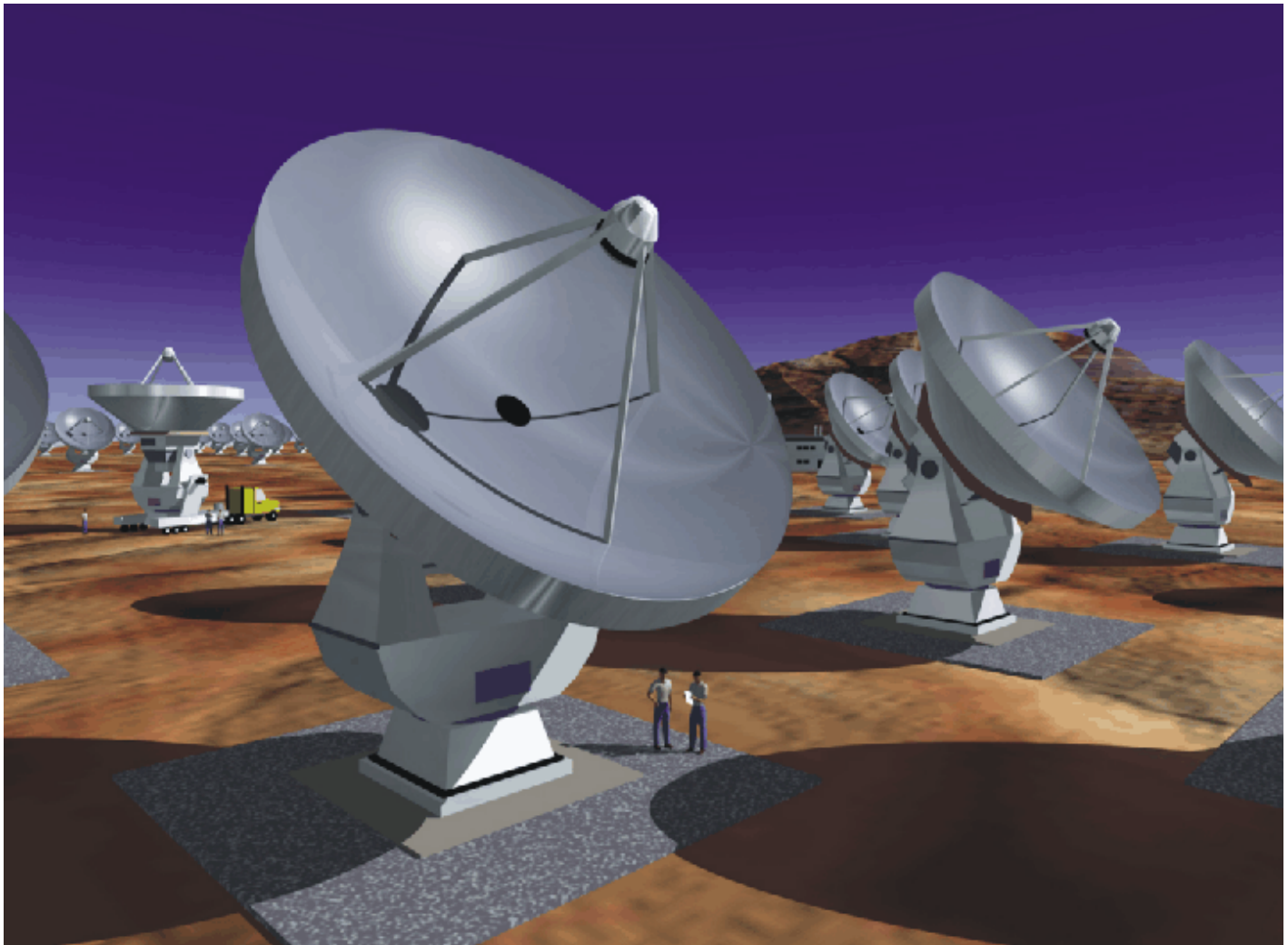
No. 80

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

## ALMA Evolution of the MMA to ALMA

The Millimeter Array (MMA) project passed a significant milestone on June 10, 1999, when representatives from the U.S. National Science Foundation (NSF) and from several European scientific agencies signed a Memorandum of Understanding (MOU) for cooperation on design and development of the Atacama Large Millimeter Array (ALMA). ALMA is to be an equal partnership between the NSF on one side and a collaboration of European institutions on the other; ALMA will subsume the MMA Project and the Large Southern Array (LSA)

Project in the U.S. and Europe respectively. The participating institutions on the European side are: The European Southern Observatory (ESO), the Centre National de la Recherche Scientifique (CNRS, France), the Max-Planck-Gesellschaft (MPG, Germany), the Netherlands Foundation for Research in Astronomy and Nederlandse Onderzoekschool Voor Astronomie, and the United Kingdom Particle Physics and Astronomy Research Council.



The goal of ALMA is an array of 64 antennas of 12 meters diameter. Recognizing the increased scientific opportunity that such an array presents over the existing MMA and LSA concepts, both the U.S. MMA scientific advisory committee (the MAC) and the European LSA scientific advisory committee (the SAC) have consistently endorsed the merger of the two projects. While each side will be entitled only to half the time on the ALMA, that half provides a net increase in capability. ALMA is an example of a partnership of augmented benefit to all participants.

The MOU signed June 10 commits both sides to a common design and development phase for ALMA. There is a stated intent of both sides to continue to the construction phase of ALMA, but no such commitment to do so—at least not yet.

The MOU sets up an organization and oversight structure for ALMA. The top level of that organization is the ALMA Coordination Committee (ACC), a board of twelve members half of whom are European appointees and half are appointed by the NSF. Under this Board is the ALMA Executive Committee (AEC)—two managers from the LSA and two from

the MMA—who are charged with defining and managing the ALMA Design and Development work program. The AEC has until October 10, 1999, to present that work plan to the ACC for approval; once approved, the AEC will implement the plan. On or before May 2000 the AEC is to submit to the ACC a draft of the construction and management plan for ALMA. In the succeeding six months the NSF and the European institutions will negotiate their commitments to that plan. If all goes well, construction will begin in 2001, just as has been planned for the MMA with no delay.

