NRAO NEWSLETTER

1 July 1994 No. 60

GREEN BANK

GREEN BANK TELESCOPE CONSTRUCTION

Much of the recent progress at the GBT site has taken place on the ground. The back-up structure supports have been installed on the hard points of the back-up structure pre-assembly platform. The reflector back-up structure will be built in 22 modules on these ground supports, and the modules will then be lifted into place with the derrick crane. A 60-foot tower topped with a survey shack has been built for precise measurement and alignment of the tipping structure. Sections of the elevation wheel support members have been arriving at the site and are being welded on the ground into the 36-inch square, 105-foot long "spokes" which attach the elevation wheel to the elevation shaft.

On the structure, the elevation bearing platforms have been installed and the manlift is now running to the elevation bearing level, good news for those not wishing to make the 166-foot vertical climb by way of the stairs! The 80-ton elevation bearing support weldments have been lifted to the tops of the alidade towers and are being prepared for welding. Once the final welding is accomplished, the structure will be ready for the installation of the elevation shaft temporary supports, the elevation shaft, wheel, and box structure. Approximately 90 percent of the electrical conduit and cabling has been installed on the alidade. Preparation is being made to seal the track gaps with silicone gel and to flush the pintle bearing with fresh grease.

Panel fabrication has begun at RSI's Sterling (Virginia) facility. Testing has begun to determine the desired combination of rivets and adhesive for attaching the surface skins to their supports. The quality and strength of the adhesive is so good that it can be considered a structural connection rather than a flexible shim. This allows a larger spacing between rivets on the panel which can lead to better manufacturing accuracy.

The use of visualization software has allowed the GBT engineers to see on a computer screen what the completed structure will look like and has allowed them to rotate the structure and look through it from different vantage points. This program is being used to determine sight paths through the structure to the laser targets on the ground, and to examine the optical path, in detail, for any potential blockage.

With the completion of the telescope design, project work now concentrates on monitoring the contractor's processes to guarantee proper manufacture, shipment and storage of the antenna parts and assemblies, on establishment of a weight control program to minimize weight growth in the 9.4 million pound elevation structure, and on implementation of a quality assurance program to oversee shop and field welding. Recent photographs of the GBT are available via the NRAO homepage on the World Wide Web server (http://info.cv.nrao.edu).

R. D. HALL and W. A. PORTER

GBT RECEIVERS

The table on the next page gives the current status and plans for GBT receivers. Four receivers have now been completed— the system temperatures given for these are derived from lab measurements and reasonable assumptions about spillover and atmospheric contributions. System temperatures for receivers under construction are estimates.

All receivers under construction, as well as the S- and Q-band receivers, should be completed by the time that the GBT becomes operational.

Receiver priorities were set by the GBT Scientific Working Group and will be reviewed regularly. We hope to be able to upgrade some receivers to improve their performance before they are installed on the GBT. The most current version of this table will soon be available on the World Wide Web server.

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.]

RECEIVERS COMPLETED OR UNDER CONSTRUCTION

PRIME FOCUS: 0.29 - 1.23 GHz under construction.

GREGORIAN FOCUS:

1.15	-	1.73 GHz	Under construction, single feed. T_{sys}: 20 K
3.95	-	5.85 GHz	Under construction, single feed. T_{sys}: 20 K
8.0	-	10.0 GHz	Done, single feed. T_{sys} 18-21 K*
12.0	-	15.4 GHz	Done, dual feed. T_{sys} 21-29 K*
18.0	-	22.0 GHz	Done, dual feed. T_{sys}: 33-48 K*
22.0	-	26.0 GHz	Done, dual feed. T_{sys}: 38-46 K*

* Based on the range of measured receiver temperatures.

PROPOSED RECEIVERS:

TOP RANKED:

S-band 1.73 - 2.60 GHz	Undergoing detailed development.
Q-band 40.0 - 52.0 GHz	7 feed with tertiary reflector; under design.

LOWER RANKED:

25 - 75 MHz	Prime focus.
- -	Dual S/X for VLBI.
12 - 15 GHz	Multi-feed array for continuum mapping.

