NRAO NEWSLETTER

1 October 1996 No. 69

GREEN BANK

GREEN BANK TELESCOPE

The accompanying photograph of the Green Bank Telescope (GBT) construction site, taken in early September 1996, shows the recent status of the antenna structure. The 140x163x40 foot deep elevation box structure, which one year ago was only half trial-erected, is now completely assembled and installed on the structure and 99 percent welded. The box structure will act as the support for the reflector backup structure, feed arm and elevation wheel. Its completion is a major project milestone.

The elevation wheel is complete. The counterweight boxes have been installed and will be filled with concrete in a pre-determined order to keep the antenna balanced and *tail heavy* as the structure grows. The elevation drive assembly is about 90 percent complete.

The top 60 feet of the upper vertical feed arm, which may be seen in the right side of the photo, have been completely trial erected at Green Bank. This assembly will be used for final setting of the subreflector surface and testing and calibrating all mechanical elements on the feed arm including the prime focus boom, the prime focus feed rotation mount (FRM), the subreflector adjustment mechanism, the turret in the feed/receiver room, and the entire feed arm servo. If possible, the entire assembly will be installed as a unit on the antenna following this extensive testing.

The subreflector backup structure, which is hanging from a frame to the left of the feed arm tip in the photo, is completely assembled and is at the site awaiting installation of the subreflector panels. The panels which have been manufactured, tested, accepted, and painted have met the specified tolerances. They were shipped to the site the first week in October.

In addition, the feed/receiver room, including the installation of the interior walls insulation and the feed turret, has been completed.

The completed backup structure (BUS), a portion of which may be seen in the left of the photo, will contain 7,625 pieces. Of those, 6,593 pieces have been fabricated and shipped to the site, and approximately 3,000 pieces are already in place. The BUS trial erection is continuing and trusses 19L through 19R are in place and aligned on the erection pad. The BUS is divided into 22 modules (1L through 11L and 1R through 11R) for assembly purposes; of those, the inner five are already completely welded. Following completion of the trial erection and installation of the horizontal and lower vertical feed arms, the BUS will be disassembled into its 22 modules and lifted into place on the antenna.

The 2,200 main reflector panels, currently in production and painting at the Contractor's plant, are scheduled to be shipped to Green Bank between January and June 1997 and installed on the BUS in late 1997. Final antenna delivery and acceptance are currently scheduled for December 1997. NRAO is encouraging the Contractor to explore every possible way to maintain this demanding schedule.

W.H. Porter

SURFSAT VLBI TESTS AT THE GREEN BANK TRACKING STATION

Testing continues at the Space VLBI tracking station in Green Bank During C band VLBI observations with the 140 Foot Telescope in conjunction with VLBA antennas, a test of the accuracy of time standard transmitted to the space radio telescopes was performed During space VLBI operations with the Japanese and Russian space radio telescopes, the tracking station will transmit a reference timing tone to the satellite, which is based on a ground based maser frequency reference. The satellite will transpond this tone back to the tracking along with the sampled wide band data. An important aspect of space VLBI is measurement of the frequency of the down link tone, which allows correction of the timing errors in the wide band data.

The hardware and software needed to measure the timing errors were tested during 96 September 8-12, when the maser signal used as the reference at the 140 Foot Telescope was first transmitted to an orbiting test satellite SURFSAT. The satellite transponds the downlink tone, which was received at the tracking station modulated on to a fiber optic link and to the 140 Foot where the tone was used as the timing reference for a VLBI observation The downlink tone contained frequency errors due to imperfect predictions of the doppler shift of the satellite relative to the tracking station Because the difference between the predicted and measured down link frequencies are continually measured at the tracking station, the resulting timing errors may be corrected at the correlator. The application of the time corrections has allowed detection of fringes between the 140 Foot and VLBA antennas

