NRAO NEWSLETTER

1985 October 1 No. 25

VLA

327 MHz

There are currently eight antennas outfitted at 327 MHz. We are hopeful that nine will be available by the end of the year, eleven by the end of March, 1986, and thirteen by mid-1986. With this number of antennas, mapping of relatively bright sources which are not too heavily resolved can be done. The rms map noise that will result in one hour of observing is 50/N mJy/beam, where N is the number of antennas. This sensitivity is appropriate for 3 MHz bandwidth, and for regions away from the galactic plane, North Pole, and the bright objects Cas A, Cyg A and the Sun. We are encouraging proposals to use this new system, but users should be aware that uncertainties in calibration, especially in "A" array, may not allow useful maps.

75 MHz

We are awaiting delivery of two prototype RFI jackets to be installed over the "B" racks in the vertex rooms of two antennas. This is the rack from which all self-generated interference is believed to originate. The design goal of 65 dB isolation will be more than sufficient for 75 MHz observing and will allow wider bandwidths to be used at 327 MHz. The jackets are expected to arrive in November, and testing will commence then.

During Bill Erickson's visit in September, single-antenna efficiency tests (made with the "B" rack off) were made of the crossed-dipole 75 MHz feed outfitted on antenna 20. The preliminary results indicate an efficiency of 30-35%, and beamwidth of 15 degrees. Further testing will be done in October.

3C 48 VARIABILITY

Evidence has been mounting that the ratio of the flux density of 3C 48 to 3C 286 is not constant in time, and that 3C 48 is primarily responsible. The discrepancy of the ratio from that given by Baars et al. increases with frequency, and probably is increasing in time. Currently, it appears the discrepancy is about 1% at L band, about 3% at C band, about 10-20% at U band, and greater than 30% at K band. Pat Crane and I will undertake a detailed program in December to determine the exact ratios, and to determine the ratios between these sources and DR 21 and NGC 7027, and perhaps to some planets as well.

SYNTHESIS IMAGING WORKSHOP

From August 5 to 9, NRAO held a Synthesis Imaging Workshop in Socorro. Approximately 185 attendees came from across North America and around the world. Sixteen lectures were given, covering a wide range of the subject of Fourier synthesis. We plan to publish the lectures in a Proceedings, and hope to have the editing completed by the end of the year.

Rick Perley

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K-BAND MASER REPLACEMENT

A prototype HEMT 22 GHz amplifier has been delivered from the Central Development Laboratory. This amplifier has the following specifications:

Frequency GHz	Noise Temp deg K
22.0	61
22.5	52
23.0	60
23.5	69
24.0	79

This amplifier will be installed in Antenna 23 in the "C-D" IF, and we will expect an additional 50 K to be added to obtain the system temperature. System tests are expected to be complete during the latter part of November to determine the operating frequency range and system noise temperature. The maser is in the process of being returned to Green Bank.

Jack Campbell

VLA MEMORANDA

The following is a list of numbered VLA Memoranda which have been issued to date during 1985:

COMPUTER MEMORANDA:

#174	More on Image Compression	F. Schwab	02/85
175	Data Display: Searching for New Avenues in Image Analysis	A. Rots	07/85

ELECTRONICS MEMORANDA:

#212	VLA Ku Band Performance at Out-of-Band Frequencies	P. Lilie	07/85
213	Future Front-End Development for the VLA	P. Lilie	09/85
214	RFI Survey for the University of Arizona Mt. Graham Radio Observatory Site	J. Oty	08/85

SCIENTIFIC MEMORANDA:

#155	Closure Errors	A. O'Donoghue	in progress

TEST MEMORANDA:

#145	Loss Measurements of Front-End Waveguide	P. Lilie	09/85

TECHNICAL REPORTS:

#57	An Overview of the New VLA Focus/Rotation Control System	D. Weber	01/85

Alison Patrick

K-BAND CALIBRATORS

On 9 and 11 August 1985, I measured the fluxes of 14 strong K-band phase calibrators. My goal was to measure those commonly used in NH_3 studies, but since these include most of the strong K-band sources, the list should be useful for other studies as well. These measurements are summarized in a VLA Test Memo which will be placed in each copy of the Calibrator Manual at the VLA site. Further historical details about these sources may be found in this manual.

Pat Palmer

12-Meter

SUMMER SHUTDOWN AT THE 12-METER

As usual, observations with the 12-meter telescope were suspended during the period mid-July to mid-September. In this shutdown period a number of improvements to the instrumentation were made.