GREEN BANK SITE TIMING SYSTEM

A project is underway to develop a timing center and timing signal distribution system for the Green Bank site. The signals will be distributed on optical fiber cables installed in conduit buried three feet below ground to reduce diurnal temperature fluctuations. The conduit is already on site and is now being installed. It will proceed up the Interferometer baseline to the GBT site and then to the 85/1 control building. From there conduits will branch to the 140 Foot Telescope, to the new USNO 20-meter, and to the OVLBI earth station antenna, and the Jansky Lab.

The primary frequency standard will be the USNO Sigma-Tau hydrogen maser located in a clock room in the Interferometer control building. The clock room will accommodate up to two masers and a rack of clock equipment. Temperature variations within the room are controlled using an inexpensive thermal mass.

Time is kept by a commercial digital clock which runs on a 5 MHz signal from the maser. The clock produces a 1PPS output which is distributed over the site, primarily for use in backend hardware to synchronize clocking of data. The digital clock contains an IRIG-B time code signal generator, and this output is also distributed as required by the GBT monitor and control design. The digital clock output can be synchronized to an input pulse which will come from a GPS receiver.

A LO reference distribution system takes sine-wave signals generated in the maser and distributes them to phase-lock local oscillators at the telescopes. Some type of round-trip measurement system with picosecond resolution will be installed to compensate for varying propagation delays caused by residual temperature fluctuations in the conduit and any open-air fiber runs at the telescopes.

R. D. NORROD

VLBA/VLBI

VLBA STATUS

The VLBA correlator now is operational in all major observational modes except narrowband spectroscopy (i.e., bandwidth less than 1 MHz). Processing of cross-polarization data is now supported. Using a polarization self-calibration algorithm developed by Kari Lepannen as part of his Ph.D. thesis, a very high quality image of the polarized emission from 3C 279 at 22 GHz has been produced. The instrumental polarization terms thus determined lie in the range 1-3%. The current capabilities of the VLBA correlator are listed in a document available via the VLBA homepage in the World Wide Web server.

The closure properties of the correlator have been demonstrated by the production of a noise-limited image of the mildly resolved source DA193 at 5 GHz (dynamic range about 13,000: peak to rms noise). The observing bandwidth was only 2 MHz, so a test is underway with the nominal 128 Mbit/s sampling rate to determine at what level, if any, closure breaks down and begins to limit the attainable dynamic range. During this test, it was found that the CLEAN algorithm itself limits dynamic range on mildly resolved sources such as DA193 by introducing off-source artifacts. This confirms the Ph.D. thesis work by Dan Briggs on deconvolution of high dynamic range data. The answer is either to use a model of the object within the self-calibration process or to use a more sophisticated deconvolution algorithm developed by Dan. Details of this will be published in a forthcoming VLBA memo by Richard Davis and others. This effect is believed to be potentially present at some level in many high dynamic range images of resolved compact objects.

Operation of the correlator is still quite inefficient. At the end of June, we had processed eleven astronomical and ten test observations dating from February onwards. The goal for the May/June period was to be able to maintain a 20 percent observing duty cycle. We are just able to maintain this level of operations. However, at the time of writing, throughput in the correlator has diminished further due to a recent and as yet unexplained drop in the recording and/or playback quality. Investigation is proceeding with high priority.

The backlog of unprocessed observations now stands at about 950 hours of correlator time. This is composed primarily of large Network or Global observations. These observations are being correlated with lower priority than VLBA test or science observations. Since the correlator has been demonstrated to work on eighteen station experiments, all the pending correlations can be processed in one pass. Processing of foreign station experiments is still difficult, however, due to a number of factors. Some are organizational: uncertainty about which foreign stations were included in an observation and the availability of the Mk 3 log files. Other factors in slowing down the processing of foreign station observations are more technical: difficulties in reading the Mk 3 log files into the database system, poor knowledge of the headstack offsets, the necessity for frequent clock determination, and sometimes poor recording quality. By comparison, the corresponding factors in the VLBA are largely under control.

