NRAO NEWSLETTER

1989 July 1 No. 40

GREEN BANK

GREEN BANK TELESCOPE

The Green Bank Telescope construction project became a reality with the enactment of the 1989 supplemental funding bill. The bill provided $37.5 M to NSF, available immediately, and an additional $37.5 M, available on October 1 of this year, to construct a replacement for the 300-foot telescope in Green Bank. AUI has submitted a proposal to the Foundation to do that construction. The proposal will receive wide distribution later this month.

The project schedule calls for preliminary design work in 1989, detailed engineering and analysis of the design in 1990, and construction in 1991-1994. After full, routine operation is achieved in 1995, the operation of the 140-foot telescope as a general user facility will cease.

A project manager will be appointed later this year. Until then the specifications of the telescope and preliminary design are being guided by an advisory working group, chaired by G. Seielstad. An outside advisory committee will be appointed soon. Advice from Observatory users is welcome and will be sought for this important, major new project.

P. A. VANDEN BOUT

140-FT PERFORMANCE AT 32.7 GHZ

A Cassegrain test receiver was used at the 140-ft telescope in May, 1989 to measure telescope performance at a frequency of 32.7 GHz. The results are:

Source	Declination (degrees)	Hour Angle (hr:min)	Aperture Efficiency (percent)
3C 84	+42	0 07 E	10.2
Jupiter	+21	0 03 E	16.2
Venus	+16	0 11 W	14.5

Measurement and flux uncertainties are each estimated to be plus and minus 10 percent.

Beam efficiency for the Jupiter measurement is calculated to be 20.7 percent.

All measurements were made using a corrugated conical feed designed by S. Srikanth and the beam splitter was bypassed. The primary edge illumination taper is calculated to be 12.5 dB.

Measurements at 19.5 GHz, 24.5 GHz, and 32.7 GHz for +42 degrees declination and zero hour angle are consistent with a total effective surface deviation of 0.94 millimeter RMS. The surface tolerance improves as declination decreases and is best at about zero degrees.

Beam maps using Jupiter show a mostly circular and unbroadened main beam to at least three hours west. There is no indication of astigmatism. The first sidelobe is enhanced about 12 dB to the south and east of the main beam; this is thought to be coma and can be improved by a slight repositioning of the subreflector.

We are now constructing a receiver in Green Bank for the 25 to 35 GHz range, and M. Pospieszalski is designing cooled HEMT amplifiers at the NRAO Central Development Lab. We plan to have one channel available on the telescope by March, 1990.

C. J. BROCKWAY

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SPECTRAL PROCESSOR IN OPERATION

The Berkeley and Princeton pulsar groups made the first pulsar observations with the spectral processor in the beginning of June. Earlier tests and the observations indicate that the system operates as expected. We are refining the pulse period doppler tracking software, and, after another pulsar run in July, we will begin activating the other pulsar and spectral line modes of operation.

Central to the spectral processor design is the ability to observe in the presence of strong interference. Narrow-band signal tests show that the profile of the spectral channels follows the predicted $(\sin x/x)^2$ pattern very accurately and that tapering the input sample block reduces the sidelobe pattern considerably. The introduction of very strong CW signals shows that there are no apparent distortion products above -40 dB, which was the limit of measurement. Further measurements and the final implementation of the pulsed noise rejection feature remain to be done. We will have a few quantitative examples in the next Newsletter.

Sensitivity to signals wider than five spectral channels is greater than about 95 percent of theoretical for perfect filters. The average sensitivity to a signal exactly one channel wide is 77 percent. The rms-to-total power ratio in each channel is exactly one over root (B*tau), but the input signal is effectively convolved with a roughly 2-7-77-7-2 spectral weighting function (no input sample taper), so that the power at a given frequency is spread over a few adjacent channels. Hence the sensitivity to wider signals approaches the theoretical limit.

At present, the active observing mode is a 20 MHz wide, 256 frequency by 128 time sample matrix which can be synchronized with a pulsar period for integrations up to tens of minutes. Only one IF channel was available for the first observations. Timing accuracy of a couple of microseconds has been demonstrated on the 1.6-ms pulsar, with the potential for internal accuracies quite a bit better than 100 nanoseconds in the works. The accuracy limits should be the signal to noise ratio of the pulsar and the fractional pulse phase resolution of the spectrometer. The highest sampling resolution is 12.8 microseconds.

The pulse signature is monitored with a grey-scale, frequency-time display, and an approximate dedispersion algorithm is on-line to show the pulsar profile. The display is rather impressive on the fast or strongly modulated pulsars. The pulsar observers have provided their own off-line data reduction, and we are working on easier data access via the local area network (Ether Net).

