NRAO NEWSLETTER

1 July 1993 No. 56

GREEN BANK

GREEN BANK TELESCOPE

SITE. There is continual activity on the site in the erection and welding of the alidade. All sixteen wheels are now in place on the azimuth track. The servo room, walkways, cryogenics room, and other equipment that will occupy the first level of the structure are being installed. The gear reducer boxes for both azimuth and elevation drives are on site. In the next two months the azimuth drive package will be installed on several wheels, allowing the structure to be rotated under its own power to facilitate further erection. The two emergency power generators that will be located on the alidade are now on site.

ELECTRONICS. Assembly of the first prime focus receiver continues, and assembly of the 12-15.4 GHz and 8-10 GHz receivers has begun. Feeds for the 12-15.4 and the 8-10 GHz receivers are fabricated and being tested. A prototype optical fiber microwave link passed extensive testing. Optical fibers will be used for carrying both the LO and IF.

MONITOR AND CONTROL. There will be an installation of the GBT Monitor and Control system on the 140 Foot Telescope this October. The 140 Foot will simulate the GBT, allowing a test of the interface software to the telescope control system and the low level antenna modules. The software will also be used to control the Spectral Processor (a device that will be moved to the GBT) in a realistic environment that includes taking data on a pulsar. The initial development of the interfaces to the 140 Foot control computers is now occurring, and the full test is scheduled for October.

ACTIVE SURFACE AND POINTING. Development of the laser rangefinders is complete, and production on these units will start soon in the Green Bank shop. An order has been placed for the 2400 retroreflectors needed for the telescope surface. A subsystem to monitor and control various parts of the active surface control system has been designed and is being tested. The system includes power supply monitoring and control, watchdog timers, and emergency stop interfaces.

SCHEDULE. In the original plan, the GBT was to begin operations in the middle of 1995, following completion of the antenna at the beginning of that year. We have recently been informed by the antenna contractor that, because of difficulties in completing design of the elevation structure, the delivery of the GBT will be delayed until the latter part of 1995. NRAO has requested a recovery schedule from the contractor and is considering plans that will minimize any potential delay.

F. J. LOCKMAN

NEW USNO ANTENNA

The U.S. Naval Observatory has obtained data in Green Bank on the rotation rate and pole orientation of the earth since 1978. Initially these observations were made using the three-element Interferometer, later supplemented with two outrigger antennas. More recently these data have been obtained by VLBI observations, incorporating Interferometer antenna 85-3 into NAVNET, a network of antennas organized for this purpose by the USNO.

The USNO is now purchasing a new 20 meter antenna for Green Bank to replace Telescope 85-3 for VLBI. It will be similar to the new NAVNET antenna at Kokee Park on Kauai, Hawaii. The new antenna will be located across the road from Telescope 85-1. A contract for construction will be placed soon, and the telescope should be completed within a year.

A related USNO activity which was to begin in Green Bank has not fared as well. Following a reassessment of the need for secondary precision timekeeping systems, the USNO Alternate Master Clock Project has been cancelled. This facility, intended as a backup for the USNO Master Clock in Washington, D. C., would have been used also by NRAO to provide time and frequency for the entire Green Bank site. In its absence we are planning to establish a local timing center from which frequency reference signals and time-of-day would be available for each telescope and all major buildings. Much of the needed equipment already exists on site, but improved performance will be achieved by consolidating this equipment with two new Navy VLBI masers into a clock ensemble in a controlled environment.

F. J. LOCKMAN

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GBT SPECTROMETER

Preliminary design specifications for the new GBT spectrometer will soon be available in the form of a GBT memo. While the specifications, priorities, and other features have been discussed widely within NRAO and with the GBT Scientific Working Group, it is important that the plans be reviewed by anyone who intends to use the GBT. Copies of the report are available from scurry@nrao.edu for those who are not on the distribution list for GBT memos.

F. J. LOCKMAN

VLBA/VLBI

VLBA STATUS

The physical construction of the VLBA is virtually complete. Only a few late additions are yet to be installed. For example, the pulse calibration system is in the midst of installation. Although the calibration signal injection is present on most antennas, detection at the antenna (rather than at the correlator as is done in the Mk3 VLBI system) requires the new digital switch board which will be installed in July and August. All presently planned receivers have been installed on all VLBA antennas. Recent detailed testing at high frequencies has revealed the presence at most antennas of anonymously steep gain curves, especially at 43 GHz. Further tests to uncover the cause are proceeding.