The U.S. side of ALMA will be the MMA Project renamed to ALMA/US but otherwise unchanged. In particular, ALMA/US will remain an integral facility of the NRAO identical in all institutional respects to the VLA, VLBA, and the GBT. The university-based Millimeter Array Development Consortium (MDC) will remain in the management structure of ALMA/US and will contribute, as previously planned, throughout the development, construction, and operational phase of ALMA.

*R. L. Brown*

## October Conference on “Science with The Atacama Large Millimeter Array”

Science with the Atacama Large Millimeter Array (ALMA) will be an international conference on the science which will be produced by ALMA, which might combine North and South American, European and Asian plans for construction of large arrays of millimeter telescopes into a single large project. Please see the accompanying article announcing the signing of the Memorandum of Understanding leading to the ALMA design and development stage.

The meeting will be held October 6-8 in Washington, D. C. The purpose of the conference will be to highlight the science that this powerful world array will accomplish, with particular focus on:

- Investigation of galaxies near the time of their formation,
- The formation of stars,
- Detection and study of planets and disks forming them around nearby stars,
- Study of the origin, distribution and evolution of the elements and their isotopes.

It will begin with a reception and demonstration for members of Congress in the House Science Committee Room of the Capitol at 5:30 p. m. Wednesday, October 6, 1999.

Lectures and posters will be presented at the Carnegie Institution of Washington, 1600 P St. NW on October 7 and 8.

Accommodations have been arranged at the nearby Omni Shoreham Hotel for the period including the nights of October 5 through October 9. Information on reserving a room at the special Associated Universities rate is at the web site. The room block will be closed on August 20, 1999.

A press conference will begin the proceedings, to explain the world collaboration to the media. This will be held in the Board Room of the Carnegie Institution of Washington at 8 a.m. on October 7.

The conference will be organized and hosted by Associated Universities, Incorporated and the National Radio Astronomy Observatory.

Invited speakers include; Sargent, Blain, Guilloteau, Scoville, Thornley, Genzel\*, Dutrey, Boss, Mundy, Jewitt, van Dishoeck, Menten, Evans, Fukui, Plambeck, Andre, Crutcher, Yamamoto, Olofsson, Tielens, Shu, and Millar. (\*= tentative).

Science with the Atacama Large Millimeter Array will be limited to 200 participants. Information on the conference will be posted on the Millimeter Array web site with the URL <http://www.mma.nrao.edu/science/science99.html>

*H. A. Wootten*

## **GREEN BANK**

### **Green Bank Telescope**

The rework of the permanent support for the backup structure was completed when the last weld was made in mid-May. The final welding inspection has been made and all welds passed.

The transferral of the load of the reflector backup structure (BUS) from the temporary supports to its permanent supports have been a long process. The contractor, unfortunately, prolonged the operation when, in an effort to save time, removed the temporary supports out of the prescribed sequence. This caused an unanticipated redistribution of loads, causing some back chord members to bend and causing one to buckle. The contractor has since restored the BUS to its original configuration, performed an engineering analysis to determine why the failures occurred, and developed a procedure/method for transferring the loads, which was then successfully accomplished.

The shape of the structure was checked after the temporary supports were removed, and the weight of the BUS was carried by the permanents. The position of the actuators was found to vary by only a small amount from the dimensions measured when supported by the temporaries.

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

The photograph in the previous Newsletter showed the Vertical Arm complete through modules H. Since then, the members of the VFA module M were bolted to the Upper Feed Arm, and the Upper Feed Arm was trail assembled to the structure made up of modules K and L, on the ground. This trial went well, and preparations for the lift of K and L were completed. Lifting of modules was delayed while their alignment was checked and confirmed, but on June 2 the modules were raised into place. Placement of the fill-in members which create the bridging module J is complete and their welding is in process. The telescope is shown in the figures (as of June 10). It is now

planned to raise the Feed/Receiver Room late in June. Beginning in mid-July, the Upper Feed Arm will be raised and connected into place.

#### **Servo**

The structure was rotated in elevation for the first time on May 19, 1999, when it was moved 12 degrees to position it for the installation of the middle portion of the Vertical Feed Arm. This important test was carried out using the portable maintenance unit (PMU) to control the elevation motion. Both motor current and voltage were monitored, and all movement of the structure was smooth, silent, and without vibration. All eight forty-horsepower elevation motors were used. Motor currents were predicted accurately by the analysis of counterweight out-of-balance and motion was readily controlled to 1/50 of an inch.

#### **Surface Panels**

Measurement of GBT panels is continuing at the RSI facility in Sterling, VA. NRAO inspections are of two types. In one, surface accuracy of the unpainted panels is analyzed on the basis of measurements provided by the manufacturer, and a number of panels selected by NRAO from the tier under review are measured again, with NRAO witnessing the measurements. If it is determined that the measurements agree with those provided by the manufacturer, and if the table of measurements for the tier shows that the entire tier is within the accuracy specified in the contract, then the panels of a tier are accepted. By May 25, 1188 panels (59 percent of the total of 2,004) from 22 tiers passed this requirement. The second type of inspection involves painted panels. As before, selected panels of a given tier are inspected, and all panels must pass scrutiny for the tier to be accepted. For the sample selected, the paint thickness is measured at many positions using a gauge provided by NRAO.

*R. D. Hall and D. E. Hogg*

### **First Field Tests of Rangefinder Metrology**

A milestone for the GBT laser rangefinder metrology program was met on Wednesday evening, June 23, 1999.

Nine of the twelve ground rangefinders were mutually scanning and ranging to one another. A pair of rangefinders also ranged to a fixed target retro-reflector 1.3 km distant from the GBT, while a second rangefinder pair ranged to the single ball retro-reflector mounted on the GBT feed arm. A complete set of range samples (AZ range pairs) was taken every two minutes, for a total observation time of four hours. Temperature, barometric pressure, and relative humidity data inputs from multiple stations were logged for each set of range scans.