A second IF channel will be available by the first of July. Pulsed RFI excision will be ready soon thereafter. Several other modes, including spectral line formats, should be active by September, including 40 MHz by 1028 channel operation. The second FFT bank of 40 MHz by 1028 channels will be installed in the fall as the observing schedule permits (six weeks down time). All eight IF channels should be constructed by the end of the year. Integration into the POPS spectral line data reduction system will happen gradually as time permits. We will keep you posted on what is currently available.

Priorities for the order of implementation of the various modes will be driven by the observing requests, so give us ample notice of new requirements.

J. R. FISHER

7-FEED/5 GHZ RECEIVER UPGRADE

In April, the 7-feed/5 GHz receiver was retrofitted with state-of-the-art cooled HEMT amplifiers designed by Roger Norrod and built by Tom Dunbrack at the HEMT Development Lab in Green Bank. The new HEMT amplifiers, replacing the original FET amplifiers, are responsible for reducing the noise temperature of all 14 channels an average of 13 K (from 30 K to 17 K as measured at the input waveguide flange).

Telescope tests made May 16-18, 1989, by Jim Condon and John Broderick, have shown the receiver to be noise and atmosphere limited for time constants ≤ 0.2 seconds. Data results from the 140-ft tests are:

$T_{sys}(\delta = +38°)$ = 39-45 K (variation from channel to channel)
$T_{sys}(\delta = -44°)$ = 60 K (sky cloudy)

Aperture efficiency:	center feed,	55%;
	6 outer feeds,	49%
HPBW:	center feed,	8.2 arcmin
	6 outer feeds,	6.3 arcmin

System noise temperatures with the old FET amplifiers measured at the 300-ft telescope prior to its collapse were 64 ± 4 K (channel to channel variations). Because of the improvement in receiver noise temperature, the absence of ground radiation through the reflector surface (approximately 8-10 K at the 300-ft telescope at 5 GHz) and an approximate two-fold increase in efficiency at the 140-ft telescope at 5 GHz, future measurements made with the upgraded 7 feed/5 GHz receiver at the 140-ft telescope should be comparable in sensitivity with those obtained previously at the 300-ft telescope.

G. H. BEHRENS

12-METER

HYBRID SPECTROMETER

The hybrid spectrometer, the 12-meter's new, general-purpose, spectral line backend, is now at the telescope. The instrument has been tested during three test sessions and is performing extremely well. The unit is not yet available for routine use by visitors, but we expect it to be on-line, operating in parallel with the filter banks, in time for startup of the autumn observing season.

The hybrid spectrometer is a combination of analog filter and digital autocorrelation technology. The I.F. signals from the receivers are pre-filtered in up to sixty-four 37.5 MHz segments, and then each segment is sampled in three levels and autocorrelated. After the FFT, the resulting filter spectra are then pieced together to form the final spectra of full bandwidth. The information available for match-up of the filter spectra include the output of total power square-law detectors, the zero-lag term of the autocorrelation, and a number of redundant, overlapping spectral channels which reduces an initial 2048 spectral channels to 1536 quality channels. The matching process can be done quite reliably.

The 1536 spectral channels of the spectrometer can be divided among up to eight independent I.F. channels. As such, it matches well with the 230 MHz eight-beam receiver, as well as with the 2-polarization channel, single beam receivers. The maximum bandwidth of the instrument is 2400 MHz, although none of our present receivers have such a large bandwidth. The typical observing mode for the eight-beam receiver will be 8x300 MHz or 4x600 MHz, which will have, respectively, 192 or 384 channels per spectrum. Higher resolution modes are available. Two-channel, single beam modes will be, typically, 2x600 MHz, 2x300 MHz, 2x150 MHz, etc., with 768 channels per spectrum. The table below summarizes a few, but not all, of the possible observing modes.

SOME POSSIBLE HYBRID SPECTROMETER MODES

No. I.F.'s	Bandwidth (MHz)	No. Channels	Channel Resolution (kHz)
Multi-beam[1]			
8	300	192	1562
4	600	384	1562
Two-channel, single beam			
2	600	768	781
2	300	768	391
2	150	768	195
2	75	768	98
2	37.5	768	49
1	37.5	1536	24

[1]Higher resolution modes are available for multi-beaming

One advantage that observers will notice immediately is that the higher resolution modes offer a much larger bandwidth than do the corresponding filter banks. For example, in the 98 kHz resolution mode, the hybrid spectrometer has three times the bandwidth of the 100 kHz filter bank, and in two polarization channels.

