NRAO NEWSLETTER

1984 March 1 No. 16

12-Meter

APERTURE EFFICIENCY, BEAMWIDTHS AND AXIAL FOCUS

Following final adjustment of the telescope optics and refiguring of the secondary reflector, we have remeasured the aperture efficiencies of the 12-meter telescope in the Cassegrain configuration. The following efficiencies were obtained using Venus as a calibrator; the efficiencies measured on Saturn were consistent with these values. We also present half-power beamwidths (HPBW).

Wavelength	Receiver	Aperture Efficiency	HPBW AZ	HPBW EL
3.33 mm	70-115 GHz Cooled Mixer	0.40 ± 0.03	77"	76"
3.33 mm	90 GHz Room Temp Rx with Improved Feed	0.45 ± 0.03	73"	71"
1.34 mm	200-240 GHz Cooled Mixer Receiver	0.14 ± 0.02	34"	34"
800 μ, 1.1 mm, 1.4 mm, 2.0 mm	Bolometer Rx	-	51" ± 5"	43" ± 5"

These measured efficiencies and HPBWs are to be compared with the following prime focus results.

Wavelength	Receiver	Aperture Efficiency	HPBW AZ	HPBW EL
3.33 mm	90 GHz Room Temp Receiver	0.48 ± 0.03	72"	72"
1.34 mm	223 GHz Room Temp Receiver	0.19 ± 0.03	28"	28"

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

The telescope beam patterns were clean at all wavelengths greater than 1 mm. Sidelobe levels appear to be very low. At the shorter wavelengths ($\lambda \leqslant 1.4$ mm), the main beam patterns measured with the bolometer were somewhat asymmetric at the lower levels. This was not the case for the 1.3-mm mixer receiver. The half-power beamwidths with the bolometer are almost independent of wavelength.

The axial focus curves of the telescope were clean and agreed with theoretical predictions for their half widths down to a wavelength of 1.3 mm. At shorter wavelengths (1.1 mm, 800 μ), the width of the focus curve becomes broader than theoretical. Measurement at 3.3 mm and 1.3 mm showed identical focus curves in orthogonal polarizations; astigmatism does not appear to be a significant problem at these wavelengths.

Even with the improved feed at 3.33 mm, the Cassegrain efficiency is probably slightly less than at prime focus. The following factors affecting Cassegrain efficiency will be investigated in the near future:

(1) The Cassegrain geometry has turned out to be slightly different from the original design. This could be contributing to loss in efficiency.

(2) The lens-corrected feed horn used at the Cassegrain focus is almost certainly less efficient than the feeds used at prime focus.

(3) There will be a slight loss in the two flat mirrors used to direct the beam from the subreflector to the receiver, and in the subreflector itself.

At λ 1.34 mm, the Cassegrain performance is significantly lower than at prime focus. The aperture efficiency is lower and the beamwidths greater. We believe that, in addition to the factors detailed above, large scale errors in the subreflector may be a major culprit. A more precise subreflector is on order, and this will be installed and tested when time and the observing schedule permit.

J. Payne, C. Salter

RECEIVERS

We now have three receivers mounted on the telescope.

(1) The old 70-115 GHz dual-channel, cooled mixer receiver (T_R(DSB) ~200 K per channel). The receiver noise temperature (DSB) varies from 180 K to 300 K per channel over its frequency range. It will be phased out in mid-1984 and replaced with a new cooled mixer receiver having a noise temperature (DSB) ~100 K per channel at 115 GHz.

(2) The new 200-240 GHz dual-channel mixer receiver (T_R(DSB) ~300 K per channel). The noise temperatures are higher than those obtained in the laboratory. We are currently investigating this.

(3) The 0.3 K bolometer receiver equipped with filters for λ 2 mm, 1.4 mm, 1.1 mm and 800 μ. The sensitivity seems to be in the range 2-3 Jy/sec at 1.4 mm. However, the sensitivity is currently being marred by microphonics induced by the cryogenic refrigerators of the other receivers. This problem will be fixed during the next month.