A laser target acquisition control algorithm developed by Ramon Creager was operational, to electronically locate and lock the rangefinders onto their targets before the evening's

scans started. The range, data, and electronic rangefinder diagnostic's data, were logged and plotted during the measurement run. The diagnostic's data consist of received beam signal intensity and return signal phase, and atmospheric data. A large data set was obtained, which will be analyzed independently by Don Wells, and by the antenna metrology group, to obtain accurate measurements of rangefinder locations.

In the next two months, the last three rangefinders will become operational, pending running of cables through the recently installed conduits. Additional target retro-reflectors will be placed on the telescope. At that time a complete test of the ground rangefinder metrology system will be conducted.

*M. A. Goldman & R. H. Hall*



## 40th Anniversary of the Tatel Telescope and First Science at NRAO

The Howard E. Tatel Radio Telescope, built in 1958, was the first major radio telescope at NRAO. Known also as 85-1, it was the first of three 85 foot telescopes of similar design built at Green Bank by the Blaw-Knox Corp. of Pittsburgh, Pa. In 1964, when the NRAO decided to build an interferometer, the Tatel Telescope became the fixed element in the NRAO 3-element interferometer system.

Howard E. Tatel worked for the Carnegie Institute Department of Terrestrial Magnetism (DTM) in the 1950s and collaborated with the Blaw-Knox Company of Pittsburgh to design a telescope for DTM. Blaw-Knox had also received telescope orders from NRAO, the University of Michigan, and the Jet Propulsion Laboratory. Tatel's concept used large diameter gears for the two axes to provide high precision at relatively low cost. Bob Hall, who is now the GBT project manager, was then manager of the antenna division at Blaw-Knox. He expanded Tatel's concept, generated a practical working design, and supervised the construction of these telescopes. Tatel died on a field trip in 1957 and never saw the completion of his telescopes. 85-1 was dedicated in October of 1958, and named in his memory.

The telescope began continuous operation in April of 1959. Fred Crews recalls (in "The Observer," March 31, 1964) that the first observations were done on Friday, February 13, 1959. "Initially there were only two operators (Fred Crews and Bill Meredith), who worked 12 hour shifts, keeping the telescope going 24 hours a day except for weekends when the scientists did their own observing."

The year 1999 is a significant 40th anniversary not only because the Tatel Telescope began regular use, but also because the first scientific results were obtained in 1959, as a result of the completion of the Tatel. According to the first NRAO annual report (July 1959), the staff astronomers in 1959 were David Heesch and Frank Drake. (It is thus quite appropriate that Frank Drake was chosen as the Jansky Lecturer for this year.) Visiting astronomers in 1959 included George Field, Hein Hvatum, T. K. Menon, Donald Osterbrock, Grote Reber, Mort Roberts, and Gart Westerhout.

The first receivers were for bands at 440 MHz, 1.1-1.5 GHz, and 8 GHz. The first observing programs included studies of the planets Jupiter and Venus (Drake), the first detailed maps of the Galactic center (Drake), attempts to detect 21 cm line emission in globular clusters (Roberts), and multi-wavelength studies of supernova remnants (Heesch). Menon studied the Cygnus loop and the Orion nebula, Field observed Cygnus A, Heesch surveyed spiral and elliptical galaxies. Drake's famous project OZMA was started in 1959.

Today the Tatel Telescope is still in continuous use as part of the Green Bank Interferometer, now funded partly by NASA for studies of x-ray and gamma-ray binary stars.

Fred Crews concludes, in the 1964 Observer article, "The 85 Foot Tatel Telescope has now been in operation for five years. Its life expectancy is 20 years." But today, in 1999, the telescope has been productive for twice its expected lifetime, thanks to Howard Tatel's initiative and Bob Hall's rugged design. How many of us can say the same?

*F. D. Ghigo*

## Last VLBI Observations With 140 Foot

On June 17 at 7:00 UTC the final VLBI observations with NRAO's 140 Foot Telescope were completed. The 140 Foot played an integral role in the early development of VLBI. From its first fringes on a baseline of 650 meters to its last fringes on baselines up to 3 Earth radii, the 140 Foot has served the VLBI community well.

The first attempts to use the 140 Foot for VLBI observations were in January 1967. The first fringes found with the 140 Foot were detected on March 5/6, 1967 with a baseline of 650 meters between the 140 Foot and the Tatel Telescope (85-1). These observations used the Mark I recording system and 720 kbps recording onto 7-track tapes. In June 1967 the first fringes between the 140 Foot and an antenna at another observatory (Haystack) were obtained. The first transcendental fringes were found in July 1967 using the 140 Foot and the 26 meters at Hat Creek. The first intercontinental fringes were found using the 140 Foot, Haystack, Hat Creek and Onsala. The first fringes found with an antenna in Russia also used the 140 Foot.

The 140 Foot has made many notable VLBI observations. The first real time fringes in VLBI observations were found using satellite communications to relay the IF and LO signals between the 140 Foot and Algonquin Radio Observatory in the mid-1970s. The 140 Foot was one of five telescopes dedicated to the first VLBI network organized in 1976. The 140 Foot, Haystack, and Hat Creek were used to make the first VLBI images of an OH maser. The first measurements of pulsar parallaxes were made using the 140 Foot, Arecibo, and Owens Valley. The 140 Foot has recorded with nearly all types of recording systems - Mark I, Mark II, Mark III, VLBA, and S2 systems.

The last VLBI observations with the 140 Foot were a part of a monitoring program for source 1928+738 as a part of a network including HALCA, the Japanese Space VLBI satellite. The investigators were D. W. Murphy (JPL), J. E. Conway (Onsala), A. Polatidis (Onsala), R. A. Preston (JPL), S. J. Tingay (JPL), D. L. Jones (JPL), D. L. Meier (JPL), H. Hirabayashi (ISAS), H. Kobayashi (ISAS), and Y. Murata (ISAS).