G.I. Langston

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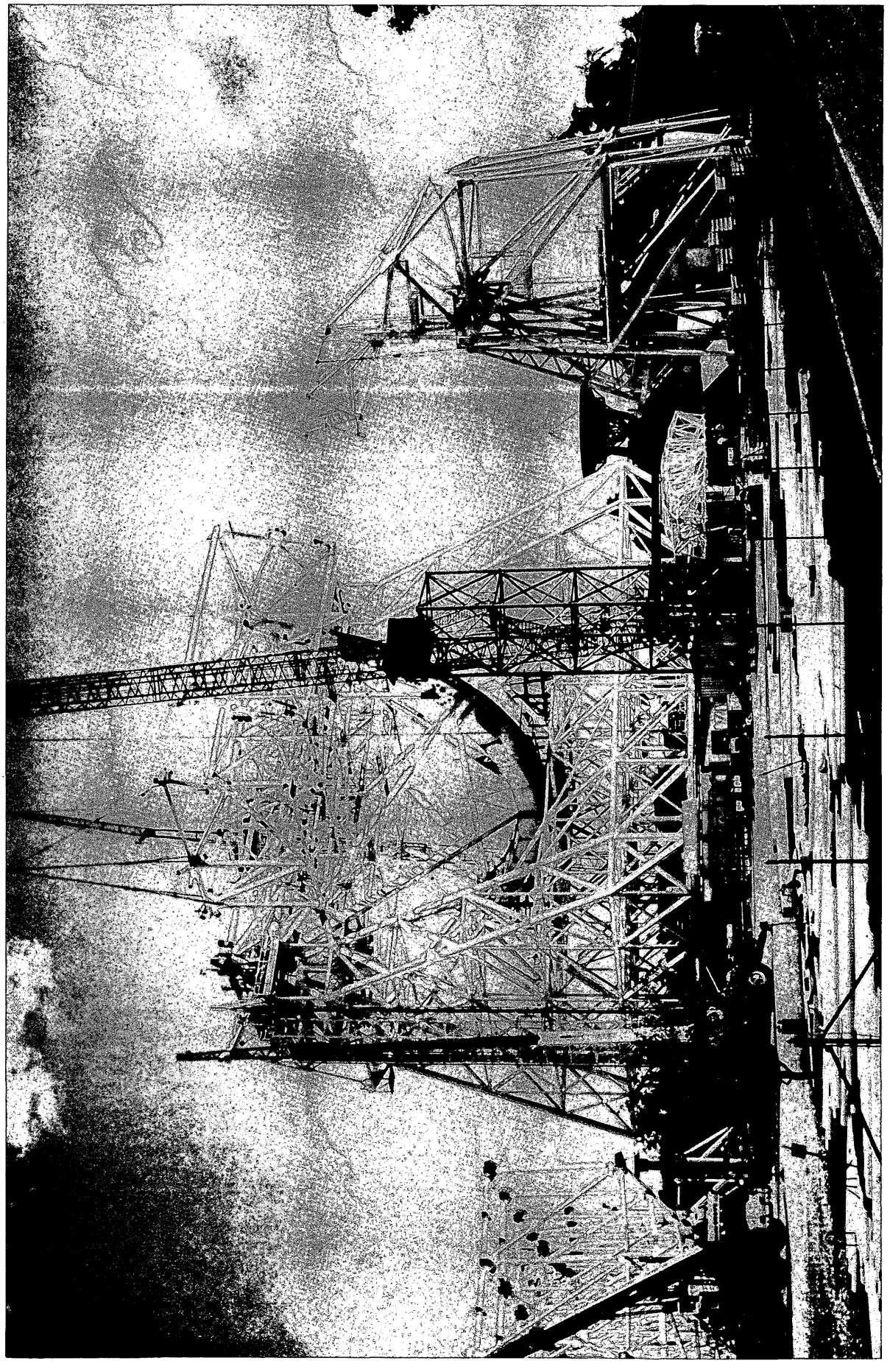

CONSTRUCTION PROGRESS OF THE GREEN BANK TELESCOPE (GBT)

STATUS OF THE 140 FOOT TELESCOPE AND FUTURE PLANS

Given that the Green Bank Telescope (GBT) will begin interim operations in 1998, the coming year will be the last year of "normal" operations for the 140 Foot Telescope. During the summer of 1997 we will begin to move equipment from the 140 Foot to the lab for refurbishing prior to its installation on the GBT. The first receivers to be removed will be at X band and Ku band. This coming winter will therefore be the last season of 140 Foot work at these bands. Because of NRAO's commitment to support of the VLBI Space Observatory Program (VSOP) mission, the K band receiver will remain on the 140 Foot telescope for general use throughout all of 1997.

As the GBT approaches completion, there are ever-increasing demands on our staff for development and installation of electronics and software. This coincides with a reduction in the number of new 140 Foot proposals received, no doubt in anticipation of the GBT. Because the GBT work is now our highest priority activity in Green Bank we intend to phase out the 140 Foot Telescope as a general user instrument as soon as possible, and this process will begin with a limiting of activities in 1997. By the end of 1997 the telescope will be used for astronomical observations no more than 50% of the time. Once the 140 Foot is retired as an NSF-supported user facility, it is expected that it will be operated for the privately-funded Project Phoenix of the SETI Institute. Project Phoenix observations are expected to begin on the 140 Foot in late 1996 and take up an increasing fraction of the time throughout 1997. After 1 January 1998, we intend to close the 140 Foot for general astronomical use, with the exception of VLBI in support of VSOP projects at L, C, and K band. Those observations will extend through the period of the first VSOP AO, approximately August 1998, after which time the telescope will be operated solely for the SETI Institute and all NSF-supported observing programs will compete for observing time on the GBT.

These plans are necessarily tentative and predicated on the present schedules for the GBT construction and VSOP launch. For now, we will continue to accept proposals for any 140 Foot system. More information will appear in future Newsletters.

F. J. Lockman

LISTSERVER FOR THE GBT SCIENCE WORKING GROUP

The GBT's Science Working Group is now being carried on as an e-mail discussion group named gbtswg. To find out how to subscribe, send e-mail to majordomo@majordomo.cv.nrao.edu with the body of the message (not the subject) consisting of the word help.

H.S. Liszt

12 METER TELESCOPE

IMPROVEMENTS TO THE 12 METER TELESCOPE

During the 1996 summer shutdown period, the following improvements were made to the 12 Meter Telescope:

New central tertiary mirror mount. A more powerful drive system which is under computer control has been installed. This will shorten the time to switch from one receiver to another to less than 15 seconds, which will allow easier cross-correlation between pointing with the various 12 Meter receivers. For example, we are investigating the possibility of using pointing measurements at 3 mm to predict the pointing offsets for the 1 mm systems. This new mirror mount will also be equipped with a cold-load system which we will use to conduct more accurate receiver tuning and monitoring of the receiver temperatures.