The Mauna Kea antenna is now completely outfitted and being used for astronomical observations. Contingency plans for exceptional weather at various sites are being developed and implemented—for ice storms at Mauna Kea and for hurricanes at Saint Croix, Hancock, and Mauna Kea.

Confidence in the correlator grows as the level of remaining bugs diminishes. Although the "First Science" milestone has not yet been passed, the correlator is being operated for three hours every night. This enables development and testing of correlator operations independently of the continuing investigation of problems in correlation. Currently only test jobs are scheduled, but we plan to shift into initial production correlation as soon as feasible. A typical eight-station, one-hour observing run takes about 0.5 hours to correlate and 0.75 hours to process in AIPS through to fringe fitting (on a Sparcstation IPX).

Observations on the array continue. In July, about 50 percent of the available time was scheduled, mainly on time-critical observations such as monitoring projects. This current observing is consuming our pool of about 420 thin tapes since we are now using thin tapes on all stations. The goal is to get as much experience as possible with thin tape operation before making the final procurement of the remaining thin tapes (about 580) in the last quarter of 1993.

T. J. CORNWELL

PROPOSING TO USE THE VLBA

Proposals requesting use of the VLBA either during or outside of VLBI Network sessions are welcome. Proposal deadlines are February 1, June 1, and October 1. Upcoming VLBI Network sessions are described elsewhere in this Newsletter. Observing periods for non-Network VLBA projects are identical to those for the VLA discussed elsewhere in this Newsletter.

Anonymous-guest FTP can be used to access VLBA information files in directory "pub" on host "zia.aoc.nrao.edu" [146.88.1.4]. Of prime interest to proposers are the file "prop.vlba," giving details of the VLBA proposing process; and the file "obssum.vlba.ps," the VLBA Observational Status Summary updated in 1993 June and available now as a PostScript file or a LaTex document. This update soon will be paper mailed to those on the VLA/VLBA master address list.

Successful proposers should be aware that the VLBI scheduling program SCHED, plus its related files, are also available via anonymous-guest FTP on "zia.aoc.nrao.edu" [146.88.1.4] in directory /u/ftp/pub/sched.

J. M. WROBEL and R. C. WALKER

VLBI NETWORK CALL FOR PROPOSALS

Proposals for VLBI network observing are handled by the NRAO. In particular, the network sessions for 1993 and 1994 are expected to be as follows:

Session	Dates	Bands	Proposal Deadline
3	08 Sep to 29 Sep	1.3, 3.6/13, 6	1 Jun 1993
4	03 Nov to 24 Nov	3.6/13, 18, 90	1 Jun 1993
1	16 Feb to 09 Mar	1.3, 6, 18	1 Oct 1993
2	18 May to 08 Jun	3.6/13, 6, other	1 Feb 1994
3	14 Sep to 05 Oct	1.3, 3.6/13, 6	1 Jun 1994
4	TBD	0.7, 3.6/13, 18	1 Jun 1994

The Caltech Mark II processor will end routine correlation for the astronomical community at the end of 1993. In order to have an orderly shutdown of this facility, no further proposals for Mark II observations will be scheduled without assurances from the manager of a Mark II correlator that the observations can be processed.

It is recommended that proposers use a standard coversheet for their VLBI proposals. Fill-in-the-blanks ASCII forms and fill-in-the blanks Tex files (for those who have Tex support on their home computers) are available by anonymous FTP from zia.aoc.nrao.edu, directory pub/vlbicover. Printed forms, for filling in by typewriter, are available on request from Candice Gutierrez, AOC, Socorro.

Any proposal requesting 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 the mailing. Fax submissions of global proposals will not be accepted. 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
(Note the recent change in postal code.)

For proposals to the US network, the VLBA only, or global network proposals, send proposals to:

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

B. G. CLARK

12 METER

NEW DATA FORMAT AND THE DEMISE OF VMS POPS

To simplify and unify the data formats, we have retired the PDFL file format in favor of the similar SDD (Single Dish Data) format, the native file format of UniPops. This change offers several advantages to the user: data access at the telescope will be faster because no format translation will be required, and "on-line" and "off-line" file formats will now be identical. The staff will also remove the limitation on the scan capacity of SDD files, so that new on-line files will not need to be created except when desired by the observer.