The Telescope Surface. J. W. Findlay and E. Stobie reanalyzed holographic and mechanical maps made last year, finding generally good agreement between them except in an outer ring of width perhaps 50 cm. They completed a new measurement of the surface in August, 1985, using the template method. The data are being analyzed. A preliminary look suggests that some improvement to the surface accuracy could be attained by the adjustment of about forty points at the edge of the dish.

The 3-mm Schottky Receiver. Adjustments were made to the optics in the receiver to correct differences in the pointing of the two polarizations. The beams are now coincident to within 4 arcseconds. An analysis was made of the various contributors to the overall system noise, and some modifications to the receiver were made. The receiver SSB temperature at 115 GHz measured at the entrance to the dewar is 200 K. The system temperature, including the polarization diplexer and the telescope coupling optics, is 280 K, with at least half of the additional noise arising in leakage through the polarizing grid. It will be very difficult to reduce this noise contribution. Over the band from 70 to 115 GHz, the system temperature ranges between 280 K and 400 K.

In the next few months the klystrons in this receiver will be replaced by Gunn oscillators.

Receiver Selection. The mirror which selects the receiver to be used has been automated. This will be of particular importance later in the observing season when up to four receivers may be on the telescope.

Baseline Problems. The spectral baseline curvature problems were from time to time very serious during the last observing season, especially for weak signals of wide bandwidth. Extensive efforts were made during the shutdown to identify components in the hardware that might contribute to the problem, and various improvements were made in the IF section. It is encouraging that the first observers, after startup this fall, were getting acceptable baselines. However, we have not as yet made deep integrations over wide bandwidths.

D. E. Hogg

SOFTWARE CHANGES AT THE 12-METER TELESCOPE DURING THE 1985 SUMMER SHUTDOWN

Control System:

Spectral Line: An automated observing procedure for spectral line five points (equivalent to the continuum five point) has been implemented.

Continuum: The setting of the synthesizer is now under software control. The commanded rest frequency is passed to the analysis system and is available in the header.

Spectral Line and Continuum: The control system computes synthesizer settings for two harmonics (HARM) automatically during data taking and updates both synthesizer frequencies. The operator selects which of the synthesizer frequencies is used.

Analysis System:

Spectral Line and Continuum: In the LINE and CONDAR systems the search for symbols is done by minimum matching similar to the OCL approach in the VAX Operating System, VMS. If the characters typed are not sufficient for a unique match, the error message "AMBIGUOUS," with the list of possible matches of the symbol, are printed.

Modgraph terminals have replaced the Tektronix 4010 graphics terminals for data processing at the telescope. The Modgraph terminals are capable of emulating both the 4010's and VT 102's. It is possible to use screen editing of procedures within the analysis programs. Instructions are at the telescope. All hard copy is now done on a laser printer.

A new table has been added to the analysis programs. Each observer has a separate table identified by his initials which is built by the LINE task. This table includes the scan numbers, disk locations, source names, velocities (LINE), and rest frequencies of an individual observer's data. The entire table (current maximum of 2,000 scans) is loaded into memory after the observer specifies his initials. The first attempt to retrieve data after starting the program will cause the program to prompt the user for his initials. Having access to all scan locations on disk in memory greatly increases the efficiency of the stacking procedures C1 and C2.

New Verbs: The verb SORT has been added to the LINE and CONDAR systems. The user may sort his data by source name, frequency range, velocity range (LINE), and/or scan range. Scans that pass the specified criteria have their scan numbers placed in the STACK. SORT does not empty the STACK before entering the sorted scan numbers in the STACK.

Verbs have been added to minimize the confusion associated with the manipulation of the three data arrays (TEMP, WORK and HOLD). The verbs BSHOW and GSHOW have been created to display a baseline shape or gaussian model over data. Fits are calculated in accordance with the parameters defined by the user, and models are displayed without altering any of the data arrays or the array pointer.

E. B. Stobie

A TENTATIVE SCHEDULE FOR RECEIVERS ON THE 12-METER

The Schottky, 3-mm receiver will be on the telescope through December 1985. On November 4, the SIS receiver for the range 95 to 115 GHz will be installed and tested. After a brief period in which the performance of the two junction types will be evaluated, the receiver will be released for use by observers. On November 27, the 1-mm Schottky receiver will be installed and calibrated.

It is our intention to put both the bolometer receiver and the 345 GHz receiver on the telescope in early 1986, probably beginning with the bolometer in mid-January. At that time a decision will be made as to which four of the five receivers should remain on the telescope.

D. E. Hogg

Green Bank

BEAM SPLITTER FOR 140-FOOT TELESCOPE

The project to split the path from the secondary mirror of the 140-foot telescope into two beams of opposite linear polarization--the beams simultaneously illuminating independent maser upconverters at the Cassegrain focus--has progressed enormously. However, installation of the complete system cannot be accomplished this winter.

