NRAO NEWSLETTER

1 July 1995 No. 64

GREEN BANK

GBT CONSTRUCTION PROGRESS

A significant milestone in the GBT project was reached on May 2 and 3 when the two halves of the 200 ton elevation shaft were lifted into place. On May 10 the two halves were jacked together, and the measured deflection of the alidade towers agreed very well with calculations, indicating that the finished structure behaves like the design. Work on the box girder that forms the base of the arm is now underway, as can be seen from the photograph on page 2. During the coming months, construction will focus on the box girder and elevation wheel, and the temporary scaffolding to the center of the elevation axle will be removed.

The alidade is now complete. It weighs 5.6 million pounds. All the lighting, power handling equipment, motor generator sets and so on are in place. Four 40 horsepower azimuth drive motors have been installed. The receiver room turret which will hold the Gregorian receivers and feeds is on site, and is visible in the lower left of the photograph.

F.J. Lockman

DYNAMIC ANALYSIS OF THE GBT STRUCTURE

In February 1995 Ben Parvin, the NRAO's consultant on servo issues, completed the first stage of an analysis of the servo system of the GBT. They developed a model of the servo which included the finite element structural model, the gear boxes and drives, and wind disturbance models. This study is available as GBT Memo No. 129.

The most important finding of the study concerned the dynamical response of the telescope to a step motion of one degree in azimuth. The analysis predicts that the structure will oscillate about the commanded position, and that it will require some tens of seconds for the oscillation to subside. The amplitude of the oscillation is about thirty arcseconds (peak-to-peak) for a telescope motion of one degree.

The report by Parvin also looked at a step in elevation and found that oscillations in elevation were very small. Also, cross-coupling from elevation to azimuth is not observed, due to the symmetry of the structural model. The pointing variations fall below 2 arcseconds within 15 seconds.

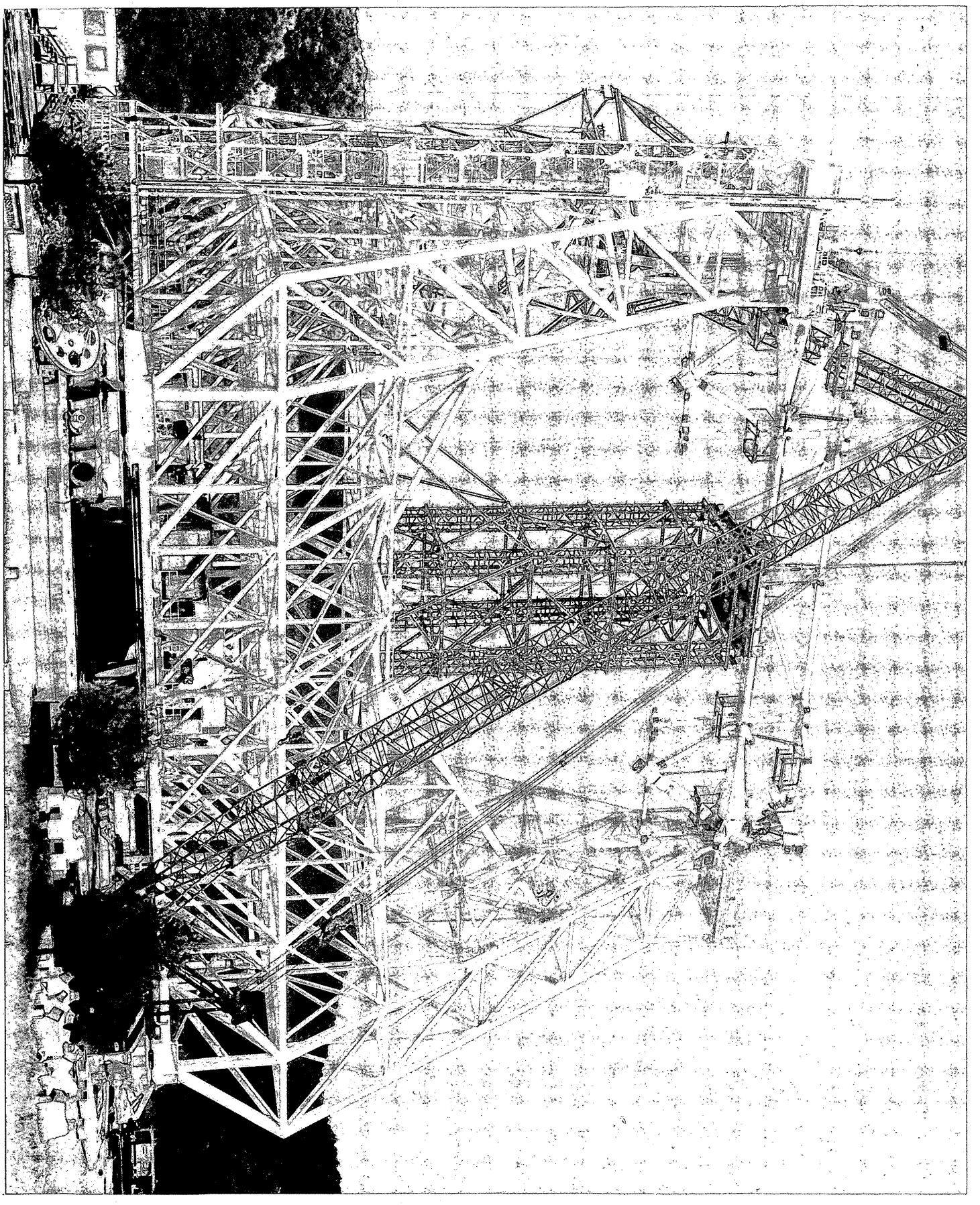
The response to a wind which is steady at 6 m/s, gusting to 7 m/s, was studied. With the wind coming from the most unfavorable aspect there is a deflection corresponding to a beam motion of about 11 arcseconds, and a fluctuation of 8 arcseconds rms due to the gusting. Measurements near the GBT at an elevation of 90 feet show that winds of this speed are observed to occur less than two percent of the time (GBT Memo No. 126).