Hardware upgrade to the 8-channel IF system The 8-channel continuum receiver system was completely rebuilt Programmable coaxial IF attenuators now make possible computer control of the total power and spectrometer signal levels Other modifications make the continuum system easier to monitor and compact in size. Frequency-agile LO synthesizers were installed in the downconverter modules. The 10 to 18 GHz synthesizers are fully computer controlled and monitored and can be adjusted to downconvert any existing IF signals from the frontends. These modifications will make automatic control and monitoring of the IF system possible and will allow for a more efficient computer-controlled receiver tuning.

Improved 258-295 GHz receiver performance. A modification to the receiver optics has lead to a 20 percent improvement in the single-sideband receiver noise temperature for this system.

Upgraded telescope monitor and control. The operator's interface was rewritten in Xlib, making the interface faster. The operator now uses a pure X11R5 windowing system, making it standard and consistent with most of the other systems in use at the telescope. Improvements to the planet/comet ephemeris loading were also made, making it easier to use

New axial focus servo Several improvements to the focus servo and brake control have been made to allow more accurate control of the radial focus. This will allow a more accurate setting of the radial focus and should find use in the damping of standing waves encountered during frequency switched measurements

J.G. Mangum for the Tucson Staff

OBSERVATIONS THROUGH THE 12 METER TELESCOPE DOME

During high winds or when a program source is too close to the sun, it is sometimes necessary to observe through the 12 Meter dome. For such observations, recent measurements at 230 GHz have shown that the decrease in signal strength through the side of the dry dome is about 1.6 dB (approximately 30% loss with a corresponding 25% increase in T_{sys}), while through the dry dome door the attenuation is about 3.2 dB (approximately 50% loss with a corresponding 40% increase in T_{sys}). Note, though, that the steel support structure in the dome and door can often block the telescope beam and make these decreases in signal strength larger, can produce standing waves in the system, and can cause additional pointing offsets from those determined with the unblocked system. Observers should use these measurements to determine the feasibility of continuing their observations when forced to observe through the dome.

J.G. Mangum

IMPROVEMENTS TO THE NRAO TUCSON WORLD WIDE WEB HOME PAGE

We have made a number of improvements to the NRAO Tucson home page. In particular, more information for prospective observers, information on data analysis software, and all telescope schedules have been added to this server. We continue to actively update this site and encourage prospective 12 Meter observers to use this site as a source of current information about the 12 Meter systems. The address is http://www.tuc.nrao.edu/Tucson.html, which can be accessed through the main NRAO home page at http://www.nrao.edu/.

J.G. Mangum

VLBA/VLBI

JOINT VLBI OBSERVATIONS WITH EFFELSBERG AND THE VLBA

The Effelsberg 100-meter telescope is now back in operation on a brand new azimuth track, after a four month period during which the 3200 ton structure was raised bodily on hydraulic jacks. In the meantime, a number of improvements have been introduced to make its participation in joint experiments with the VLBA as smooth as possible (see also NRAO Newsletter # 63, April 1995)

Following the successful playback at the VLBA correlator of a test recording, the VLBA terminal in Effelsberg will now use "thin" tape recorded at high density, as at the VLBA sites. This should simplify the construction of observing schedules MPIfR has purchased some Sony thin tapes, but tapes from the VLBA stock will be used until they have been packed on to glass reels.

The new 3-frequency receiver has been installed at the secondary focus. This supports dual-polarization observations at 15, 22, and 43 GHz.

First observations using a new frequency-switching capability have already taken place. Schedule-driven changes of frequency are now supported between receivers mounted at the secondary focus (2 3, 5.0, 8.4, 15.0, 22 0, 43 0 GHz) Tests show that frequency changes take about 45 seconds, thus allowance must be made for this when planning schedules Improvements in the telescope control program have reduced the time taken to react to a new source command.

Further technical information concerning Effelsberg and advice on preparing observing schedules can be obtained from the VLBI technical friend, Dave Graham (graham@mpifr-bonn mpg.de).

Proposals for using Effelsberg together with the VLBA should be submitted to:

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

and to:

Dr. R. Schwartz
Max Planck Institute für Radioastronomie
Auf dem Hugel 69
D 53121 Bonn
Germany

Electronic proposals (as a single Adobe Postscript file) should be e-mailed to:

propsoc@nrao edu

and to:

proposal@hp.mpifr-bonn.mpg.de.

The next proposal deadline is February 3, 1997.

R. Porcas (MPIfR) and P. J. Diamond (NRAO)

VLBA STATUS

During the third quarter of 1996 (period ending September 12, 1996) a total of 71 projects were correlated, an increase of more than 50 percent over the same period last year.

Two major milestones were reached recently. First, the backlog of old global MKIII projects finally was cleared. This was a source of great relief to VLBA Operations, and I would like to take the opportunity to publically thank all those who worked so hard to accomplish this. Jon Romney has written a memo (available in the VLBA News Page) describing the history of the backlog and the lessons learned.

The second milestone was the detection of fringes on the VLBA correlator from the old (1986) TDRSS data. Fringes were found using the software written especially for the correlation of VSOP data and so this achievement gives us confidence in our ability to correlate data from VSOP.

Earlier this year, the VLBA switched to using high density recording on thin tapes. This move enabled us to reach the goal of sustained 128 Mb/s recording. However, it has not been achieved without problems. The major problem is unexpected difficulties in reading the tapes by the playback drives at the correlator. However, we are optimistic that these problems can be solved.

