NRAO NEWSLETTER

1 April 1994 No. 59

GREEN BANK

THE GREEN BANK TELESCOPE

The accompanying photograph shows the GBT on March 22, 1994. Although construction has been hampered by the worst winter weather in recent memory, the alidade is now essentially complete. The next major pieces to be installed are the elevation weldments, which will sit atop the alidade towers and hold the elevation bearing assemblies. The actuator control room has been delivered to the site and is being assembled and welded on the ground. It will eventually be lifted to its position behind the backup structure.

During the winter many of the electrical systems on the first level of the alidade were installed. These include transformers, conduit, breaker boxes, a load bank for the generators, and wiring of the servo and cryogenics rooms. One of the large azimuth wheels was found to be slightly out of tolerance, so the alidade was jacked up and the wheel was removed and sent to be remachined. It was recently returned to the site, installed in place on the track, measured, and aligned. The alidade can now be rotated as needed for construction.

The telescope surface panels are being fabricated in the contractor's plant. The panel tools have an rms error of 33 microns, and the first few panels measured have rms surface errors of less than 100 microns.

We were disappointed to learn that the high-speed chips which are the basis of the new spectrometer do not work at the required speeds. The problem has been traced to one part of the design, and a fix seems straightforward. It will require a new chip fabrication, which will take several months, but this still seems to be the most desirable way to achieve the scientific requirements. A discussion of receiver priorities for 1995 and 1996 is now underway. An article on this will appear in the next newsletter.

F. J. LOCKMAN

140 FOOT TELESCOPE CASSEGRAIN RECEIVERS

Plans are underway to remove one of the 4 K maser amplifier dewars from the 140 Foot and to put in its place the 18-26.5 GHz GBT front-end. The usual 140 Foot feed horn will be used with the new receiver, and unless unexpected mechanical difficulties are encountered, the installation is expected to be accomplished in mid-April. The 22-26.5 GHz GBT front-end has a system temperature of approximately 30 K, including a portion of the feedhorn. This compares with 16 K measured for the K-band maser receiver in 1990. The new system should thus have a 15 K penalty in system temperature over the maser, but will provide dual circular polarization without use of a beam splitter.

There are several reasons we have undertaken this process. It will be advantageous for the GBT project to get real-world shake-outs of the front-ends, IF systems, and monitor/control functions. Maintenance of the 4 K maser systems has become increasingly difficult, and the new HFET receivers should provide better reliability and stability. We hope that 140 Foot users will bear with us during this transition.

If installation of the GBT K-band system is successful, we will proceed with plans to install the GBT 12-15.4 GHz and 8-10 GHz front-ends. The 140 Foot will then be equipped with dual-polarization HFET receivers covering 8-10, 12-15.4, 18-22, and 22-26.5 GHz at the Cassegrain focus.

R. D. NORROD

CHANGES TO 300-1000 MHz RECEIVER

Several changes were recently completed to the 140 Foot 300-1000 MHz front-end which should improve its performance in the presence of strong interfering signals. The conversion scheme was changed to a single down-conversion with a variable first local oscillator. The receiver IF is now 210-290 MHz for all three receiver bands. In addition, band reject filters were inserted to notch out the 892-898 MHz "AirPhone" band used by commercial airlines. And finally, a bandpass filter was installed to reduce the effect of two-way radios operating near 460 MHz at the GBT construction site. Users interested in using this front-end can obtain block diagrams and other information by contacting Roger Norrod or Bill Shank, Green Bank.

R. D. NORROD

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[Contact Joanne Nance (804) 296-0323, if you wish to receive mailings of the Newsletter.]

VLBA/VLBI

VLBA STATUS

The VLBA is progressing steadily. The correlator is waking up and being used for production work. We can now look at the data quality of observations recorded last year. The most discouraging recent news is that a number of problems with tape formatters have led to errors in observations recorded in VLBA format. The result is that most such observations made prior to February 1994 are corrupt and will be re-observed. The remaining backlog of recorded tapes consists exclusively of MKIII format observations with some non-VLBA stations. We now have the ability to read and interpret MKIII format log files that is needed for processing of the backlog. Another limiting factor has been the compute and memory capacity of the Motorola 68030-based real-time computer used in the correlator. An upgrade to a 68040-based computer is now complete and should allow correlation of up to 14-15 station MKIII format experiments.