J. Payne, C. Salter

TELESCOPE POINTING

Pointing is the principal problem observers are encountering with the new system. The always difficult problem of determining pointing correction and pointing stability at millimeter wavelengths has been exacerbated by the lack of strong sources at 1 mm wavelength and the present clustering of the planets. Thanks to the efforts of the first observers, pointing corrections have now been determined at 1 mm and 3 mm. At 1 mm the peak-peak uncertainty, after correction, is about 20 arc sec. How much of this may be due to temperature effects or other systematic effects that may eventually be calibrated is not known. It is going to take a lot of observing to fully understand the pointing characteristics of the telescope, and considerable time will be devoted to this.

D. S. Heeschen

RECEIVER CHANGING

During the test period we routinely changed receivers by rotating the central flat mirror. We could change from one receiver to another in less than 15 minutes. The pointing differences between all receivers were less than 20", and the repeatability of pointing on reselecting a given receiver was better than this.

J. Payne, C. Salter

IMPRESSIONS FROM AN EARLY OBSERVING RUN

The Editor, along with L. J Rickard (Howard U.), observed CO (J = 2-1) in galaxies during the period 4-14 February. Of importance to this project were accurate pointing, good spectral baselines with the 2 MHz filter banks, and reliable calibration.

Pointing. Only two specifics might be mentioned in addition to the remarks made by Dave Heeschen. We could follow the pointing with great precision on the galaxies, because the shape and velocity centroid of the CO lines depends strongly on position offset from the nucleus. Although pointing curves were generally fairly smooth over the tracks of six galaxies, there are occasional jumps in both azimuth and elevation within a few degrees of position change on the sky. These jumps were ~10 arc sec in size. Regarding temporal aspects, our pointing curves remained stationary for 7-8 days, then (for two of the galaxies) shifted over part of the track by about 12 arc sec. Pointing appears to be a problem at this level of precision, and observers must take quite extreme measures to characterize it carefully, source by source.

Spectral Baselines. Problems of instability in the IF's and of generation of birdies caused use of the 2 MHz filters to be inefficient. Sometimes the baselines were excellent, other times the data were useless. Causes were hard to pinpoint. Some radar interference may be getting into the 1.5 GHz first IF despite careful filtering. Baseline instability may be due partly to lack of temperature control of the first IF, a problem we intend to rectify. Eventually, fast chopping will be implemented (although with a maximum throw of 10 arc min). Until these problems are remedied, observers can expect less than 50% efficiency in useful data with the 2 MHz filters, if our observing run was typical. Note: A corner cube was installed in mid-February, leading to a significant improvement in both narrow and broadband baselines.

The Editor

VLA

LONG-TERM VLA CONFIGURATION SCHEDULE

Various users have asked for information on the long term VLA configuration schedule. The following table shows the plan based on the 1-1/4 year cycle time used since the VLA started observing with its standard configurations. This schedule cycles any given array through all seasons after four years. We adjust the relative length of each configuration depending on demand, and to a lesser extent on local reconfiguration constraints, but we do not let the configuration phase drift. All these configuration changes are uncertain by about 6 weeks, so it is not advisable to plan on using the last possible deadline for proposals for any given configuration. In 1987 we may modify the schedule to avoid A array in summer.

Between each adjacent configuration we stop in the long north arm hybrid which is optimum for observations of sources with declination less than -15°. The time spent in this hybrid also depends on proposal pressure. We also schedule observations which do not require any particular configuration during the periods when we are moving the telescopes. At these times at least 22 antennas are normally available for observing.

Approximate Long Term VLA Configuration Schedule

Year	Quarter	Array
1984	Q1	B
	Q2	C
	Q3	D
	Q4	A
1985	Q1	A
	Q2	B
	Q3	C
	Q4	D
1986	Q1	D
	Q2	A
	Q3	B
	Q4	C
1987	Q1	C
	Q2	D
	Q3	A ?
	Q4	B

R. D. Ekers

VLA ON-LINE SYSTEM UPGRADE

The proposal to upgrade the VLA on-line (synchronous) system using ModComp computers was agreed upon by the computer advisory group in the last quarter of 1983. By the end of 1983, the detailed specification for the whole project was complete, and the order for the first half of the computer hardware was placed. This comprises two ModComp Classic 11/75 computers with the peripherals necessary for hardware and software development. Delivery is projected to be in April 1984. The current upgrade plan is for the second hardware procurement to be in the first half of 1985, with the installation of the new system in 1986.