*A. H. Minter*

## The Galactic Plane Survey

The images and source list from the first Galactic Plane (GPA) survey at 8.35 and 14.35 GHz are now publicly available on line. The GPA survey is part of a program to monitor the galactic plane at 8.35 and 14.35 GHz for transient and variable sources. The first images of the galactic plane cover the region  $|b| < 5^\circ$ ,  $l = -15$  to  $255^\circ$ . These images have  $11.17 \times$  arcmin and  $7.25 \times$  arcmin FWHM resolution at 8.35 and 14.35 GHz respectively. These observations used the NRAO/NASA Green Bank Earth Station to survey the sky simultaneously at these frequencies.

The first survey, GPA, covers 0.82 sr (6.5 %) of the sky. The survey is sensitive to discrete galactic and extragalactic sources. A source list is presented for all 599 sources brighter than  $0.9 \sim \text{Jy}$  at 8.35 GHz or brighter than  $\sim 2.5 \text{ Jy}$  at 14.35 GHz. The FITS format images, residual images, source lists, and archive data are all available at <http://www.gb.nrao.edu/~glangsto/GPA/>.

*G. I. Langston & A. T. Minter*

## Green Bank Computing Developments

We have decided to remove all Unix login accounts in Green Bank that have not been used recently. There are two principal reasons for this. First, unused but active accounts are a security risk. There can be unwanted intrusion into the computer systems without the account owner being aware of anything amiss. Second, most of the dormant accounts belong to visiting observers. Many of these visitors' accounts have home directories on an old Sun at the 140 Foot Telescope. The home directories will have to be moved and the Unix environments will also need to be completely reconfigured for eventual use with the GBT. The accounts will be purged in such a way as to be simply restorable. If anyone, whose account has been removed, would like to retain it as it was, we will be happy to restore it to its original state - please send a message to Chuck Van Tilburg or Gareth Hunt. However, we expect that most observers will find

it convenient to have a new account with a completely fresh environment when they observe with the GBT.

Observatory-wide, funds in the computer budgets are tight this year. However, we have sufficient resources to upgrade the main Unix server (Arcturus). In addition, we will be able to replace five of the older public Suns with PCs running Linux.

The projection system in the new Green Bank auditorium is a very flexible one based on NTSC. For use with today's computer graphics, however, it does not have sufficient resolution, as was clear during two GBT meetings last year. We have purchased a dedicated projector with improved resolution and brightness to use for computer-based presentations.

*G. C. Hunt*

## Busy Season for Education

The NRAO staff at Green Bank have literally been running from one educational project to the next this spring and summer!

Once again, we worked with local seventh grade students on a six-week astronomy project entitled "Our Place in the Universe." This year, all Green Bank seventh graders spent the night at the Observatory conducting research projects on The 40 Foot Telescope, using our library and interacting with staff astronomers. At the conclusion of their project, they presented their findings during a colloquium held at the NRAO. This kind of "extended visit" by students was much more popular this year. Since January 1999, nearly 700 students (from grade 5 through undergraduate astronomy students) have participated in research activities at the Observatory.

In May, we began our workshop series starting with Glenville State College students. Preservice teachers enrolled in the methods course at GSC spent the first week of their semester at the NRAO. This field experience was essentially a compressed version of our summer research institutes. Teams of students conducted research using The 40 Foot Telescope and interacted with scientist "mentors" who assisted them with their projects.

As the course continued back at the college, students designed a classroom research project, and field-tested it in a K-12 classroom.

Also in May, NRAO-Green Bank hosted a three-day Chautauqua Short Course entitled "A Radio View of the Universe." The Chautauqua Short Course Series is an NSF sponsored program designed to update undergraduate college faculty members' knowledge in forefront science research and teaching. A record 35 professors attended the course this year. In addition, University of Hawaii astronomer, Gareth Wynn-Williams, led a short course at the Observatory entitled "Teaching Introductory Astronomy." The two NRAO workshops are held back-to-back so that participants can attend both, if desired.

The last two weeks of June brought 16 in service teachers to the Observatory for the "RARE CATS" Research Institute. RARE CATS (a rather tortured acronym) stands for Radio Astronomy Research Enhancing Coordinated and Thematic Science, where CATS is the acronym given to the new West Virginia Science Curriculum. For two weeks participants gain first hand

experience in conducting science research and improve their content knowledge in astronomy. Project RARE CATS is a two-year summer/academic year program for participants. During a second summer, participants return to Green Bank for the "Hands-On Universe" Technology Institute.

Hands-On Universe (HOU) is an image processing software package that allows teachers and students to analyze FITS format astronomy images. The software and curriculum were developed at the Lawrence Berkeley National Laboratory, and the University of California at Berkeley. Two HOU institutes are scheduled for this summer. The first of these took place immediately following the June RARE CATS program.

Participants in the HOU institute obtain a site license for the software as well as a set of curriculum materials.

And finally, to bring you up to the present, the National Youth Science Camp will visit the Observatory during the second week of July. First, a small group of students will camp overnight at The 40 Foot Telescope and make observations all night long. The entire NYSC delegation will visit for a tour of the GBT on July 8. This event coincides with a visit to the site from Senator Robert C. Byrd (D-WV). Senator Byrd will address NRAO staff and the Science Camp delegation, and then join them for a tour of the GBT.

*S. A. Heatherly*

## VLA VLA-Pie Town Link

Work on the VLA-Pie Town link over the past few months has concentrated on the hardware necessary to upgrade the system, from one with a few antennas operating with one intermediate frequency (IF) channel, to a capability for using all 27 antennas and all four IFs. In addition, new optical isolators have been inserted to prevent command dropouts. Measurements also have been made of the rate of change of the length of the 103 km fiber link (length increase of approximately one micron per second as the ground temperature increased in the summer months). This measurement helps characterize the relative contributions of link variation and maser differences to frequency offsets between Pie Town and the VLA, needed to assess the requirements for correction of these offsets.