Initial experience with VLBA data strongly emphasizes the power of the stand-alone VLBA. The data quality is high, and calibration, even at high frequencies, is straightforward. For these reasons, and the relative ease of correlation of VLBA data, we urge that at the moment users consider submitting VLBA-only proposals if possible. For those proposals that have been accepted but not yet observed, users should consider submitting a proposal addendum indicating that VLBA only is acceptable.

In the area of documentation, a chapter for the AIPS cookbook on VLBI and VLBA data reduction is under preparation. Also, a brief cookbook is being put together on preparing an observing schedule for the VLBA. Both these will be made available via the World Wide Web server. Other activities at the VLBA include improvement of the Internet communications to various VLBA sites, completion of the installation of the 43 GHz phase calibration system, and completion of the formatters.

T. J. CORNWELL

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
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

Session dates and frequencies have yet to be chosen for 1995. The question is being considered by the EVN program committee chaired by Peter Wilkinson. With the VLBA in regular use, 1995 may be radically different from past practice.

The Caltech Mark II processor ended routine correlation for the astronomical community at the end of 1993. It is still available for astronomer operation in some circumstances. In addition, the Block 0 correlator in Bologna may occasionally be available. 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 cover sheet for their VLBI proposals. Users familiar with the World Wide Web (WWW) server using Mosaic or some other viewer system can get fill-in-the-blank TeX or ASCII files through the NRAO homepage (http://info.aoc.nrao.edu). TeX and postscript files are also available via anonymous ftp from ftp.cv.nrao.edu in the directory "proposal." Hard copy forms are available from Joanne Nance (jnance@nrao.edu, 804-296-0323).

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 date; allow sufficient time for mailing. In general, fax submissions of Global proposals will not be accepted. For Global Proposals, or those to the EVN alone, send proposals to:

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

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

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

B. G. CLARK

SUBMISSION OF VLA/VLBA PROPOSALS: SOME CHANGES

Several changes have been made to the cover sheets for VLA proposals. These are substantial, and we request that proposals submitted for subsequent deadlines use this new form. A hard copy is available from Joanne Nance (jnance@nrao.edu, 804-296-0323).

Some of the questions in the original cover sheets have been eliminated as they are no longer relevant given the changes in our computers and the software used. Some questions on the desired sensitivity have been added. In addition, we have dropped the possibility of requesting a "staff collaborator" at the time of submission of the proposal. We emphasize that such a request is still welcome, but prospective users who would like a staff collaborator should request it from the VLA site director well in advance of the submission of the proposal.

As the back cover is no longer in landscape mode, the previous two TeX templates (vlacover1.tex and vlacover2.tex) have been merged into one (vlacover.tex) which is available as before via anonymous ftp from ftp.cv.nrao.edu. Both TeX template and postscript file are available with the command "get" after changing directory with the command "cd proposal" (see the file "instructions" in that directory).

Forty-seven proposals were successfully received by e-mail for the June 1, 1994, deadline. Most of these were successfully printed on the first try; the rest were printed successfully on the second try. The problems mostly were due to the assumption of DIN A-4 paper in our printer which resulted in pages that were chopped at the top. Please, remember that our printers use standard USA paper (8.5" x 11.0"). We believe that e-mail submission of proposals will work reliably and would like to encourage that proposals be sent this way. Proposals are printed promptly during working hours and acknowledged shortly after that.