P.J. Diamond

VLBI NETWORK CALL FOR PROPOSALS

Proposals for VLBI Global Network observing are handled by the NRAO. Global network sessions currently planned are:

Date	Bands	Proposals Due
12 Feb to 12 Mar 1997	0.7 cm, 1.3 cm, 6 cm, 18 cm	01 Oct 1996
21 May to 11 Jun 1997	1.3 cm, 6 cm, 18 cm *	01 Oct 1996
10 Sep to 01 Oct 1997	1.3 cm, 6 cm, 18 cm, other?	03 Feb 1997
05 Nov to 26 Nov 1997	1.3 cm, 6 cm, 18 cm, other?	02 Jun 1997

* On the EVN, this also includes 5 cm line observations.

It is expected that European VLBI observing in 1997 will be dominated by observations with the VSOP satellite. Further information about Global Network VLBI observing may be transmitted on the VLBI e-mail exploder (send subscription requests to vlbi-request@nrao.edu).

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 WWW. Printed forms, for filling in by typewriter, are available on request from Betty Trujillo, AOC, Socorro.

Any proposal requesting NRAO antennas and antennas from two or more institutions in the European VLBI network constitutes a Global proposal Global proposals MUST reach BOTH Network's Schedulers on or before the proposal deadline date; allow sufficient time for mailing. In general, fax submissions of Global proposals will not be accepted. Proposals 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 even 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

B.G. Clark

VLBI SOURCE POSITIONS

Users of the VLBA correlator are reminded that VLBA Operations requires accurate positions well before correlation occurs. A rule of thumb is that the required precision in arcseconds be better than the observing wavelength in centimeters divided by twice the integration time in seconds Due to the small time lag (typically 10 days) between observing and correlation, we strongly suggest that users use the best available positions when generating their schedules. The current "sources.vlba" catalog provided with SCHED is derived from the correlator source catalog and contains positions that are among the best available. Users are requested to use that catalog. At the time of correlation, VLBA Operations will use the position from the correlator catalog. If the target source is not present in our catalog we will use the position in the " sum" file generated by SCHED.

Users are also reminded that when using the phased VLA very accurate (< 0 1 arcsec) positions are required at the time of scheduling, especially when transferring the phase corrections from a calibrator observed in mode VA to a VLBI source observed in mode VX.

There are occasions when a source position is not well known and might be bad enough that the residual fringe rates can drift outside of the fringe-rate window. If a user knows in advance that this is the case, we now offer a service whereby we will attempt to refine the position for them. This will be done by correlating a small amount of data (~ 2 hours), reading it into AIPS and running the task FRMAP to determine the offset from the nominal position by analysis of the residual fringe-rates. The whole project will then be correlated using the new position Users must tell us at the time they write their observing schedule that they will be requesting source position determination. We wish to avoid abuse of this service and therefore each request must be approved beforehand by Phil Diamond.

P. J. Diamond

VLA

PROGRESS ON THE VLA UPGRADE

A desirable goal for a VLA Upgrade is to provide continuous frequency coverage between 1 and 50 GHz. Such frequency coverage could be obtained using ten feeds, each with the 1 5 1 bandwidth ratio (the ratio of the highest to lowest useable frequency with the band) that can be produced by modern polarizer design for circular polarization However, the current subreflector is too small to permit ten feeds to fit around the secondary focus ring, so a new, much larger subreflector would have to be designed and installed This necessarily large subreflector would be so large that it is impractical to design a system to remove it Thus, prime focus operation, which is necessary for frequencies less than about 1 GHz, would not be possible.

Alternatively, we could consider an eight-feed system, with the lowest three bands (L, S, and C bands) each having a 2.1 bandwidth ratio The latter option permits use of the current subreflector, but may require use of linear polarization A distinct advantage of this option is that it should permit retention of the current subreflector, which is small enough to consider ways to mechanically remove it, thus exposing the prime focus for low-frequency operation. Both options are being carefully studied in terms of their mechanical requirements and electromagnetic performance.

A key aspect of the VLA Upgrade is linking nearby VLBA antennas, and possible new antennas, to the VLA correlator through optical fiber, so as to make an extended array (usually referred to as the A+ configuration). A fiber connecting the VLBA Pie Town antenna to the VLA control room is now in place (having been provided by the Western New Mexico Telephone Company) The AOC engineering and on-line programming staff are developing a plan to incorporate the Pie Town antenna into the VLA for testing purposes. Such an arrangement would double the VLA's resolution, and provide excellent imaging capability for objects north of declination 40 degrees

R A Perley and R.A Sramek

OBSERVE

The most current version of observe is 3 2.29, dated 1996 05 06

A new version of observe is being prepared that supports offset cards (fast switching, mosaic, and tipping). This version was implemented late in September 1996 (as the newsletter is going to press) The new version will be numbered 4 0 0 and should be available around October 1, 1996

The latest version may be obtained via anonymous ftp from ftp aoc nrao.edu or from the WWW URL ftp //ftp aoc nrao edu/ pub/observe/.