UniPops will still be able to read the old PDFL format; however, the old VAX VMS POPS program will not be able to read the SDD format. As UniPops is now mature and reliable, and VMS POPS has fallen into disuse, we will expend no further effort to maintain or upgrade it. All support for VMS POPS ends now.

D. T. EMERSON AND P. R. JEWELL

SUMMER SHUTDOWN PLANS

The annual summer shutdown period will be busy with both upgrade and major maintenance projects. Work in the following areas is planned:

Receiver Upgrades. Replacement of the 2 mm mixers with improved, lower noise units developed at the Central Development Laboratory and the University of Virginia is planned. The 1 mm receiver will be nearly completely rebuilt to increase its cryogenic capacity, to accommodate the new 270-300 GHz SIS mixers, and to improve sideband rejection tuning. Changes to improve reliability will be made to the 1, 2, and 3 mm SIS receivers.

Hybrid Spectrometer and IF Processor Upgrades and Repairs. We expect to finish and install the hardware portion of the Hybrid Spectrometer IF processor that will ultimately allow for flexible, computer tuning of the center frequency of all eight IF bands. We expect to address some flaws in the Hybrid Spectrometer itself, including a long-standing problem with the end filter segment of the 600 MHz bandwidth mode.

Control System Upgrades. We will upgrade the graphical user interface to the system and plan to offer the observer more direct control of the telescope, if desired. We hope to have the first version of a new command line and script interface finished this summer. Work on several enhancements to remote observing capabilities, including remote video images of the site and control equipment, is being done.

Pointing Improvements. Installation of the 2-axis tiltmeters to measure excursions in the azimuth bearing tilt is planned. We hope to bring the new apex translation sensor into routine use and to improve the temperature stability of the feedlegs.

Dome and Cherry Picker Renovation. Major maintenance on the dome door drive system will be done this summer. The cherry picker utility lift will likely be replaced for safety reasons.

P. R. JEWELL

VLA

COMPUTING AT NRAO-NM

Now that the VLBA computing procurement is complete, the computing environment at the AOC has stabilized. Minor improvements this spring included the addition of 2 gigabytes of additional disk space on each of the three high-end IBM RS/6000s which previously had only 3 gigabytes available for data. As well, the new Solitaire image recorder installed at the AOC is now supported by AIPS and is available for making 35 mm slides. Documentation describing how to use it from within AIPS is available to any AOC visiting observer. It is especially important that visitors allow their images to be labelled with their AIPS user number (this is the default). Otherwise it is very difficult to determine where to send the slide when it comes back.

A T1 link to the VLA site was installed in May, providing approximately 1 megabit/sec bandwidth for data. This is a considerable improvement over the previous 14.4 kilobit connection, and in addition to better response and throughput for interactive traffic and file transfers, it will allow us to do real-time filling of VLA data to computers at the AOC. Testing of this capability is now being done. This is essentially an extension of the near-real-time visualization already in place on the local network at the VLA site.

A new initiative is underway at the AOC, and at other NRAO sites, to provide networked online documentation to our user community. The goal is to allow easy access to PostScript files of various NRAO manuals, memos, and general information, which are then viewed or printed at remote locations. Access is through public-domain software which runs over Internet using standard network information protocols. Early tests have been encouraging. During the next few months we will continue to bring more documents into the system, and to do substantially more testing. We anticipate that this will ultimately make it much easier for users of NRAO instruments and facilities to obtain up-to-date information.

In the personnel area, I would like to welcome Bruce Rowen, who joined the VLBA real-time programming group in June. Bruce comes to us from New Mexico State University and is working on tasks related to VLBA monitor and control systems and VLBA archive distribution.