Gareth Hunt

VLA CONFIGURATIONS 1984/85

Quarter	Configuration	Proposal Deadline
1984 Q2	B/C, C, possibly C/D	January 15, 1984
1984 Q3	C/D, D	April 1, 1984*
1984 Q4	D, D/A, A	June 15, 1984*
1985 Q1	A, A/B, B	September 15, 1984*

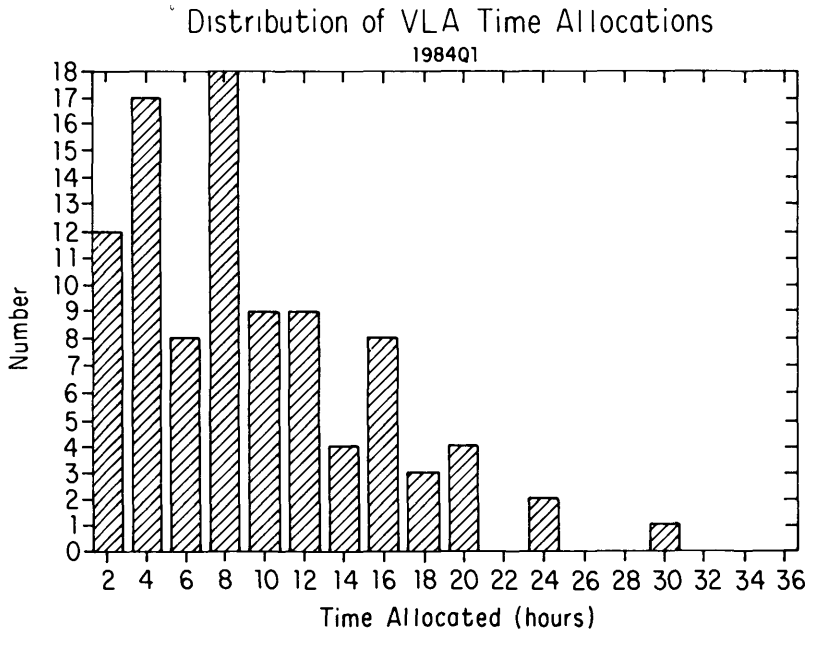
*Note change in proposal deadline (see NRAO Newsletter 15)

R. D. Ekers

DISTRIBUTION OF TIME ALLOCATED PER PROPOSAL AT THE VLA

The figure shows the distribution of time allocated per proposal at the VLA during the first two months (B array time) of 1984. This histogram may provide a useful guideline for proposers who are unsure about the amounts of time currently being granted to VLA proposals. The histogram is generated from total time granted to a project in this period. It includes all sources requested in a proposal but does not include time allocated to a proposal for observations with a different array.

The total number of proposals received for VLA observations has continued to increase, so at present there is no indication that we can easily increase the average time per proposal. There were 139 proposals requesting time during the period. Time was allocated for 95; 23 (which could use other configurations) were deferred; and 21 were rejected.



R. D. Ekers

Green Bank

300-FOOT TELESCOPE MODERNIZATION

As has been mentioned previously in these pages, the 300-foot telescope is being modernized. Rick Fisher is Project Manager for a two-component effort: (1) installation of a new control computer, and (2) design, construction, and installation of a new backend.

Project Scientist for the control computer portion of the project is Harry Payne. For the backend, Dan Stinebring is Project Scientist.

The control computer is obviously of interest to all telescope users. Here we point out that the backend is also of interest to all telescope users. For continuum observers, it offers the possibility to eliminate bursts of interference limited in time and frequency without losing entire scans; for spectral line observers it provides the necessary frequency resolution; and for pulsar observers the backend provides time resolution and the capability to remove the dependence of pulse arrival time on frequency (dedispersing in the insider's imaginative vernacular).

Now, in the early stages of the project, is the time to offer suggestions of desirable features. Please contact Rick Fisher, Harry Payne, Dan Stinebring, or myself.

