



NRAO NEWSLETTER

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In General

FUTURE INSTRUMENTATION IN RADIO ASTRONOMY

A workshop on "Future Instrumentation in Radio Astronomy" was held on October 11 and 12, 1982 in Green Bank. Scientists and engineers from all NRAO sites attended and contributed to the success of this internal meeting. There were three basic themes: "Foreseeable Technology Improvements and Scientific Desiderata", "Foreseeable (mostly long range) Projects", and "Improvements in Existing Instruments".

Suggestions for future projects that were presented at the Workshop included:

- (1) At millimeter wavelengths--arrays and filled aperture instruments, with emphasis on the former. An antenna in the Southern Hemisphere as well as observations from space-borne instruments were also discussed.
- (2) At centimeter wavelengths--again arrays and (large) filled aperture instruments. A short baseline array was described in the context of use with the VLA. It could also be realized in the millimeter array mentioned above. Extensions of the VLA or the VLBA, i.e., outrigger or "inrigger" telescopes, and a space VLBI involvement were also discussed.
- (3) At meter wavelengths two arrays, one operating at a few to tens of megahertz and one at ~100 megahertz, were described.
- (4) A detailed rationale for studies and development in image construction was presented by Tim Cornwell. He urged the development of a group to this purpose.

A frequent theme throughout the two days of discussion was that of computers and computing. Witness the following three quotes: "Easy if you have enough computers around" (Clark); "It only takes computing" (Kellermann); and "Both of these imply lots and lots of computing" (Wells).

The Observatory's current effort is directed to the completion of the 12-meter upgrade and the realization of the VLBA. Within this framework we intend to examine and evaluate the above suggestions (and others that may develop) as areas of future development. Additional suggestions, as well as comments on the above, are welcome. As appropriate, progress will be reported at User meetings, in this Newsletter, and via special reports.

Morton S. Roberts

PAGE CHARGE SUPPORT REVISITED

Although there have been several recent write-ups in this Newsletter concerning payment by the NRAO of page charges, there still seems to be some confusion lurking in the minds of NRAO staff and users about the policies. Therefore, herewith is yet another attempt to explain page charge support:

1. THE RULE: NRAO will pay 50% of the page charges for papers when a significant portion of the work was done, or the observational material taken, at the NRAO.
2. THE EXCEPTIONS:
 - (a) On non-VLBI papers, NRAO is not able to provide page charge support for authors from non-U.S. institutions. In practice, this means that support for page charges will be prorated by the percentage of U.S.-based authors. For example, for a paper with two U.S. authors and one foreign author, NRAO will pay 33% of the page charges (= 50% of the U.S. authors' portion of the charges).
 - (b) On VLBI papers where there is at least one author from a U.S. institution, NRAO will pay that portion representing NRAO telescopes. For example, on a 5-element VLBI experiment involving the 140-foot and the VLA, NRAO will pay 40%.
 - (c) When significant portions of the observational material come from non-NRAO facilities, NRAO's contribution will be proportionately reduced. For example, if data are reported from NRAO, IRTF, and Palomar Observatory, the NRAO will pay 17% of the page charge (which is equal to 50% of NRAO's one-third involvement). If one of the three authors is non-U.S., NRAO's support would be 11% (= 50% of the U.S. authors' portion of the NRAO fraction of the charges, i.e., $50\% \times 67\% \times 33\%$). As long as at least one of the authors is from a U.S. institution, NRAO page charge support will not go below 10%.
 - (d) For papers which report data which has been obtained at more than one national observatory (i.e., NRAO, KPNO, NAIC, etc.), the maximum amount of page charge support will be 50% of the charges attributable to the authors at U.S. institutions. This amount will be equally shared by the national observatories involved.
 - (e) In all cases, if the portion of NRAO staff member authorship is greater than the amount that would otherwise be paid, NRAO will pay the greater amount. To use the example from "a" above, if both U.S. authors were NRAO staff members, NRAO would pay 67% instead of 33%.