The highest priority for development of the correlator is given to establishing routine, reliable, robust operations, allowing processing of observations of both VLBA and MKIII format experiments, the latter including non-VLBA stations. Next in priority comes cross polarization and support of up to 20-station experiments. Finally, in a third phase, comes support for the pulsar gate and MKIII hybrid modes. The goal at each phase is to add new capabilities only when existing capabilities are well-established and robust.

To avoid recording bad data in the future, we have adopted a policy that can be summarized by the following statement: "We will not schedule new observations in modes that cannot be correlated." A policy statement to this effect concerning priorities for observing and testing was issued on February 25, 1994. (This can be found via the Mosaic system under the links VLBA->VLBA NEWS.) The highest priority for observing and correlation is given to verification tests of the array. Since putting this policy into effect, we have conducted a number of tests covering:

- Verification of the formatter performance in MKIII and VLBA formats;
- A comparison of the data produced by the Haystack and VLBA correlators on a simple MKIII format observation;
- Testing of the correlator geometric model via a horizon-to-horizon track of a single unresolved source (DA193) and via an ultra-wideband short track;
- Testing of the performance of the Base-Band Converters (BBCs).

Encouragingly, the overall data quality from these tests is very good. Recording and playback performance is usually good, and the correlations seem to have few problems. In addition, following a fix to the firmware of the formatters, all the basic recording modes seem to work. We can now start to move on to investigation of more subtle performance issues. For example, we can already see that, as expected, some tweaking of the performance of the BBCs will be necessary.

Next in priority for observing and correlation come new observations using the VLBA alone for simple, low data rate experiments. The backlog of MKIII format observations will be correlated as time permits. We expect that the backlog will be cleared sometime near the end of this year. The tapes released from the backlog will join those now being acquired in this year's purchase of 500 thin tapes which is expected to be complete and available for observing in June. Observing on the array will then pick up as the correlator gains in efficiency and robustness.

The overall goal of this plan of development is to expand the capabilities of the VLBA, array and correlator, in a controlled way so that at all times we can operate a scientifically productive instrument. By controlling and moderating the rate at which new capabilities are added, we expect to minimize the time required to attain the fully functioning VLBA.

T. J. CORNWELL

VLBA PROPOSALS

The VLBA correlator is coming into full operation slowly but steadily. At this time some experiments have been successfully correlated and tapes have been recycled. We expect the rate at which data is correlated to increase over the next month.

A long list of proposals has been approved but not yet observed. We anticipate that, at best, we will be able to schedule only on the order of ten "pressing" proposals at the next June 1 deadline. In order to avoid fruitless work by proposers and referees, we recommend that only very urgent observations should be proposed for the June 1 deadline. (Proposers should note that date of receipt is <u>not</u> a consideration when choosing proposals to schedule. They are scheduled on the basis of quality of the science proposed and the likelihood of a successful experiment.)

W. M. GOSS AND B. G. CLARK

VLBI NETWORK CALL FOR PROPOSALS

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

Session	Dates	Bands	Proposal Deadline
2	13 May to 03 Jun	3.6/13, 6, 5, 92	1 Feb 1994
3	14 Sep to 05 Oct	1.3, 3.6/13, 6	1 Jun 1994
4	02 Nov to 23 Nov	0.7, 3.6/13, 18	1 Jun 1994

The Caltech Mark II processor ended routine correlation for the astronomical community at the end of 1993. It still is available for astronomical operations in some circumstances. In addition, the Block 0 correlator in Bologna may be available occasionally. In this somewhat confusing situation, Mark II proposers are requested to make arrangements for correlation before submitting proposals and to mention their arrangements in the proposal. In any event, no proposals for Mark II observations will be scheduled without assurances from the manager of a Mark II correlator that the observations can be processed.

It is recommended that proposers use a standard coversheet for their VLBI proposals. Fill-in-the-blanks ASCII forms and fill-in-the-blanks TeX files are available by anonymous ftp from ftp.cv.nrao.edu, directory proposal. They are also available through Mosaic's world-wide area information service. A new version of the coversheet was installed on September 9, 1993, including a new version of the EVN logo, evn.ps. Printed forms, for fill-in-the-blanks by typewriter, are available on request from J. Nance, Charlottesville.