In June, new piggyback boards were installed on all VLA correlator cards in order to achieve an expanded delay range of more than 800 microseconds for all antennas. These boards will enable observing anywhere in the sky, allowing compensation for the sum of the link delay and the geometric delay, which has a maximum value of approximately 670 microseconds. The VLA correlator has been operating with this new hardware since June 2; the change is completely transparent to observers. Test observations on the VLA-Pie Town link using all four IFs are planned for late July and throughout August, with a goal of obtaining some preliminary scientific observations before the end of A configuration in late September.

*J. S. Ulvestad*

## New Mexico Computing Developments

The transition from our old Auspex file server to the Network Appliance Filer 720 is progressing well. Another milestone was reached when e-mail was moved from Arana (the Auspex) to zia. Zia, a SPARC 20, is taking over Arana's mail hub and administrative duties. We expect to be able to decommission Arana completely in the second half of 1999. This is important since our current Auspex operating system is not Y2K compliant.

We have concluded the installation of the Pentium II 400 PCs running the Linux operating system. It appears that in the current year we will not be able to add more than one or two of these systems. After almost one year of supporting this class of machines we conclude that Pentium based PCs running Linux are a good and fast alternative to classic workstations.

Over the next three months we intend to start upgrading our Solaris and Linux operating systems. Late this summer the AOC should begin upgrading all Linux systems to RedHat 6.1

and all Sparc systems to Solaris 2.6 or 2.7. The upgrades are necessary for Y2K compliance as well as third party software compatibility.

We are currently testing JOBSERVE internally at NRAO. JOBSERVE is a utility written in Java by Bill Cotton. It allows preparation of VLA OBSERVE files and will eventually replace OBSERVE. Advantages of JOBSERVE over old OBSERVE include its operating system and keyboard independence and its graphical user interface. We also intend to add the possibility to create OBSERVE files for VLA observations which include the antenna at Pie Town. We hope to announce the first public release of JOBSERVE later in 1999.

As part of the VLA online system upgrade and rewrite we have begun to connect the VLA monitor and control system to a VME/VxWorks computer system. Requirements documents for the VLA Expansion have been started, and a first draft of the computing plan for the VLA Expansion has been written.

*G. A. van Moorsel*

## VLA Configuration Schedule

Configuration	Starting date	Ending date	Proposal Deadline
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
C	18 Mar 2000	30 May 2000	1 Oct 1999
DnC	09 Jun 2000	26 Jun 2000	1 Feb 2000
D	30 Jun 2000	18 Sep 2000	1 Feb 2000

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 nighttime. 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 2000, the C configuration daytime will be about 02<sup>h</sup> RA and the D configuration daytime will be about 10<sup>h</sup> 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*

## A Celebration of 20 Years of Observations with the VLA

The NRAO and New Mexico Tech will jointly host a conference in Socorro, NM, entitled "The Role of Gas in the Evolution of Galaxies." The conference will run from May 20-24, 2000, and is projected to involve some 100-150 scientists. Please check out the conference web site at:

<http://www.aoc.nrao.edu/doc/vla/html/Y2K/hiconf.shtml>. For further details contact Michael Rupen, Jacqueline van Gorkom, or John Hibbard.

*J. E. Hibbard*



## Graduate Student Visits for 1-5 Months at the AOC

Graduate students affiliated with U.S. universities are welcome to visit the AOC for periods of 1-5 months. Visiting students will work on their VLBA or VLA data under the guidance of members of the NRAO scientific staff and then return to their home institutions to complete the scientific work. This is an excellent opportunity for students to work one-on-one with NRAO staff to learn how to use the VLBA or VLA as part of their scientific repertoire. Students may bring funding from their home institutions or may be awarded stipends from

NRAO. Awards will be decided on a case-by-case basis. This visiting program will initially emphasize students with VLBA data.

Students or their faculty advisors interested in taking advantage of this visiting program should contact [julvesta@nrao.edu](mailto:julvesta@nrao.edu), [jwrobel@nrao.edu](mailto:jwrobel@nrao.edu), or [mgoss@nrao.edu](mailto:mgoss@nrao.edu).

*J. M. Wrobel, J. S. Ulvestad*

## VLBA/VLBI Space VLBI

VLBA participation in the Japanese-led international Space VLBI mission, VSOP, has continued since about the beginning of 1998 at a rate very close to NRAO's commitment of 30 percent of scheduled observing time. Two recent outages caused by a failure in on-board electronics of four months at the end of 1998, and three weeks in February-March 1999, have been excluded in computing this statistic.

Beginning early in 2000, the pool of proposed observations recommended by the VSOP Science Review Committee will be exhausted, although some could not be observed until as late as mid-2000 due to orbit evolution. New proposals for VSOP observations will thus be required in the next few months. NRAO has requested that these proposals be submitted and reviewed through the same mechanism used for VLBA and global ground-based VLBI observations, with all proposals requesting VLBA resources thus being reviewed jointly. This new procedure and details for implementing it, are under

consideration by the VSOP mission and the VSOP International Steering Committee (VISC). It is hoped that a decision can be reached in time for new proposals to be submitted by 1999 October 1, so that some of these can start being observed by 2000 January 1. Further information will be available as soon as possible through the VSOP Newsletter, the "vlbi" e-mail list, or from the undersigned.

The VSOP mission has announced a symposium on "High Energy Astrophysical Phenomena Revealed by Space-VLBI," to be held at ISAS January 19-21, 2000. The program is expected to include the following topics: high brightness temperature sources; intra-day variables; GeV and TeV gamma-ray sources; GHz-peaked-spectrum sources; structural changes revealed by monitoring; survey programs; and future prospects for Space VLBI. The announcement, which includes an Expression of Interest form due by July 30, 1999 may be accessed at URL <http://www.vtop.isas.ac.jp/Symposium.html>.