The beam splitter itself is nearly finished. It consists of intermeshed "surfaces" of 1600 wires each, each wire having diameter 0.01 inches, and separated from its neighbor by the same 0.01 inches. Its construction was a test of patience and skill.

Also completed are the stands and elliptical reflectors forming the tertiary mirrors (those directing the beams reflected from the beam splitter into the feeds of the masers). These are not yet installed on the telescope, however.

Yet to be designed and constructed is a shelter to cover the delicate beam splitter. Its window will have to be tough enough to hold a load of snow or ice, yet thin enough to be transparent to 25-GHz radiation. Hot air will need to be blown on the top of the window to eliminate moisture accumulation, and the interior of the shelter may need to be temperature controlled to prevent excessive expansion and contraction of the beam splitter.

Current plans are to complete all the above construction items and to test the survivability of the beam splitter in a sheltered, but outdoor environment. Installation on the telescope can be attempted in the spring of 1986.

George A. Seielstad

LATERAL FOCUSING ON 140-FOOT TELESCOPE

The potential for moving the subreflector on the 140-foot telescope in a direction orthogonal to the existing nutation has been physically implemented. The purpose is to reduce the falloff in gain as the telescope moves to large hour angles or declinations. The mechanism is by tilting the subreflector to follow the shifting focal point.

Before the capability can be brought on line, however, the motion must be brought under computer control. Engineering to accomplish this is currently in progress.

George A. Seielstad

NORTH-SOUTH FEED TRANSLATION ON 300-FOOT TELESCOPE

The 300-foot telescope was out of service from August 5 until September 19, 1985. During that time, three major improvements were accomplished: (1) the electronics box was expanded to accommodate more equipment; (2) the traveling feed was repaired; and (3) a new north-south motion was added to the degrees of freedom of the focus.

The purpose of the feed translation was to follow the focus as it moves when the telescope's zenith angle changes. The effect will be to slow the fall-off in antenna gain as the telescope moves farther from the zenith. It will be particularly noticeable at 5 GHz.

The physical installation is now completed. The new capability cannot be utilized, however, until digital readouts and interfaces put the movement under computer control. This aspect of the engineering is currently being addressed.

Care was taken to position the focus in its previous north-south location. Preliminary pointing checks indicate that this was achieved to an accuracy of about 10 arcseconds.

George A. Seielstad

TELESCOPE SCHEDULING FACTORS

Many factors must be considered when scheduling the telescopes at Green Bank. The following list, not in order of significance and not all-inclusive, guides the present Site Director:

(1) Scientific merit, as determined by referees who are advisory to the Director.
(2) Time specific, e.g., an occultation, an observation coordinated with other telescopes, or the like.
(3) Weather dependent, e.g., no K-band in summer.
(4) Length of time in queue. Old proposals generate a "clear-the-decks" pressure.
(5) Graduate student thesis project.
(6) Availability of receiver. Many receivers are shared between the 300-foot and 140-foot telescopes.
(7) Competition. A project which is likely to be scheduled at several telescopes, and whose significance diminishes after initial observations, should either be scheduled at NRAO-Green Bank first, or not at all.
(8) "Dovetailability." A proposal might get scheduled sooner than others which have been in the queue longer, because it is complementary in time to an already scheduled project not using all hours of each day.
(9) Holidays, vacations. Ending a project on the Wednesday night before Thanksgiving, for example, and attempting to start a new one requiring a receiver change approaches the impossible.

George A. Seielstad

NRAO-GREEN BANK ELECTRONICS

Effective September 1, 1985, Roger Norrod became Division Head of Electronics in Green Bank. Roger replaced Bill Brundage, who transferred to Socorro to become Project Engineer, Voyager 2.

On October 1, 1985, Bob Mauzy will assume the position of Assistant Division Head, Green Bank Electronics.

George A. Seielstad

REPORTS FROM REFEREES TO USERS

A new policy concerning proposal review has been adopted at Green Bank. The policy brings Green Bank into line with the practices of the 12-meter and VLA telescopes.

Proposers will receive a written copy of the referees ratings, suggested time allocations, and comments. Ratings are on the scale: REJECT, POOR, AVERAGE, GOOD. Time allocations use categories of <20%, 20-40%, 40-60%, 60-80%, 100%, >100% (don't laugh, it has happened). The summary sheet sent to proposers will indicate the center of the corresponding ranges. The comments will be edited only to the extent that irrelevant material may be removed.