In April 1995, at the request of Bob Hall, John Payne convened a study group in Tucson to examine the Parvin report and to recommend what actions should be undertaken in response to it. The report of the study group is available as GBT Memo No. 127. In summary, the group recommended that a more advanced servo should be studied, that the position of the arm should be measured by a quadrant detector, that the feasibility of compensating for the motion of the arm using tertiary optics be investigated, and that a preliminary study of passive and active damping systems be made. Bob Hall has initiated work in these areas.

The first results arising from the new work are now available. A new servo simulation which uses a more advanced command preprocessor projects a much-improved performance for the telescope when it is position-switching. The preprocessor is modeled after one in use at JPL's Deep Space Network, and basically uses sinusoidal functions to accelerate and decelerate the antenna smoothly in response to step position input commands. The results indicate that for a 1 degree azimuth step command the antenna beam reaches position in ten seconds and overshoot and ringing is less than three arcseconds.

D.E. Hogg and F.J. Lockman

The NRAO Newsletter is published quarterly by the National Radio Astronomy Observatory,
520 Edgemont Road, Charlottesville, VA 22903-2475, USA NRAO is operated by
Associated Universities, Inc , under cooperative agreement with the National Science Foundation.
[Contact Joanne Nance (804) 296-0323, if you wish to receive mailings of the Newsletter]



GBT VLBA RECORDER AT THE 140 FOOT

A VLBA-type data acquisition system, intended for use on the GBT, has been installed at the 140 Foot, replacing the old Mark 2 and 3 systems for VLBI. The system, consisting of a VLBA data acquisition rack and tape recorder, was on loan to the former Soviet Union during the past few years and was used for several successful VLBI runs on a telescope near Vladivostok. It was returned to us last year, and was re-furbished and upgraded in Socorro last winter.

In April of 1995, the system installation at the 140 Foot was verified in a fringe test with two VLBA antennas, which set a record for time between observing and correlation of about two days. Since then it has been used successfully in the May network run.

The system is compatible with the VLBA recording system, and can record both in VLBA and Mark 3 modes. Potential VLBI users for the 140 Foot should plan to schedule it almost as if it were a VLBA antenna. Like the VLBA, the back end has 8 baseband converters (instead of the Mark 3's 14), and the recorder is capable of 14 tape passes instead of 12. Unlike a VLBA station, there is only one tape recorder, so users must allow time in the schedule for tape changes. At present, only thick tapes (9000 ft reels) are supported.

Scheduling is normally done through Socorro, with the help of the usual VLBA advisors and operators out there. Users can prepare schedules with the NRAO-sched program or with PC-SCHED, and should ftp the DRUDG files to "aspen" in Socorro. A pointing file for the 140 Foot needs to be prepared as well. Details of VLBA setup and scheduling are available through the WWW at URL http://info.aoc.nrao.edu. Local Green Bank contacts for VLBI are Bob Vance and Frank Ghigo.

F. Ghigo

DOCUMENTATION ON REMOTE OBSERVING WITH THE 140 FOOT

We continue to try to make remote observing with the 140 Foot easier. For example, a few new utilities have been created recently to help observers submit observing files and look at the Modcomp status screen. In addition, we will soon have available a package of documentation describing these new facilities and how to use the 140 Foot remotely. Observers should either write for a copy of the documentation or look for the documentation on the WWW among the 140 Foot pages under the Green Bank home page.

Please note that only certain classes of observations can be done remotely and observers must conform to certain restrictions. Anyone who is contemplating remote observing with the 140 Foot should read the article on this subject in the January 1, 1994 Newsletter. They should also contact me for guidance at least a month before the observations are to be performed.

R.J. Maddalena

140 FOOT DATA ARCHIVE

In September 1993, a new data archiving software system was installed on the 140 Foot (see the October 1993 Newsletter for details). The system recently has been expanded to include a data base management facility that allows anyone to query the archive for observations that meet a very wide range of search criteria. The user has a choice of commercial data base managers or spread sheets like Paradox, Excel, Lotus 1-2-3, DBase, Quattro, and Quattro Pro on any architecture on which these products run (PC, Mac, Sun, ...). In fact, any software package that can read files that are formatted as ASCII delimited text files can make use of the data base files. The system we find most useful (i.e., fast, powerful, and easy to learn) is Paradox for Windows (version 4.5 or later).

The data base files for the last quarter of 1993 and first half of 1994 are available and include all observations made with the autocorrelator or continuum backends but not the spectral processor. Since the data base files are large, users typically would not copy the files to their home institutions. Instead, they can query the data base during visits to Green Bank. Or, if they cannot be in Green Bank, they could have a member of the Green Bank staff query the data base.

This is a new facility in Green Bank so we do not know exactly what use will be made of the system. Anyone interested in using the data base should contact me to discuss how best to accomplish your goals.

R.J. Maddalena

CYGNUS A WORKSHOP

The scientific workshop entitled "Cygnus A" was held in Green Bank, WV from May 1-4, 1995. About 50 scientists from around the world gathered to discuss all aspects of this proto-type powerful radio galaxy. Countries represented included: the USA, Australia, Japan, Canada, the UK, the Netherlands, Denmark, Germany, Spain, and France. Likewise, the entire electromagnetic spectrum was represented, with presentations of observational data ranging from 75 MHz, through the optical and X-ray, to gamma rays. The workshop involved reviews of results from extensive observational and theoretical work on Cygnus A over the last 40 years, plus presentations of the most recent results from new instruments such as ASCA and the VLBA. Scientific questions addressed included: the physics of the active nucleus, quasar-radio galaxy unification, jet formation and propagation, relativistic particle energetics, radio source hydrodynamic evolution and its effect on the intercluster medium, magnetic field strengths and morphologies both in the radio source and in the cluster gas, and the cosmic evolution of powerful radio sources to large redshift.