*J. D. Romney*

## New VLBA Services for Novice U.S. Users

The VLBA is instituting a series of new services for novice users of the instrument who are affiliated with U.S. institutions. "Novice" users are defined as those who have used the VLBA no more than once, and are not very familiar with the general techniques of VLBI. They may be students, postdocs, faculty members, or affiliates of non-degree-granting institutions. The new services will be available for proposals submitted in advance of the October 1, 1999, proposal deadline.

The primary new service that is being offered is a complete scheduling and data-calibration service, where the calibration includes all aspects of amplitude and fringe (delay, delay-rate, and phase) calibration. The user would receive a complete, calibrated data set suitable for imaging and self-calibration. An additional service providing the actual imaging is also available on request; since the method of imaging may depend quite strongly on the scientific goals of a particular project, this service will be negotiated on a case-by-case basis.

Initially, these new services are being offered on a trial basis for one year, and are restricted to relatively straightforward projects until more experience is gained in balancing the needs of the users with the load on NRAO staff. The eligible projects will be continuum observations including no more than ten source-frequency combinations in the frequency range between 1.4 and 15 GHz. The services may also be requested for observations at 22 GHz; these requests will be filled if the demand and the staff load permit.

Calibration and/or imaging services can be requested at the time of proposal submission, preferably by checking the appropriate box on the new proposal cover sheet (available at <http://info.cv.nrao.edu/html/headquarters/vlba-gvlbi.html>), by making a request directly in the body of the proposal, or by direct request to Jim Ulvestad at [julvesta@nrao.edu](mailto:julvesta@nrao.edu).

*J. S. Ulvestad*

## VLBI Network Call For Proposals

Proposals for VLBI Global Network observing are handled by the NRAO. There usually are 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
09 Sep to 30 Sep 1999	6 cm, 5 cm?, 18 cm, UHF	01 Feb 1999
12 Nov to 03 Dec 1999	6 cm?, 5 cm?, 18 cm, 1.3 cm	01 Jun 1999
10 Feb to 02 Mar 2000	6 cm, 18 cm, other?	01 Oct 1999
25 May to 15 Jun 2000	6 cm, 18 cm, other?	01 Feb 1999

The bands above marked with a question mark have been suggested, but the final choice 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 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 für 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](mailto:proposevn@hp.mpifr-bonn.mpg.de) or [propoc@nrao.edu](mailto:propoc@nrao.edu), respectively. Care should be taken to ensure that the Postscript files request the proper paper size.

*B. G. Clark*

## Dynamic Scheduling

If you have looked at VLBA schedules recently, and wonder why they contain so much white space, without scheduled projects, it is because these spaces are being filled shortly beforehand from a list of projects approved for dynamic scheduling. This queue was filled with 46 proposals submitted for the 1 October 1998 proposal deadline and an additional 17 were submitted for the 1 February 1999 proposal deadline. The queue was first used in late February to fill in time originally scheduled for HALCA observations canceled due to problems with the spacecraft. Through the end of May, 45 segments of 28 proposals were scheduled dynamically.

Currently, it takes too much time to prepare a dynamically scheduled program for observing to take account of the weather. However, it has been used successfully to avoid observing when

a required receiver is inoperative. Streamlining the system to permit choosing the project to be run immediately before the observation starts is currently underway.

Observe files for dynamically scheduled projects are written in LST for the Pie Town antenna (chosen as approximately the center of the array), so they can be easily relocated in UT. The dynamic schedule process starts when observers send their observe files to "vlbiobs." These are then checked by the technical contact for the project, and then entered into the queue. The current contents of the queue may be found through the VLBA schedule web pages, at <http://www.nrao.edu/vlba/schedules/dynqueue.html>. Since a dynamically scheduled observe file must make its way through several hands, it is a good idea for observers to check to ensure

that their project has indeed made it into the queue. Since it sometimes takes more than a week for an observe file to get through this process, observers should prepare their observe files as soon as possible, and not expect files to be observed as soon as received.

Once in the queue, proposals remain there until they are observed (see [dyndone.html](#)) or until they have been there about a year (we shall notify the contact person of any superannuated

proposal removed from the queue). In order to increase the likelihood of being scheduled, proposers may specify that the observation could be made with one or more missing antennas, or that time could be trimmed from the ends of allocated slots. This may be done at any time, before or after the proposal is inserted into the queue, by email to [bclark@aoe.nrao.edu](mailto:bclark@aoe.nrao.edu).

*B. G. Clark*

## The VLBA at the AAS

The NRAO hosted a topical session entitled "High Angular Resolution Science with the NRAO Very Long Baseline Array" at the Centennial Meeting (30 May - 3 June 1999) of the American Astronomical Society in Chicago. This event included an all-day series of oral papers, a poster session, a press reception, press conference, and a VLBA-specific promotional display.

Throughout the AAS meeting, a specially-prepared NRAO display on the exhibit floor showcased some highlights of research done with the VLBA in its first five years of full operation. The display also emphasized the capabilities of the VLBA, as a reminder to users and hopefully as an enticement to astronomers who have not yet used the VLBA. NRAO announced new services for novice U.S. users at this meeting, and a handout provided at the display outlined those services. (See article by J. Ulvestad).

On Monday evening (May 31), AUI hosted a very successful reception for the press, in which NRAO scientists and our invited speakers for the topical session met with science journalists covering the meeting. Tuesday, June 1, saw a poster session that presented many exciting research results from the VLBA. The discussions around the posters were animated and drew many visitors and interested, non-expert VLBI users.

With so many excellent research results presented at the two VLBA sessions, NRAO hosted a press conference to highlight some of those results as well as to review the VLBA's major research accomplishments over the past several years. The geometric measurement of the distance to NGC 4258 by J. Herrnstein et al., received the most press coverage, with

stories appearing in the New York Times and numerous other newspapers through wire reports by the Associated Press and Reuters. The story also appeared on numerous web news sites, including CNN and ABC.