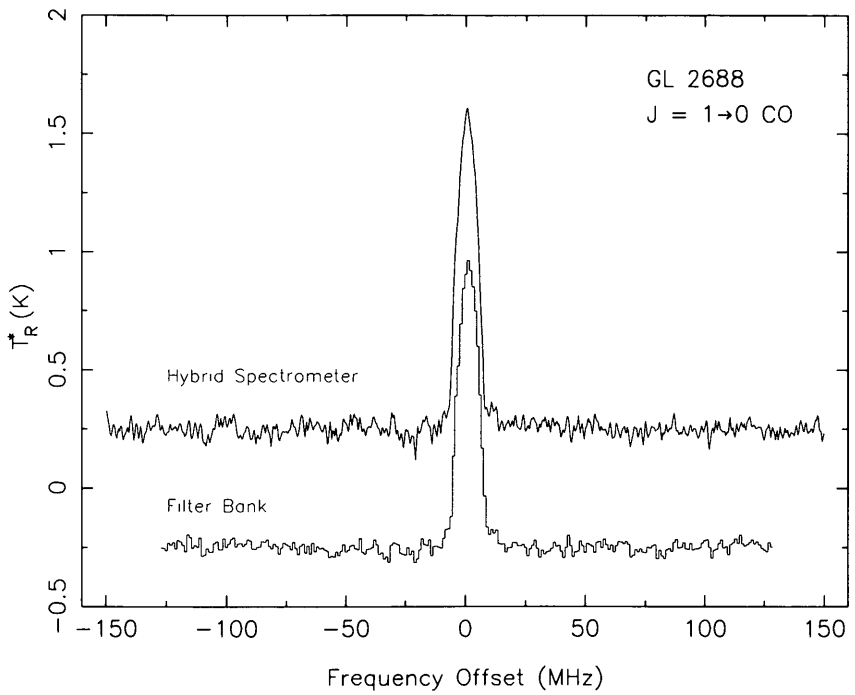
A sample spectrum made with the hybrid spectrometer, with a comparison spectrum made simultaneously with the 1 MHz filter bank, is shown. This spectrum is of GL 2688, the Egg Nebula, and was made on June 15 using the SIS receiver. The hybrid spectrometer was in 300 MHz mode and 768 channels are displayed, yielding a channel resolution of 0.39 MHz. The filter bank has 256x1 MHz channels. Both spectra were averaged from 35 minutes of on-source integration, and were made in position-switched observing mode. Only a linear baseline was removed from each spectrum. After taking into account the higher resolution of the hybrid spectrometer spectrum, the rms noise is actually somewhat better with the new spectrometer than with the filter bank.

The tests indicate that the hybrid spectrometer is performing superbly. We see no problems with instrumental baselines, the rms noise is comparable to that in the filter banks, and the match-up of filter segments is very good, even when a strong line falls on the edge between two filters. Nearly all of the bandwidth/resolution modes, including the 8-beam modes, have been tested and are operating properly. Some details relating to communication and synchronization with the control and analysis computers still must be smoothed out.

We intend to place the hybrid spectrometer in parallel with the filter banks and have both spectrometers routinely available in the fall. At first, the filter banks will still be

the primary spectrometer while operation of the hybrid spectrometer is fully checked. At some point during the coming observing season, the hybrid spectrometer should take over the role as the primary spectrometer. Nevertheless, we will not rush to retire the filter banks until we are fully satisfied with the performance of the hybrid spectrometer. We intend for the filter banks to be available until at least late 1990.

A. V. DOWD, D. T EMERSON, P. R. JEWELL



EIGHT-BEAM RECEIVER

In May, the eight-beam, 230 GHz receiver was used for the first time in full eight-beam mode with the hybrid spectrometer and beam rotator. The Observatory staff has now used the receiver and spectrometer in two test sessions, and one visiting group has used it for an observing run, albeit in test mode. The combined system of eight-beam receiver, beam rotator, and hybrid spectrometer are now performing quite well.

The eight-beam receiver improves mapping efficiency at 230 GHz dramatically. For example, in one test observation in late May, we performed a ~10 minute mapping observation of the galactic center region in J=2-1 CO. In that time, 72 spectra, of one-minute's integration each, were obtained, and this is by no means the maximum data-rate possible. Each of the spectra were of 300 MHz bandwidth, with 192 points per spectra, for a channel resolution of 1.56 MHz. A large number of other bandwidth and resolution modes are available in full 8-beam mode, starting with 8 x 300 MHz and going down in steps of 2 to 8 x 37.5 MHz, with 192 points in each spectrum. A bandwidth of 600 MHz is available for 4 beams (4 x 600 MHz, 384 channels per spectrum).

