NRAO NEWSLETTER

1 April 1991 No. 47

VLBA

VLBA CONSTRUCTION STATUS

The first six antennas are outfitted and operable to at least some degree (see below). The Pie Town NM, Kitt Peak AZ, and Los Alamos NM antennas routinely participate in Network observations. The Fort Davis TX antenna will be fully staffed to support Network observations starting in June 1991. The North Liberty IA antenna was declared operable September 1990. The Owens Valley CA antenna was declared operable in February 1991. Antenna erection at the Hancock NH site is largely complete with final assembly scheduled for completion in June 1991. Outfitting of the Brewster WA antenna was recently completed, and is scheduled to be operable in May. At St. Croix VI the antenna erection has started. At Mauna Kea HI antenna foundation and site preparation construction are underway.

Current VLBA Operational Capabilities as of 13 March 1991

Item/Site	PT	KP	LA	FD	NL	OV	BR	HN	SC	MK
20, 6, 4, and 1 cm	A	A	A	A	A	A	4/91	9/91	1/92	5/92
Mark II Recorder	A	A	A	A	A	A	4/91	np	np	np
VLBA Recorder	A	A	A	3/91	3/91	4/91				
8 BBC's (Mk III)	A	A	A	4/91	7/91	5/91				
Dual Freq 13/4 cm	A	A	A	3/91						
90/50 cm	A	A	4/91	3/91						
3 cm	A	np	np	np	np	np	np	np	np	np
2 cm	A									
7 mm	A									
Fully Staffed	A	A	A	6/91	1/92	1/92				

A = currently available; blanks indicate uncertain dates; np = not planned

K. J. STETTEN, J. M. WROBEL

VLBA CORRELATOR SOFTWARE STATUS

The first formal release of the VLBA correlator control system was completed on 1991 January 31. While not yet an operational version, the release integrated substantially complete initial versions of five major real-time subsystems, described briefly below, plus a wide variety of support and utility code. All of this software has been tested quite thoroughly, although in general only with limited access to correlator hardware thus far.

Two of the completed subsystems interface with and supervise the primary sections of the correlator hardware configuration: the station-oriented FFT and cross-multiplier/accumulator sections and the tape-oriented playback interface. A third subsystem manages the interconnections between these two; another exercises overall supervision of ongoing correlator "jobs." The delay and phase model server, finally, has been complete for several years.

Supporting these major elements are essential utilities for task management, event synchronization, bus communications, message logging, and operator/programmer interface screens. Some of this code is shared with the VLBA Monitor and Control group. Beneath all the application software is the VxWorks real-time operating system, which has more than fulfilled expectations for performance and utility.

The NRAO Newsletter is published quarterly by the National Radio Astronomy Observatory, Edgemont Road, Charlottesville, VA 22903-2475 USA. NRAO is operated by Associated Universities, Inc., under agreement with the National Science Foundation.

Two primary software subsystems are not yet complete. The job control and scheduling system operates in rudimentary form at present, while architectural design of the data archive and distribution supervisor is well under way. Purchase of DAT drives for the archive has been initiated. These, and a variety of drives for the distribution system, will be the last major procurements for the VLBA correlator.

Not included in the initial real-time software release, but nevertheless well advanced, were elements of the higher-level control system which obtains station observation logs, recognizes arrays, and constructs correlator jobs. Development of this software, based primarily on applications of the Ingres database management system, progressed quite rapidly during the early phases of implementation, to the point that further work was suspended to concentrate available personnel resources on the real-time system. Resumption of development in this area is anticipated in the next quarter.

Coordination of the software team's parallel development effort, as well as administration of the release process itself, was facilitated through use of the Network Software Environment computer-aided software engineering system. After substantial initial and continuing investment of effort in configuration and familiarization, this tool has begun to yield a noticeable return in enhancing of the group's productivity.

While much remains to be done to finish the VLBA correlator control system, the recent release represents a significant milestone. The software is essentially ready for the extensive correlator tests which will begin when initial integration of the hardware is complete.

J. D. ROMNEY, D. C. WELLS

STATUS OF VLBA/VLBI POST-PROCESSING SOFTWARE

Due to the major changes occurring within the AIPS project, we felt that we should inform the community of the status of VLBA/VLBI postprocessing software within AIPS. Since the manpower that was devoted to the VLBA software is being trimmed somewhat, due to the effort being diverted to AIPS 2 (a complete rewrite of AIPS), we shall be unable to fulfill the goals that we would have liked. We have therefore defined a limited subset of the software that we feel the community needs in order to process VLBA data. Some items (described below) are being postponed until AIPS 2; none are being canceled.

There has been a significant amount of development over the past two years and most pieces of the system are now in place and working to some extent. The major pieces that have recently been implemented are:

(1) MK3IN: a task that reads "A" tapes from a MkIII correlator.
(2) Development and debugging of the fringe-fitting and calibration software dealing with MkIII/VLBA style data.
(3) IBLED: an interactive TV based editor, most useful for VLBI data, edits data on a baseline-by-baseline basis.
(4) Several tasks for the calibration of spectral line VLBI data.
(5) Several utility tasks for the display and diagnosis of VLBI data.

The areas in which we shall be concentrating our effort over the next year are:

(1) The definition of a FITS format for the VLBA distribution/archive, and the development of routines to read/write this format.
(2) The development of a suite of tasks and procedures to make VLBI self-calibration easier for the novice user. This is an area which has traditionally deterred newcomers from entering the VLBI arena. We feel that some effort should be expended on making this process less painful.
(3) Minor development and extensive debugging of the fringe-fitting, polarization calibration and imaging, self-calibration, spectral line and editing tasks.

The areas in which we must unfortunately postpone our effort, possibly until AIPS 2 is in place, are:

(1) Astrometry/phase-referencing: there will be some development continuing outside of the AIPS group but we do not have the manpower to devote effort, other than advisory, in this area for some considerable time.
(2) Spectral line fringe-rate mapping: this is a technique that has been used with some success in the past on spectral line VLBI data. Any effort in this area will wait until AIPS 2.