The scientific organizing committee for the meeting was: Dan Harris (chair), Peter Barthel, Geoff Bicknell, Chris Carilli, Steve Eales, Anne Kinney, Rick Perley, Herman-Joseph Roser, Clive Tadhunter, and Martin Ward. The local organizers included Mark McKinnon and Becky Warner. Written contributions to the proceedings are being assembled by Chris Carilli and Dan Harris. The proceedings will be published as a 1996 release by Cambridge University Press. Dan Harris is also assembling a CDROM containing various images of Cygnus A across the electromagnetic spectrum. Those interested in contributing to the CDROM, or getting a copy, should contact: harris@ zaphod.harvard.edu.

The SOC would like to thank NRAO for their hospitality and commend the LOC for an extremely smoothly run workshop. Thanks also goes to AURA for providing travel support for some workshop attendees.

C. Carilli

140 FOOT BIRTHDAY CELEBRATION

Planning is underway for the 140 Foot 30th birthday celebration at the end of September. There will be a Green Bank Workshop on Sept 29 and 30, and a party at the telescope on the afternoon of the 30th. Anyone who is interested in further information can consult the Green Bank home page on the WWW.

F.J. Lockman

VLBA/VLBI

SPACE VLBI

NRAO is participating in two international Space VLBI missions involving orbiting 8-10 meter antennas. The VLBI Space Observatory Programme (VSOP), a project of the Institute of Space and Astronautical Science (ISAS) in Japan, is scheduled to be launched in September 1996, and is expected to begin scientific observations, after in-orbit commissioning, in January 1997. The Radioastron project of the Astro Space Center (ASC) in Russia is to be launched in 1997. Both spaceborne antennas will operate at 1.6, 5, and 22 GHz (plus 300 MHz for Radioastron) in elliptical orbits with apogee altitudes of approximately 22,000 km (VSOP) and 77,000 km (Radioastron).

These missions depend upon a substantial degree of "co-observation" by arrays of ground radio telescopes. NRAO's primary participation is a commitment of up to 30 percent of the VLBA's scheduled observing time to Space VLBI programs. The VLBA correlator has also been committed to correlate all Space VLBI observations in which NRAO telescopes participate. To ensure that these dedicated VLBA resources are available to all VLBA users, NRAO has taken the lead among ground observatories in establishing "open skies" policies for both Space VLBI missions, with observations open to proposers from throughout the astronomy community and subject to peer review.

An Announcement of Opportunity for VSOP was released by ISAS on June 30, 1995. The deadline for receipt of proposals at ISAS will be November 17, 1995. Further information on the AO, on VSOP, or on Space VLBI more generally can be obtained from the sources listed at the end of this article.

Other aspects of NRAO's participation in Space VLBI include the Green Bank Earth Station, described previously in NRAO Newsletter Nos. 57 and 63, and the "NRAO Space VLBI Project" at the Array Operations Center in Socorro. The latter project, funded by the Astrophysics Division of NASA, includes enhancements of the VLBA correlator, and of AIPS, to accommodate Space VLBI observations, and a program of specialized user support.

Although the VLBA correlator was designed as part of a ground-based array, its eventual use in Space VLBI observations was foreseen, and the design facilitates this application wherever it was possible to do so without additional cost. As a result, only fairly minor modifications to the correlator will be required; the main signal paths, comprising 95 percent of the hardware modules, are already Space-VLBI-capable. Among the enhancements required are the following. The correlator must

obtain and evaluate an ephemeris for an orbiting "station" which is not fixed on the surface of the earth. The SPICE software provided by JPL's Navigation Ancillary Information Facility will be used for this purpose, and is currently being integrated into the correlator's operational system.

The geometric delay, and its derivatives, for the orbiting element can exceed those for terrestrial stations by an order of magnitude. The wavefront model in the original VLBA correlator design allowed a more than adequate (in most cases an unlimited) range of all model parameters except the delay rate. Expansion of the delay rate range to accommodate Space VLBI orbits has been completed.

Imperfect knowledge of the orbit requires that the output data flow be sufficient to preserve unusually wide windows in residual delay and fringe rate. It has been determined that full exploitation of the basic VLBA capabilities—including a baseline-dependent integration interval—will provide a satisfactory margin for Space VLBI correlation. These capabilities have not yet been completed for ground-based observations, however, and currently are under development.

Finally, the current generation of Space VLBI missions have no on-board precision frequency standard; the phase-transfer process from a hydrogen maser on the ground is accompanied by errors which must be corrected in the correlator.

As in the case of the correlator, most of AIPS is already Space-VLBI-capable. The general facilities for calibration, integration, and visualization are all available for Space VLBI data analysis. Some additional capabilities are being added, to "Classic AIPS," to accommodate certain unusual features of Space VLBI imaging.

The wide residual delay and fringe rate windows provided by the correlator require more versatile fringe-fitting than is normally necessary for ground-based observations. Two new tasks, "BLING" and "BLAPP," have already been written to perform baseline-based fitting with baseline- and time-dependent search windows, at potentially large offsets, and with forward and backward extrapolation of fringe parameters.

The extremely high spatial resolution of Space VLBI makes direct imaging of maser emission regions impractical. This is already a problem, although an order of magnitude less severe, in ground-based observations. The fringe-rate mapping technique references the phases of all emission components to a given feature, and locates the rest using the resulting fringe rate residuals. A new AIPS task, "FRMAP," has already been completed to implement this technique.

Since the current generation of Space VLBI missions have relatively small antennas, observations of weaker sources will be limited to sparse arrays comprising only the largest available ground-based radio telescopes. To interpret these measurements effectively, a recourse to the model-fitting techniques used in the early days of VLBI is expected to be necessary. An interactive task to implement this technique conveniently and with a modern graphical user interface is under development.