J. M. USON

VLA

VLA CONFIGURATION SCHEDULE

Configuration	Starting Date	Ending Date	Proposal Deadline
B	03 Jun 1994	12 Sep 1994	1 Feb 1994
CnB	23 Sep 1994	10 Oct 1994	1 Jun 1994
C	14 Oct 1994	19 Dec 1994	1 Jun 1994
DnC	30 Dec 1994	30 Jan 1995	1 Oct 1994
D	03 Feb 1995	15 May 1995	1 Oct 1994
A	02 Jun 1995	14 Aug 1995	1 Feb 1995
BnA	25 Aug 1995	11 Sep 1995	1 Jun 1995

The VLA currently is scheduling two large surveys. One will be done at night in the DnC and D configurations (01^h-13^h and 06^h-18^h, respectively, for the 1995 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. The options are: (a) to keep the present cycle, or (b) to reverse the order of the configurations, i.e., D->C->B->A->D. Either option can be traversed in either a 16-month or a 20-month cycle and maintain the property that a given configuration precesses through the seasons. Any change from the present 16-month cycle would bring a transitional period of two or three years which could be adjusted to accommodate the surveys with less pain to prospective observers. NRAO welcomes your opinion regarding this change. This was discussed at the Users Committee meeting in Socorro in June, and their tentative recommendation was to keep the cycle as it is. Send your thoughts to Miller Goss, Assistant Director for VLA Operations.

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 nightime. These include observations at 327 MHz (solar and other interference; disturbed ionosphere, especially at dawn), line observations at 18 and 21 cm (solar interference), polarization measurements at L-band (uncertainty in ionospheric rotation measure), and observations at 2 cm and shorter wavelengths in B and A configurations (tropospheric phase variations, especially in summer). They should defer such observations for a configuration cycle to avoid such problems. The D configuration daytime will be about 00^h RA and the A configuration daytime will be about 07^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

THE VLA UPGRADE

The Very Large Array is fast approaching the fifteenth anniversary of its dedication. Conceived in the 1960s, constructed during the 1970s, and dedicated in 1980, the VLA is the most successful and productive radio telescope ever built. It continues to be used by more than 600 investigators from more than 150 institutions every year. There is every indication that demand for the VLA will continue unabated.

Even so, the VLA is an aging instrument. Its design is based on technology available in the 1970s. Since that time, major technical improvements have been made in receiver components, correlator design, and the transmission of broadband signals, rendering many elements of the VLA obsolete. Furthermore, many components are becoming increasingly vulnerable to failure—and are increasingly difficult to repair or replace. A major upgrade to the VLA is therefore very much needed, but not just to avoid instrument degradation. The intent of the upgrade is to take advantage of available technology to greatly enhance its performance.

A significant upgrade of the VLA was first discussed before the Bahcall Committee (Perley 1989), and its need was emphasized in the Report of the Radio Astronomy Panel of the Bahcall Committee. More recently, the need for a comprehensive upgrade of the VLA has been highlighted in the NRAO Long Range Plan (1994). Early this year, a committee was formed by T. Bastian to begin discussion of the many aspects of the VLA upgrade. For the purpose of introducing the VLA upgrade to the astronomical community and to initiate discussion, a document has been prepared which summarizes key elements of the upgrade and discusses many of the issues raised to date.

A copy of the VLA upgrade document is available from Rita Salazar (rsalazar@nrao.edu, 505-835-7300) or through the World Wide Web via the NRAO home page under New Initiatives. Comments are welcome.

T. S. BASTIAN AND R. A. SRAMEK

COMPUTING AT NRAO-NM

During a small ceremony on April 15, the last NRAO Convex, Yucca, was finally shut down. The Convexes have played a vital role in bridging the gap between the VAX dominated era in the early and middle eighties and the increased availability of moderately priced workstations in the early nineties. During its last months, Yucca's modest but very useful contribution was to allow the archive copying project to use its tape drives to handle a particularly troublesome batch of early VLA tapes.

With the demise of the Convexes, some related capabilities have now disappeared as well. This includes the ISIS reduction software, the capabilities of which have now been completely taken over by AIPS, and the ISU unit, which, coupled to the IIS, enabled interactive visualization of images and cubes of images. If and how we are going to replace the functionality of this ISU system is not yet clear.

During March and April the AOC's high-performance Auspex NFS file server, which provides SunOS and all our application software to more than ninety workstations, was upgraded with an additional 10 gigabytes of disk space, a high-density Exabyte for backups, and two more Ethernet interfaces. This brings the server to a total of eight Ethernets and 30 GB of disk, which will allow us to proceed with the upgrade to Sun's new operating system, Solaris 2 (aka SunOS 5). We anticipate that the majority of the AOC Suns will be running SunOS 5.3 by the fall; this is later than initially predicted, largely because of limited resources.