If anyone in the VLBI community has strong feelings on this, please contact me by e-mail: pdiamond@nrao.edu or pdiamond@nrao.bitnet. I can also be reached by phone at (804) 296-0238.

P. J. DIAMOND

GREEN BANK TELESCOPE

FIRST RECEIVERS FOR THE GREEN BANK TELESCOPE

The versatility of the GBT will require a full complement of receivers covering all frequencies for which the telescope is usable. Providing that complement remains NRAO's ultimate goal. However, NRAO must decide which to build first. After consideration of anticipated scientific uses of the GBT and the staged developments of its capabilities, the recommended initial five are:

Frequency (GHz)	Driving Science	Comments
1.25-1.75	Gal & ExtraGal HI, OH, Pulsars, VLBI	Observations possible in all weather; G/T high; test of clear-aperture concept
0.3-1.3	Pulsars, High-z HI, VLBI, deuterium	Prime focus receiver
18-25	Molecular spectroscopy (esp. water and ammonia), VLBI	Heavily subscribed band on 140-ft
42-46	Molecular spectroscopy, VLBI	Test of GBT's active surface; SiO masers provide strong point sources for GBT evaluation; possible test of receiver array
4.5-7	Molecular spectroscopy (esp. formaldehyde and OH), VLBI, continuum survey?	Most useful of Orbiting VLBI frequencies

The listed frequency ranges are only approximate. Furthermore, the exact type of receiver construction is yet to be determined.

The scientific considerations were developed through discussions with telescope users, with the GBT's advisory committees, and with scientists who participated in workshops following the collapse of the 300 ft telescope. Some of the rationale was described in the June 1989 Proposal to NSF for the GBT.

GBT plans call for three stages of development: (1) the contractor produces a telescope usable to 15 GHz; (2) NRAO installs an open loop system of surface adjustment and an autocollimator scheme to improve pointing, permitting use to 45-50 GHz; (3) NRAO implements a laser distance-ranging scheme applicable both to closed-loop, accurate surface adjustment and to precision pointing, permitting operation at frequencies as high as the research and development effort enables. Stage 1 is supposed to be operational in early 1995, Stage 2 shortly thereafter, and Stage 3 as soon as the in-house effort develops the necessary new technology. A prudent policy, it seems, would allow some operational experience with the GBT to be acquired before advancing to Stage 3. Therefore, the initial set of receivers did not include frequencies > 59 GHz.

Actual receiver construction has not begun, so comments are still welcome.

G. A. SEIELSTAD

THE LASER RANGING SYSTEM FOR THE GREEN BANK TELESCOPE

Since our last report in the Newsletter, progress has been made on the development of a ranging system suitable for the GBT active surface and pointing system.

In recent months a computer-controlled mirror has been added to the prototype rangefinder. This fast-moving, accurately positioned mirror permits steering of the laser beam to any selected target retroreflector. The system in its present form satisfies the GBT requirement of five range measurements per second with a 50 μm accuracy over ranges of up to 120 meters.

Figure 1 shows the result of 30 minutes worth of data taken on two targets at a 5 Hz rate. Both targets were the 1.5-inch diameter retroreflectors that will be installed on the surface of the GBT. One range was 50 m, the other 120 m.

For successful operation of the metrology system, it is necessary that any variation in refractive index of the atmosphere be uniform over all measurement paths. For example, a temperature difference of 1°C between two 100-m paths will give a range difference of 100 μm, an unacceptably high value.

In order to investigate this effect, we programmed the ranging instrument to measure the range to both the 50-m target and the 120-m target once every 30 seconds for a 24-hour period. As expected, the measured ranges changed with air temperature and pressure but, as shown in Figure 2, the ratio of the ranges remained constant.

Our future plans include an extension of this experiment to include inclined measurement paths by perhaps measuring to targets placed on the 140-ft structure.

J. M. PAYNE, D. H. PARKER

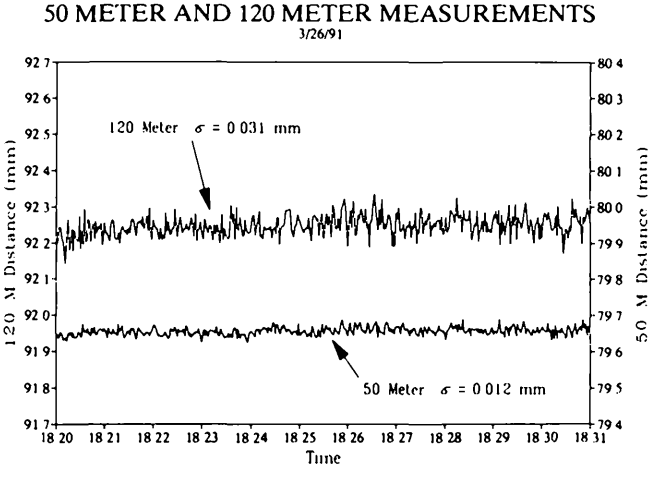

Fig. 1

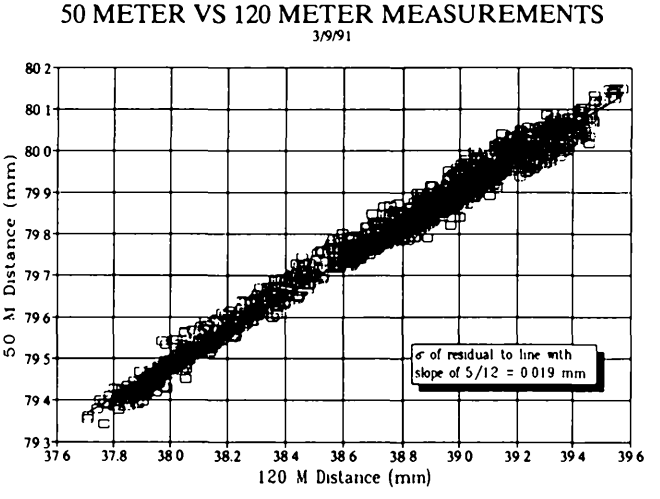

Fig. 2

THE GBT'S OPEN-LOOK SURFACE CONTROL

An LVDT is a Linear Variable Differential Transformer. Its use on the GBT will be in conjunction with the actuators used for surface adjustment. The LVDT will tell to what length the actuator has been extended. Approximately 2000 of each, actuator plus LVDT, will be needed. Accordingly, extensive LVDT tests are prudent.