In addition to the referees' reports, the Site Director will add a PROGNOSIS: the likelihood that the project will be scheduled, and approximately when. Because scheduling requires intricate dovetailing, it is difficult to make precise commitments on individual observations; several proposals must be considered simultaneously. The prognosis will, therefore, be correspondingly vague.

George A. Seielstad

In General

MILLIMETER ARRAY SCIENCE WORKSHOP

On 30 September - 2 October, 1985, about sixty astronomers gathered at Green Bank, West Virginia, for a workshop to develop and define the scientific goals of a Millimeter Array. Discussion was divided among seven working groups: Star Formation and Molecular Clouds (N. Evans, chairman), Low-z Extragalactic Studies (L. Blitz, chair), High-z Extragalactic Studies (B. Partridge, chair), Chemistry (L. Snyder, chair), Evolved Stars and Circumstellar Shells (P. Schwartz, chair), The Sun and the Stars (G. Dulk, chair), and The Solar System (I. de Pater, chair). Most groups found the strawman array (see Millimeter Array Newsletter Vol. II, No. 2) well suited for doing the science they wanted to do. Most of the discussion centered on tradeoffs between long baselines and high frequency operation of the array. Some highlights of the science that might be done with a Millimeter Array include: (1) mapping of galaxies in CO at 1" resolution and 10 km/s velocity resolution to distances beyond the Virgo cluster (~1 day per average galaxy); (2) radial isotopic (^{13}C and ^{18}O) abundance variations in Local Group galaxies; (3) identification and characterization of protostellar fragments on 100 AU scales; (4) mapping of thermal emission from circumstellar material, such as the disk surrounding Beta Pictoris (the array will be 10 times more sensitive than the final IRAS product); (5) imaging of the chromospheres of ~10 supergiant stars; (6) mapping of the Sunyaev-Zeldovich effect in clusters of galaxies; and (7) determination of the nature of the surface of Titan. In his closing remarks, Jack Welch, chairman of the Science Advisory Committee, pointed out that the millimeter array concept incorporates broad advances in the instrumental capabilities available to us--for example, mapping of CO in galaxies with the array is about thirty thousand times more efficient than mapping of HI in galaxies with the VLA at constant resolution. Chairmen of the working groups will summarize the discussions, which will be disseminated through the Millimeter Array Science Memo Series. These summaries will form the basis for the science section of a conceptual proposal for the instrument to be issued in 1986.

Al Wootten

INTERNATIONAL HALLEY WATCH

The International Halley Watch and NRAO encourage observers to adopt comets as targets of opportunity during the current apparition of Halley. If an observer can donate some program time, the IHW will coordinate the data collection. Target of opportunity comet observations should be cleared with the NRAO site director in order to avoid any possible conflict with previously scheduled comet programs. Note, however, that comet variability insures that all observations will have unique aspects.

IHW contact: W. M. Irvine (413) 545-0733
F. P. Schloerb Telex 955491

W. M. Irvine and L. E. Snyder

HAS ANYONE SEEN THIS OBJECT?

On November 6, 1977, from 29900s to 31000s (UT), the Goddard and Wisconsin experiments on OSO-8 detected an intense X-ray event at $20^h\ 14^m\ 29^s$, 30° 53' 24" (1950.0 R.A. and Dec.). At peak it was nearly twice as bright as the Crab Nebula; its spectrum was highly absorbed ($N_H \approx 2 \times 10^{22}$ cm^{-2}); and the light curve appeared very spiky, sometimes varying by a factor of 5 in 10 seconds. (See Serlemitsos, Bunner and Swank 1978 in Bull.A.P.S. 24, No. 4, 584.) The transient was never seen to recur. The properties of this object do not match those of any other identified X-ray transient. Speculations about its origin have ranged from sporadic accretion onto a compact object to a flare from the corona of an accretion disk.

Despite subsequent optical and X-ray searches, we have found no unusual or varying sources within the position error box, perhaps because of the large interstellar absorption in this region. However, if this object is a radio source (either in quiescence or outburst), the absorption may not be such a hindrance to detection.

(1) Does anyone know if any radio telescopes were pointing in this direction around the time of the known outburst?

(2) Has anyone done a radio search of this region? Are there good upper limits on radio flux from this transient's error box?

[($20^h\ 15^m\ 7^s$, 30° 45' 0") ($20^h\ 14^m\ 43^s$, 31° 0' 36")

($20^h\ 13^m\ 41^s$, 31° 1' 48") ($20^h\ 14^m\ 14^s$, 30° 48' 36")].

Since the 6 November 1977 event was so unusual, we are very interested in gathering more information on it. If you have data that may be of use, please contact me:

Alanna Connors
NASA/GSFC
Greenbelt, MD 20771
(301) 344-6350.