The eight-beam receiver consists of a 2x4 array of Schottky mixers. The SSB receiver temperature is about 500 K in each channel. The tuning range of the mixers is from ~215-240 GHz, so that all the major CO isotopes plus a number of other important spectral lines are observable. Each beam in the array is separated by 87", or about 3 FWHP beamwidths. The telescope may be stepped in position to fill the spacings between the beams. The array can be oriented to any position angle by a computer-controlled rotator. If a particular source geometry is to be mapped, such as the major axis of a galaxy, the array in the RA-DEC frame does not change as the AZ-EL telescope tracks the source across the sky.

The eight-beam receiver is mounted in one of the 12-meter's four receiver bays. In general, other receivers will be available for supporting observations during most eight-beam observing runs. For example, during the May eight-beam tests, 16 independent mixers, installed in four receiver chassis, were at cryogenic temperatures and available for use.

When 230 GHz observations resume in the autumn, we anticipate that the combined system of eight-beam receiver, beam rotator, and hybrid spectrometer will be available routinely. Observing proposals for the system are welcome.

D. T. EMERSON, P. R. JEWELL

VLBA

SELECTED ITEMS

Operation - The Pie Town antenna participated in the March-April Network run at 1.3, 2.8, and 6 cm for both Mk II and Mk III observing. It also participated in the June Network run at 18 and 90 cm. Pie Town also participated in a March 27-28 Crustal Dynamics run. The Kitt Peak VLBA site performed its first Network observations during June 13-19 at 18 cm, using Mk II recording. The Kitt Peak antenna was remotely controlled from the Socorro Array Operations Center, simultaneously with the Pie Town antenna.

General - Investigation of a problem with the azimuth drive system at Los Alamos led to the discovery of a design error in the gear boxes used for both the azimuth and elevation drives. The gear boxes are multi-stage planetary devices manufactured by Sumitomo Machinery Corporation. The problem is one of accelerated wear in the box. Sumitomo has identified the cause and has designed and tested a fix which can be installed in the gear boxes without removing them from the antennas. Sumitomo will install the fixes, at their expense, at Pie Town and Kitt Peak by the end of July and at other antennas by the end of August.

Construction Status - Final outfitting of the Los Alamos, NM antenna is underway, and is expected to be completed in July. The Fort Davis antenna is scheduled to be outfitted beginning in August. (This is a return to an earlier outfitting sequence necessitated by delays in completing erection of the North Liberty, IA antenna.) The North Liberty antenna is scheduled for outfitting to begin in January 1990. The Owens Valley antenna is virtually assembled. Brewster, WA is scheduled for antenna erection to start imminently. At the St. Croix, VI site preparation by the general contractor began in mid-June. At Hancock, NH final permits are being sought to allow site preparation to start in July. Soil tests at the Mauna Kea site are scheduled for completion in July, which will allow architect-engineers to start preparation of drawings for construction bidding in the fall.

K. J. STETTEN

NRAO TRAVEL REIMBURSEMENT FOR VLBI OBSERVERS

NRAO would like to have more involvement of the VLBI community in exercising, debugging, and criticizing the VLBI capabilities of AIPS so areas needing work may be better defined. Additionally, until the VLBA correlator is operational, the experiences of users with the first few VLBA antennas are crucial to NRAO's efforts to identify and correct problems with the VLBA. To encourage such user feedback, NRAO will now cover the travel expenses of a VLBI post-processing trip to an NRAO facility, provided the following points apply: (1) the post-processing is done with AIPS; (2) the VLBI experiment involves at least one NRAO telescope; and (3) the traveller is from a U.S. institution. We envisage that most such trips would be either to Charlottesville or to Socorro. The standard NRAO deductible policy will apply. Only one trip per VLBI experiment will be allowed.

J. M. WROBEL, R. J. HAVLEN

VLA

VOYAGER 2 AT NEPTUNE

August 1989 will mark another milestone in the exploration of the solar system when Voyager 2 flies by Neptune and its satellite Triton. The VLA will play a significant role in this event by providing additional earth receiving aperture and thereby allowing a 50 percent increase in the number of near-encounter images received from Voyager. The public interest in Voyager at Neptune surprised us when approximately two thousand visitors came to our Open House at the VLA, partly a result of the statewide media blitz on the VLA and our connection to Voyager. In addition to network TV coverage, NASA/JPL will broadcast information, images, and preliminary scientific interpretations via the NASA satellite channel (GE station FZR, transponder 13, 70° West, vertical polarization, 3960 MHz, C-band), August 24-27.

The VLA-Goldstone Telemetry Array (VGTA) for Voyager at Neptune began in 1982 with overtures by the Jet Propulsion Laboratory (JPL) to NRAO and followed with feasibility tests in 1983/84, then management plans in 1984 and construction/implementation of the X-band receiver system starting in 1985 and ending in January 1989. Since then we have concentrated on improving reliability and smoothing procedures, culminating in "freezing" the online system software in early June.