Although this seems (and is) terribly complicated, it is only complicated for the complicated papers. For the most part, the rule as stated above will apply. If in doubt, contact me in Charlottesville and we'll figure it out (presupposing you have sent the requisite preprints so we have something on which to base the decision.)

Sarah Stevens-Rayburn

IT'S UP TO YOU!

The minimum lead time between proposal submission and telescope time for the VLA and the 12-meter--currently less than three months--is amazingly short in comparison to other visitor-oriented observatories. The system places a heavy burden on the external referees who respond with reviews of up to 50 or more proposals (depending on telescope and discipline) in a brief five or six weeks span before the scheduling committee meets to assign telescope time.

Before submitting your next proposal, please consider the task of the referees, swamped under a barrage of proposals which have all been received during the last few days prior to the deadline. Please do not expect the system to accommodate late arriving proposals. Receipt in Charlottesville by the 15th of the third month preceding the start of a quarter is essential to the health of the system. Postmarks prior to the deadline indicate good intentions and a superior faith in the postal system, but are merely curious collectors items at best. Make the extra effort to get proposals in on time, and the NRAO, in return, will continue to provide a minimum lead time between proposal submission and the actual observations.

R. J. Havlen

RECRUITMENTS AND REFERRALS

This is a reminder that the NRAO is currently accepting applications for a number of postdoctoral positions for research in astrophysics. Each year rumor has it that a number of well-qualified applicants neglect to apply, for one reason or another. If you have students or are aware of qualified potential applicants who will have completed their Ph.D. dissertations by November 1983, please encourage them to apply for these very attractive positions. All application materials must be in Charlottesville before January 15th. These include a curriculum vitae, three reference letters, and a statement of planned research activity.

R. J. Havlen

VLA

WHAT HAS THE VLA OBSERVED?

Keeping track of what has been observed with the VLA has become a major problem and our inability to do this adequately has resulted in some unnecessary overlaps in VLA observing programs. Since June 1982 we have been running a new observation summary archiving program. This program extracts information from the "GO SUMMARY" output of the DEC10 LISTER program, adds the name of the principal investigator, the VLA program code and the VLA configuration, and merges this into a file sorted into right ascension order. Each quarter a copy of this listing will be made available in all NRAO libraries. It is our intention to bring out an annual summary with the four quarters combined, and with snapshot observations removed to keep the summary to a manageable size. This will be provided to users and libraries on demand. We are also investigating the possibility of interactive access to this file from outside terminals.

For VLA observations made before June 1982 we can currently only provide a very superficial summary based on proposal titles. We propose to use the MODCOMP archive tapes to extend the new observation summaries back in time towards the beginning of full VLA operation. Owing to limitations of manpower, this will proceed slowly.

R. D. Ekers and B. Clark

VLA CONFIGURATIONS FOR 1983

We propose to modify our normal sequence of VLA configurations from 1983 on. These proposed changes result from consideration of a number of (mostly conflicting) requirements:

1. Solar and line users prefer to have the two compact configurations (C & D) spread out in time.
2. Solar observers prefer to have a compact configuration during summer.
3. Low declination observers like the long north arm hybrids which are only available when we reconfigure between adjacent arrays.
4. All adjacent hybrids should be available for scaled arrays.
5. Summer daytimes are bad for A array observations.
6. We do not like to reconfigure during the windy season.

Our proposal is to switch to a basic A B C D A ... cycle in order to provide all adjacent hybrids. As before, the basic cycle is to be spread over one and a quarter years in order to slide the sidereal times available through each configuration. However, we plan to perturb this cycle whenever A array occurs in summer by inserting one of the more compact arrays. This happens in 1983 so we will insert an extra D configuration.

This results in the following schedule for 1983:

<u>Quarter</u>	<u>Configuration</u>	<u>Proposal Deadline</u>
1983 Q1	C	October 15, 1982
1983 Q2	C + D	January 15, 1983
1983 Q3	D + A	April 15, 1983
1983 Q4	A + B	July 15, 1983
1983 Q1	B + C	October 15, 1983

The previously unavailable B/C hybrid will occur in the first or second quarter of 1984 so all scaled hybrids will be covered. As previously, the actual length of each configuration will be varied in response to proposal pressure. We also continue to support observations during the reconfiguration.

