

NRAO Users Committee Report 2006

Executive summary

All 21 members of the Users Committee of the National Radio Astronomy Observatory met on May 18-19, 2006 in Socorro, NM. The committee considered and discussed presentations covering aspects of all NRAO facilities and programs. In particular, significant consideration was given to balancing the needs of the VLA, VLBA, and EVLA, as well as the effects of increased time allocation for Large or “Legacy” projects on the Observatory-wide time allocation process.

The NRAO continues to provide and enhance world-class radio telescopes and instrumentation to the benefit of the entire astronomical community. Indeed, the Users Committee was energized by the potential of the position in which NRAO now finds itself: with development of EVLA and ALMA largely completed and construction on both facilities underway, the Observatory can now turn its full attention to optimizing the formidable suite of NRAO observing facilities as they continue to mature (VLA/VLBA, GBT) or come online (EVLA, ALMA).

The main recommendations and related requests of this Users Committee (UC) are summarized below. A full description of these and additional recommendations can be found in the sections of the report which follow.

Summary of Recommendations and Requests from the Users Committee

1. The Users Committee endorses the NRAO plan for increased time allocation to “Large” or “Legacy” projects, and encourages Observatory staff to consider changes to the time allocation process that will optimize the use of observing time for programs covering a range of sizes and facilities.
2. The UC recommends that the NRAO should freeze the organization of e2e in its current form, in order to focus e2e efforts on maximizing development with limited resources and ensure that this is a useful addition to the commendable “One-Observatory” effort currently being pursued by the NRAO. We also request that the NRAO consider developing an Observatory-wide archive policy, in light of the size and complexity of datasets which will come from the EVLA and ALMA.
3. The UC continues to recommend maximum progress toward the EVLA, even with the possible short-term inconvenience to current VLA/VLBA users. The UC also expresses concern about the amount of available construction and development support, which are necessary to bring all aspects of the EVLA online in a timely manner.
4. Now that the first science observations with the EVLA are only a few years away, the UC requests a more concrete discussion at next year’s meeting of possible scenarios for loss of VLA accessibility as more EVLA antennas come online. In addition, the UC urges Observatory staff to accelerate the development of plans for early science projects to ensure they will demonstrate the capabilities of the EVLA, and recommends that the NRAO devote some staff effort toward developing a wider awareness in the astronomical community of the science potential of the EVLA.
5. The VLBA continues to produce unique and valuable science, and the conversion to the Mark 5 playback system is a major advancement. The UC recommends that the NRAO concentrate VLBA resources in favor of additional disk modules over additional playback units.
6. We commend the NRAO for the increased stability and accessibility of the GBT and its supporting software to outside users. The UC remains hopeful that current problems with the Ka and Q band receivers will soon be solved, and that the NRAO will proceed judiciously in the acceptance of

proposals for new instrumentation in order to avoid a recurrence of a large backlog in the observing queue.

7. The UC is pleased to hear of the acceptance of the rebaselined ALMA plan, and of the developments toward staffing the NAASC. The UC urges NRAO to pursue full support for the Science Development Division to ensure that US-based astronomers can take full advantage of the capabilities of ALMA.
8. The UC remains concerned about the progress of the development of aips++/CASA toward the support of EVLA and ALMA, two powerful facilities capable of producing datasets which are both large and complex to process. The UC recommends a more transparent exchange of information with users about the status and expected usage of CASA. In particular, the UC requests an interim report (December 2006/January 2007) on the status of aips++/CASA software development for both EVLA and ALMA, and a focused discussion of the current and expected capabilities of CASA at next year's UC meeting.
9. The UC remains keenly interested in the outcome of the NSF Senior Review, though the Review committee was still deliberating at the time of the UC meeting. If the Senior Review committee releases its recommendations well before the next UC meeting, we request that the NRAO convene a teleconference with the UC to discuss user response to those recommendations.

1. Existing and Developing NRAO Facilities

1.1. VLA/EVLA

The Users Committee was very encouraged to see steady progress on the VLA expansion to the EVLA, and we are very eager to use the new capabilities of the upgraded receivers and correlator. We especially applaud the extra energy of many NRAO staff towards these efforts, given the loss of several staff scientist positions in the last few years.

VLA Archive

Access to the VLA archive is clearly much improved over previous years, and it is now easy for an experienced radio astronomer to retrieve datasets quickly and efficiently. A number of Committee members remarked that this is one of the most valuable NRAO efforts in making VLA data more widely used. We were impressed by the recent development of automated routines to process and produce maps of data obtained in standard observing modes. This type of "image" archiving can go a long way in making VLA data more widely used and will benefit the entire astronomical community but should not come at the expense of EVLA development. As discussed further in Section 2.1, we urge the NRAO to put considerable effort into maintaining the accessibility and transparency of the archive in the EVLA era.