Nearly 100 science journalists from around the world attended the AAS meeting. The press conference, and the press releases about radio astronomy research distributed by NRAO and other institutions, showed these reporters the wide range of contributions made by the VLBA and other radio telescopes to the progress of astrophysics.

On Wednesday, June 2, the oral presentations highlighted the work of eight VLBA users, including that of two graduate students and two postdoctoral fellows. The presenters were J. R. Herrnstein (NRAO), A. P. Marscher (BU), K. Blundell (Oxford), C. G. Mundell (UMd), N. Bartel (York U.), M. D. Faison (U. Wisconsin), W. F. Brisken (Princeton), and P. J. Diamond (Univ. Manchester). The presentations covered a wide range of topics, from pulsar distances to radio-quiet quasars. Two additional presentations were made by J. Ulvestad and J. Wrobel on the capabilities and the use of the VLBA. During the day, more than 100 people were in attendance at the presentations.

In all, we felt the effort to showcase the science of the VLBA and present its capabilities and usage to our AAS colleagues was quite successful; ongoing activities of this kind for the VLBA and all instruments of the NRAO will continue this effort.

*M. J. Claussen and D. G. Finley*

## 12 METER

### Major Summer Shutdown Projects at the 12 Meter

The 12 Meter Telescope will be shutdown for approximately six weeks starting on June 28th. We will follow this with an approximately three-week period of system tests before resuming regular observing. During these periods we will do a number of repair, maintenance, and upgrade tasks, which include:

1. Replace the dome cover,
2. Install a new prime focus control system,

3. Improve diagnostic routines and reliability of the MAC,
4. Do maintenance on the central cold load calibration system,
5. Improve the receiver and IF system to increase continuum sensitivity.

Note that we are shutting the telescope down one week earlier than usual this year to accommodate the dome cover replacement project.

*J. G. Mangum & T. W. Folkers*

## Symposium on Imaging at Radio through Submillimeter Wavelengths

A symposium on "Imaging at Radio through Submillimeter Wavelengths" was held at the Ventana Canyon Resort in Tucson on June 6-9, 1999. This symposium brought together scientists and engineers working in the rapidly developing field of astronomical imaging at radio through submillimeter wavelengths.

Topics included:

- Single dish heterodyne imaging,
- Bolometric imaging,
- Techniques for acquiring and processing single dish images,
- Interferometric multi-field imaging,

- Phase and amplitude calibration techniques for interferometric imaging,
- Algorithms for processing interferometric multi-field images.

Approximately 125 scientists representing research institutes from at least 14 different countries attended "Imaging99". A total of 49 invited and contributed oral presentations combined with 41 poster contributions offered a plethora of scientific and technological developments. The proceedings from this conference will be published in the Astronomical Society of the Pacific (ASP) Conference Series.

*J. G. Mangum*

## IN GENERAL AIPS++ Release

We expect to release version 1.0 of AIPS++ on CDROM in September following a final round of in-house and beta testing. The CDROM will contain installations for Linux (Red Hat 5.1, 5.2 and 6.0, SuSE 6.0), and Solaris (2.5.2 and 2.6). AIPS++ can be run from the CD, but for better performance an installation to disk is recommended. Installation is very easy and requires no special system privileges.

If you would like to receive a copy of the CDROM, please email [aips2-request@nrao.edu](mailto:aips2-request@nrao.edu) with your name, email, and shipping address. There is no charge.

The capabilities of the package as released can be toured from the AIPS++ home page at <http://aips2.nrao.edu>. In brief, the package contains tools for:

- interactive single dish processing,
- synthesis imaging, including nearly all standard and many non-standard approaches,

- connected element synthesis array calibration,
- image manipulation and display,
- data table access, browsing, and editing,
- astronomical coordinate calculations and conversions,
- general mathematical processing such as Fast Fourier Transforms,

Extensive and powerful scripting capabilities are available via the Glish command language. Commands may be entered both from the command line and from graphical user interfaces. Documentation and support are both available on-line.

A second release is planned for early 2000. This next version is expected to include support for VLBI processing, single dish On-The-Fly processing, more advanced interactive data editing and visualization.

*T. J. Cornwell*

## Observatory-Wide Computing Developments

**Security** - Computer and network security continues to be a major concern at the Observatory. The NRAO's computer security practices must balance the need for reasonable access by users to our computing services from outside the Observatory with the need to protect those services from willful damage by unauthorized users. In recent months, we have seen a considerable increase in the "probing" of computers and networks from outside the NRAO. These probes are often used to detect vulnerabilities in our systems' configuration. There have also been a few break-ins which briefly disrupted some of the services we provide to non-NRAO sites and had the potential for greater damage.

The Computing Council and a group of NRAO technical staff are studying ways to improve the security of the computers and networking without compromising any services that are fundamental to our role as a user facility. It is likely that some changes may be required in the ways that users at other locations connect to NRAO systems. Because many network services contain security holes which cannot always be easily fixed, any to which access from outside of the NRAO is not essential may in future be blocked, to reduce our vulnerability.

Every effort will be made to identify the impact of new security measures, and to notify users they may affect, before changes are implemented.

To reduce the risks associated with remote access, we strongly recommend, and may eventually require, the use of the secure shell ("ssh") package to replace the more common "telnet", "rlogin", and "rsh" connections between the NRAO and your home system. ssh encrypts the transmitted data, including your password, and thus hides account information from "sniffer" programs. ssh is supported at all NRAO sites. Software to make ssh connections is available for UNIX and Windows, in both free and commercial versions. We urge all NRAO users to install ssh on the computers that they will use to connect to our systems.

**Computing Facilities** - Budget limitations have reduced the number of workstation upgrades that we can do this year. This also applies to facilities for visiting observers. We expect to upgrade one high-end visitor workstation in Charlottesville and five older systems in the visitors' areas at Green Bank, but upgrades of the online system at the VLA and of data storage capabilities at the 12 Meter were given higher priority at the AOC and Tucson. Since most of our existing public workstations will be three years old at the end of 1999, we plan to do additional upgrades at all sites next year.