R. D. Ekers

DEFINITION OF STOKES V PARAMETER

As of April 26, 1982 the definition of the Stokes parameter V (= (AA-CC)/2) in the DEC10 and MAPPER is positive for right circular polarization (using the IEEE definition). The AIPS system changed to this convention on September 21, 1982.

Carl Bignell

INSTRUCTIONS FOR TRAVEL BETWEEN ALBUQUERQUE AND THE VLA SITE

Since the removal of the GSA cars from the Albuquerque airport we have been operating under a government contract with Thrifty-Rent-A-Car. Comparisons have been made with other car rental agencies and for the majority of our users Thrifty is the most economical. Several different approaches to transportation between Albuquerque and the VLA site are under study. When it is complete, further changes may be made.

The current procedure is:

Reservations

Reservations for a rental car may be made by calling the VLA site on FTS 476-8357 or commercial (505) 772-4357. To make your rental car booking we will have to have an accurate arrival time and, if possible, the arrival flight number, as well as your departure data and time.

Arriving at Albuquerque's Airport

1. Upon arrival telephone 842-8733, Thrifty-Rent-A-Car at 2039 Yale Boulevard S.E. They will dispatch a shuttle to take you to their office, which is open 7 days a week from 7:00 a.m. to 11:00 p.m.

2. Observers and employees being reimbursed for travel expense should decline extra insurance on the rental contract.

At the VLA Site

If you are being reimbursed for travel, please turn your car keys in to the receptionist and they will be placed on the keyboard for general site use if needed. Circumstances may occur that will necessitate swapping your vehicle with another. If this happens we will insure your return to the airport.

Return to Albuquerque Airport

1. Return the car to Thrifty at 2039 Yale Boulevard S.E., where you picked it up. They will transport you to the airport.

2. Attach your copy of the rental contract to either your request for reimbursement or to your travel voucher, whichever is applicable.

3. If you are not to be reimbursed by NRAO for the travel, then you should make arrangements directly with Thrifty for payment.

Bob Dorr

REVISED GREEN BOOK

The revision of "An Introduction to the NRAO Very Large Array" in the new green notebook format was completed, with an initial production run, in June 1982. Unfortunately, owing to unexpectedly high demand, we are temporarily restricting the distribution of the new green notebooks to observers arriving, or about to arrive, at the VLA site. More general requests will be deferred until another production run is finished in early 1983.

Robert M. Hjellming

VLA ANTENNA POINTING PERFORMANCE

The long-term, nighttime pointing performance of VLA antennas has recently been determined by analysis of data from routine pointing runs made over the past two years. Results are summarized below:

	<u>Not Over-the-Top</u>	<u>Over-the-Top</u>
Azimuth RMS Error (arcsec)	12.00	12.08
Elevation RMS Error (arcsec)	14.38	12.76

Each "Not Over-the-Top" value includes over 50,000 pointing error measurements, while each "Over-the-Top" value includes about 6000. The higher values for "Elevation RMS Error" are believed to be caused by significant elevation errors in certain azimuth ranges for certain antennas which, in turn, are caused by imperfections in azimuth bearings. This effect has been observed in Antenna 6 via tiltmeter and bearing measurements which show imperfections that cause a 30 arcsecond elevation error over a specific 60° azimuth range. The two-year pointing database indicates that seven other antennas seem to have significant imperfections of this sort. A study of the feasibility of on-line corrections for these types of elevation errors is currently in progress.

Polyurethane foam insulation has proven to be effective in precluding large thermal differences among pedestal tubes and between yoke faces which are known to significantly degrade daytime pointing (cf. VLA Test Memorandum No. 138, June 1982). Installation of insulation is complete on Antenna 22 and in progress on Antenna 14. The estimated completion date for all 28 antennas is December 1985.

A new focus-rotation system which contains a sub-reflector locking device was installed on Antenna 12 in July 1982. Preliminary tests indicate some improvement in RMS pointing error at the higher frequencies (2 and 1.3 cm). It is planned that a decision be made early next year regarding installation of this F-R system on all antennas.