George A. Seielstad

ADMINISTRATIVE SERVICES, GREEN BANK

Richard L. Fleming was appointed Business Manager for Green Bank Operations effective February 1, 1984. He has been employed by NRAO-GB for fourteen years, first as an electronics engineer and most recently as purchasing and property officer. A search for a replacement for the latter position is underway.

At the same time, Becky Warner has been promoted to the position of Housing and Food Services Supervisor. This move ensures that visitors' "creature comforts" will maintain a standard of excellence.

Also, a ten-year employee, Fred Bierer, has been promoted to Division Head for Plant Maintenance.

All these people stand ready to serve you.

George A. Seielstad

STATUS OF THE GREEN BANK INTERFEROMETER

The second long baseline of the Green Bank interferometer is now in operation, and preliminary results indicate that it is performing well. Conversion of the original 1347-MHz data link to 17 GHz is expected to take place in April.

R. Fisher

BUGS IN THE GREEN BANK INTERFEROMETER PROGRAMS

We have found many bugs in the Green Bank interferometer programs NEWCLEAN and NEWAVG. The editing algorithm in NEWCLEAN has many logical flaws, and our Fortran version of NEWWAVG will produce artificially lowered amplitudes if any records of a scan are flagged. We have written an improved program which corrects all the bugs we have found and which consists of about 3400 Fortran card images. Should anyone be interested in these programs, please feel free to call us at 202-653-1205 or write to us at the U.S. Naval Observatory, Washington, D. C. 20390.

Demetrios Matsakis and Phil Angerhofer

In General

MILLIMETER ARRAY STATUS

A technical advisory committee has been appointed to aid NRAO in preparations for building the array. The first meeting will take place on March 1 and 2 at the VLA-Socorro. The members of the committee are:

Paul Goldsmith	University of Massachusetts
Alan Moffet	California Institute of Technology
Pat Palmer	University of Chicago
Tom Phillips	California Institute of Technology
Larry Rudnick	University of Minnesota
Tony Stark	Bell Labs
Bobby Ulich	University of Arizona
Jack Welch	University of California, Berkeley
Bob Wilson	Bell Labs

Bob Wilson will serve as chairman of the committee.

F. Owen

NOW AVAILABLE: UNION LIST OF ASTRONOMY SERIALS

Physics-Astronomy-Mathematics Division, Special Libraries Association: 180 + pages; loose-leaf compilation of the astronomy holdings of 14 astronomy collections including U.S. Naval Observatory, Kitt Peak National Observatory, Yerkes Observatory. Over 1800 titles.

Orders should be directed to:

Judith A. Lola
Yerkes Observatory Library
P.O. Box 258
Williams Bay, WI 53191

$20.00 prepaid; $25.00 for billing. Checks should be made payable to PAM Division, Special Libraries Association.

J. A. Lola

NEW FACES ON THE SCIENTIFIC STAFF

Since the mid-1983 Newsletter announcement anticipating the arrival of new Research Associate appointees, there have been a number of additional arrivals to positions on the Basic Research Staff which we have neglected to bring to your attention:

John Romney — is a Systems Scientist with the VLBA project in Charlottesville. He was previously affiliated with the MPI in Bonn and his research areas are the active nuclei of radio galaxies and QSOs.

Wolfgang Batrla — is a Visiting Systems Scientist at Green Bank where he is the "friend" of the 140-foot telescope. He also came to NRAO from MPI in Bonn. His research interests are in molecular radio spectroscopy and the physics of interstellar molecular clouds.

Dick Miller — is a Visiting Scientist from the University of Chicago, now in Charlottesville for a couple of months after having already spent a comparable length of time at the VLA. Dick specializes in the dynamics of galaxies and clusters.

Paul Coleman — is a Junior Research Associate from the University of Pittsburgh who is completing dissertation research under the joint direction of J. Condon at NRAO and C. Hazard at Pitt. His research is on the cosmological implications of the multivariate QSO luminosity function.