VLA Proposal Submission & Scheduling

Users who have experience with the NRAO web-based proposal tool were pleased with it. This is a welcome capability, and we encourage NRAO to continue to seek feedback from proposers to optimize this tool for regular use at (and between) all NRAO facilities.

The Committee is looking forward to routine dynamic scheduling on the VLA and encourages efforts toward this goal. We think this is excellent preparation for both observers and Observatory staff for using both EVLA and ALMA, where dynamic scheduling will be the rule, not the exception. In addition, the call for dynamically-scheduled observing opportunities during configuration-move and filler times has been welcomed and used by the community.

Transition to EVLA

The UC is excited about the prospect of early science from EVLA which highlights the new capabilities of this facility. It is important to be able to provide early science results for distribution to the science community and the public even before the full EVLA is complete, in large part to demonstrate the new and unique capabilities of the instrument and attract more and future users. These programs should consist of high-profile, showcase science similar to the HST and Chandra deep pointings. An EVLA science workshop could be a good way to select the programs.

Members of the UC expressed some concern that planning for early EVLA observations has not yet taken place. The UC encourages the NRAO to take the lead on planning for early EVLA science projects in collaboration with the astronomical community. Therefore, these early science projects would have the benefit of Observatory staff familiarity with the unique capabilities of the EVLA as it comes online. The UC also feels that the NRAO should solicit early science EVLA projects widely, perhaps as part of a "shared risk" category during commissioning. Ideally, these projects would consist of a mix of small and large projects with high visibility. For time-variable or proper motion science, programs conducted early in the lifetime of the EVLA could prove to be vital. The possibility of conducting a large survey sometime early in the EVLA timeline should also be considered. The "Legacy" Workshop held in Socorro in May was a good step toward encouraging more large, high-interest VLA and EVLA programs.

The UC has some concern about the ability of even experienced VLA users to efficiently process the data from the EVLA, especially once the new correlator is functional and data volumes become very large. Delays and bottlenecks in processing EVLA data due to delays in software development would negatively impact the visibility of exciting science to be done with EVLA and prevent rapid publication of early results. NRAO effort on algorithm development and software is critical here. The UC is concerned that more concrete details on the software plans were not yet available at the time of the meeting. (We report on specific issues related to EVLA software efforts below, in Section 2.1 on the e2e initiative.)

The UC notes that the current EVLA project contingency of 7% appears somewhat low from a project and risk management perspective, relative to other efforts of this overall scope. This appears as potential concern since inadequate contingency may eat into future resources in order to close unforeseen resource shortfalls. Having the software resources in place to test the system has been acknowledged to be a challenge for the effort. The importance of tracking this aspect of the project can not be overstated given previously demonstrated performance in this area. The additional oversight allocated in this area is seen as key aspect of maintaining the stated integration and test schedule. In any case, we hope that community scientific input will be widely solicited in a timely manner by the Observatory if descoping the project is deemed necessary.

At next year's meeting, the UC requests time to discuss with NRAO the balance between the potential gains of shortening the EVLA timeline and the impact of lost science if the VLA were to be shut down for some period of time. Not enough data were presently available for the UC to endorse a particular course of action, but as the Committee is anxious to see progress on the EVLA, we are interested in discussing this issue.

Responses to Direct Requests for Input from UC on VLA/EVLA Issues:

Upcoming VLA Configuration Schedule

Most of the UC supported proposals to shift the VLA configuration schedules to either lengthen the configuration duration, or reorder the configuration sequence, as needed, to speed delivery of the EVLA. Longer and/or flexible configuration durations would help equalize the oversubscription

between configurations and it would enable less frequent proposal calls which could be better synchronized with NSF funding cycles. In addition, the longer configurations would allow for NRAO to be more open to “Large” or “Legacy”-style proposals, while still preserving fair coverage at even the most oversubscribed configuration and LST combinations.

Pie Town Link

The Committee understands that the Pie Town link has provided some very interesting science and has been instrumental for a few groups of users, but not as widely used as a mainstream observing mode. Pie Town Link users have been well aware that the Link may not be available for some time. Overall, we did not feel that the arguments to include Pie Town in the VLA or EVLA were sufficiently strong to warrant the resources required, especially if these efforts would delay the main commissioning of the EVLA.

Transition of the VLA Array to include EVLA Antennas

While the EVLA antennas are being brought online, the UC would prefer that all antennas automatically be included in the array, with appropriate warnings to users in FILLM and in the observing logs mailed to users. The guiding philosophy here, as with related issues along the EVLA upgrade path, should be to do as little filtering as possible, provided that problematic data can be flagged.

1.2. VLBA

The VLBA continues to be a powerful and unique instrument, producing high quality science that cannot be achieved with any other instrument. In particular, the astrometric capability of the VLBA is unrivaled by any other instrument at any wavelength. The proposed program to measure the Hubble constant using water masers is an excellent example of the power of the VLBA.