W.K. Young

VLA CONFIGURATION SCHEDULE

Configuration	Starting Date	Ending Date	Proposal Deadline
A	18 Oct 1996	13 Jan 1997	03 Jun 1996
BnA	24 Jan 1997	10 Feb 1997	01 Oct 1996
B	14 Feb 1997	26 May 1997	01 Oct 1996
CnB	06 Jun 1997	23 Jun 1997	03 Feb 1997 5 p.m. EST
C	27 Jun 1997	15 Sep 1997	03 Feb 1997 5 p.m. EST
DnC	26 Sep 1997	13 Oct 1997	02 Jun 1997 5 p.m. EDT
D	17 Oct 1997	12 Jan 1998	02 Jun 1997 5 p.m. EDT

The VLA is currently scheduling two large surveys. One was done in the DnC and D configurations and is essentially completed, except for making up time lost to interference, etc. The other covers the north galactic cap (07^h-17^h) in the B configuration Observing time in B configuration at this LST will be much reduced over past practice; on the other hand, observations disjoint with the survey 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 configurations are the hybrid configurations with the long north arm, which produce a round beam for southern sources (south of about -15 degrees declination).

Approximate Long-Term Schedule

	Q1	Q2	Q3	Q4
1996	C	D	D	A
1997	B	B,C	C	D
1998	A	A,B	B	C
1999	D	D,A	A,B	B
2000	C	C,D	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. In 1997, the B configuration daytime will be about 23^h RA and the C configuration daytime will be about 08^h RA.

Time will be allocated for the VLBA on intervals approximately corresponding to the VLA configurations, from those proposals in hand at the corresponding VLA proposal deadline. It is anticipated that the VSOP satellite will be launched early in 1997, and a gradually increasing fraction of VLBA observing, eventually approaching one third, will be devoted to observations with the spacecraft VLBA proposals requesting non-NRAO antennas must be sent to the institution operating these antennas. 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. 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

VLA - RFI AT 1665-1667 MHz OH

Since spring 1996, mainline OH observations with the VLA have become virtually impossible because of new geostationary- satellite emissions at 1533-1535 MHz. Owing to intermodulation in the first mixer, this satellite signal overlays any 1665-1667 MHz signal also entering the feed horn The power from the new satellite is very strong, even when observed by the isotropic sidelobes of the VLA antennas pointing 20 degrees away from the GSO (geostationary orbit) arc, which the VLA sees at -5 degrees declination

However, this serious problem should disappear early next year, before March 1997, when we fully implement a new phase switching scheme in all antennas In early October 1996, six prototype 180 degree phase switches will be installed and tested in the output of the L2 200 MHz reference frequency. Tests with early prototypes showed this phase switching can reduce the image by more than a factor of 100, and also reduce several other images and internal birdies See VLA Electronics Memos 222, 223, 224.

W.D. Brundage

MODIFIED C CONFIGURATION IN 1997

Many C array observations – notably, most extragalactic HI work – require the addition of some short spacing information from D array to adequately model the large-scale structure of the source. We have developed a modified C configuration, the CS (C-short) array, which gives a similar resolution to the regular C array, but includes spacings as short as the shortest in the D array.

In the new CS configuration two telescopes will be shifted from the middle of the C array east/west arms to inner D array stations to provide the short spacings Specifically, we will move antennas from W12/E12 to W3/E3. Extensive tests of this configuration using HI observations of the face-on spiral galaxy NGC 1058, with HI extents in individual spectral channels ranging from a few to 15 arcminutes, show that the CS array performs as well as the combined C+D arrays on all spatial scales, to within the thermal noise level. While 12 2 hours on-source in C array leave an obvious negative "bowl" surrounding the source, missing a third to half of the flux density, 5 4 hours on-source in CS array yield flux densities in individual channels which agree with single-dish measurements to within the single-dish errors (of order 5 %). Subtracting the deconvolved C+CS+D array images from those made from CS array alone shows further that the CS array reproduces the structure of the source in each channel to within the thermal noise, at resolutions of 15, 30, and 60 arcseconds. The total flux densities in each channel from the CS and C+CS+D arrays also agree to within the thermal noise, corresponding to better than half a per cent on channels with reasonable signal. These results agree quite well with detailed noiseless simulations (Holdaway 1994) Based on these tests, there is no reason to prefer the combined C+D arrays to CS array alone, in cases where uv-coverage rather than surface brightness sensitivity is the limiting factor. Further, it is very unlikely that the standard C array will perform better than CS array for any realistic (non-pathological) brightness distribution

In summary: observers who would normally propose short D array observations to fill in missing short spacings should ask for CS array instead. In most other cases CS and C should be basically equivalent. The one obvious exception is for scaled-array mapping, e.g., the derivation of spectral indices, which require nearly identical uv-coverage at different wavelengths.

We will move to the conventional C configuration in May 1997; at some time during the configuration we will move to the CS configuration. Proposers are invited to note on their proposal cover sheet their preference for the conventional or the modified configuration. We will make some effort to honor this preference, but will not guarantee to do so. For sample uv-plots, see VLA Scientific Memo #167 (Holdaway 1994). For further details, please contact Michael Rupen (mrupen@nrao edu, 505-835-7248)

M P. Rupen

ANTENNA 23 BEARING REPLACEMENT

A third azimuth bearing has been replaced, this time on antenna 23 at the VLA The antenna was selected on the basis of pointing performance and measurements of bearing motion done with a computerized dial micrometer There were 18 damaged spacers and some damage to the induction-hardened bearing races, but the roller bearings and races did not show the damage seen on one of the previous antennas with a replaced bearing, antenna 9.