R. J. Havlen

MORE BANG FOR THE BUCK IN 1983

1983 was another banner year for the NRAO as measured by the total number of scientists using the Observatory's telescopes throughout the year. In spite of the fact that the newly resurfaced 12-meter telescope was in service less than four months, the four NRAO telescopes were used by a grand total of 677 different scientists from a total of 138 different world-wide institutions during 1983. This is a jump of 12% over 1982 and a whopping 188% increase in the past decade. In 1973 (pre-VLA), 235 scientists, representing 54 institutions, competed successfully for NRAO observing time. Included in the statistics for 1983 were 42 NRAO staff observers compared to 33 in 1973. For comparison, the NRAO operating budget between 1973 and 1983 increased less than 1% in constant dollars (!).

1983's telescope usage statistics break down into the following user-telescope categories:

	12 meter	140-foot	300-foot	VLA
Visitors	28	145	35	445
Students	2	31	12	91
NRAO Post Docs	1	1	1	8
NRAO Permanent Staff	3	15	8	27
Total Observers	34	192	56	571

R. J. Havlen

National Radio Astronomy Observatory
12-Meter Telescope/Arizona Operations
Observing Application
Cover Sheet

NRAO USE ONLY

Received:

SEND TO: Director, NRAO, Edgemont Road, Charlottesville, VA. 22903
DEADLINES: 15th of Jan., Apr., July, Oct. for Quarters 2, 3, 4, 1, respectively.

1 Date:

2 Title of Proposal

3 Authors	Institution	Who Will Observe?	Grad Student?	Observations for PhD Thesis?	Anticipated PhD Year

4 Contact Author(s) for Scheduling.

Name

5 Telephones:

Office | Home

6 Scientific Category. ☐ atmospheric; ☐ planetary, ☐ solar, ☐ stellar, ☐ galactic, ☐ extragalactic

7 Mode ☐ spectra, ☐ continuum, ☐ other (specify).

8 Receiver (please consult Front End Box Status Sheet).

9 Ancillary Equipment. ☐ Fabry-Perot filter, ☐ Polarimeter, ☐ Sunshield, ☐ Offset Oscillator, ☐ No of Continuum Backends

10 Filters ☐ Expander, ☐ 30-kHz, ☐ 100-kHz, ☐ 250-kHz, ☐ 1-MHz, ☐ 2-MHz

11 Frequencies (include test lines)

12 Special Software? (describe on separate sheet)

13 Special Hardware? (describe on separate sheet)

14 Sessions/Days Requested.

15 LST Range:

16 Abstract (do not write outside this space)

Please attach a summary (of less than 1000 words) which contains the following information

1) Scientific justification,

2) Observing strategy;

3) Source list with **coordinates.**

After your proposal is scheduled, the contents of this cover sheet become public information (supporting documents are for referees only)

For Internal Use Only

MAG 83 10 26

SUBMISSION OF PROPOSALS

The NRAO (mercifully) requires that prospective users submit only one copy of an observing proposal. Please do not send duplicate copies in the same envelope in an effort to expedite the proposal handling procedures. Saundra Mason, the secretary who so ably handles the logistics of referee mailings, etc., prefers to treat all proposals identically in order to avoid slipups.

If you are sending two or more copies of a proposal in order to insure mail delivery, please clearly mark the redundant proposals as "duplicate."

R. J. Havlen

DATE CHANGE

The next NRAO User's Committee meeting will be held on May 22 at the VLA site. A VLA-related workshop is also being considered for the following day, May 23rd.

R. J. Havlen

YET ANOTHER FORM

Inserted as an unnumbered page in this issue of the NRAO Newsletter is an observing application cover sheet for 12 meter telescope proposals. Three different NRAO cover sheets are now in use for the VLA, the Green Bank telescopes, and the 12 meter telescope. Use of these forms has greatly improved the efficiency of proposal handling/refereeing, of telescope scheduling, and of equipment preparation for the increased number of proposals now being submitted. Their routine usage is greatly appreciated. Extra copies are available from the Director's office or from each telescope site and the use of photocopies is encouraged. Updated versions will occasionally be distributed in the Newsletter. Please avoid the use of outdated forms. (A revision to the VLA observing application is due in the next issue.)

R. J. Havlen

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