Our experience with Solaris to date has been quite favorable, and at the time of writing there are eight Suns at the AOC which run this version of SunOS. If you have concerns or questions about your own migration to Solaris 2, please feel free to contact Ruth Milner (rmilner@nrao.edu, 505-835-7282), manager of NRAO-NM computing systems.

G. VAN MOORSEL

NRAO GUEST HOUSE

Since March 1994, visitors have experienced living in the NRAO Guest House. Landscaping with native plants and trees is the final touch being added. The courtyard is complete with the area surrounding the Guest House also being leveled and prepared for landscaping.

Visitors are encouraged to comment on the Guest House. Suggestions, useful in making improvements, are also welcome.

M. T. ROMERO

VLA 7-MM SYSTEM STATUS AND D ARRAY CONFIGURATION

The VLA 7-mm system is now complete. Under good conditions with ten new receivers operating at 40-50 GHz, the rms noise in one hour of on-source integration is ~1 mJy/beam at 43 GHz. Several projects have already used the new system. Tests are underway to assess the high frequency performance which is expected to have four to five times worse signal-to-noise ratio than the nominal operating frequency of 43.3 GHz. For more information on the VLA 7-mm system, please contact Doug Wood (dwood@nrao.edu, 505-835-7398).

For the upcoming C configuration, the ten systems will be located on the inner stations of each arm. For the coming D configuration, we have elected to spread the Q-band systems along the arms in a spiral pattern (each receiver one station further out as you go around the array in azimuth). This arrangement was suggested by Luis Rodriguez in order to increase the spatial dynamic range of spacings, to improve the side lobes of the dirty beam, and to reduce the effects of shadowing. Simulations of this arrangement for a ± 4 hour HA observation in the D array yield a synthesized beam size of ~1.5" (elevation dependent) and a sensitivity to structures smaller than ~30". If other configurations are desired, please let me know for future planning.

D. O. S. WOOD

FIRST RESULTS FROM THE NRAO VLA SKY SURVEY

Observations for the 1.4 GHz NRAO VLA Sky Survey (NVSS) began in 1993 September and should cover the sky north of $\delta = -40°$ (82% of the celestial sphere) before the end of 1996. The principle data products will be:

(1) A set of 2326 continuum map "cubes," each covering 4°x4° with three planes containing Stokes I, Q, and U images. These maps were made with a relatively large restoring beam (45" FWHM) to yield the high surface-brightness sensitivity needed for completeness and photometric accuracy. Their rms brightness fluctuations are about 0.45 mJy beam^{-1} $\approx$ 0.14 K (Stokes I) and 0.29 mJy beam^{-1} $\approx$ 0.09 K (Stokes Q and U). The rms uncertainties in right ascension and declination vary from 0$''$.3 for strong ($S \gg 30$ mJy) point sources to 5" for the faintest ($S \approx 2.5$ mJy) detectable sources.

(2) Lists of discrete sources.

(3) Processed (u,v) data sets. Every large map was constructed from more than 100 smaller "snapshot" maps. All of the edited and calibrated single-source (u,v) data sets used to make the snapshot maps contributing to each large map have been combined into a single multisource (u,v) file for users who want to investigate the data underlying the large maps.

The NVSS is being made as a service to the astronomical community, and the principle data products are being released into a directory accessible by anonymous ftp as soon as they are produced and verified. To ensure equal access for everyone, the NVSS team members have agreed to use only these electronically released results for their own research. Unprocessed data are available on request. If you have any questions, comments, or special requests, please contact Jim Condon by e-mail at Internet address jcondon@nrao.edu or by telephone at 804-296-0322.