The goal of the LVDT tests is to determine their dependence upon temperature. We intend to apply corrections in a computer for non-linearity and for temperature drift in the LVDT's. The amount of correction required may impact the decision on which LVDT to buy.

The linearity test fixture has a resolution of 0.0001 inches, or ten times better than the LVDT. A computer varies the temperature of a freezer in which the LVDT's are placed between 5° F and 85° F. Under computer control we position the LVDT's +1.7 inches to -1.7 inches and record the indicated position at 20° F increments. With these data we can then compare different LVDT's. We are also testing different signal-conditioning systems in order to determine which would be best to convert the LVDT indicated position to a digital number.

By the end of March the software should be in place to automatically control the freezer, position the LVDT's and record the indicated positions from 5° F to 85° F. I hope to be able to run tests during the night and analyze the data during the day. We have a total of 58 LVDT's to check and four different signal conditioning systems. In addition, we have to investigate how cable length affects the LVDT indicated position as a function of temperature.

Before we installed LVDT's on the actuators we recorded linearity data at room temperature, and we plan to compare the data with these after the LVDT's have been out in the weather to see if the linearity has changed over time.

D. R. SCHIEBEL

GBT ACTUATOR TESTING

The surface panels of the GBT will be supported by over 2000 actuators. These will permit correction of the soft surface for gravitational deformations. Also, the actuators will have the travel required to "shape" the primary surface if this is desired at some future date.

Since the actuators are such critical and unique components of the new antenna, custom prototypes were ordered from five vendors. Accelerated life tests of them are presently being conducted in the field. The actuators are cycled between full extension and full retraction under maximum dynamic load, both side and axial, at 50 percent duty cycle. Our estimates of telescope use indicate that 2200 hours of such testing is equivalent to 10 years of telescope use. At present, 1230 hours have been logged, with three of the five sets still performing well.

R. J. LACASSE

VLA

1000TH ANTENNA MOVE

The first documented move of a VLA antenna occurred with a newly bright red transporter nearly sixteen years ago on the 18th of July 1975. Astronomers typically take the mechanical aspects of reconfiguring the array for granted, but over the years the VLA antenna crew has shown how experience and dedication can pay long-term dividends. Moves that once took a full day now require only about two hours to complete. The current D configuration is the 34th to be in use (not counting hybrids) since the construction was completed.

On February 26, we all paid tribute to the efficiency and safety record of the crew as the 1000th antenna move took place in the bright New Mexico sunshine. Present to watch the official milestone move were several of the NRAO employees who had witnessed the original move. The celebration was capped off with a luncheon for all of the VLA site employees.

R. J. HAVLEN

VLA CONFIGURATION SCHEDULE

Configuration	Starting Date	Ending Date	Proposal Deadline
D	01 Mar 1991	28 May 1991	15 Oct 1990
A	21 Jun 1991	16 Sep 1991	15 Feb 1991
BnA	27 Sep 1991	14 Oct 1991	15 Jun 1991
B	18 Oct 1991	30 Dec 1991	15 Jun 1991
CnB	10 Jan 1992	27 Jan 1992	15 Jun 1991
C	31 Jan 1992	27 Apr 1992	15 Oct 1991
DnC	08 May 1992	25 May 1992	15 Oct 1991

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 degree declination).

Approximate Long-Term Schedule

	Q1	Q2	Q3	Q4
1991	C,D	D	A	B
1992	C	C,D	D	A
1993	B	C	C,D	D
1994	A	B	C	C,D
1995	D	A	B	C

Observers should note that in these years of sunspot maximum, daytime observations at 327 MHz are unlikely to be successful in the smaller configurations because of solar interference and in the larger configurations because of a disturbed ionosphere. In particular, only the most urgent A configuration observations near 10^h RA should be considered; B configuration observations near 15^h RA will also be difficult.

B. G. CLARK

AN UPDATE ON USING DIFFERENT BANDWIDTHS WITHIN ONE IF PAIR

As mentioned in the previous issue of the NRAO Newsletter (January 1991), the VLA correlator can be configured to observe with different bandwidths within one IF pair (IF's A and C, for example). It was also said that unless there is good scientific reason to do so, one should try to avoid this mode. The main reason is that in that case the fringe rate is calculated with the wrong frequency for IF's B and C (IF's A and D are correct). The frequency error amounts to half the difference in bandwidths. For example, when observing IF A with a 1.56 MHz bandwidth and IF C with a 3.125 MHz bandwidth, the frequency used in calculating the fringe rate is in error by +0.758 MHz for IF B and -0.758 MHz for IF C. This effect causes decorrelation within an integration period when dealing with long baselines and/or large differences in bandwidth due to phase winding in IF's B and C. Moreover, the phase winding causes the standard calibration method to fail as the phases of the longer baselines shift by more than a radian between consecutive observations of the phase calibrator.

Gareth Hunt has added a function within the AIPS program CLCOR which calculates phase corrections for the affected IF's. This program adds the phase corrections to the CL table, shifting the phases for IF's B and C, after which one can proceed with the usual calibration. The resulting maps are fully corrected for the phase winding and correct results can now be obtained in this highly non-standard mode, provided, of course, that the decorrelation per unit of integration time is negligible. Observers wishing to use this mode should consult Elias Brinks (505-835-7029) well before the run to discuss the feasibility and possible limitations.