Post-launch activities in the NRAO Space VLBI Project include maintenance, and if necessary further development, of the correlator and AIPS enhancements; operations support for the incremental cost of the VLBA's participation in Space VLBI observations; and a major user-support program. The latter is intended to provide expert assistance in data analysis to Space VLBI observers, at a level similar to the support NRAO currently provides for ground-based VLBI observations.

Extensive on-line documentation on the VSOP and Radioastron missions, and on all aspects of U. S. participation, is maintained by the U. S. Space VLBI Project at JPL. Their WWW home page can be accessed via URL 'http://sgra.jpl.nasa.gov.' The VSOP Announcement of Opportunity, and a Proposer's Guide, are available through this service. The U.S. Space VLBI Project also distributes an electronic newsletter (subscription requests, consisting of the single word "subscribe" in the message text, may be sent to 'svlbi-request@sgra.jpl.nasa.gov'), and operates an e-mail "help desk" to assist proposers at 'vsop_help@sgra.jpl.nasa.gov.'

J.D. Romney

THE ROLE OF VLBA CONTACT PERSONS

Due to the increased amount of VLBA observing and the welcome trend towards the use of the VLBA by non-traditional VLBI observers, the role of the contact persons for VLBA projects has been expanded. When assigning VLBA and/or Global observing time, Barry Clark will assign an AOC contact person to each project. The role of the contact person is to:

(a) Answer questions from the observer prior to the project.
(b) Advise observers on the preparation of nonstandard setups for the VLBA and/or VLA.
(c) Check that the schedule files are correct.
(d) Ensure that the schedule file does not conflict with the "Guidelines for VLBA Observations." The latest version is available on the WWW.
(e) Answer questions from the observer during the processing and post-processing stages.
(f) If the observer comes to the AOC to process his/her data, be the local "friend" during their stay.

P.J. Diamond

VLBA STATUS

The VLBA correlator has been in a mode of routine operation for most of 1995. We had a period of a few weeks in the spring during which the correlator software was upgraded as the first part of a major system redesign. This upgrade has resulted in more reliable and robust operation.

During the first half of 1995 (period ending June 14, 1995), a total of 111 projects were correlated (86 VLBA, 11 tests, and 14 Global). As in the previous quarters, the correlator is keeping up with the observing load for VLBA observations, including VLBA* format projects from the VLA, Effelsberg, and Green Bank. MkIII format Global projects observed since the beginning of 1995 are correlated as soon as possible after the tapes arrive in Socorro. In addition, we are also working through the pre-1995 backlog at a steady pace.

The handling of Global projects is still far from routine and is labor intensive. The problems encountered are many and varied, from the late arrival of tapes, the incompleteness of log information, the need for clock searches, and the varied quality of tape recording to the need for an increased level of scrutinization. Until these problems are solved satisfactorily, the throughput of Global projects will remain at the current level.

There are 28 MkIII projects requiring software that is not yet implemented but is being worked on. These projects are either Mode C, contain source and/or frequency sub-arraying, have many short scans, or do not have synchronized tape changes.

All the thin tapes have now been received, inspected, and transferred to self-packing reels. The VLBA has been scheduled for 60 percent astronomical observing during June.

P.J. Diamond and R.C. Bignell

VLBI NETWORK CALL FOR PROPOSALS

Proposals for VLBI network observing are handled by the NRAO. In particular, the Global network sessions for 1995 and 1996 are expected to be as follows:

Session	Dates	Bands	Proposal deadline
3	October	90	1 Jun 1995
1	07 Feb to 28 Feb	18, 0.7, 1.3	2 Oct 1995
2	22 May to 12 Jun	6, 3.6/13	2 Oct 1995
3	16 Oct to 06 Nov	TBD	1 Jun 1996

The October 1995 session will be one week or less, at 90 cm only. This rudimentary session is dictated by the schedule of the azimuth track repair work at Effelsberg. Exact dates have not yet been set.

Proposers should note that Mark II format recording is supported neither on the VLBA nor on the EVN.

It is recommended that proposers use a standard coversheet for their VLBI proposals. Fill-in-the-blanks TEX files are available by anonymous ftp from ftp.cv.nrao.edu, directory proposal. Printed forms, for filling in by typewriter, are available on request from Lori Appel, 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 Networks' 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

VLBA SUMMER SCHOOL PROCEEDINGS

The proceedings from the 1993 VLBA summer school are now in press: *Very Long Baseline Interferometry and the VLBA*, ed. J. A. Zensus, P. J. Diamond, and P. J. Napier, ASP Conference Series No. 82, 1995

The book contains 21 lectures from the 1993 VLBA summer school, covering:

1. Basic Theory
2. The Very Long Baseline Array
3. VLBI Data Analysis
4. Advanced VLBI Topics
5. Other Networks and Global VLBI
6. Planning VLBI Observations
   plus bibliography and index.

PREPRINTS

There is a WWW page giving access to preprints (postscript) of the chapters. This can be accessed from the NRAO Home Page, under "Workshops."

The book is published and distributed by the Astronomical Society of the Pacific in the ASP conference series. To order, contact the ASP directly at (800) 335-2624 (toll free, US) or (415) 337-5205, fax (415) 337-5205. NRAO is not selling or distributing the book.