Any proposal requesting 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; sufficient time for mailing must be allowed. In general, fax submissions of Global proposals will not be accepted. For Global proposals, or those to EVN alone, send proposals to:

R. Schwartz
Max-Planck-Institut für Radioastronomie
Aug dem Hugel 69
53121 Bonn
Germany

For proposals to the U.S. network, the VLBA only, or Global network proposals, send proposals to:

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

B. G. CLARK

12 METER TELESCOPE

POLARIMETER

The 3 mm polarimeter mentioned in the 1993 October 1 Newsletter has been completed and has undergone preliminary tests on the telescope. Considerable more work remains to be done in the areas of computer interfacing, observing mode development, and detailed evaluation of the polarization characteristics of the device itself, the dish, and other components of the telescope system. However, these first tests were most encouraging.

The polarimeter consists of a rotating wire grid in front of a plane mirror. The device is placed in the optical path between the receiver box and the telescope quaternary mirror. The distance between the grid and the backing mirror can be adjusted to make the polarimeter sensitive to linear or circular polarization. The wire grid can be stepped through a series of position angles or rotated continuously. Data acquisition will be synchronous with the positioning of the polarizer. This device is intended for use with either spectral line or continuum modes. At present, the device can be used only at 3 mm wavelengths, but might eventually be available at 2 mm and 1 mm wavelengths. Proposals for the polarimeter are being accepted.

D. T. EMERSON, J. M. PAYNE, AND P. R. JEWELL

UPDATE ON REMOTE OBSERVING CAPABILITIES

We have made a number of enhancements recently to the remote observing capabilities at the 12 Meter. Remote observing may be useful and appropriate in a variety of circumstances, but a principle goal of these efforts is to allow efficient use of small blocks on the schedule, such as unassigned time. Observing at the 12 Meter is usually very interactive, and much of our recent work has been aimed at improving the information flow needed for on-line decision-making.

Remote observing displays can be run from most X Window workstation consoles. The current remote observing displays include:

- Data reduction (Line, Condar, etc.);
- Telescope status display;
- Real-time data display (shows the last scan and automatically reduces pointing and focus checks, etc.);
- System console messages (Monitor screen);
- On-line weather displays, including 24-hour site conditions (temperature, pressure, humidity, wind speed and direction, rain, 225 GHz tipmeter records, and various satellite images and surface weather conditions);
- Digital total power and switched power chart records;
- Communications session with the telescope operator;
- Video displays (this is new and we have only one view so far, but several more are planned).

A remote session can be run from anywhere on the Internet and can be initiated with a single command. Documentation is available upon request.

P. R. JEWELL AND T. W. FOLKERS

MOSAIC DOCUMENTATION

As with other NRAO sites, the Tucson operations have begun to place several items of user documentation on the Mosaic system, accessible via the NRAO Homepage. We expect to make increasing use of Mosaic to distribute information. Of particular note, we now place the 12 Meter Telescope observing schedules on Mosaic in Postscript format. Observers interested in unassigned time blocks may find this useful.

P. R. JEWELL

VLA

VLA ALL SKY SURVEY

The oversight committee for the VLA B- and D-array surveys met March 18th to review progress. Committee members present for the review were Jackie Hewitt, Jill Knapp, Rogier Windhorst, Barry Clark, and Frazer Owen (chair). Representing the survey teams were Bob Becker, Dave Helfand, Jim Condon, Qi-Feng Yin, and Rick Perley. The B-array team completed observations, totalling about 120 hours, of a strip near the north galactic pole in May 1993. The D-array team completed a much longer run covering about one-third of the sky between -40 and +90 declination last fall and winter. Both survey teams are making good progress toward final images and should start releasing the images and calibrated u-v data to the community this summer. We hope more details on the data distribution will be available for the next newsletter.

The committee recommended that both surveys continue during the next configuration cycle. They proposed that the B-array team get their first long run, 48 ten-hour periods between 7 and 17 hours LST this summer. The D-array team would observe the second third of the sky early in 1995 in the CnD and D-arrays, all at night.

More verification tests were requested of both groups and the B-array team was asked to study some changes in their image processing to improve the images and flux densities for extended sources. The committee also suggested that NRAO study its plan for the VLA configuration schedule to try to reduce the pain caused by the surveys for individual users.