E. BRINKS

VLA PRIMARY BEAM AND POINTING AT 333 MHZ

The VLA P band feed consists of a pair of crossed dipoles that use the subreflector as a ground plane. As is well known, the subreflector is shaped in order to illuminate the Cassegrain feeds and the dipoles are ~0.4λ closer to the primary reflector than what would be required for correct focusing. Extensive tests run from January 1990 to February 1991 have shown that the primary beam of the VLA antennas at P-band is somewhat different from what was previously assumed. We have found that between 330 MHz and 335 MHz it behaves as follows:

- The HPBW (333 MHz) is about 145'.

- Between 330 MHz and 335 MHz the HPBW is a steeper function of frequency than expected from a correctly focused beam. With this 1.5 per cent change in frequency, the HPBW changes by 4.5 per cent. This induces steep spectral indices for sources away from the central area of the primary beam. For example, a source 1° from the beam center (still at about 60 per cent of the peak response) acquires a "spectral index" of ~5; and a source 1.5° away from the center acquires a "spectral index" of ~10. This effect must be responsible in part for the failure to reach the rms noise levels given by the receiver noise and the confusion noise.

- The antennas have been consistently mispointed by about 8', a small fraction (~6%) of the HPBW. This small error has significant consequences at P band as the entire field of view is littered with faint radio sources. Although the primary beam is very nearly circularly symmetric (the non-circularity is ≤ 4%), as the sky rotates the mispointing causes sources to be modulated in amplitude. Thus, the sidelobes of the synthesized beam do not behave as theoretically expected, with a subsequent error in the ability to "clean" the images.

We have installed a new "Subreflector Rotation File" that now provides for (average) pointing within about 1'. The individual antennas do not show significant offsets from the average, albeit the errors here are somewhat larger due to confusion (~2.5').

J. M. USON, D. S. BAGRI

NEW RELEASE OF VLA OBSERVE

A major new release of the VLA OBSERVE program will be made May 1, 1991. Several new features have been added to OBSERVE and several bug fixes have been incorporated. Major changes include:

1. Doppler corrections (i.e., DOPSET) to give apparent observing frequency.
2. Automatic calculation of local oscillator settings (i.e., LOSER plus automatic selection).
3. Global change and edit features.
4. Limited search capabilities.
5. Better handling of old observe files generated by OBSERVE.
6. "Improved" navigation of menus and lists.

The newest version 3.0.1 is available for the following machines:

Sun workstations - Sun 3 & 4's
IBM RS6000 workstations
VAX VMS
IBM PC's - MS-DOS

Observers are urged to obtain the latest version if they wish to run OBSERVE at their home institution. OBSERVE for Unix and PC's is available via anonymous ftp from zia.aoc.nrao.edu (192.43.204.7), and the relevant VMS files may be copied from NRAO:: on SPAN. You may also contact Theresa McBride (tmcbride@nrao.edu) at the AOC in Socorro for floppy disk or tape copies.

Please send bug reports or enhancement requests to obsbugs@nrao.edu.

W. K. YOUNG

UPDATE ON THE PRICING OF DATA STORAGE MEDIA

Users may have copies of their data provided to them on two common media, 9-track, one-half inch magnetic tape or 8 mm "Exabyte" mag tape at a cost of $10 per tape. Shipping costs for the 9-track tapes will be extra, but are included in the $10 fee for the cassette tapes. Shipping charges will be determined at actual cost for the tapes depending on the method and destination. Other media could be available but will be priced at actual cost.
Users should be aware that all requests for mag tape must be paid for in advance before shipping of tapes is authorized. A purchase order from their institution can serve as advance payment.

J. P. LAGOYDA

APPLYING FOR NON-NETWORK VLBA AND VLA OBSERVING

This is a reminder to those applying for time to use the VLBA and/or VLA outside of the Network for VLBI experiments. Two immediate concerns have to be addressed. Is there enough correlator time to process the data, and are there enough tapes available for the experiment? This is especially important for Mark III. To complicate the issue of tape supply is the fact that three of the VLBA antennas (Pie Town, Kitt Peak, Los Alamos) use only thin tapes and the current supply of these thin tapes is very small. It is the responsibility of the proposer to check with the correlators to make sure that enough processor time will be available to process their experiment. Also the experiment will only be scheduled if there are enough tapes available.

R. C. BIGNELL, J. M. WROBEL

THE FOURTH NRAO SYNTHESIS IMAGING SUMMER SCHOOL

NRAO will hold the Fourth NRAO Synthesis Imaging Summer School in Socorro from June 12 to 19, 1991. Lectures on novice topics will be given June 12-14, a weekend data reduction tutorial will be held June 15-16, and lectures on advanced topics will be given June 17-19. The textbook will be the published lectures from the third summer school, augmented by write-ups for a few new advanced lecture topics. All lectures will be aimed at beginning graduate students, and will include many illustrative and practical examples.

Summer school announcements, including application forms, were widely distributed in February 1991. If you are interested in attending the summer school but cannot locate an announcement at your institution, please request one from me via phone at 505-835-7000; via e-mail to jwrobel@nrao.edu; or via postal mail to J.M. Wrobel, NRAO, P.O. Box O, Socorro, NM 87801, USA.

J. M. WROBEL

VLA ARCHIVE AND CALIBRATOR PROGRAM FOR THE IBM PC

The IBM PC program (and all the necessary data) that will (a) search the VLA archive list for sources observed with the VLA, (b) display information on the VLA proposals, and (c) search the VLA Calibrator List has now been updated to include all of the 1990 data. It is available over Internet using FTP from our anonymous account. Use the Internet address zia.aoc.nrao.edu (192.43.204.7) to gain access to Zia and log into ftp with some password. Change to the sub-directory pub/vlasors and transfer all the files. You can still order the program and data on diskette. Contact Meri Stanley at P. O. Box O, Socorro, NM 87801; 505-835-7310. The Internet address is: mstanley@ zia.aoc.nrao.edu. Please specify diskette size (5.25" or 3.5") and density (DD or HD).