J.A. Zensus

VLA

VLA CONFIGURATION SCHEDULE

Configurations	Starting Date	Ending Date	Proposal Deadline
A	23 Jun 1995	05 Sep 1995	1 Feb 1995
BnA	15 Sep 1995	02 Oct 1995	1 Jun 1995
B	06 Oct 1995	08 Jan 1996	1 Jun 1995
CnB	19 Jan 1996	05 Feb 1996	2 Oct 1995
C	09 Feb 1996	15 Apr 1996	2 Oct 1995
DnC	26 Apr 1996	27 May 1996	1 Feb 1996
D	31 May 1996	02 Sep 1996	1 Feb 1996

The VLA is currently scheduling two large surveys. One will be done at night in the DnC and D configurations (10^h-24^h and 14^h-04^h, respectively, for the 1996 D configurations), and one in the north galactic cap (07^h-17^h) in the B configuration (with a smaller strip in the south galactic cap in the 1996 B configuration). Observing time in those configurations and LSTs will be much reduced over past practice; on the other hand, observations disjoint with the surveys in those configurations will have more time available for scheduling than has previously been the case.

The maximum antenna separations for the four VLA configurations are: A-36 km, B-11 km, C-3 km, D-1 km. The BnA, CnB, and DnC 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
1995	D	D,A	A,B	B
1996	C	D	D,A	A,B
1997	B	C	D	D,A
1998	A,B	B	C	D
1999	D,A	A,B	B	C

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 (trophospheric phase variations, especially in summer). They should defer such observations for a configuration cycle to avoid such problems. In 1995, the B configuration daytime will be about 17^h RA and the C configuration daytime will be about 23^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

B.G. Clark

AN UPDATE ON THE STATUS OF THE VLA Q-BAND SYSTEM

Those observers who are planning to use the VLA Q-band (7 mm) system are advised to consult the Q-band section on the WWW which contains a complete set of documents relevant to Q-band. After accessing the NRAO home page (http://www.nrao.edu), click on "The Very Large Array," and "Q-Band Information." VLA Test Memo #189 gives a brief overview of the Q-band system from May 1994; the VLA 7 mm System Status Report and Ken Sowinski's memo entitled "Some Issues for Q-Band Observing" are required reading for anyone contemplating observing at 7 mm. The latter two documents are updated on a regular basis. Because of the extra complexity of Q-band observing (e.g., the need for frequent reference pointing at X-band), all Q-band observers are advised to send their observe files to analysts@nrao.edu to be checked well in advance of their scheduled observing time. Approximate Q-band flux densities have been measured for a number of VLA calibrators and are listed in VLA Test Memos #192 and #193, also available under "Q-band information" on the WWW.

Absolute flux calibration at Q-band is non-trivial and is currently under active investigation. Preliminary flux densities have been determined for 3C48 and 3C286 which are thought to be suitable for use at Q-band. It is anticipated that more definitive values will become available in the next few months. Observers who have successfully mapped objects in the previous year and who need more accurate flux densities may contact Elias Brinks (ebrinks@nrao.edu) for an update.

The VLA has just been moved to its longest baseline configuration. The ten antennas with Q-band receivers are placed on the inner three stations of each arm, with the tenth unit on the fourth station along the north arm. The maximum baseline length is about one-fifth of the nominal A-array. Given the unsettled weather over the summer months, users should expect poor phase stability at the higher frequencies, and at Q-band in particular. Much better conditions can be expected in the upcoming B-array. At that time three additional 7 mm receivers should be installed on the array. The thirteen Q-band antennas will continue to occupy the inner stations of the B and C configurations, but be distributed around the D-array. The suggestion has been made that the A configuration in 1996 should have the Q-band antennae on the longest baselines for a season of maximum resolution. Comments on the preferred Q-band configurations will be much appreciated.

E. Brinks and C.J. Chandler

OBSERVATIONAL STATUS REPORTS

Updated versions of the observational status reports for both the VLA and the VLBA are now available over the WWW. They can be accessed through the NRAO home page or directly via the following URLs:

VLA status report
http://www.nrao.edu/doc/vla/obstatus/vlas.ps

VLBA status report
http://www.nrao.edu/doc/vlba/obstatus/obssum.vlba.ps

If you desire paper copies of these reports, please contact Lori Appel in Socorro (lappel@nrao.edu).

P.J. Diamond

VLA ARCHIVE POLICY

All data obtained in VLA and VLBA observing proposals are archived. That is, the raw correlator output is archived, including in the case of VLBA programs correlated data from any non-VLBA telescopes that have been used. These data are reserved for the exclusive use of the observing team for a period of 18 months following the end of the last observations requested in the original proposal or a direct extension of the proposal. For VLBI programs that use the phased VLA, the VLA correlator data are immediately available to all unless the proposal specified that a VLA image was to be made as well as a VLBI image.

To obtain archive data after the 18-month period you must make a request to either the Assistant Director for VLA/VLBA Operations (Miller Goss) or the VLA/VLBA Scheduler (Barry Clark). You are strongly encouraged to contact the original observer. More often than not, she or he will be happy to provide a processed image. In any event, NRAO will inform them that a request has been made

If you wish to gain access to the raw data before the 18-month limit, you must obtain explicit permission from the Principal Investigator of the original proposal and then notify Miller Goss or Barry Clark. The name and address of the PI can be obtained from the publicly available cover sheets in any NRAO library or from the VLA/VLBA Site Director's office.

The contents of the VLA archive can be listed using the program VLASORS. See the January 1995 issue of the NRAO newsletter for more information.

A different policy applies to data obtained as part of the VLA Sky Surveys. Those data are immediately available to all, as are the images as they are produced. See the NRAO home page http://www.nrao.edu for more details.

P.A. Vanden Bout

COMPUTING AT NRAO-NM

In March, a meeting was held with all AOC scientific staff to discuss computing priorities. This was prompted by our wish to spend the limited Research Equipment budget as efficiently as possible. The prevailing opinion was that we should limit use of the powerful IBM machines to the most CPU- and disk-intensive projects. Currently, many medium-sized projects require too much CPU and/or disk space for the SPARCstation IPX systems to handle, and thus are forced to compete for limited IBM time. The plan is: (1) to start gradually replacing visitors' IPX workstations, beginning with two dual-processor SPARCstation 20s later in the summer; and (2) to enhance the CPU power of around 60 percent of the remaining IPX-class Suns (including the rest of the visitors' workstations) by upgrading them with the Weitek CPU chip, which is capable of boosting CPU performance by 70–80 percent.