F. N. OWEN

VLA CONFIGURATION SCHEDULE

Configuration	Starting Date	Ending Date	Proposal Deadline
A	25 Feb 1994	02 May 1994	1 Oct 1993
BnA	13 May 1994	31 May 1994	1 Feb 1994
B	03 Jun 1994	19 Sep 1994	1 Feb 1994
CnB	30 Sep 1994	17 Oct 1994	1 Jun 1994
C	21 Oct 1994	26 Dec 1994	1 Jun 1994
DnC	06 Jan 1995	02 Feb 1995	1 Oct 1994
D	10 Feb 1995	22 May 1995	1 Oct 1994

The VLA is currently scheduling two large surveys. One will be done at night in the DnC and D configuration (18^h-06^h and 00^h-10^h respectively, for the 1993 D configuration, and one in the north galactic cap (07^h-17^h) in the B configuration). Observing time in those configurations and LSTs will be much reduced over past practice. On the other hand, observations disjoint with the surveys in those configurations will have more time available for scheduling than has previously been the case.

Several suggestions have been made for changing the above cycle to better accommodate the large surveys. A memo, by Juan Uson, discussing desiderata and options is available from Rita Salazar, Socorro. NRAO welcomes your opinion regarding this change. We anticipate making a decision soon after the Users' Committee meeting in June.

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
1994	D,A	A,B	B	C
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

Observers should note that some types of observations are significantly more difficult in daytime than at nighttime. These include observations at 327 MHz (solar and other interference; disturbed ionosphere, especially at dawn), line observations at 18 and 21 cm (solar interference), polarization measurements at L-band (uncertainty in ionospheric rotation measure), and observations at 2 cm and shorter wavelengths in B and A configurations (tropospheric phase variations, especially in summer). They should defer such observations for a configuration cycle to avoid such problems. The C configuration daytime will be about 15^h RA, and the D 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

OBSERVE

Observe now supports Q-band observing at the VLA. The most current version of Observe is 3.2.0, dated 1994.03.31. Observe is available via anonymous ftp from ftp.aoc.nrao.edu. Executable versions exist for SunOS 4.1, Solaris 2.3, IBM R6000, and VMS.

W. K. YOUNG

7 mm RECEIVERS FOR THE VLA

The eighth 7 mm receiver will be installed on the VLA by the end of March 1994, and the ninth receiver should be installed by end of April. The tenth receiver will be put on the array, but will not be permanently installed until after the early receivers undergo some retrofits.

The measured zenith system temperature of the receivers ranges from 80 K to 110 K in the range 41 and 45 GHz, rising to 150 K at 40 GHz and 49 GHz. The zenith optical depth under good winter conditions ranges from 0.06 at 41 GHz to 0.15 at 50 GHz.

Doug Wood maintains a "VLA 7 mm System Status" report which he will e-mail to you on request. He also is available to help observers plan their 7 mm observing strategy (contact dwood@nrao.edu or (505)835-7398).

R. A. SRAMEK

COMPUTING AT NRAO-NEW MEXICO

A new powerful IBM 580 workstation called Piro has been installed at the AOC. With its 128 MByte memory and 15 GByte disk space, Piro is, after Hopi and Kiowa, the third machine of its kind. All three are primarily aimed at VLBA data reduction, but sometimes may be used for large VLA spectral line projects as well. Yucca, the last of our venerable Convex generation, is still up and running. Its shutdown had to be delayed until April 15, 1994, since its tape drives are required for a small fraction of the archive copying effort. We expect to upgrade all AOC Sun workstations to Solaris 2 sometime in the spring. Though this inevitably will cause some interruptions, we will try to make the switch as painless as possible. In February, 15 JAN 94 AIPS was released with numerous additions and fixes, which are listed in the most recent AIPS Newsletter. One outstanding feature is the support of Linux AIPS, which allows AIPS to run on 486 PCs. This should bring full AIPS reduction capabilities within the reach of those institutes which cannot afford full workstations.

G. VAN MOORSEL

NRAO GUESTHOUSE

The new NRAO Guesthouse in New Mexico is complete. Occupancy began on March 5, 1994. The new facility offers visitors pleasant, quiet accommodations. The Guesthouse is located only a few minutes' walk from the Array Operations Center (AOC) on the campus of New Mexico Tech. There are both single and double units and two, two-bedroom apartments. All guests have the use of a common room which includes kitchen facilities, TV lounge, and a terminal as well as a laundry room with ironing facilities.