R. C. BIGNELL

REMOTE CALIBRATION PHASED OUT

The ever-increasing number of tasks that have been undertaken by the data analysts, Peggy Perley and Dave Wunker, in order to improve the efficiency of array observations has forced us to re-evaluate their role at the Observatory. With limited manpower the data analysts are now required to devote a much greater fraction of their time assisting visiting observers, preparing OBSERVE files, analyzing VLA test data, and (in future) providing VLBA assistance. Coupling this increased workload with the overall availability of the AIPS calibration package in the astronomical community therefore leads us to eliminate remote calibration as a standard service provided by the data analysts. The service will be phased out gradually to allow requests that are already in the queue to be honored. New requests, however, will be turned down. For cases involving unusual circumstances (e.g., no AIPS package or ready access to an NRAO facility, or a one-time VLA user), scientists should contact Miller Goss for special consideration. Dave or Peggy should still be contacted, however, for copies of uncalibrated archive data, help with OBSERVE, or consultation about the calibration process.

R. J. HAVLEN

MEASURING ENGINE MOVING

Visitors to the AOC who expect to use the Mann measuring engine during April, May, and June, should be sure to check on its availability well in advance of their visit. The machine will be out of service for about two weeks in early April and again intermittently in mid-May while it is relocated to a permanent site. Portions of the AOC electronics and computer floors are being outfitted for VLBA operations during this time. Potential users should contact Frazer Owen (x7304) or Dick Sramek (x7394) for the machine's current status.

R. J. HAVLEN

VISITING SOCORRO - PLAN AHEAD

In spite of our efforts to advertise the need for advance reservations, we continue to receive requests from visitors who wish to make last minute arrangements for a technical visit to the AOC. No less than two weeks notice is required, and we again repeat our announcement from the April 1990 Newsletter:

It is extremely important that all scientific visitors to NRAO/Socorro/VLA give us two weeks advance notice of their intent to visit. Please do not just "drop in" at a moment's notice. As much as we like to see you, we need an appropriate amount of time to make the necessary logistic arrangements to insure that your visit is a productive one. This includes lining up staff technical assistance, avoiding conflicts in computer support (especially disk space), and coordinating housing and transportation. This advance courtesy applies uniformly to current observers as well as to those visitors who will only be analyzing existing data. Please call Eileen Latasa at (505) 835-7357 to make reservations.

Generally, all requests with less than a two-week advance reservation will be denied. Further appeals will be channeled to the VLA Site Director.

A copy of the new VLA Observing Application is enclosed. Please use it from now on.

R. J. HAVLEN

RECENT VLA MEMORANDA

Electronics Memorandum #216, "Closure Errors in the VLA," D.S. Bagri (11/90)

High Time Resolution Processor (HTRP) Memoranda,

#100 "A Proposal to Allow High Time Resolution Observing with the VLA," D. Stinebring (08/83)

#101 "Status of Plans for Phased Array Processor at the VLA," R. Hjellming, D. Bagri, J. Cordes, M. McKinnon (06/87)

#102 "Short Time Constant Processor at the VLA," D. Bagri, R. Hjellming, M. McKinnon (08/87)

#103 "Plan for VLA High Time Resolution Processor HTRP)" (03/88)

#104 "Status of Plans for High Time Resolution Processor (HTRP) at the VLA," R. Hjellming (05/88)

#105 "Detector for the Analog Sum," T. Hankins (10/88)

#106 "HTRP Rack Layout and Interface Module," M. McKinnon (12/88)

#107 "Polarization Calibration of the VLA Analog Sum," M. McKinnon (03/90)

#108 "Allowable Operating Ranges for the HTRP," M. McKinnon (03/90)

#109 "HTRP Bench Test Results," M. McKinnon (05/90)

#110 "Determination of MkIII Videoconverter Sky Frequency," M. McKinnon (08/90)

#111 "Gated Sampling of the HTRP," M. McKinnon (01/91)

#112 "HTRP Use," R. Hjellming, M. Goss (02/91)

Technical Reports,

#66 "Temperature Sensor Array for Antenna No. 6," C. Janes and A. Sittler (02/91)

#67 "The VLA MkII Data Gathering System - A Manual for Operation," C. Janes (02/91)

Test Memoranda,

#155 "ALC Testing Report," T. Cotter (06/90)

#156 "VLA Antenna Tilt and Temperature Tests," C. Janes 03/91)

Millimeter Array Memoranda,

#62 "An Independent Simulation of Imaging Characteristics of a Millimetre Array, With and Without a Single Large Element, and an LE Pointing Correction Algorithm," D. T. Emerson (11/90)

#63 "Pointing Errors and the Possibility of Pointing Calibration," M. A. Holdaway (02/91)

Copies of any VLA numbered memorandum or a copy of the listings of all VLA numbered memoranda are available from Meri Stanley, P. O. Box O, Socorro, NM 87801 (or 505-835-7310).

M. STANLEY

STAFF SUPPORT AT THE AOC

Quick access to local NRAO staff experts in all aspects of VLA data acquisition and analysis is an obvious advantage that AOC Visiting Scientists have over remote observers. With recent developments in software for preparing observations (OBSERVE) and for calibrating data in AIPS, however, there has been a clear evolution in the type and style of visitor-staff interactions that lead to a successful visit. AOC visitors routinely receive assistance on an ad hoc basis from the following people:

- Data Analysts - Dave Wunker and/or Peggy Perley are usually available during working hours and some "off hours" as a resource for data calibration and/or AIPS procedures and the production of archive tape copies. They should be your "initial filter" when problems in these areas arise. They are also the primary contact for OBSERVE file preparation.

- Computer Operations Staff - Computer systems and hardware problems, including the tape drives and Dicomed imaging device, should be referred to these people. They can also provide documentation when required.

- On Call Experts - Assistance of every imaginable type is available during normal working hours. During "off hours" visitors will find call-out lists posted by the YUCCA image processing room for questions arising in the following areas: Astronomy, AIPS, and Computer Systems.