The large (4°x4°) map cubes and their associated multisource (u,v) data sets are stored as binary files in FITS format. Each map is named by the J2000 right ascension and declination of its center, and the name extension specifies the polarization planes. For example, J2230+84.IQU is the map cube with Stokes I, Q, and U planes centered on $\alpha = 22^h30^m$, $\delta = +84°$. The corresponding multisource (u,v) data file is called J2230+84.MS. The .IQU and .MS files are typically 6 to 13 megabytes in size. Smaller (2 to 4 megabytes) maps containing only the total-intensity plane (e.g., J2230+84.I) are available for faster access by users not interested in linear polarization. Users should read the postscript file "paper.ps" containing a detailed description of the NVSS. An introduction to the NVSS is also available on the WWW at URL address http://info.aoc.nrao.edu.

A typical ftp session might go as follows:

ftp gibbon.cv.nrao.edu	
login: anonymous	
password:	(type your name or e-mail address here)
cd pub/nvss	(to access the NVSS public directory)
ls	(to list the directory contents)
get paper.ps	(to get a postscript copy of the paper)
binary	(to copy binary files)
cd MAPS	(to access the MAPS directory)
get J2230+84.IQU	(to get the map cube centered on $\alpha = 22^h30^m$, $\delta = +84°$)
quit	

J. J. CONDON

VLAPLAN

VLAPLAN is an MS-DOS PC-based program to help continuum and line observers design VLA proposals and observing strategies. It makes the basic calculations needed when designing an observation to produce a given image quality and sensitivity within the restrictions imposed by the VLA hardware. With it, you can adjust imaging parameters interactively while seeing their consequences for VLA configuration selection, bandwidth, total integration time, and other critical parameters. The program warns of conflicts between your imaging parameters and the VLA's hardware capabilities, and suggests strategies for removing such conflicts. It can plot context-sensitive graphs of the bandwidth and time-average smearing effects, the VLA primary beam correction, and Gaussian source visibilities. For L-band observing, it also warns of conflicts with persistent RFI signals.

Starting with Version 2.0 (May 1994), VLAPLAN is available both as a stand-alone MS-DOS executable and as a worksheet template that can be run under Lotus 1-2-3, Borland Quattro, or any other spreadsheet program that reads Lotus .WK1 format and macros. The stand-alone and worksheet forms of VLAPLAN use the same menus to lead you through the basic calculations and to document the required input parameters. Either can be used without much prior experience of spreadsheets.

The program and its documentation can be obtained by anonymous ftp from the /pub/vlaplan directory on zia.aoc.nrao.edu. Paper documentation is also available from Theresa McBride at the AOC; ask for VLA Computer Memorandum No. 187. Please contact Alan Bridle in Charlottesville (abridle@nrao.edu; 804-296-0375) if you have any comments on, or questions about, VLAPLAN.

A. H. BRIDLE

12 METER

MORE ABOUT ON-THE-FLY OBSERVING

Both spectral line and continuum on-the-fly (OTF) observing techniques have matured over the past few months. In this observing mode, the telescope is driven continuously back and forth across a field. Data are recorded very rapidly (10 times a second), and are tagged with the actual antenna encoder position. The images are regridded in the analysis stage and so do not require perfect telescope tracking. For many projects, this is a superior observing technique. One advantage, for example, is that observing overhead is very low. Source fields can be covered rapidly, minimizing the effects of receiver, sky, and pointing drifts. Such drifts are often easier to correct globally from map to map than within one conventional map that is observed more slowly. The required integration time is built up by repeating each rapid map as necessary.

The largest hurdle in on-the-fly observing is coping with the data analysis and storage. When in OTF mode, the filter bank spectrometers generate about 1 MB for each minute of observing time. When the hybrid spectrometer is included in OTF (expected later this year), the data rate will approach about 5 GB per day. Even a modest spectral line map taken in a half-hour will contain in excess of 50,000 complete spectra before gridding. The large data rates, the required reduction effort, and the reduction techniques used are comparable to those of large aperture synthesis images. Despite the large processing load, we feel that it is important that observers be able to reduce their data as they are taken so that they can make on-line judgements, as is normal with millimeter-wave single dish observing.