As the most sensitive VLA observing band, the X-band system has produced valuable new radio astronomical science, thanks to Voyager 2 and NASA/JPL. Past and future Newsletter items will describe some of these.

W. D. BRUNDAGE

VLA CONFIGURATION SCHEDULE

Configuration	Starting Date	Ending Date	Proposal Deadline
C*	02 Jun 1989	28 Sep 1989	15 Feb 1989
C/D	06 Oct 1989	30 Oct 1989	15 Feb 1989
D	02 Nov 1989	22 Jan 1990	15 Jun 1989
A	16 Feb 1990	29 May 1990	15 Oct 1989
A/B	08 Jun 1990	25 Jun 1990	15 Feb 1990
B	29 Jun 1990	20 Aug 1990	15 Feb 1990
B/C	31 Aug 1990	17 Sep 1990	15 Feb 1990

* The current C configuration is modified, by removing the antenna on station CW2 to station BW5, to reduce shadowing at the declination of Voyager.

The maximum antenna separations for the four VLA configurations are: A-36 km; B-11 km; C-3 km; D-1 km.

Approximate Long-Term Schedule

	Q1	Q2	Q3	Q4
1989	A	B	C	D
1990	A	A	B	C
1991	D	A	B	B,C
1992	C	D	A	A,B
1993	B	C	D	A

Observers should note that in the ensuing years of sunspot maximum, daytime observations at 327 MHz are unlikely to be successful in the smaller configurations because of solar interference and in the larger configurations because of disturbed ionosphere. In particular, D configuration observations near 17 hours RA should not be proposed, and only the most urgent A configuration observations near 01 hours RA should be considered.

W. M. GOSS

VLA COMPUTER TARGET DATES

The new Convex C1-XP computer (now known as Yucca) was successfully installed as planned. Unfortunately, problems with the peripherals have delayed its full use as an image processing system. The disk problems have been resolved, but only three of the six tape drives are currently usable. Some image displays should be functional by the end of July 6, although the IIS IVAS is not likely to be installed before the end of August. The disks on Yucca may be accessed from the older Convex (Cholla) using the Network File System. It is therefore possible, in the interim, to use the IIS on Cholla to display images from Yucca.

We can now proceed with the decommission of the DEC-10 and Pipeline. The Pipeline computers will be removed from the maintenance contract on June 30, the DEC-10 on July 31. As of July 1, all support will be withdrawn from the DEC-10 operation with two exceptions. The program (MAINT) which is used by the electronics division to track failures is not yet fully implemented on the MicroVAX; a sufficient capability should be ready by the end of July. The observation preparation program (OBSERVE) is now usable, but there is still insufficient user familiarity with the new program. The documentation is also still rudimentary. Therefore, the DEC-10 will remain on the maintenance contract until July 31 for the use of these two programs only.

The data reduction software will not be removed from the system, so users may still run the old programs. However, effective July 1, NRAO will not provide any user support such as for backups and disk space management, nor will there be a computer operator at the VLA site. Since all DEC-10 backup tapes will soon be unprocessable, we will begin the process of purging all DEC-10 backup tapes from the tape library on July 1.

WARNING TO ALL VLA OBSERVERS. Since we will be using a new program to create observation files, and a new system to copy the files to the on-line system, please allow much more time for submitting these files to the VLA operators. Until this new scheme becomes a routine operation, it will take longer to create the files, and the operators will need longer warning time than in the past to copy them.

G. C. HUNT

THE VLA ON-LINE COMPUTER SYSTEM

As per our agreement with JPL, the VLA on-line software was frozen as of June 8, 1989 to allow an unchanged operating environment during the Voyager II fly-by of Neptune. Software development will proceed as normal, but there will be no changes to the standard system until the next software update. At present this is planned for September. It is hoped that some new spectral-line capabilities will be installed at that time.

G. C. HUNT

NEW ORGANIZATION FOR VLA/VLBA OPERATIONS

Upon the return of Dick Sramek from a year's sabbatical at the Australia Telescope in Sydney in mid July 1989, a new organization will be implemented for the VLA and VLBA operations. Dick will return to his old job as Deputy Director for Socorro Operations with responsibilty for engineering. The Engineering and Services Division and the Electronics Division will fall under Dick's responsibilty. Rick Perley, who has been serving as Dick's replacement since mid 1988, will become the Deputy Director for Socorro Operations with responsibility for operations, which include the Array Operations Division and the Computing Division. The data analysts will become a part of the Observatory Services Division, headed by R. Havlen.