The original Kaydon bearing assemblies that are failing have metal spacers between the bearing rollers. Because of wear the spacers can rotate, and when one does, it wears rapidly introducing metal particles into the lubricant. The particles and the damaged spacer accelerate wear to the bearing races. Plastic spacers in the replacement Rotek bearings may also rotate but are unlikely to cause further damage when they do.

A major expense in the previous azimuth bearing replacement on antenna 9 was having the bearing support surfaces turned to a tolerance of 0.012", work necessary to reduce any twisting moment of the bearing to within specification Since the surface cannot be measured until the bearing is out, a substantial reservation fee was necessary to insure the machining vendor would be available while the antenna was disassembled This time, a rotating lathe was designed and fabricated in-house. An assembly consisting of a radially-controlled machine tool on the end of a rotating 10 foot beam fits inside the bearing pocket once the part of the antenna from the yoke arm up is removed Although it was unnecessary to use the instrument on antenna 23, a "trial run" went satisfactorily and the tool was able to machine a sample surface to within tolerance The saved reservation fee alone will amortize the cost of the instrument in about 2 ½ bearing changes

C.C. Janes

VLA AD HOC OBSERVATIONS and VLA AND VLBA TARGET OF OPPORTUNITY OBSERVATIONS

For description, see the URL. http://www nrao edu/vla/html/tooprop shtml

B.G. Clark

Q BAND (43 GHz) ON THE VLA

Fast switching phase calibration will be supported by the on-line system at the VLA for the upcoming A array, and the mode has been incorporated into the latest OBSERVE program. Following is an example of the implementation of fast switching in an observe file:

```
1013+248          10 10 00 10 13 53.4344 +24 49 16.359C   XX   IRC  0000  1.05
//DS              10
1013+248          10 50 00 10 13 53.4344 +24 49 16.359C   QQ   C      0000T
//DS              1
//OF   NOD SKY    10 14 47.0654 +23 01 16.568                         30  70
```

In this example the calibrator source is 1013+248 and the target source is 1014+230. The first source card entails a pointing scan at 8 GHz on the calibrator. The second source card indicates the stop time for the fast switching series, and gives the calibrator position; the observing band (Q), the calibrator code (C), the bandwidth code (0000) and applies reference pointing (T). Fast switching between the source and the calibrator is delineated in the last card, which is an "off-set" card (//OF) in "NOD SKY" mode, giving the position of the target source, and the amount of time to spend on the calibrator and source (30 sec, 70 sec), respectively, move time inclusive. For instance, in the above example the total observing time at 43 GHz is 40 minutes, during which time a series of 100 sec observations are made of the source and calibrator, with 30 seconds for the calibrator and 70 seconds for the target source.

It is recommended to use a 1.6 second averaging time in this mode. Off-set pointing is allowed, as is any correlator mode consistent with the integration time and the number of antennas. The minimum allowed time per source is 20 seconds, implying a minimum total cycle time of 40 seconds. The amount of on-source time for such a minimum cycle depends on the distance, and orientation, of the slew between the source and calibrator As an example, in a recent test observation of a source and calibrator separated by 1.8 degrees, a minimum cycle (20 sec for source /20sec for calibrator) yielded 7 seconds of on-source time for each source.

For fast switching phase calibration a minimum calibrator flux density of 0.3 Jy is recommended. It is also recommended that every hour or so an observation be made of a stronger calibrator (1 Jy or greater), to determine pointing corrections and to track amplitude variations. The desired total cycle time, and time spent on the calibrator, will depend on the weather, the strength of the calibrator, the distance to the calibrator, and the desired image dynamic range. As an example, a "typical" cycle might involve 30 seconds on calibrator and 70 seconds on source, with a source-calibrator distance less than 2 degrees In this case the expected residual tropospheric phase fluctuations under good weather conditions at the VLA will have an RMS of about 20 degrees after calibration for all baselines longer than about 500 m, and less than this on shorter baselines.

Details of the technique can be found in VLA Scientific Memo No. 169. See the NRAO home page or call C. Carilli in Socorro (505-835-7306) for details.

C.L. Carilli and K.P. Sowinski

IN GENERAL

LARGE PROPOSALS COMMITTEE

The large scale surveys currently in progress at the VLA have raised a number of issues. Paul Vanden Bout has recently appointed a committee to consider whether or not the Observatory needs a written, disseminated policy for handling observing projects that require unusually large amounts of observing time on any of the NRAO telescopes. If so, the committee will also consider the following questions. What is the threshold for large? Should there be any upper limit to the fraction of observing time at each telescope that could be allocated to large projects? What mechanism should be used to receive and evaluate such proposals, if the normal system is judged to be inappropriate? What, if any, special procedures are needed to evaluate, schedule, supervise, archive, and disseminate the data from large observing projects?

The committee members are Donald C. Backer (Berkeley), Alan H. Bridle (NRAO, Chair), Edward B. Churchwell (Wisconsin), Martha P. Haynes (Cornell), Jacqueline N. Hewitt (MIT), David E. Hogg (NRAO), and K.Y. (Fred) Lo (Illinois)

All users of NRAO telescopes are welcome to express their views on these questions, or others related to the handling of unusually large projects at the telescopes, by contacting any of the committee members. It will however be particularly helpful if any written comments on these issues are sent by e-mail to abridle@nrao.edu before mid-November.