To process on-the-fly data, we are developing a data reduction pipeline utilizing Classic AIPS. The first version of this is available for tests; we are still streamlining the process. We are also acquiring faster computers and more disk storage capacity to facilitate this observing technique. Although development is still in progress, the data acquisition and analysis systems are already suitable for use by visiting observers. We invite observers to try it and give us their reactions.

D. T. EMERSON, J. G. MANGUM, AND P. R. JEWELL

MULTI-FEED SYSTEMS WORKSHOP EPILOGUE

The Multi-feed Systems Workshop was held on May 16-18 and was a great success. About 100 participants from 14 countries and 5 continents attended. The presentations were most stimulating and informative. The proceedings are being compiled now and will be published soon in the ASP Conference Series. We thank all the participants for their excellent contributions.

D. T. EMERSON AND J. M. PAYNE

POLARIMETER UPDATE

The rotating grid polarimeter has been completed and was inaugurated by three observing groups in late May and early June. Although we still have things to learn about the instrument and how to utilize it best, all indications are that it is performing extremely well. From our initial observations, it appears that we should be able to integrate down to very low polarization percentages in both continuum and spectral line modes.

As discussed in a previous Newsletter, the device consists of a rotating wire grid backed by a plane mirror. The separation between the wire grid and mirror can be adjusted to make the polarimeter sensitive to either linear or circular polarization. The grid rotation is under full computer control; we are in the process of automating the grid/mirror separation control. Compared to conventional half-wave or quarter-wave transmission plates, this reflective device has lower losses and is more broad band. At present, the wire grid is appropriate for observations in the 3 mm band. If there is interest, grids for shorter wavelength bands may be constructed in the future. Observing proposals to use the polarimeter are welcome.

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

SUMMER SHUTDOWN PLANS

This year's summer shutdown plans include major projects in receiver development and repackaging, computer enhancements, and dome repairs. In the receiver area, we hope to finish the 8-beam receiver upgrade. The staff also plans to combine the 3 mm and 2 mm receivers into one package, which will make room for the 8-beam receiver on the telescope without having to change receiver boxes between observing programs. We are also planning a simple optics upgrade to the 3 mm receivers which will allow them to be used together as a 4-beam receiver for lines and continuum near 90 GHz. We will discuss this more in a future Newsletter. In the computer area, we are enhancing the user interface to the control system to allow observers to write observing scripts and to control the telescope themselves, if they so choose, through a GUI interface. We also hope to install a digital signal processing (DSP) card in the Hybrid Spectrometer computer to allow on-line FFTs, which are needed for the on-the-fly observing mode discussed in this Newsletter. The major renovation project of the summer is replacing the fabric on the dome door. The 12-year-old fabric has lasted longer than expected, but has now become cracked and tattered and must be replaced. The fabric covering the rest of the dome is not subjected to folding as is the fabric on the door, and is still holding up. Other renovation projects are planned, including some remodeling of the control room to create more work areas for both observers and operators.

P. R. JEWELL AND J. S. KINGSLEY

IN GENERAL

ASTRONOMICAL SOCIETY OF THE PACIFIC SLIDE SET

As part of an ongoing program of the Astronomical Society of the Pacific to get current research images/results into the hands of educators, a new slide set of radio images from NRAO telescopes will be available in the fall. The new slide collection begins where the popular ASP set "The Radio Universe" left off. The best of the radio images from the NRAO files (primarily VLA) since 1985 have been assembled and captioned for educators with the assistance of Pat Smiley from Charlottesville and Dave Finley at the VLA. The ASP thanks the NRAO and the community of radio observers for making the set possible. Other new slide sets that will be available from the ASP include images and information about the ROSAT, GRO, ASTRO 1, and KECK programs. Anyone who would like to help the ASP produce additional slide sets on other topics should not hesitate to contact the ASP via internet:

asp@bkyast.berkeley.edu OR rhavlen@stars.sfsu.edu

R. J. HAVLEN
(Executive Director, ASP)

AIPS++ PROJECT

The AIPS++ project continues to make progress, with a number of significant accomplishments during the past quarter.