W. M. GOSS

REQUESTING VLA ANTENNAS IN A VLBA PROPOSAL

Proposal guidelines for the use of operational VLBA antennas were given in the 1 April Newsletter. According to those guidelines, proposers can request one or more operational VLBA antennas. Proposers of interferometry projects who also wish to request one or more antennas at the VLA can do so by using the "Non VLBA" entry on the VLBA proposal cover sheet. A separate VLA proposal does not have to be submitted. The VLA requests will affect the probability of acceptance of the VLBA proposal.

VLBI use of the VLA usually involves recording the VLBI data either from the phased array or from a single antenna, depending upon sensitivity needs. These needs should be discussed in the VLBA proposal. At 1.3 cm, three VLA antennas can be made available to provide more accurate calibration information for single-dish VLBI experiments. Thus, VLBA proposals requesting VLA antennas should specify either one VLA antenna, three VLA antennas, or the phased VLA.

J. M. WROBEL

K-BAND RECEIVER UPGRADE COMPLETED

All 27 antennas in the array have received the K-band upgrade. This eliminates parametric amplifiers and cooled mixers. Receiver temperatures have been improved by a factor of 3 at K-band, and reliability at all bands has been considerably improved.

P. HILIE

SPECTRAL LINE OBSERVING AT 20 CM IN D ARRAY

It is very likely that the upcoming solar maximum will cause serious problems for daytime spectral line observations at 20 cm in D array. Observers are strongly advised to try to avoid daytime observing if at all possible.

I would like to collect information on the seriousness of the problem. Therefore, I would greatly appreciate it if people could send me information on the results of their last year's daytime 20 cm spectral line observing in D array and of the coming C array. It would be particularly interesting to hear about successful strategies to correct data that are badly affected by the sun.

J. H. VAN GORKOM

ERRORS IN THE ONLINE GAIN CALIBRATION OF SOLAR VISIBILITY DATA

During the years 1982-1988, there were serious errors in the online gain calibration of solar visibility data at the VLA. Tim Bastian has written two memoranda describing the nature of these errors (Computer Memorandum No. 180) and their effect on solar observations made during this period (Scientific Memorandum No. 160). Those interested in obtaining copies of either memorandum should contact Sandra Montoya or Tim Bastian.

T. S. BASTIAN

IN GENERAL

NRAO USERS COMMITTEE MEETING 31 MAY - 1 JUNE, 1989

The following is an abstract of the report of the recent Users Committee meeting prepared by John Bally, who served as the Committee chairman.

300-ft and the Replacement Telescope - Much of the Committee discussion was centered on the implications of the collapse of the 300-ft telescope and the options which must be decided if funding for a replacement telescope becomes available. Although there was concern that building a 100-m class single dish telescope may delay construction of the Millimeter Array (MMA), the Committee fully supports NRAO's effort to realize a replacement instrument. The apparent availability of funds to design the world's largest fully-steerable dish may permit the construction of a telescope having unprecedented wavelength coverage and sensitivity. The Committee feels that it is important for the new dish to open some new region in parameter space; it must be capable of doing science not possible anywhere else in the world. At the same time, the dish should fulfill all the functions served by the 300-ft.

The Committee finds the following considerations to be especially important:

• The replacement telescope should be primarily a cm-wavelength instrument which works at the lowest possible frequencies (to support studies of pulsars and recombination lines). On the other hand, it is highly desirable to have some capability at 115 GHz (to support work on CO, the brightest spectral line next to HI).

• Wide field imaging capability should be maximized and not sacrificed at the outset by the optical configuration. Although not presently available, focal plane arrays will probably be developed within the design lifetime of the instrument. The optics must provide a wide usable field-of-view. Such arrays will greatly speed the all-sky surveys previously performed by the 300-ft.

• An unblocked aperture, provided by offset design is desired. High dynamic range observations require high main-beam efficiency, and low side-lobe levels. An unobstructed aperture greatly enhances performance for continuum mapping, HI surveys, and cosmological measurements such as microwave background anisotropy which require very clean main-beams and low spill-over. For spectral line observers, the absence of reflections between optical elements will provide better baselines, especially when using frequency switching.

• Some performance at frequencies up to 115 GHz is desirable. A large aperture single dish will enable us to search for CO at high red-shift and probe the cosmic evolution of galactic interstellar media. Millimeter lines such as HCN, HCO^+, CS, and H_3CN provide powerful probes of star-forming regions, molecular clouds, and post-main-sequence stars which could be observed with unprecedented resolution and sensitivity with the new telescope.

• The Committee recommends that NRAO produce two rapidly drafted "straw-man" telescope designs, one maximizing large aperture and the other maximizing high frequency mm-wave performance. Input from the community-at-large should be solicited to evaluate would-be user preferences regarding design options.