R. MILNER

VLA CONFIGURATION SCHEDULE

Configuration	Starting date			Ending date			Proposal Deadline		
C	11	Jun	1993	30	Aug	1993	1	Feb	1993
DnC	10	Sep	1993	18	Oct	1993	1	Jun	1993
D	22	Oct	1993	24	Jan	1994	1	Jun	1993
A	18	Feb	1994	25	Apr	1994	1	Oct	1993
BnA	06	May	1994	23	May	1994	1	Feb	1994
B	27	May	1994	29	Aug	1994	1	Feb	1994
CnB	09	Sep	1994	26	Sep	1994	1	Jun	1994

The VLA is currently scheduling two large surveys. One will be done at night in the DnC and D configurations (18h-06h and 00h-10h, respectively), and one in the north galactic cap (07h-17h) in the B configuration. Observing time in those configurations and LSTs will be much reduced over past practice. On the other hand, observations disjoint with the surveys in those configurations will have more time available for scheduling than has previously been the case. 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 configuration are the hybrid configurations with the long north arm, which produce a round beam for southern sources (south of about -15 degree declination).

Approximate Long-Term Schedule

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

Observers should note that some types of observations are significantly more difficult in daytime than at 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. The D configuration daytime will be about 17h RA, and the A configuration daytime will be about 23h RA.

Time will be allocated for the VLBA on intervals approximately corresponding to the VLA configurations. The VLA time schedule will be selected from those proposals in hand at the corresponding VLA proposal deadlines.

B. G. CLARK

VLA/VLBA SCHEDULING COMMITTEE

The Scheduling Committee for the VLA/VLBA meets three times a year in Socorro to evaluate the referees' comments and plan the VLA/VLBA schedule for the following trimester. Recognizing the increased importance of the VLBA, we have added K. I. Kellermann to the group to increase the VLBI expertise. The other members of the committee are B. Clark, W. M. Goss, E. Fomalont, and J. Uson.

W. M. GOSS

ELECTRONIC SUBMISSION OF VLA AND VLBA PROPOSALS

We intend eventually to accept proposals submitted electronically. We would like to experiment with this procedure to test its reliability. Early tests have resulted in a significant failure rate which we believe can be eliminated.

Proposals for the October 1, 1993, deadline should be submitted in the same way as previous ones; i.e., we need to receive the paper copy of your proposal at the Director's office in Charlottesville by October 1. We also can accept a proposal if you fax the cover sheet to the Director (804-296-0278) by October 1, and the paper copy is received within the next 48 hours.

If you produce a standard PostScript version of the cover sheets and scientific justification and would like to help us evaluate the feasibility of electronic submission, please do the following:

1. Concatenate the three PostScript files (for example, cat if you have a unix system).

2. E-mail the concatenated file to the account propsoc@nrao.edu.

3. Use only the following fonts:

AGaramond	(Bold, BoldItalic, Italic, Regular, Semibold, Semibold Italic)
AvantGarde	(Book, BookOblique, Demi, DemiOblique)
Bookman	(Demi, DemiItalic, Light, LightItalic)
Courier	(Bold, BoldOblique, Oblique)
Helvetica	(Bold, BoldOblique, Condensed, Condensed-Bold, Condensed-BoldObl, Condensed-Oblique, Narrow, Narrow-BoldOblique, Narrow-Oblique,Oblique)
NewCentury Schlbk	(Bold, BoldItalic, Italic, Roman)
Palatino	(Bold, BoldItalic, Italic, Roman)
Symbol	
Times	(Bold, BoldItalic, Italic, Roman)
ZapfChancery	(Medium Italic)
ZapfDingbats	

4. Include figures (black on white or greyscale) only if they are produced as standard Postscript.

We believe that most of the failures encountered in our previous tests were due to the use of fonts that our printers do not recognize, use of encapsulated or other non-standard PostScript, and use of locally defined control characters for some of the Tex files that we received.

If the success rate of this test is sufficiently high, we expect to accept electronically submitted proposals by the February 1, 1994, deadline. We will report on the results of this test sometime in the fall.

J. M. USON

7 MM RECEIVERS FOR THE VLA

The first 7 mm receiver is nearing completion in the Socorro electronics lab, and is scheduled to be placed on VLA antenna 8 in late July. The second receiver should be installed in late September. Holographic images of all VLA antennas have been made to aid in selecting the best antennas for the 7 mm receivers. The predicted aperture efficiency at 7 mm, based on holography, the antenna pointing accuracy, and the 1.3 cm gain-versus-elevation curves, was used to select the seven best antennas. There are six other candidate antennas for the final three receivers. The final selection will be made later this year.

We are resetting the primary surface of antenna 4 to see if we can turn one of the antennas with the worst aperture efficiency into one of the best. If this is successful, antenna 4 will get a 7 mm receiver. Users are reminded that they may submit proposals for 7 mm in 1994 at the 1 October 1993 deadline.