As noted on the VLA Proposal Cover Sheet, each observer must request the level of staff assistance that they will require during their visit. In order that this prearranged tutelage be optimal for the experience of the observer and the difficulty of the project, we encourage all observers to refer to the following guidelines when submitting a proposal. Four levels of prearranged staff support are common:

- Staff Contact - For frequent visitors and/or experts who don't need technical assistance, the staff contact will provide a brief update on new procedures, hardware, and software at the AOC/VLA since the last visit. Staff contacts are generally available to be called upon when no other assistance is available.

- Consultant - Available to the moderately experienced user who needs occasional technical advice and assistance. The Consultant will also be responsible for the general contact duties described above.

- Friend - Inexperienced users who are new to synthesis imaging and infrequent visitors whose experience is out of date will require a Friend for more than just an occasional consultation on technical matters relating to observing and data analysis. Extensive initial "hand holding" is generally involved on the part of the Friend.

- Collaborator - For many VLA users, both experienced and inexperienced alike, who anticipate the need for extensive staff interaction, we encourage them to seek the assistance of a staff collaborator who has common scientific interests. Often the investment of staff time in observing preparation and follow-up warrants this level of involvement in the project. Users who are not familiar with the VLA/VLBA staff should contact Miller Goss for help in arranging staff collaborations.

The nature of the astronomer/instrument interface is in a continual state of flux, and even the most experienced, long-time users of the VLA and the off line data analysis systems at the AOC need occasional refresher courses in their use. For the sake of efficiency and optimal use of the VLA/VLBA telescopes, we urge observers regularly to visit the VLA/AOC.

R. J. HAVLEN

VLA OBSERVING APPLICATION

A

DEADLINES: 15th of Feb., June, Oct. for next configuration following review
INSTRUCTIONS: Each numbered item must have an entry or N/A
SEND TO: Director NRAO Edgemont Rd. Charlottesville, VA 22903-2475

rcvd: _____

(1) Date Prepared:

(2) Title of Proposal:

(3) AUTHORS	INSTITUTION	Who Will Come To The VLA?	For Grad Students Only: Observations for Ph.D Thesis?	For Grad Students Only: Anticipated Ph.D Year

(4) Related previous VLA proposal number(s):

(5) Contact author
for scheduling:
address:

(6) Telephone:
Telex:
Internet:
Other E Mail:
Telefax:

(7) Scientific category: ☐ planetary, ☐ solar, ☐ stellar, ☐ galactic, ☐ extragalactic

(8) Configuration(s) (one per column) (A, B, C, D, BnA, CnB, DnC, Any)					
(9) Wavelength(s) (400, 90, 20, 18, 6, 3.5, 2, 1.3 cm)					
(10) Time requested (hours)					

(11) Type of observation: ☐ mapping, ☐ point source, ☐ monitor, ☐ continuum, ☐ lin poln, ☐ circ poln, ☐ solar, ☐ VLBI,
(check all that apply) ☐ spectroscopy, ☐ multichannel continuum, ☐ phased array, ☐ pulsar, ☐ high-time resolution,

(12) ABSTRACT (Do not write outside this space. Please type.): ☐ other _____

NRAO use only

(13) Observing File Prepared by? ☐ NRAO ☐ Observer Calibration done at? ☐ Home ☐ AOC or CV (2 weeks notice)
Observer present for observations? ☐ Yes ☐ No Mapping done at? ☐ Home ☐ AOC or CV (2 weeks notice)

(14) Help required: ☐ None ☐ Consultation ☐ Friend (extensive help) ☐ Staff Collaborator (contact VLA Director's Office)

(15) Spectroscopy Only:

	line 1	line 2	line 3		line 1	line 2	line 3
Transition (HI, OH, etc.)				IF bandwidths(s) (MHz)			
Rest frequency (MHz)				Hanning smoothing (y/n)			
Velocity (km/sec)				Number of channels per IF			
Observing frequency (MHz)				Frequency resolution (KHz/channel)			
Correlator mode				Rms noise (natural weighting) after 1 hour (mJy)			

(16) Number of sources_____ (If more than 10 sources please attach list. If more than 30 give only selection criteria and LST range(s).)

(17) NAME	Epoch 1950☐ 2000☐ RA hh mm Dec ±xx°x	Config.	Band (cm)	Band width (MHz)	Total Flux line (Jy)	Total Flux cont. (Jy)	Largest ang. size	Weakest signal (mJy/beam)	Required dynamic range	Possible LST range hh - hh	Time Requested

(18) Special hardware, software, or operating requirements:

(19) Preferred range of dates for scheduling:

(20) Dates which are not acceptable:

(21) Please attach a self-contained Scientific Justification not in excess of 1000 words. (Preprints and reprints will be IGNORED!) 4/91
When your proposal is scheduled, the contents of this cover sheet become public information (Any supporting pages are for refereeing only)

12-METER TELESCOPE

HYBRID SPECTROMETER ON LINE

The staff has completed the interface between the Hybrid Spectrometer and the new telescope control system, and the Hybrid Spectrometer is now in routine use. The system records data from both the Hybrid Spectrometer and the filter banks simultaneously, but writes the data into separate files. Observers can gain access to either of these data files from within the LINE analysis program via simple toggle commands (FBDATA or HCDATA). A given observation has the same scan number in either data file.

The Hybrid Spectrometer has 1536 spectral channels that can be distributed among up to 8 IF's. For single beam, dual polarization observations, the spectrometer is most often used in a 2-IF mode. We can also support a 4-IF mode, in which the IF's can be centered on two different frequencies in each of the two polarization channels. This mode currently requires some manual set-up, so observers should give us some advance notice if they desire this mode. We will eventually be able to support eight different, computer-tuned IF frequencies, but this is not available yet. The Hybrid Spectrometer can also support the 8-beam receiver, which is currently undergoing upgrades.

As a reminder, here are the bandwidth and resolution capabilities for the 2-IF mode of the Hybrid Spectrometer.