• The Committee is concerned about potential adverse impact on other NRAO activities, such as design of the MMA or other enhancements to existing facilities. These activities occur in response to careful consideration and peer-review, and we hope that this process is not short-circuited in the haste of obtaining and spending funds for a replacement telescope.

GENERAL COMMENTS CONCERNING NRAO OPERATIONS

• The Committee endorses the overall distribution of resources. We recognize that operating a growing institution with level funding is difficult and feel that management has been very sensitive to user needs in its allocation of funds to the different sites.

• There is a very strong and unanimous sentiment that the MMA is the most exciting single project being contemplated within NRAO.

• Following the lead of the VLA group in presenting an overall package of "enhancement and expansion" at the VLA (the VLA/E^2 idea), we urge that NRAO draft a document which is a plan for the "enhancement and expansion" of all of NRAO. Such a document could be a "10 year plan" and should be written in time for consideration by the Bahcall decade review committee. A unified plan for all sites would be more comprehensive, complete, and would enjoy wider support in the community. Funding agencies may also look more favorably on a single unified plan than on a piecemeal approach generated locally at each site. Although the MMA is an order of magnitude greater on a funding scale than either the VLA/E^2 plan, or the 15-m millimeter-wave telescope, the Committee believes the MMA should play a role in such a document.

• We support the joint venture between NRAO, UI, and the BIMA consortium to develop high frequency SIS receivers. As recommended last year, the Committee encourages further participation by NRAO staff in observations and other activities at the mm-wave interferometers.

• Single dish software is still perceived to be a problem. The NRAO needs to plan for increased data rates from single dish telescopes. Since many individual software packages exist and users frequently have their own favorites, NRAO needs to worry more about providing a standard interface and less about writing a general package. A key problem waiting for action is the specification of a universal FITS standard for spectra. NRAO may be in a position to decide this standard, and in consultation with non-US institutions should play an aggressive role in setting the standard. We specifically recommend that NRAO consider establishing a committee to look into what would constitute an international standard. Membership should be representative of the international community. Other useful actions may be to hold a Green Bank workshop on both single-dish software and the FITS standard, and to publish a paper on a proposed new standard.

• The Committee encourages NRAO to consider how it can help counteract the growing tendency of recent Ph.D's to have little or no hardware (or software generation) experience. The nature of radio astronomy has been changing over the past decades. Fewer observers build equipment or write control systems or reduction packages. Can NRAO spend more effort training graduate students in these skills? NRAO should create more opportunities in its Central Electronics Lab for Ph.D. candidates to work. Students should be encouraged to participate in hardware and software projects since this makes them more employable.

GREEN BANK

• The Committee encourages the development of spectral line capability for the spectral processor. This will enable spectral line observers to take advantage of its superior interference rejection features.

• Development of 30 GHz capability on the 140-ft should be in response to specific proposals.

TUCSON

• The Committee supports the high priority placed on the development of the control system, and further investigation of the pointing problems, even if it cuts into some observing time.

• The Committee does not favor total discrimination against 3-mm proposals during the winter trimester. Meritorious proposals should still get time. The decision about 3-mm vs higher frequency proposals should be left with the referees. Both the referees and the users should be informed that high frequency work can only be performed during the best weather, and to keep this in mind in making evaluations.

VLA

• The Committee was impressed by the lack of problems generated by the move to the AOC.

• Maintenance should take priority over all other improvements. If funds do become available, the Committee recommends that cable and track replacement be accelerated at the expense of providing other upgrades or enhancements.

VLBA

• Fort Davis outfitting should take precedent over North Liberty.

• Solar astronomers would like single dish capability at the Hawaii site in time for the 1991 eclipse.

CHARLOTTESVILLE

• The Committee suggests that the annual AIPS surveys include questions about what home-grown tasks have been written. Also there should be room for the most important gripe from each site. A specific gripe: Can a standard VLBI data set be adopted and re-reduced by each new version of AIPS prior to release to verify the absence of bugs?

• The Committee again urges the AIPS group to publish a review article on AIPS.

• The Committee is impressed with the work done by the Central Electronics Labs. Their efforts have led, among other things, to the best SIS mixers and HEMT amplifiers in the world. NRAO should support this effort as much as possible to promote further developments in these technologies.

USERS COMMITTEE
ORGANIZATIONAL MATTERS

• The Committee should be given a short period at the end of each session to discuss issues by itself. This will enable the Committee to focus its attention on the presentations just given and allow the members to provide prompt feedback and ask more questions early in the meeting. Two full days per meeting would provide sufficient time for this change. The Committee also endorses extending the tenure of the committee member to four years so that with an annual meeting schedule each member can visit each site.