Reservations for visits may be made with Eileen Latasa. She can be contacted by:

Telephone: (505)835-7357
Fax: (505)835-7027
E-mail: elatasa@nrao.edu

M. T. ROMERO

IN GENERAL

1994 JANSKY LECTURER

I am pleased to announce that Dr. Vera Rubin has accepted the 1994 Jansky Lectureship. A distinguished astronomer at the Carnegie Institution of Washington, she is well known for her studies of galaxy rotation curves which served to define our understanding of dark matter in galaxies. The Rubin-Ford effect was the first demonstration of large-scale motion in the Universe. The title and dates of her lecture will be announced later.

P. A. VANDEN BOUT

AIPS++ PROJECT

During the past quarter, the AIPS++ project has made significant progress in a number of areas, despite some technical setbacks. One item of interesting trivia: the project passed the 100,000 lines of code mark sometime during January this year. Progress has focused in several areas of design and implementation:

The AIPS++ User Interface and Visualization Tools. As the underlying structure of AIPS++ has clarified over the past few months, work on the design and prototype of the AIPS++ user interface (UI) has begun. A preliminary answer to the question "What will a user see when AIPS++ is running?" has been worked out, with a working prototype scheduled for testing in early April, thanks to our colleagues at the University of Illinois. The UI will combine a fully programmable command line interface (CLI) with a graphical user interface (GUI). Users will be able to work in either or both environments, depending on their personal preference.

AIPS++ System Development. The AIPS++ project has been struggling with a number of problems related to buggy compilers and unreliable debuggers. As the amount of AIPS++ code and its complexity increased, the time required for a compile-edit-debug loop was becoming intolerable. Happily, these problems have been largely resolved by a combination of clever tools developed by the AIPS++ project and improvements in operating systems and compilers from various vendors. During the past months, substantial improvements were achieved in how the project uses a number of language features, particularly templated classes. These problems have caused some delays. We are still assessing their impact on the project schedule.

AIPS++ can now support multiple architectures. The AIPS++ beta release (scheduled for distribution near the end of 1994) will support at least SUN (both SunOS and Solaris) and IBM architectures. Later releases will support additional machine types, with the priorities still to be determined.

AIPS++ Implementation Milestones. Several important goals were achieved during the past quarter, despite the technical difficulties that compilers and operating systems were causing the project. The design and coding of an early version VLA Archive Measurement Set (MS) is complete. This is the preliminary implementation of the data structure using AIPS++ Tables which will store VLA data. The VLA MS is especially important because it serves as a prototype for other MS's from other instruments in the AIPS++ consortium, including ATNF, WSRT, BIMA, DRAO, and GMRT.

A number of other pieces of AIPS++ have also been completed. AIPS++ classes required for FITS I/O have been completed and are under test. These classes provide I/O for FITS images, random groups, and binary tables. Recently, during testing, a VLBA data set was imported into an AIPS++ table and browsed using the AIPS++ table browser. Implementation of various CLEAN algorithms is underway.

AIPS++ Plans. We are still assessing the impact of various technical delays on the schedule for this year. The basic goals laid out for this year (an internal prototype release in June and a publicly available beta release at the end of the year) remain the same at this writing. It still appears that no major schedule changes will be required, although some minor delays may occur.

R. S. SIMON

ON THE FUTURE OF AIPS

There seems to be some confusion in the community regarding the future of AIPS and AIPS support. The driver for this confusion, of course, is the AIPS++ project. AIPS++ is the project to create a new, object-oriented system for processing radio astronomical data. NRAO is one of seven members of the AIPS++ Consortium created for the project. The ultimate expectation is that AIPS++ will replace AIPS completely, with full support for all of the current functionality within AIPS, as well as new capabilities (improved programmability, full support of other interferometers, single dish support, and many other ambitious goals).

NRAO is fully committed to the AIPS++ project, but also recognizes the vital role that AIPS currently plays and the necessity for maintaining AIPS until AIPS++ is a truly viable alternative.