We anticipate another performance improvement when we install the new fast disks on four of the most powerful IBM workstations. With the current older disks, many AIPS applications are I/O limited. The new disks are expected to arrive in June or July. One intended use for the existing disks after the replacement is to increase disk space on the SPARC visitor workstations, which, combined with the Weitek upgrade, is then expected to create a serious alternative to the IBMs for many medium-sized projects.

Computer security has become more of a problem recently. As a result of a recent incident, we have put a password on the "vlais" account. For more information on what VLAIS is, and how to obtain the current password, please see the article "VLA Information System" in this Newsletter.

We would like once more to remind you that the VLA archive database is now accessible on the World Wide Web with URL http://info.aoc.nrao.edu/doc/vladb/VLADB.html. It allows querying of the VLA database using various user-supplied criteria, after which the program displays a list of observations satisfying these criteria. The user can click on an item in this list to obtain a detailed view of the header information for that item. Note that the database is not yet complete; it is growing as our archiving project proceeds. Currently this covers all of 1976-1983 and 1991-1995. The complete list is given in the WWW page. A feedback mechanism allows the user to report problems and make suggestions for improvement.

G.A. Van Moorsel and M.R. Milner

VLA AND VLBA DATA TAPES

Upon request, the NRAO in Socorro, NM, has been preparing copies of VLA archive data on tape (usually Exabyte) and sending them to observers for a nominal charge. Now that the VLBA correlator is operational and we are preparing copies of the VLBA correlated data on tape for distribution to observers routinely, it is time to help offset the cost of this effort by charging for the tapes. Beginning August 1, 1995, there will be one policy covering cost for the distribution of either VLA or VLBA archive data. There will be a charge of $10 per tape (Exabyte, Dat, or 9-track) shipped to the observer. NRAO will pay for shipment of either Exabyte or Dat tapes to any location within the continental US by Federal Express and all other locations by surface mail. The observer will have to pay for the shipment of 9-track tapes. (These will be sent UPS ground unless other instructions are received.) The tapes will not be shipped until payment has been made to NRAO. Payment may be made either in cash, check ($US) on a US bank, money order, traveler's check, purchase order, or credit card. To arrange for payment and/or to expedite the shipment, please contact E. Latasa in Socorro (phone: 505-835-7357; fax: 505-835-7027; internet: elatasa@nrao.edu).

R.C. Bignell

VLA INFORMATION SYSTEM

NRAO has available a simple ASCII-oriented information system for VLA Observers. The system contains observing logs, baseline corrections, and a list of sources observed by the VLA since 1978. This system is normally accessed through any one of NRAO's Socorro systems and until now has not been pass-word protected. Unfortunately, due to security break-ins, we have had to password protect this account. If you need the password, you may contact Lori Appel at the AOC in Socorro (phone: 505-835-7310; internet: lappel@nrao.edu).

R.C. Bignell

SOCORRO SHUTTLE SERVICE

The Socorro Roadrunner Shuttle service is requesting that cancellations or changes in reservations be made with at least a three-hour notice or the customer will be charged for a "no show." Please keep this in mind when you travel to the NRAO in New Mexico and plan to use this service. The service should be contacted at (505) 835-1010 and if time permits, call Eileen Latasa at (505) 835-7357 during regular work hours 8:00 a.m.–5:00 p.m. MST, Monday through Friday or (505) 854-2328 (home) after work hours. The no show charge is the responsibility of the traveler.

J.P. Lagoyda and M.T. Romero

VLA DEVELOPMENT PLAN

The first Science Workshop to discuss the VLA Development Plan was held January 13-15 1995, in Socorro. It was attended by roughly 60 scientists from the NRAO and elsewhere. We have assembled a document that gives a technical overview of the project and collects the discussions that occurred in five scientific working groups during and after this workshop. The document is a first step towards a proposal for major enhancements in the sensitivity, frequency coverage, bandwidth, spectral line resolution, and angular resolution of the VLA. It illustrates–but likely does not exhaust–the exciting scientific opportunities offered by these enhancements. It also discusses some of the technical issues that will need to be resolved, and tradeoffs that will have to be made, before an explicit proposal for funding for this effort can be made to the NSF.

The purpose of the present document is to promote discussion of the scientific value of enhancing the capabilities of the VLA. We urge all who are interested in the long-term scientific future of the VLA to send comments and suggestions about the astronomical and technical content of the document by E-mail to newvla@nrao.edu. As the document will gradually be refined into a funding proposal, it is most important that it accurately reflect the wishes of the whole VLA user community for development of this key instrument.

Postscript files containing the entire document and its individual chapters are now available over the WWW under "Major Initiatives" on the NRAO home page (URL: http://info.aoc.nrao.edu); soon it will be in hypertext format. Further reports on the VLA Development Plan will be posted on the WWW, as well as in this Newsletter.

T.S. Bastian and A.H. Bridle

FIFTH ANNUAL SYNTHESIS SUMMER SCHOOL

The fifth summer school in synthesis imaging was held in Socorro from June 5 to 9. As in preceding schools, the central goal was to produce a series of lectures which introduces students to the fundamentals and practice of synthesis imaging. Twenty lectures were given, starting Monday morning and ending Friday at noon. On Friday afternoon, a "data tutorial" was arranged, so that attendees could practice reducing VLA or VLBA data, under the tutelage of an expert staff member.

There were approximately 150 attendees to this edition of the summer school — the same as in recent summer schools. Approximately thirty of these were our own local staff and students.

Besides the lectures, tours of the VLA and VLBA control rooms were arranged and were well attended. And, following well-established tradition, a hike to the top of Mt. Baldy was held after the school was over.