A feasibility study of using tiltmeter measurements for real-time correction of wind-induced pointing errors is also in progress. Simultaneous tiltmeter and astronomical pointing error measurements made on windy days during Spring 1982 are being analyzed in an attempt to determine the fraction of wind-induced pointing error which is caused by deformation below the elevation axis. This fraction represents error which is correctable via tilt measurements. Study completion is anticipated by the end of 1982.

R. T. Newell

12-Meter

PROGRESS ON THE 12-METER PROJECT

The resurfacing project continues to move forward. All of the ESSCO plates have been installed. The (extensive) modifications to the control building are now complete. The control and data systems have been reinstalled in the control building.

John Payne's prophesy has been realized, however. A month ago, he said "Things are going so well that we're due for a setback". We actually had two--probably not a bad record for a project of this type.

The first problem relates to the surface setting. As they were being bolted in place, the surface plates were roughly adjusted by using an optical theodelite. Calculations predicted that this initial setting should give a surface accuracy between 100 and 200 μm . When we later installed the template to check the rough setting, there was a disagreement of as much as 1 cm between the template and the optically-set surface. A check of the optical calculations showed no obvious error.

Which method was correct? Because of the much greater accuracy inherent in the template method, the surface was completely reset to match the template. The 1-cm magnitude of this resetting sometimes required the complete removal and reinstallation of the surface plates. We are now installing a 3-mm receiver at the prime focus to make a radiometric measurement of the aperture efficiency before proceeding to the final setting of the surface. Time lost: two weeks.

To make the efficiency measurement, the telescope must track radio sources. We have discovered an error in the balance of the telescope about the elevation axis. Approximately 5000 pounds of lead must be cast and attached to the bull gear. This requires bids, a purchase order, and two more weeks of delay.

These delays offset some of the gains of earlier successes. While our expectations for the telescope's performance remain unchanged, it appears increasingly likely that the telescope will be first available to visitors in February rather than mid-January 1983.

Mark Gordon

NEW RECEIVER FOR THE 1-mm BAND

Laboratory tests of the performance of the new receiver for the 1-mm band have recently been completed. The novel design incorporates eight individually coolable, fixed tuned, millimeter-wave Schottky barrier mixers and GaAsFET I.F. amplifiers mounted in separate cryogenic sub-dewars. Four pairs of mixers, one pair for each polarization, with 30 GHz instantaneous bandwidth, are required to cover the 200-350 GHz band. For ease of maintenance each sub-dewar can be removed without disturbing the cryogenic operation of the remaining seven. A dual-polarization Martin-Puplett L.O. diplexer mounted on a rotary table above the sub-dewars allows the double sideband R.F. signal to be fed to any pair of mixers for band changing purposes. The input beam to the receiver from the telescope optics remains precisely aligned on the rotational axis of the table. L.O. power is provided by a frequency tripler pumped by a lower frequency klystron.

At present, the limited bandwidth of the frequency tripler restricts the operating frequency of the receiver to L.O. frequencies in the range 200 to 235 GHz. In this range the receiver temperatures are less than 600 K SSB, with a minimum of 490 K SSB at 230 GHz L.O. frequency. The usable instantaneous receiver bandwidth is at least 500 MHz. Work is proceeding, as a high priority, on the development of an improved frequency tripler which will extend the L.O. coverage to 270 GHz. Initial test results in this area are encouraging. When a suitable L.O. source is available, it will be possible to evaluate the performance of the mixers at frequencies up to 270 GHz and to extend receiver operation to higher frequencies.