**Networking** - As described in the previous NRAO Newsletter, the NRAO recently received an NSF grant to upgrade our internal network. This grant will allow us to improve inter-site data exchange capabilities, and to support video- and data-conferencing connections within the NRAO and to external sites which have such equipment. It will also improve Green Bank's link to the Internet in anticipation of the increase in traffic associated with bringing the GBT on-line. Significant

increases in bandwidth will be required. These enhancements are now being specified, and are expected to be in place by the Fall.

**Y2K** - NRAO's Year 2000 (Y2K) readiness in mission-critical areas, such as fiscal and telescope operations, and NRAO-written software such as AIPS, AIPS++, and UNIPOPS, was addressed earlier this year. The Y2K readiness of the VLA, VLBA and 12 Meter Telescopes has been verified by direct testing. We are continuing to examine potential Y2K-related problems in less critical areas, such as third-party software used regularly by NRAO employees but which would not seriously affect fundamental Observatory operations should it malfunction. A full inventory of all third-party software installed and supported by computer division staff, under both UNIX and Windows, has been carried out. A web-based search utility, including Y2K compliance information where available, has been made accessible to all NRAO sites, to allow NRAO staff to make sure that any software they depend on is included. "Time machines" whose system dates have been advanced beyond the century rollover are being used for stand-alone tests of any software packages for which significant concerns remain.

Like many organizations, the NRAO's Y2K readiness also depends on that of outside providers of supplies and services. Again like many organizations, we are finding that firm assurances from third parties about Y2K readiness are hard to come by, so some Y2K contingency plans are being made.

*M. R. Milner*

## Charlottesville Computing Development

**Linux News** - One of the two remaining IBM RS/6000 AIX systems at NRAO has been recently decommissioned; it was replaced by a public Linux Intel system with dual processors, twice the memory, and more disk space (for a very small fraction of the cost of the RS/6000!). Judging by the popularity of the machine with local staff and visitors, the improvement has been much appreciated.

As the deployment of Linux/Intel systems throughout the observatory becomes more commonplace, it is important for NRAO to keep sensibly up to date with releases of the kernel and the operating system. To that end, staff in Charlottesville have tested the new 2.2 kernel, which allowed us to make early use of symmetric multi-processing and also the much desired NFS file locking. Initial results with this new kernel are very encouraging, and a standard NRAO Linux distribution based on it is currently being tested and deployed.

A new record AIPSMark was set for Intel systems with this distribution. A Pentium III 500 MHz system with 256 Megabytes of memory and a 7200 RPM EIDE disk (tuned) was

used with the 15APR99 version of AIPS; the result was an impressive 17.9 AIPSMarks. This is still short of the absolute record (24.6, for a HP system); details as usual are in the benchmarking section of the AIPS web page at <http://www.cv.nrao.edu/aips/>.

**The Year 2000 (Y2K)** - In addition to the Y2K issues mentioned in the section on Observatory-wide Computing, progress has been made in Charlottesville on several fronts. At the time of writing, we have almost completed upgrading our Suns to a Y2K compliant operating system version. In addition, we have established a Y2K "war room" with several machines whose date has been advanced to beyond January 1, 2000. One of these machines (Linux) has been operating for several months already without a hitch (and has successfully run AIPS, including data transfer via FITS files to systems operating in "normal" time). A Sparcstation and a Wintel PC are to be added to this list. These machines are intended for local staff to test out programs or packages of concern to them.

*P. P. Murphy*

## Frank Drake to Give Jansky Lecture

The 1999 Jansky Lecture, "Progress in the Search for Extraterrestrial Intelligence," will be given by Dr. Frank Drake, currently a Research Professor at the University of California, Santa Cruz and President of the SETI Institute in Mountain View, California.

Frank Drake was one of the earliest U.S. trained radio astronomers and one of the first members of the NRAO scientific staff. While living in Green Bank 40 years ago, Drake used the 85 Foot Tatel Telescope and the 300 Foot Telescope to study the nature of planetary surfaces and atmospheres. Together with Hein Hvatum, he discovered the non thermal radiation from Jupiter's Van Allen Belts. Following a brief period at JPL, he became Director of the Arecibo Observatory where he initiated the early pulsar observations there. Before leaving Arecibo to become Dean of Science at the University of California in Santa Cruz, he was a strong proponent for the construction of a Gregorian subreflector to correct for the

spherical aberration which ultimately led to the recent major upgrade of that telescope.

Dr. Drake is well known for his work on the search for intelligent life in the universe. His Green Bank Project Ozma was the first serious attempt to detect extra terrestrial intelligence. His formulation of the number of intelligent civilizations in the galaxy, which has become known as the "Drake Equation," has been the guiding principle behind all searches for radio signals from extra terrestrial civilizations.

Dr. Drake will present the Jansky Lecture in Charlottesville on October 26, in Green Bank on October 27, in Tucson on October 29, and in Socorro on October 30. The Annual NRAO-UVA Internal Symposium will be held in Charlottesville on October 26, while the annual New Mexico Symposium will be held in Socorro on October 30.

*K. I. Kellermann*

## NRAO Real-Time Computing Meeting

A meeting on real-time computing systems at the NRAO was held at the AOC in Socorro and at the VLA Site from April 12-14, 1999. The meeting principally consisted of reports from NRAO software developers and hardware engineers, with additional contributions from non-NRAO scientists and engineers. This meeting, the first of its kind in more than ten years, was particularly timely as the observatory plans for its

software contribution to the ALMA project, and prepares itself for the VLA expansion. The meeting was a success, and it is hoped that similar meetings can be held in the future. The agenda and some of the papers presented at the meeting are available at [http://www.nrao.edu/Real\\_Time/](http://www.nrao.edu/Real_Time/)

*B.E. Glendenning*