R.A. Perley

12 METER

EIGHT-BEAM RECEIVER PROGRESS

We conducted a successful observing test with the 1.3 mm eight-beam SIS receiver in mid-May. Four of the eight beams were installed for the tests and all four performed extremely well. We paid particular attention to the beam shapes and efficiencies and found the performance to be exactly as intended.

Having passed this initial checkout, the receiver should now proceed to completion rather quickly. At this writing, the remaining four beams are being installed. The beam rotator, software control, and final electrical wiring work will be completed in the next few weeks. We plan to conduct further test and commissioning observations in the early autumn and expect to release the receiver to observers by mid-autumn. Observers may submit proposals for use of the 8-beam receiver at any of the upcoming deadlines.

To recap the properties of the array, it is in a 4 x 2 rectangular configuration with each beam separated by 87". The array can be rotated under computer control to any arbitrary position angle and can track changes in source parallactic angle. The mixers are tunerless SIS devices. We have not yet quantified the actual tuning range, but expect the mixers to cover most of the 200 - 260 GHz band. The mixers have double-sideband response with an equivalent SSB system temperature of about 700 K (T_R^*) under modestly good weather conditions; future improvements in T_{sys} are expected. Discrete grid mapping will definitely be supported in the initial release of the instrument. In a separate development project, we are also working to implement spectral line on-the-fly (OTF) mapping with rapid data dumps from the hybrid spectrometer. The hybrid spectrometer is required for eight-beam data acquisition. We will provide an update on the hybrid spectrometer OTF project in future newsletters.

P.R. Jewell and D.T. Emerson
(for the Tucson and Charlottesville Receiver Groups)

MMA SITE TEST INTERFEROMETER INSTALLED IN CHILE

Over the last 18 months, we have developed and constructed two site test interferometers in Tucson. These instruments measure variations over a 300 m baseline in the electrical path length through the atmosphere by observing 11.5 GHz beacons on geostationary communications satellites. The first interferometer was installed at the VLBA site on Mauna Kea (3720 m) in September 1994 and has been collecting data since. In April 1995, following the successful deployment by a Socorro team of a container with a solar and wind power system, a satellite telephone, and a 225 GHz tipping radiometer, we installed the second interferometer at 5000 m near Cerro Chajnantor about 50 km east of San Pedro de Atacama. Data summaries from both instruments are received daily in Tucson. Initial indications of the Chilean site are very, very encouraging. We are now beginning detailed analysis of the data from both sites and will post the results in the NRAO WWW pages when they are available.

S.J.E. Radford, G. Reiland, and W. Shillue

SUMMER SHUTDOWN PLANS

The 12 Meter will suspend visitor observing from July 13 to September 12 for the annual summer "monsoon" season in the southwest. The staff will use the time for significant upgrades and the installation of new telescope equipment. This summer, a number of improvements will be made to the 2 and 3 mm receiver and to the 1 mm receiver. The receiver group will also be completing the 8-beam receiver this summer. The electronics group will be concentrating on projects relating to the Hybrid Spectrometer, including filter shapes and sampler performance and the completion of a flexible IF distribution system. The computing group will focus on the implementation of on-the-fly observing with the Hybrid Spectrometer, the completion of new observer interfaces to the telescope control system, and a new status and monitor display system. The site operations group will conduct the annual inspection and maintenance of the dome and telescope. Although the number of projects is quite large, visitor observing will resume about a week earlier than in the past few years. We hope this will partially ease the over-subscription rate of observing time requests.

P. R. Jewell and J. S. Kingsley

CO CONFERENCE EPILOGUE

IAU Symposium 170, "CO—Twenty-Five Years of Millimeter-Wave Spectroscopy" was held from May 28 to June 2 in Tucson. About 225 participants from all over the world attended. The Symposium consisted of five days of sessions on all major aspects of Galactic and extra-galactic research using CO and other molecules. Topics included molecular clouds and the interstellar medium, cloud cores and star formation, starbursts, evolved stars, galactic nuclei, and extragalactic CO including high redshift CO emission. In addition to the daily oral sessions, the Symposium included a week-long display of about 150 posters and evening sessions on instrumentation and the "X Factor" ratio. The conference dinner featured a talk by Robert Wilson on the early days of molecular spectroscopy. Charles Lada concluded the meeting with a summary of the significance of CO to current astrophysical knowledge. The proceedings are being assembled and will be published in the IAU Symposium Series by Kluwer Academic Publishers.

The Scientific Organizing Committee for IAU 170 was chaired by John Bally and included Jaap Baars, Leo Blitz, Dennis Downes, Edith Falgarone, Tetsuo Hasegawa, Harvey Liszt, Nick Scoville, Ewine van Dishoeck, and Glenn White. The Local Organizing Committee was co-chaired by Bill Latter and Simon Radford. The Symposium was coordinated by Jennifer Neighbours.

The IAU 170 Local Organizing Committee

TELEPHONE NUMBER CHANGES

To repeat the information in the last Newsletter, telephone numbers for the 12 Meter Telescope were changed in April of this year. These numbers are completely different from the old numbers. In addition, the area code for all Arizona numbers outside metropolitan Phoenix has been changed to 520. For an interim period -- recently extended to October 21 -- both the new 520 and the old 602 codes will be accepted. There have been numerous reports from around the country of older PBX's that are unable to dial the new 520 codes. These older systems may lock out area codes with any number other than 0 or 1 as the middle digit. Operator assistance may be required in these cases.