The key questions are:

- When is AIPS++ likely to be delivered?
- When is AIPS++ likely to be fully functional and relatively bug-free, from a user's perspective?
- How long does NRAO plan to continue AIPS support?

The first question can be answered fairly simply. The AIPS++ project plans to release a beta version of AIPS++ in December of this year, followed by a full release in early 1995. The beta version will have some interesting capabilities, including some not currently available within AIPS. It will not be a full replacement for AIPS. This schedule means that a functional AIPS++ should be available by the second quarter of 1995. Full functionality for AIPS++

will be achieved in a subsequent release, perhaps later in 1995. This schedule is admittedly ambitious.

The second question above is harder to answer. Users who are currently happy within AIPS may or may not see reasons to switch during 1995. It is difficult, if not impossible, to predict the amount of time between the release of a large package and its general acceptance by the community. If fully functional is defined as encompassing all of the current capability of AIPS, the end of 1995 may be a reasonable target to aim at for AIPS++.

Concerning the last question, it is clear that AIPS will be needed and supported through the end of 1995, and very likely to the end of 1996. In other words, the current lifetime of AIPS is about two to three years, with a large margin of error, depending on how optimistic one is about AIPS++. It will be important that AIPS and AIPS++ have some overlap, with both packages fully operational, so that new or translated algorithms can be thoroughly tested and compared between the two packages.

AIPS is a very difficult act to top; the AIPS++ Consortium has its work cut out for it. It is fair to say that one of the successes to date of AIPS++ has been to make the radio astronomy community realize how good AIPS really is.

R. S. SIMON

DIGITAL LIBRARY OF ASTRONOMY IMAGES

As part of an NSF funded High Performance Computing and Communications project at the University of Illinois National Center for Supercomputing Applications, a digital library of radio astronomy images is being established. Observers are asked to contribute their fully processed maps in the form of FITS files to the library. For further information, including instructions on how to send FITS files to the anonymous ftp server established for this purpose, please get the README file from the anonymous ftp server for this project (which will be operational no later than April 15):

Ftp to: atlas.ncsa.uiuc.edu
At login prompt, type: anonymous
At password prompt, type: e-mail address (name@node)
At ftp prompt, type: get README

When the library is operational (planned for later this year) an astronomer will be able to browse the library "card" index, searching on object names, regions of the sky, object types (galaxies, molecular clouds, etc.), type of data (continuum map, spectral-line data cube, etc.), frequency and/or spectral-line transition, etc. The user interface will be the NCSA Mosaic software, interfaced with a database software system. When a set of files of interest has been located, a "postage stamp" representation of the image (subsampled to a small size) or a short movie of a data cube, they can be viewed in NCSA Mosaic. If the astronomer then wants to work with full data set(s) at his/her home institution, simply pushing the data transfer button in the user interface will extract the data set(s) from the library and copy files to the astronomer's local computer disk. Postage stamp images and movies, short text descriptions of data sets, and metadata (header information) will be maintained on magnetic disk for rapid browsing. Full data sets will be stored in the NCSA mass storage system. The capacity of the system for astronomy images is essentially unlimited (several terabytes right now).

There are several ways in which the digital library will make it easier to do astronomy and therefore increase astronomers' productivity. Observers planning a project will have access to work previously carried out on the same object, perhaps at different frequencies or in different spectral lines. Observers interpreting new data will be able to compare fully with other results. As part of the development of the AIPS++ software system, visualization and analysis tools are being produced which can be used to re-bin and re-register image data sets, so astronomers will be able to use the archive for easy and straightforward overlay of existing images for comparison and analysis. The library will also directly benefit those who deposit their data sets. When a paper is submitted for journal publication, instructions may be included so that readers may view the data sets at full resolution in full color on their home workstations, and follow instructions in the paper to see phenomena that are difficult to reproduce on paper even with color prints. Moreover, data now on tapes that are hard to keep track of and keep current can be permanently stored in the library for easy retrieval by the originator for later use.

No library is of any use without books. It is essential for each of us to take the few minutes required to place our data which we have already interpreted and published in the library. We will be ready to receive fully-processed data sets of any size by April 15. Please, help make this new and powerful tool for astronomical research a benefit for all of us by contributing your work.