P. A. VANDEN BOUT

NRAO SINGLE DISH ANALYSIS

In the April Newsletter, I described the efforts being made to revise and update the programs for analyzing data from the NRAO single-dish telescopes. I will, in this report, describe the advances we have made since the last newsletter. Please see the April Newsletter for the overall plan of what we intend to do. Note that this is an Observatory wide effort and includes the contributions and efforts of staff from most NRAO sites.

In Green Bank, observers for the last two months have been reducing their data using the SUN 3/60's either at the telescope or in the Jansky Lab. We originally had some serious problems in the transfer of data from the control computer to the analysis computer, but, thanks mainly to the work of Allen Farris and the help of an intern student, Roxane Leribillard, we no longer lose data. Note that the analysis program that observers run on the SUN is an improved offspring of the program which used to run on the Modcomps. (By the time this is published, we will have retired the analysis Modcomps after nearly fifteen years of service.)

I will need to put in a few more weeks of work in order to complete the SUN version of the vastly superior Tucson version of the analysis program. The user interface, graphics, and help facilities for the SUN version of the program are superior to those in the old VAX and Modcomp programs. Please contact me if you would like to be a beta tester of the revised Tucson program.

Presently, we are also discussing revising the format of the FITS export tapes we now produce. We are also trying to finalize an Observatory-wide format for storing data on disk. Documentation for the analysis programs is also being updated at this time. We are planning to produce a "Cook Book" type of manual in the near future.

R. J. MADDALENA

PROCEEDINGS FROM THIRD NRAO SYNTHESIS IMAGING SUMMER SCHOOL NOW AVAILABLE

The Third Synthesis Imaging Summer School was held last June in Socorro, NM. The Proceedings from this summer school, edited by Alan Bridle, Fred Schwab, and myself, are now available as Volume 6 of the Astronomical Society of the Pacific Conference Series. The 509-page volume includes 25 lectures, 23 of which are as given at the summer school; two have been added to improve continuity. The volume may be ordered for $32 from BYU Print Services, ASP Conference Series Orders, 205 UPB, Provo, UT 84602.

R. A. PERLEY

VISITING SCIENTIST ACCOMMODATIONS IN CHARLOTTESVILLE: ALDEN HOUSE

The NRAO now maintains, and makes available to visitors at modest cost, housing accommodations in Charlottesville at Alden House. Located on Observatory mountain, a short walk from the NRAO Edgemont Road offices, Alden House is the property of the University of Virginia. The NRAO leases the upper floor of this house as a residence for visitors. Four bedrooms, two baths, a spacious living room with a television, and a fully equipped kitchen are provided.

The Alden House accommodations are available for use by anyone visiting the NRAO offices in Charlottesville, but are particularly beneficial to astronomers who come to Charlottesville to do AIPS analysis and imaging on the CONVEX. Operation of the Charlottesville CONVEX is designed to facilitate the work of those users with large datasets and/or need for extensive computing. Visitors may sign-up for large continuous blocks of priority time and disk resources, work through the night (if they wish), and retreat to Alden House to sleep through the daylight hours undisturbed. We believe you'll find Alden House quite comfortable and convenient.

The room charge for Alden House is $25 per night, $150 per week; reservations should be made with Amy Shepard (804-296-0317). AIPS time is scheduled by Jim Condon; to optimize your access to the computer resources and to avoid conflicts with other users having demanding computing work, contact Jim (804-296-0322).

R. L. BROWN

PAGE CHARGE SUPPORT

Despite several recent notices about NRAO's page charge policy, there still seems to be confusion about some points. Here is a summary:

1. When requested, NRAO will pay the larger of the following:

a) 33 percent of the page charges reporting original observations made with NRAO instrument(s) when at least one author is at a U.S. scientific or educational institution.

b) 100 percent of the page charges prorated by the fraction of authors who are NRAO staff members.

2. No page charge support is provided for publication of color plates.

3. To receive page charge support, authors must comply with ALL of the following requirements:

a) Include the NRAO footnote in the text: "Operated by Associated Universities, Inc., under cooperative agreement with the National Science Foundation."

b) Send four copies of the paper PRIOR to publication to the NRAO librarian in Charlottesville.

c) Notify the librarian in Charlottesville of the proposed date of publication and apportionment of page charges so that the necessary purchase orders may be initiated. The best way to do this is to send a photocopy of the completed page charge form.

R. L. BROWN

CHANGE OF ADDRESS

We would like to implore subscribers to the Newsletter whose addresses have changed to send us their new addresses. Many subscribers are conscientious about this, but many understandably overlook it. We have limited manpower for purposes of tracking down changes of address, and we cannot guarantee we will always do so. In keeping the statistics of Newsletter subscriptions, we have noted that, among those discontinued, the majority involve changes of address which we have not yet remedied.

THE EDITOR

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