Bandwidth	Channel Spacing
600 MHz	781 kHz
300 MHz	391 kHz
150 MHz	195 kHz
75 MHz	98 kHz
37.5 MHz	49 kHz

With one IF, a 24 kHz resolution mode is also available.

A. V. DOWD, J. R. HAGEN, R. W. FREUND,
D. T. EMERSON, P. R. JEWELL

1 MM SIS RECEIVER

The new 1 mm SIS receiver is performing extremely well. It has good performance from 200 to 260 GHz, and is usable up to about 265 GHz. At 230 GHz, receiver noise temperatures as low as ~80 K (DSB) have been measured on the telescope. Observers have measured T_R^* - scale system temperatures as low as 600 K, in each of the two polarization channels (the T_R^* scale includes corrections for atmospheric extinction and for both rear and forward spillover). The receiver has experienced some cryogenic and electronic problems in the early days of operation, but we believe that these problems are now behind us.

J. W. LAMB, J. G. COCHRAN,
J. M. PAYNE, A. A. PERFETTO

MAINTENANCE AND TESTING SCHEDULES

Beginning with the late April schedule, we will be experimenting with a plan of reducing the number of weekly 8-hour maintenance sessions. Maintenance time will be consolidated with more extended engineering test sessions, which are scheduled every 2-3 weeks. The reason for this plan is to try to reduce the disruption to observers that Maintenance Days sometimes produce. By consolidating maintenance with frequently scheduled test sessions, we hope to provide a more orderly environment for repairs and enhancements, and to provide adequate time for the staff to thoroughly test the system before observers use it. Although the advantages of this plan to observers are obvious, a possible disadvantage is that the staff must wait longer to have access to the telescope to fix minor problems. As a trade-off, we may occasionally ask observers to cooperate by giving up time--at their convenience--for repairs, so that minor problems don't debilitate several programs in a row. As always, the staff will respond immediately to repair fatal problems.

Note that this plan is an experiment. If we discover that the smooth operation of the telescope is suffering, we reserve the right to reinstate the Maintenance Days at any time. We welcome observer comments on this plan.

P. R. JEWELL, D. T. EMERSON

GREEN BANK

TEST OF THE 25 TO 35 GHZ RECEIVER ON THE 140-FT TELESCOPE

In January, the new 25 to 35 GHz cooled, HEMT receiver was tested on the 140 ft telescope by Chris Salter and Ron Maddalena. The single-channel Cassegrain receiver has an instantaneous bandwidth of 500 MHz and measured system temperatures at the zenith of between 50 and 100 K, depending on frequency. We are planning to produce a full report describing the results of our tests.

Preliminary examination of the data indicate that the aperture efficiency of the telescope at 30 GHz is about 0.12 at a declination of 40° and at 0 hour angle. Aperture efficiencies drop to about 0.08 at an hour angle of 5^h. Beam efficiencies vary from 0.24 to 0.16. With the lateral focusser in operation, the beam was rather well shaped with the highest sidelobe level at -9 dB. All measurements are consistent with a total surface accuracy of 1.0 mm. Pointing measurements with the new receiver at these high frequencies were extremely reliable and repeatable and proved not to be much of a challenge.

In mid March, three different teams of observers used the receiver for spectroscopy. Although some problems were found with the receiver, all of which are presently being addressed, the observers were well satisfied with the performance of the receiver and telescope. The spectra shown below, courtesy of Morley Bell, illustrate detections of SO, HC_7N (J=24-23), and a 30 GHz Hydrogen Beta recombination line with the new receiver.

For more details about the receiver, please contact Ron Maddalena or Chuck Brockway.

R. J. MADDALENA

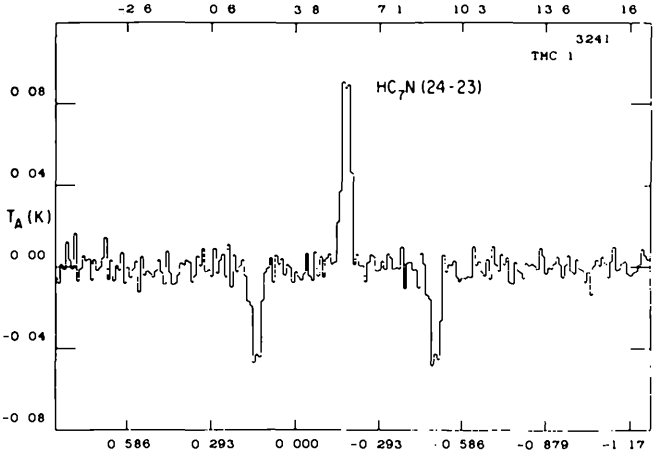

Fig. 1. A four-hour frequency-switched observation of TMC-1 at 27.1 GHz, with a 2.5 MHz bandwidth.

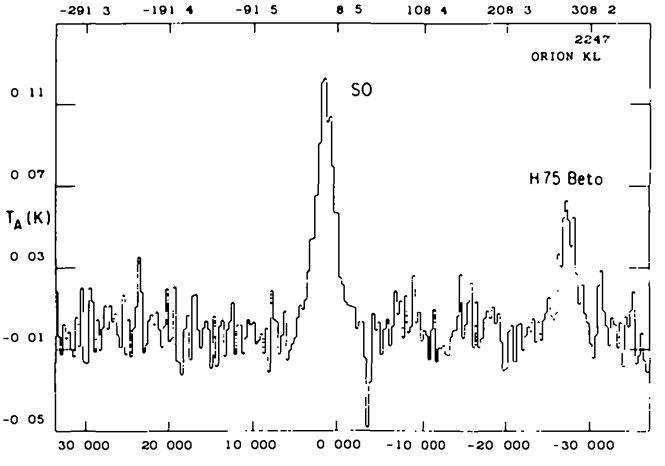

Fig. 2. A three-beam-switched observation of Orion at 30.0 GHz with an 80 MHz bandwidth.