John W. Archer

STATUS OF THE RECEIVERS

The same people working on the new telescope surface and control building are also responsible for the receivers. Time does not permit a complete rebuilding of all receivers by February 1983. Here's how we see the situation:

- a. 9-mm continuum receiver. It must be repackaged to cope with our new "quasi-coude" feed system. This is yet to begin.
- b. 70-120 GHz mixer receiver. This trusty receiver is ready for use now, but we plan to upgrade it in the spring.
- c. 130-180 GHz. Same as above.
- d. 200-240 GHz mixer receiver. This old receiver will be available as a backup, but the noise temperature of the present mixer is worse than last year.
- e. 200-250 GHz mixer receiver. This new receiver is being built jointly by John Archer in Charlottesville and by Graham Moorey in Tucson. We hope that it will be ready by February 1, but it will be a tight squeeze.
- f. Bolometer. This is now being repackaged in a smaller dewar vessel. Additional filters have been added. It will be ready sometime in the spring.

No sunscreen will be available until summer.

Mark Gordon

PROPOSAL SITUATION

As of this writing we have about 70 proposals asking for about 300 days of telescope time. There are only 90 days available in each full quarter and 60 days available in the shortened first quarter of 1983.

Mark Gordon

Green Bank

25TH ANNIVERSARY

Twenty-five years ago ground breaking ceremonies took place at the Green Bank High School for the establishment of the National Radio Astronomy Observatory. On November 5, 1982, employees at each of NRAO's four sites got together and celebrated the occasion. During the festivities, Morton Roberts, Director, and Martha Haynes, Green Bank Site Manager, spoke to all the employees via teleconference hookup. In Green Bank, French Beverage, Beaty Sheets, and Bedford Taylor were honored for their twenty-five years of service.

Wally Oref

JANSKY WORKSHOP MAY 4, 5, AND 6, 1983

On May 4, 1932, Karl Jansky presented his now famous paper on "Electrical Disturbances Apparently of Extraterrestrial Origin" at the Spring URSI meeting in Washington, D.C. The next day the New York Times carried the following headline on the front page:

NEW RADIO WAVES TRACED TO THE CENTRE OF THE MILKY WAY

To commemorate the 50th anniversary of this historic event, the NRAO and Bell Laboratories will hold a three-day workshop in Green Bank on the topic:

Serendipitous Discoveries in Radio Astronomy

In addition to reviewing the events leading to the well-known serendipitous discoveries and their impact on the development of radio astronomy, the nature of modern astrophysical research and the potential for future breakthrough discoveries will be discussed.

For further information contact Ken Kellermann in Green Bank.

Ron Ekers and Ken Kellermann

140-FOOT USERS: DATA WEIGHTING BY INVERSE T_{SYS} SQUARED

At the shorter wavelengths for which the 140 foot is routinely used, atmospheric fluctuations, especially under marginal weather conditions, can seriously affect spectral line data, often on a minute-to-minute basis. We have implemented a program to weight the data, record by record, according to the inverse square of the system temperature. This program can be applied to both switched-power and total power data and to data both from the old 384-channel 1-bit Mark II autocorrelation and to the new multi-level Mark IV autocorrelator. (The formalism for total power is somewhat different for 1-bit and multilevel.)

This facility is available only on the IBM 4341 version of the POPS program in Charlottesville. It is applied to the telescope tape and writes a corrected user tape which can then be used on the Green Bank Modcomps or elsewhere as usual. Unfortunately, we do not handle record-by-record data editing or manipulation on the Green Bank Modcomps as yet. Inverse-square system temperature weighting is of course available on a scan-by-scan basis at the Green Bank Modcomps.

The Editor

GREEN BANK TOUR SEASON

During the 1982 tour season, 16,000 people visited the Observatory. Despite a 30% reduction in the number of tours given because of budget cuts, this year's total was only 690 less than last years. On a daily average basis, 1982 was the best since 1978.

Wally Oref

AN APPEAL TO SUBSCRIBERS

Our mailing list for the Newsletter now numbers about 650 and is continuing to grow, albeit slowly. In these times of stringent budgets we must consider how large our subscription should become. The primary purpose of the Newsletter is to inform NRAO users and would-be users. If you do not fit these categories and have other access to the Newsletter (such as your library, or a posted copy at your department), we would appreciate your letting us know if you think you could live without your personal bi-monthly copy. We will continue to send the Newsletter to everyone who doesn't reply, with one exception. Those whose address has changed and who do not inform us will be dropped from our mailing list. They can be reinstated if they send us their new address.

The Editor



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