A.H. Bridle

MILLIMETER ARRAY

Over the past few months work has proceeded in a variety of directions all aimed at better characterizing the site in Chile. From archival stereo pairs of photographs obtained by the Chilean Air Force a digital elevation map of the Chajnantor site has been created which gives elevation contours to an accuracy better than five meters. This map will be used to layout the possible location of antenna foundations, site roads, utility distribution lines and so forth. An image of the site has been created from these same data; it can be accessed via the WWW (http·///www.tuc.nrao.edu/mma). Also given here is an image of an adjacent area of the same site known as Pampa la Bola that is being studied by the Nobeyama group as one of the possible sites for the Large Millimeter and Submillimeter Array (LMSA)

Preparations are underway to measure the usefulness of the site for submillimeter astronomy. The 225 GHz tipping scans that give the opacity at 1300 microns suggest that the transparency in the 450 and 350 micron atmospheric windows should be very good. However this inference is based on atmospheric models that have as their input the column density of atmospheric water. This quantity is indirectly inferred from the 225 GHz opacity measurements: the 225 GHz opacity if a sum of a contribution proportional to the precipitable water vapor (PWV) and a "continuum" contribution that is itself the integrated effect of the opacity in the very distant line wings from many 0_2, N_2, and 0_3 lines in the IR. It is very difficult to disentangle these two terms and extract PWV from the opacity measurements. There was an entire session at the recent URSI meeting in Lille addressed to this subject that served to emphasize how complex the analysis is. Fortunately, our interest is in the total submillimeter opacity and this is a quantity we can simply measure. To this end a 350 micron bolometer tipper has been built in Tucson as a collaboration between the NRAO and the CARA south pole observatory. In the next three months copies of the tipper will be installed both on the Chajnantor site and in Antarctica. A comparison of the 350 micron opacity with the 1300 micron opacity will give us a reliable estimate of the fraction of the time submillimeter astronomy can be done from the Chilean site and it will be useful to atmospheric scientists as well.

The MMA Development Consortium (MDC) working groups continue to make progress in addressing the central design issues facing the MMA. The antenna working group is concentrating on a goal of having a fiducial design complete in sufficient detail by the start of FY98 that a contract for a single prototype antenna can be let at that time. The hope is to test that prototype with sufficient rigor that the construction contract for the remaining antennas can be confidently bid as a "build to print" contract which has the potential for substantial cost savings. The MDC receiver group is encouraging an exploration of the use of photomixers as a LO source. Several groups are now reporting success mixing two optical/IR lasers such that the beat tone can be used as an extremely broadband microwave local oscillator. Should this technique achieve its potential it has the capability to simplify greatly the complexity of the MMA LO and produce a substantial savings. Plans for some basic experimental work are being drafted.

The interest of the NSF in seeing the MMA secure the participation of other government agencies and/or international partners is being pursued with a variety of initiatives proposed. One possible collaboration between the MMA and the LMSA to create, periodically, a single combined instrument with a resolution of about 10 milli-arcseconds will be discussed from a scientific and technical standpoint at a meeting in Tokyo next March. Please contact me if you would like details of this meeting. Meanwhile, the prospect for other partnership initiatives will certainly be enhanced if the MMA design and development phase is indeed included among the NSF plans for FY98 major research equipment.

R.L. Brown

USERS COMMITTEE MEETS – SYNOPSIS OF REPORT

The NRAO Users' Committee met June 17-18 in Charlottesville Mary Barsony (UC - Riverside) chaired the meeting The following is a synopsis of the Committee's report; the full report is available on request.

The Users' Committee commends NRAO for doing a remarkable job of providing research instrumentation and computational resources at its diverse sites for the entire astronomical community. NRAO deservedly leads the radio astronomy world due to the quality of its personnel and their dedication and hard work The Committee praises NRAO for taking the leadership role in planning the forefront research infrastructure of the future: the Millimeter Array and the VLA Upgrade

The Committee expressed concern over the consequences of reduced operating budgets, particularly if these continue into the future, and appreciation for the level of progress that has been achieved despite dimished resources. In particular, the Committee noted that the Observatory had managed to bring the VLBA on line, support space-VLBI, made progress in the construction of the Green Bank Telescope, continued the effort to develop AIPS++, added On-the-Fly mapping and multi-beam receivers to the 12 Meter Telescope, continued Millimeter Array site testing and development, and made improvements to the efficiency at high frequencies of the VLA antennas

The Committee strongly endorsed the Millimeter Array. The Committee was encouraged by the excellent characteristics of the Chilean site and urged the NRAO to approach NASA for support for submillimeter receivers The timely development of an antenna concept was commended.

Among the specific recommendations made by the Committee was that the Observatory develop a policy for handling observing proposals that require unusually large amounts of observing time. Better communications and dissemination of information by NRAO was encouraged, specifically, by the use of listservers and the World Wide Web.

With respect to the Green Bank Telescope, the Committee expressed a number of concerns: that there be a spectrometer at first light, that the development of the operating plan and staff begin soon, and that radio frequency interference (rfi) issues be addressed in constructing the local control building. The Committee was pleased with the program of testing the laser metrology system on the 140 Foot Telescope, and endorsed plans to hold GBT science workshops. Noting that the GBT will be the largest collecting area at 7 mm in the world, the Committee asked that a high priority be placed on the 43 GHz receiver system and the pointing ability of the GBT.