If you ever have business with NRAO Arizona Operations, you may wish to dial a Tucson number to see if the call goes through. The new telephone numbers are

12 Meter Telescope Operator: 520-318-8670 (completely new!)
12 Meter Observer's Console: 520-318-8671

NRAO Tucson Downtown Office: 520-882-8250
Downtown Fax: 520-882-7955

P. R. Jewell

IN GENERAL

MILLIMETER ARRAY

Progress on the MMA project has accelerated in 1995 owing both to the availability of the first NSF funds specifically devoted to MMA planning and to the organization and efforts of the Millimeter Array Development Consortium (MDC) Working Groups. At the NSF, the Astronomy Division is providing $0.5M for MMA planning in 1995 and, budget permitting, we understand that they hope to double this amount in 1996. Major development and ultimately construction funding will come from the NSF Major Research Equipment (MRE) account, funds from which are presently being used for the Gemini and LIGO projects. Since these two projects are now financially sound and are on constant or declining funding trajectories, the NSF is planning for future projects.

Development of the MMA is being done in collaboration with OVRO and BIMA through the MDC. Community wide input and advice is provided by the MAC, the Millimeter Array Advisory Committee. There are four active MDC working groups that meet regularly to review and refine the technical design of the MMA. The four groups and their chairs are these:

Antenna:	Peter Napier
Receivers:	Jack Welch
System Design:	Dick Thompson
Phase Calibration:	David Woody

We expect these four groups, plus a further working group on array control computing, to continue to guide the technical work on the MMA through construction.

Testing and evaluation of possible sites for the array is an NRAO activity under the leadership of Frazer Owen. We are now testing two sites simultaneously, a site near the VLBA antenna on Mauna Kea and a site east of the village of San Pedro de Atacama in northern Chile. Atmospheric transparency on both sites is measured several times an hour with 225 GHz tipping radiometers. Phase stability of the atmosphere is measured as well, using an interferometer observing a geostationary satellite beacon. Monthly summaries of the opacity data and meteorological data (temperature, wind) from both sites are currently available on the WWW. To access this information go to the NRAO Home Page, to MMA, to Development of the Instrument, and finally to Sites, or use the URL http://info.aoc.nrao.edu/mma/sites.html.

The next major milestone for the MMA project is a Science Workshop October 5-7 in Tucson at which we intend to discuss scientific and technical priorities for the project. At that time we intend to have status reports from each of the MDC working groups that can be used to focus our attention on the principal technical challenges of the MMA. These reports will be made available on the WWW.

R.L. Brown

AIPS++ STATUS

An AIPS++ Development Plan for the next 12-18 months has been instituted to provide a coherent overall picture of the direction of the project in the intermediate term (see the URL http://info.cv.nrao.edu/aips++/docs/html/devplan.html). Tracking of progress in AIPS++ is now performed using a Target Dates mechanism (see URL:http://info.cv.nrao.edu/aips++/docs/html/targets.html).

The NRAO AIPS++ effort has split into two principal groups: one in Charlottesville concerned mainly with support of single dish processing and another in Socorro concerned with project management and synthesis support.

The Single Dish group has been working towards supporting the GBT systems integration tests on the 140 Foot Telescope that are planned for July. The objective is to allow examination, manipulation and plotting of both engineering and astronomical data. The data will be filled into AIPS++ tables and will be manipulated and plotted using Glish and a plotting widget. In addition, the SD group has developed and installed at the 12 Meter a tool for On-The-Fly mapping using the 12 Meter Telescope in rapid scanning mode.

The Synthesis group is still being assembled in Socorro. The short-term goals include a self-calibration/deconvolution tool using the Briggs Non-Negative Least Squares Algorithm. This is targeted primarily towards the analysis of VLBA/VLBI observations of compact objects requiring high dynamic range. We will also be working towards the production of a generic calibration and imaging suite using the UV-matrix formalism for polarization calibration recently developed by Bregman, Hamaker, and Sault.

Development of the "Infrastructure" Library of AIPS++ Classes is driven by the need to support the applications development described above. The key areas of development are the Coordinate Classes (overseen by ATNF staff) and the Tasking design (done by NRAO staff). In addition, a system for class documentation is now in place, and numerous improvements have been made to the Glish system used for task control and Command Line Interface (CLI).

Finally, the Visualization tool developed by the BIMA group at NCSA, AIPSView, has entered into a second alpha stage.

T.J. Cornwell

1995 JANSKY LECTURESHIP

I am pleased to announce that the 1995 Jansky Lecture will be given by Prof. Jocelyn Bell-Burnell of the Open University, in Milton Keynes, U.K. As a research student at Cambridge, Prof. Bell-Burnell participated in the construction of an 81.5 MHz antenna array which she and her academic advisor, Prof. A. Hewish, hoped to use to identify quasars by means of their scintillation. In the early operational stage of the array, Bell-Burnell discovered a population of previously unknown sources of periodic radio emission, the pulsars. For her discovery she has received many prizes and awards, including the Tinsley Prize of the AAS and the Herschel Medal of the RAS. We are honored that she will be the Jansky Lecturer at the NRAO in 1995. She will give her lecture in Socorro and Charlottesville on October 27 and 31, respectively.

P.A. Vanden Bout

WORKSHOP "COMPACT EXTRAGALACTIC RADIO SOURCES"

The proceedings from NRAO Workshop No. 22 (ed. J.A. Zensus and K.I. Kellermann) can be ordered directly from Green Bank. To order, contact:

Ms. Carol Ziegler
NRAO
P. O. Box 2
Green Bank WV 24944
Fax: (304) 456-2229 / Phone (304) 456-2230

Cost is $10 plus $3 shipping for US and foreign surface mail, or $10 plus $10 shipping for foreign air mail. Prepayment required, by personal US check payable to NRAO — or Visa or Master Charge.

J.A. Zensus

EDITOR NRAO NEWSLETTER
NATIONAL RADIO ASTRONOMY OBSERVATORY
520 EDGEMONT ROAD
CHARLOTTESVILLE, VA 22903-2475

NON-PROFIT ORG.
US POSTAGE PAID
PERMIT #373
CHARLOTTESVILLE, VA

ADDRESS CORRECTION REQUESTED

To:

DATED MATERIAL — DO NOT DELAY