R. A. SRAMEK

IN GENERAL

JANSKY LECTURE

I am pleased to announce that this year the Jansky Lecture will be given by David S. Heeschen, retired director of NRAO. His contributions to our understanding of the radio emissions from galaxies are well-known, particularly, his studies of source variability. The title of his lecture is "The Development of Radio Astronomy in the U.S." As an active and influential participant in that development, he brings a unique and interesting perspective to the subject of his lecture. The lecture will be given on October 29 in Socorro, NM, and on November 9 in Charlottesville, VA.

P. A. VANDEN BOUT

ANNOUNCEMENT

I am pleased to announce the appointment of Richard Simon as Assistant Director - Computing Systems. He will join the NRAO by the end of August. Simon comes to us from the Naval Research Lab where he is Head of the Radio/IR/Optical Sensors Branch of the Remote Sensing Division. In addition to the knowledge of computing and management experience he brings to this position, he has research interests in high resolution astronomy, both optical interferometry and VLBI.

I also want to take this occasion to thank Geoff Croes for all he accomplished during nearly three years in this position. As the first Assistant Director for Computing Systems, he guided the Observatory through a major hardware acquisition, started the AIPS++ project, and organized Observatory computing along lines that will serve us well in the future. Croes will return to Penticton, BC, Canada, when he retires at the end of this month.

P. A. VANDEN BOUT

MILLIMETER ARRAY

The atmospheric stability measurements that have been made on all the candidate MMA sites suggest that the atmospheric phase stability will permit "conventional" coherent interferometry on the largest array baselines for only a small fraction of the time. The atmospheric phase fluctuations arise in cells of water vapor that are small compared to the array dimension and which are carried by the wind across the array. The problem is most acute for the very longest baselines and the higher frequencies (where the path length for given water vapor content is greatest). However, it is possible to remove the atmospheric phase noise, or correct for it, by one of three techniques and recover most of the observing time for useful scientific interferometry on the longest baselines even at the highest array frequencies.

The three phase calibration techniques being investigated are (1) paired antennas, (2) rapid switching between source and calibrator, and (3) pulsecal T_{sys} measurements. The first two are variants of the traditional synthesis interferometry scheme of tracking the instrumental phase by repeated switching between pointings of the source and a nearby unresolved continuum calibration source. For the MMA on the longest baselines, the switching must be done very rapidly, approximately every 10 seconds. The continuum sensitivity of the MMA is such that the density of suitable calibration sources is sufficiently great that one can expect a calibrator to lie within 1-1.5 degrees of any array pointing position. The array antennas must switch rapidly, but not far, in angular displacement. One can reduce the switching time to zero by "pairing" the antennas in the longest array configuration. That is, place two antennas close together along the locus of the longest configuration. One antenna of each pair continuously observes the source being imaged while the other continuously observes the nearby calibration source; the phases from the latter array are used to correct the phase of the former. Finally, there is the technique of using a pulsecal comb of fixed amplitudes injected in the IF to measure T_{sys} on short time scales which was suggested by D. Bagri for the VLBA (VLBA Electronics Memo 137). Variations in T_{sys} will have a component resulting from the changing opacity of the atmospheric water vapor. Since it is these same water vapor cells that lead directly to phase fluctuations, one can correct the phase from measurements of T_{sys}. This technique has been explored in depth at BIMA in the thesis work of S. Zivanovic (U.C. Berkeley).

All three techniques appear suitable for the MMA, but they have quite different implications for the design of the array. Paired antennas drive the layout of the long array configuration, rapid switching has implications for the antenna design, and T_{sys} monitoring places unusual demands on the instrumental RF and IF design. Useful experiments can be designed to evaluate each of these approaches quantitatively.

The antenna design continues to make progress. Two reports have recently been published on the slanted axis antenna design that seems to be well suited to the requirements of the MMA (MMA Antenna Memos 12 and 13). Over the summer we will discuss our design work with antenna manufacturers and seek their guidance in identifying ways that the complexity, weight, or estimated cost of the antennas can be reduced.

The work on the MMA done to date will be reviewed for the MMA Advisory Committee, which will meet in Charlottesville September 16 and 17. The Committee will be asked to provide guidance for the MMA efforts over the next twelve months.

R. L. BROWN

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