The Committee understood the necessity of phasing out the 140 Foot Telescope operations, but urged the Observatory to be sensitive to the needs of the space VLBI program for observing time during this period.

The Committee, cognizant of the growing threat of radio frequency interference, urged the NRAO to continue and expand programs to monitor rfi and seek any solutions that may be available. Early negotiations, such as led to the agreement between the NRAO and Motorola on IRIDIUM, were encouraged, as were efforts to educate public and corporate sectors to the consequences of rfi.

With respect to the 12 Meter Telescope, the Committee had praise for the steady increase in capability over a wide frequency range, particularly, the development of On-The-Fly mapping. NRAO was urged to rebuild the staffing levels in Tucson and place a high priority on completion of the 3 mm 8-channel receiving system. A new spectrometer for the 12 Meter was given lower priority than completion of the GBT spectrometer

With respect to the Very Long Baseline Array, the Committee was pleased with the progress made toward routine and efficient operation and the reduction of the backlog of uncorrelated projects. NRAO was urged to particpate in the promising development of thin film head stacks for data recorders, and to continue to work on improvements to data analysis software. Enthusiasm was expressed for the participation in orbiting VLBI

With respect to the Very Large Array, the Committee was very enthusiastic about the Q-band receiver system, the improvements in aperture efficiency, and the success of the Socorro Guest House. While impressed with the job being done to restore and maintain the VLA, the Committee was concerned that funding levels were harming this program.

The Committee endorsed the VLA Upgrade as the highest priority construction project for NRAO after the Millimeter Array. The Observatory was urged to continue to prototype and test new receiver systems, such as the K-band and L-band systems currently in progress, and to hold a second VLA Upgrade Science Workshop.

The Central Development Laboratory was commended for a number of new developments, including low-noise wide-band amplifiers, millimeter mixers, high performance polarization splitters, and the GBT spectrometer. Development work relevant to the Millimeter Array was strongly encouraged and the NRAO support for the Microwave Anisotropy Probe mission was endorsed.

The Committee was dismayed by the lack of funds to maintain the Observatory's computing hardware at a level more compatible with industry developments. A high priority was given to maintaining a critical mass of AIPS programmers. Recent improvements to AIPS were welcome and encouraged. The planned cooperation with the National Center for Supercomputing Applications was endorsed.

The Committee found AIPS++ to be more controversial and Committee members expressed widely divergent opinions on what the future of this system should be Most agreed that an assessment of AIPS++ was in order following the beta release in early 1997. Concern was expressed that AIPS++ be able to take advantage of more powerful systems than the minimum hardware being specified. Opinion was divided on the issue of whether developing new capability or replacing the capability in AIPS should have the higher priority.

Next year the User's Committee will be chaired by Roger Foster (NRL). The current subcommittees are:

VLA/VLBA. J. Cordes (Cornell), R. Mutel (U. Iowa), J van Gorkom (Columbia), R Windhorst (Arizona State).

MMA: J. van Gorkom.

GBT: M Bell (HIA), J Cordes, R. Foster, Z. Arzoumanian.

AIPS++: R. Foster, L. Higgs (DRAO), R Mutel

Mary Barsony, Chair

THE NRAO FRAME RELAY "INTRANET"

At present, the NRAO uses the Internet for communication between all of its sites, as well as for communication to other institutions. As any Internet user is aware, the performance is inconsistent and is getting worse, mainly because usage is growing faster than the Internet communications lines and hubs are being upgraded.

Communication via asynchronous, relatively low volume, methods (e g., electronic mail) is still acceptable but interactive response, for most of the working day, is not. The business groups at both eastern sites do all of their work on the AS400 computer in Socorro. When the Internet is "impossibly slow," there is an "emergency" dial-up line; this is now in use most business days. Communication between Socorro and the VLBA antenna sites, although nominally 56kb, is less than would be achieved with a dial-up modem. In addition, the NRAO serves the community through the WWW, and especially in Green Bank, the bandwidth is not sufficient to support the traffic.

While the NRAO has no choice but to continue to use the Internet for external traffic, there is an economical way of providing improved internal communication. This is to install an "intranet" using frame relay service.

The frame relay service will provide guaranteed bandwidth between six of the VLBA sites and the AOC. It will also provide guaranteed service between the NRAO's four major locations. Further, it will provide much improved service from Green Bank to the Internet. In addition, it will provide secure service for all traffic between these sites; this is especially important for the Fiscal Division. The single contract for frame relay service will replace seven existing contracts for Internet service for eight locations. The current schedule is for most of the intranet to be in place in mid-November.

All circuits were specified by analyzing the current inter-site traffic on the existing connections. It will clearly be necessary to review the new network continuously after it is installed and make the appropriate bandwidth adjustments where possible.

How will this affect the NRAO user community? First, the bandwidth to Green Bank will obviously be much superior. In addition, since the internal NRAO traffic in Tucson, Socorro, and Charlottesville will no longer use the Internet gateway, there may some improvement in the access from outside the NRAO to those sites. Secondly, institutions and projects that need relatively high volume dedicated access to the NRAO can be added to the network. Currently a special circuit, funded by Project Phoenix, has been added to the intranet to support the SETI project in Green Bank. Other organizations are also considering dedicated connections.

G.C. Hunt

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