Data Handling and Storage.

Early versions of the data structures ("Measurement Sets") for the VLA and the Australia Telescope were finished. These allowed the importation of FITS and AT data (the latter directly from the on-line "RPFITS" format) into AIPS++ tables for further processing. A Visibility Set (VS) in AIPS++ contains generic UV data. Using a preliminary version of the design for an AIPS++ VS (with multi-frequency and multi-polarization capability), the data were imaged using a simple UV imaging routine.

Imaging and Cleaning.

Mark Wieringa from ATNF used high level AIPS++ classes and created a set of Clean Tools (Hogbom, Clark, and Steer-Dewdney-Itoh) for image deconvolution. He was able to do this in less than three weeks; adding the SDI clean took only a few additional days. This experience is a promising hint that AIPS++ will eventually be as programmable as everyone hopes. A couple days of further effort for optimization yielded correct results on the same data used by the AIPS medium-sized DDT test, with comparable processing time.

Glish.

Glish is a "Software Bus for High-Level Control" (Paxson, 1993 in the Proceedings of the 1993 International Conference on Accelerator and Large Experimental Physics Control Systems). We have selected Glish to provide the underlying control and communications needed by AIPS++ to link processes and tasks. Besides providing an interactive, programmable environment for process and task control, Glish also provides support for distributed processing. In particular, it will provide the mechanism to connect AIPS++ to on-line control systems. This will allow for nearly transparent use of AIPS++ for near-real-time data analysis, the sort of processing often needed by observers at telescopes. Interestingly, other radio astronomy projects are also seriously considering Glish for use in their control systems. (Glish will be used by the monitor and control group for the Green Bank Telescope to provide interprocess communications and compatibility with AIPS++.)

Other recent progress:

- FITS I/O Classes (images, binary tables, and random groups fully compliant with the newly approved IAU standard for FITS);
- Image Class: dummy version created, coordinates in progress;
- Revised design for the AIPS++ Table system (implementation nearly complete);
- Units and (astronomical) coordinates: progress on design and implementation;
- Compiler problems largely resolved;
- Support for multiple architectures in place;
- Selection of Glish for communication and process control, Command Line Interface plans;
- Design and initial prototype of User Interface, Graphical User Interface;
- AIPS++ Arrays, Math Classes, utilities, distribution system, and revision control stabilizing;
- Initial version of the AIPS++ Table Browser (read-only) completed.

Release plans.

The table below summarizes our current release plans for AIPS++, with target dates. There is a degree of optimism built into these dates, but we hope that AIPS++ can achieve them barring unforeseen technical problems. This plan reflects the effects of recent personnel and organizational changes experienced by the project. In the short term, the NRAO part of the AIPS++ project will be concentrating on the overall AIPS++ infrastructure along with some single dish applications with a view to testing out the relevant infrastructure. In particular, we will use on-the-fly mapping as the test application for August 1994. Non-NRAO members of the AIPS++ consortium are focusing on other key areas: UV imaging and calibration, visualization, and image analysis.

Target Date	Release	Comments
August 1994	Version 0.1 ("Friendly Astronomer") (Internal use only)	Demonstration AIPS++ applications for early user feedback Basic tools for application development Key classes needed for Image Analysis Documentation system framework
January 1995	Version 0.5 ("Alpha Release")	Basic user interface Useful programmable command line Graphical User Interface prototype Core Single Dish applications GUI tools: 1- and 2-D display, some feedback Sample interferometric applications Spectral imaging Cleaning Antenna based calibration (I pol) Sample Image Analysis applications Image geometry correction, regridding Line and component fitting Basic documentation
July 1995	Version 0.9 ("Beta Release")	User interfaces Command Line, Graphical Core Single Dish applications Core UV applications Image analysis applications
January 1996	Version 1.0 (full AIPS++ release)	Nearly full AIPS and UniPOPS functionality Comparisons, testing of AIPS++ against AIPS, MIRIAD, UniPOPS, GYPSY, etc.

R. S. SIMON

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

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