THE NATIONAL RADIO QUIET ZONE

The National Radio Quiet Zone (NRQZ) provides Green Bank unique and essential protection against stationary ground transmitters. The Green Bank Telescope project is going to considerable effort and expense to minimize harmful interference. It follows that our vigilance over potential intrusions into the NRQZ must be maintained.

An extremely long legal proceeding affecting the Quiet Zone continues. The Federal Communications Commission (FCC) has allocated television channel 64, 770-776 MHz, to the Charlottesville, Virginia area. Two companies applied for a license. One, Achernar Broadcasting Company, selected a transmitter site within the NRQZ. The other, Lindsay Television, Inc., selected a site outside the Zone. NRAO initially objected to the Achernar application only, but after a Review Board hearing at which it was pointed out that both transmitters would generate objectionable interference at Green Bank, NRAO entered an objection to Lindsay's application as well.

The same Review Board has issued its latest decision: Achernar's application is denied and Lindsay's is recommended. For the Quiet Zone this represents neither victory nor defeat. The boundaries of the Zone remain inviolate: that is, no application within the Zone to which NRAO has objected has been approved. Lindsay's broadcasts, however, will produce interference exceeding the limits NRAO has established. While that interference originates outside the NRQZ, it will be a new source radio astronomers must contend with.

Although NRAO-Green Bank's protection is less than perfect, it may be the best that can be achieved in the face of present heavy pressure for commercial use of the electromagnetic spectrum. A Zone is established whose boundaries are arbitrary in the sense that they do not extend so far that no interference will ever plague Green Bank; but these same boundaries provide a legal definition without which disputes could never be resolved.

Resolving disputes is not a speedy process. Achernar Broadcasting has appealed the Review Board's ruling. The next body that must hear the appeal (or decide not to) is the Commission itself. On March 28, 1991, the FCC released an order calling for comments from the two television companies. One option they are asked to consider is "whether it would best serve the public interest to deny the application of both Achernar and Lindsay on the basis of the current evidentiary record because of the detrimental effect that the proposed operation would have on the NRAO."

G. A. SEIELSTAD

IN GENERAL

1991 VAN BIESBROECK AWARD GOES TO BARRY CLARK

George Van Biesbroeck (1880-1973) (or "Van B" as he was affectionately called by his colleagues) made fundamental contributions to binary star astronomy until after his 90th birthday. He was widely known to several generations of astronomers for his selfless devotion to astronomy and for his behind the scenes contributions to the work of others. His meticulous attention to detail was legendary. In honor of Van B's lifelong unheralded accomplishments, a Tucson committee annually bestows the Van Biesbroeck Award to a contemporary astronomer who best characterizes the traits that were evident in Van B.

The 1991 Van Biesbrock Award has been given to the NRAO's own Barry Clark. Few of you who know Barry well will disagree with the appropriateness of the committee's choice. As a matter of fact, few of you who have ever observed with the VLA since 1976 or who have made VLBI observations since the early 1970s will have been immune to Barry's influence on your scientific productivity. Barry knows every aspect of the VLA hardware and software and has been the key to much of its development since he came to the NRAO in 1964. Currently, Barry spends a major portion of his time molding the control software for the soon-to-be-completed VLBA. Not one to let instrumentation concerns obscure his real love of astrophysics, however, Barry's extreme breadth of astrophysical knowledge has made him the mainstay of the VLA Time Allocation Committee. Since the start of VLA operations he has reviewed more than 5000 applications for observing time, and he personally schedules the 400+ programs per year that make use of the instrument.

Congratulations, Barry, and thanks.

R. J. HAVLEN

NRAO CD-ROM OF RADIO IMAGES

The National Radio Astronomy Observatory (NRAO) is collecting digital images of radio sources to be archived and distributed on a CD-ROM. A single CD-ROM can hold about 700 Mbyte of data, a capacity sufficient to hold about 300 16-bit maps 1024 pixels on a side, or about 5000 256^2 maps. We hope to collect the best radio images available that will fit, without restriction on source type (planets, radio stars, galaxies, etc.), radio telescope(s) used to obtain the data, or institution affiliation of the image donors. The images may be sent in any FITS format readable by AIPS (e.g., 2-dimensional continuum maps, 3-dimensional spectral line cubes, sets of 1-dimensional spectra, FITS extension tables listing source parameters) by 1991 July 1. Each must be accompanied by a signed copy of the NRAO CD-ROM submission form that describes the image (and will be included on the CD-ROM). You may obtain a copy of this form electronically as indicated below.

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

FITS tapes (9-track or EXABYTE) may be mailed to: J. J. Condon, NRAO, Edgemont Road, Charlottesville, VA 22903-2475.

Images on disk may be sent electronically via FTP as follows:

% ftp fits.cx.nrao.edu	(or % ftp 192.33.115.8)
> login anonymous	(or Name: anonymous)
> Password: guest	
> cd radio-cdrom	(subdirectory for the NRAO CD-ROM)
> get cdform.tex	(to get a TEX copy of the submission form)
> put imagename.tex	(to return the renamed and complete form)
> binary	
> put imagename	(to submit the image itself
> quit	

Send E-mail to dwells@nrao.edu to notify him of the file(s) sent, and mail a signed copy of the completed submission form to Jim Condon. If you have any questions about this CD-ROM project, contact Jim Condon by phone (804-296-0322) or E-mail (jcondon@nrao.edu).

J. J. CONDON

1991 JANSKY LECTURESHIP

It is a pleasure to announce that Dr. Allan R. Sandage of the Observatories of the Carnegie Institution of Washington will be the 1991 Jansky Lecturer. Dr. Sandage is well-known for his accomplishments regarding the size, age, and expansion of the universe. His many contributions to extragalactic astronomy and cosmology have earned him, among many other honors, the 1991 Crafoord Prize from the Royal Swedish Academy of Sciences. He will deliver his Jansky Lecture in both Charlottesville and Socorro in late Fall.

P. A. VANDEN BOUT

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NATIONAL RADIO ASTRONOMY OBSERVATORY
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