R. M. CRUTCHER
University of Illinois

THE MILLIMETER ARRAY

Considerable progress has been made in development of the conceptual design for the MMA antenna. The MMA requirement for an antenna that can maintain 1/20 beamwidth pointing while exposed to the environment calls for a stiff compact structure constructed, at least partially, with materials of low thermal expansion. Since the antenna must also be transportable, the structure should again be compact, and it should be of low weight. An antenna design that meets all these requirements is the slant-axis antenna that has provided us with a useful fiducial concept that we could both refine technically and we could cost accurately. The slant-axis design is very rigid and of low weight; the 8 m antenna is less than 20 metric tons. To the extent that cost is proportional to weight, the antenna cost should also be minimized. However, the initial slant axis design has restricted space for receiving electronics, and it is difficult to analyze as a homologous structure so that gravitational deformations are likely to be problematical.

Recently Jinquan Cheng has come up with quite an elegant solution to the gravitational deformation problem involving the combination of an offset reflector with the slant axis mounting. The refined design not only preserves the structural advantages of the slant axis concept but it also simplifies the optics, greatly reduces the blockage, and provides adequate space for receivers such that they suffer little or no movement as the antenna tracks. The design is described in detail in a forthcoming MMA memo.

Since it has been nearly four years since the MMA proposal was submitted to the NSF, we felt it was time to review carefully the cost to construct the MMA. In the intervening years we have acquired more precise cost information, some as a result of building equipment for the 12 Meter Telescope similar to that we expect to put on the MMA (especially front-end equipment and cryostats) and much as a result of the pioneering work the Smithsonian is going through in constructing the SMA. The latter has been especially helpful in allowing us to obtain a realistic antenna cost. The work involved in completing the new cost analysis for the MMA is still in progress, but it appears as if the total estimated cost in the MMA proposal given in dollars of 1990 is very consistent with our new estimate once the 1990 dollars are inflated to become 1994 dollars.

Finally, at the March, 1994 meeting of the NSF Astronomy Division to review the long range plan for the national astronomy centers, the NRAO was encouraged to explore broadening participation in the MMA to include some form of international partnership. There are several possibilities. As the options become clearer, they will be reported in these pages.

R. L. BROWN

JOHN W. FINDLAY

The many people throughout the world radio astronomy community who knew John Findlay will be sorry to learn of his death on March 22. John came to AUI in 1957 as one of the first employees of the Observatory (NRAO No. 5) and played a major role in planning for the development of NRAO. He started the NRAO Electronics Division and later served NRAO as Deputy Director and as Assistant Director for Green Bank.

Until his retirement in 1985, John led the NRAO efforts in the design of new antennas. He planned and supervised the design and fabrication of the 300 Foot Telescope in Green Bank as well as the 36-foot millimeter telescope on Kitt Peak, and later its upgrading to the current 12-meter configuration. Even after his formal retirement from the Observatory, he continued his efforts to further improve the performance of the Kitt Peak antenna. He also was the leader of the technical group responsible for the design and construction of the 28 VLA antennas. During the 1960's, he led a small team investigating the design of the Largest Feasible Steerable Telescope, and later led the groups designing the 65-meter and 25-meter millimeter radio telescopes.

John also contributed in many ways to astronomy through his activities outside NRAO. Throughout his career he was involved in the international effort to protect radio astronomy frequencies from interference from the expanding use of radio communications. For many years he was Chairman of the U.S. Committee on Radio Frequencies (CORF) and the IAU-URSI-COSPAR Inter Union Committee on the Allocation of Frequencies. During the 1960's and 1970's, John was a member of the National Academy of Sciences Space Science Board and Chairman of the Lunar and Planetary Missions Board which advised NASA on the planning and conduct of all missions to the Moon and planets, including the manned Apollo missions to the Moon.

John received his PhD in 1950 from Cambridge University. During WWII he served in the Royal Air Force, where he supervised the installation of radar stations throughout the Middle East and Asia. Following the War, he led a radar development group in Britain and did research in ionospheric physics. Perhaps John's best-known research contribution to astronomy was his effort over a long period of time to establish an absolute calibration at 21 cm, for which he constructed the Little Big Horn which still stands in Green Bank.

John was a Fellow of Queens College at Cambridge University as well as a Fellow of the IEEE and AAAS. He is survived by his wife Jean and his two married sons, Stuart and Richard, and their families.

P. A. VANDEN BOUT