STUDENT OBSERVERS

All requests for observing time from graduate students, whether or not the observations form part of a dissertation, should be accompanied by a supporting statement from their faculty adviser indicating that the student is in good standing at their institution and is fully capable of carrying out the observations.

In keeping with NRAO's historical policy on this subject, the faculty endorsement emphasizes the primary role that the university assumes in training students in the techniques of radio observations. The NRAO will provide every reasonable assistance to faculty and students alike in their interface with the NRAO instrumentation. Faculty members should, as a matter of course, however, expect to participate fully during the initial observing run(s) of student observers.

R. J. Havlen

SINGLE DISH DATA REDUCTION IN CHARLOTTESVILLE

In the recent past, almost all of the Single Dish Astronomers who wished to reduce their Green Bank spectral line data in Charlottesville have done so on the IBM POPS system. As a result, there has been quite a bit of discussion about how to handle Green Bank data when the IBM is no longer in operation.

I am currently implementing both the Green Bank spectral line and continuum data reduction systems on the Charlottesville VAX 11/780. When the implementations are complete, a user will be able to load into the VAX system any of his User format or Keep format tapes that he was previously able to load into the IBM. It will not be necessary to translate any User or Keep tapes. These implementations should be complete long before the IBM is removed. To the user, the VAX systems will look like the IBM, but in addition there will be some improvements. When the IBM replacement computer is installed, LINE and CONDAR will remain on the VAX, so no changes to any data tapes will be necessary in order to accommodate the new computer.

Presently, 12-meter spectral line data also can be reduced in Charlottesville--a copy of the LINE program from the Mountain VAX is installed and available on the Charlottesville VAX. Removal of the IBM will not affect this facility.

If you have any questions, please feel free to contact me.

Lorrie Morgan

CHARLOTTESVILLE TAPE LIBRARY

As reported earlier, the Charlottesville IBM system will be removed near the end of 1985.

The Charlottesville tape library will also be significantly reduced at that time. After January 1, 1986, the tape library will be used only for tape storage for Charlottesville staff, visitors, and people actually planning remote processing in the near term. Telescope tapes will be stored in Green Bank.

We anticipate the reduced library being less than 20% of the number of tapes currently held.

Observers having tapes in the Charlottesville tape library will be contacted in the near future. They will have the option of releasing the tapes or taking possession of them. No charge will be made for tapes containing data. NRAO will also cover the cost of shipping in this case.

W. R. Burns

SUMMER RESEARCH ASSISTANTSHIPS FOR UNDERGRADUATE AND GRADUATE STUDENTS

The National Radio Astronomy Observatory will have a number of research assistantships available to qualified undergraduate and graduate students of astronomy, physics, electrical engineering and computer science during the summer 1986. The students will be assigned to work closely with one of the staff scientists on various radio astronomy programs in progress at the Observatory. This may involve observing, data reduction and analysis, equipment development or theoretical study.

Qualifications: Undergraduate applicants must have completed at least three years of academic training by June 1986. Graduate applicants must not have completed more than two years of graduate school.

Location: Students will work at one of the four NRAO geographic locations: Green Bank, Charlottesville, the VLA site, or Tucson depending on the location of their assigned adviser. Most of the students will be assigned to either Charlottesville or the VLA. A series of lectures will be given during the summer for Charlottesville and VLA-based students by NRAO scientists. The students are invited to attend the frequent seminars and colloquia given by visiting scientists.

Arrangements: Students are expected to be in residence for approximately 10 weeks. The beginning date will be arranged individually with the student. The salaries in the Summer Student Program range from $900 to $1200 per month, depending on educational level. Travel expenses between the NRAO site and the student's home or institution, whichever is more appropriate, will be reimbursed in accordance with the standard NRAO travel policy. Up to two days lodging will be reimbursed while the student is looking for a place to live. The summer students will be expected to make their own arrangements for lodging; however, for students based in Green Bank, on-site housing is available at reasonable rates.

Application: The deadline for receipt of the following is February 1, 1986:

1. Completed application form. (Available from address below.)
2. Letter from applicant giving educational background and goals, and scientific experience.
3. Official transcripts from all colleges or universities attended. A list of courses in progress should also be sent.
4. Letters of recommendation from three or four people who can evaluate the applicant's ability, experience and potential.

Notice of the decision on each application will be sent by March 15, 1986.

Application and recommendation forms may be obtained by writing directly to:

National Radio Astronomy Observatory
c/o Program Director
Summer Student Program
Edgemont Road
Charlottesville, Virginia 22903-2475

Telephone (804) 296-0211

R. J. Havlen

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