The conversion to the Mark 5 disk recording and playback system is a major advance and is especially laudable given the financial and personnel constraints that the VLBA has been working under. The UC recommends that the NRAO continue to invest in the Mark 5 system and emphasize the purchase of more disk modules rather than more playback units. Achieving greater sensitivity through higher bandwidth recording will maximize the potential of the instrument. The delay introduced for correlation of global VLBI experiments with greater than 14 stations is regrettable but does not compromise the scientific returns of the instrument.

The 3mm system on the VLBA is unique. Adding new receivers at SC and HN is unlikely to produce any scientific gains, however. The measurement of the size of Sgr A* at 3mm with the VLBA is an important result. Overall, however, the scientific output of the 3mm system has been limited. The UC does not recommend that support be withdrawn from the system, but we recognize that in times of depleted resources the least productive components are the most vulnerable.

We are particularly concerned about the lack of staffing for the VLBA. The Earth-orientation-parameter problem experienced by the VLBA was costly for users and is certainly a result in part of the lack of staff available to test and use the VLBA.

1.3. GBT

The Green Bank Telescope continues to produce world-class science while enhancing its capabilities and improving and streamlining operations and user support. Cooperative instrumentation, such as focal plane arrays and wideband spectrometers, are extremely beneficial to the NRAO and the user community and should continue to be supported.

For the azimuth track repair scheduled for summer 2007, we recommend making a special call for unique long-duration proposals that can be performed in an automated fashion during track repair. In general, we find it advisable to convey the Observatory's plans to the community and remind them of the necessity of these repairs and its impact on operations.

The UC is deeply concerned about staffing shortages at the GBT due to promotions and the movement of personnel to Charlottesville. In particular, we are concerned about the effects of missing staff on user support, continued improvement in performance and capabilities, and science output. It is difficult at the moment to see how some aspects of GBT operations could avoid being affected.

Increased Observing Productivity

The reduction of set-up time allocated for observers should significantly enhance scientific productivity and the discharge of queued proposals. We are happy to see the set-up time reduction is consistent with scheduling block implementation and the streamlining of observing protocols. The large gains in time scheduled for astronomy over the past year due to reductions in maintenance and test time are impressive and should continue as much as is possible. Online quick-look display of data at the GBT has improved with Astrid and GBTIDL. However, the current implementation of the official data reduction package, GBTIDL, does not yet fully replicate the functionality of the AIPS++ dish package, which is no longer supported. This seems like a step backward, especially for users who require high-level interactive and automated flagging of data. We encourage NRAO to make all required, high-level analysis tasks available to GBT users as soon as possible.

Observation Queue

The backlog of high-frequency proposals and the need to omit Ka and Q bands from the last call for proposals are concerns of the user community, particularly as they create a negative relationship with NRAO for both successful and unsuccessful observers. We hope that offline testing can identify and correct the existing performance problems in the high-frequency receivers, and we are glad to see that the CDL and GB scientific staff are more actively involved in the process. Members of the UC are also concerned that previous calls for proposals have "over-advertised" receiver performance, leading to some accepted proposals sitting in the queue for years. We encourage NRAO to reevaluate the process used for determining when new instruments are offered, and in particular to assess whether proposals for the newest instruments should be accepted as regular or "shared risk" proposals, where "shared risk" time allocations would be granted to those seeking to use incompletely tested or underperforming receivers or observing modes.

We believe that the lack of transparency and the apparently ad-hoc nature of the proposal queue is a serious concern to all observers at the GBT. To increase transparency for the proposal process, we encourage NRAO to adopt a firm and clear-cut policy on the lifetimes of accepted GBT proposals in any category, and on time lost to bad weather or telescope/instrument failures. The NRAO should allocate observing time such that the vast majority of accepted proposals will be conducted within the trimester in which they are scheduled. As an example, Arecibo keeps proposals in the queue for two trimesters; if a program has not yet been observed after two trimesters, for whatever reason, then observers must resubmit their proposal. Traditionally, bad weather and equipment malfunction at

ground-based facilities is part of the risk observers assume, and resubmitting a proposal which failed due to circumstances beyond the control of the observer is a common practice. It is particularly important to have such a policy in place before dynamic scheduling begins.

The UC recommends that proposals that have been waiting in the GBT queue for more than two years should be reviewed at least once a year. Proposals which cannot be pursued in the foreseeable future should be removed from the queue and the authors notified that they may reapply if their required instrumentation becomes available. Programs which are evaluated to be technically feasible should be scheduled with highest priority to clear out the backlog. Once the queue has been cleared, a time-limiting policy, such as that suggested above, should prevent the formation of another backlog queue, and thus remove the need for intensive reviews of the queue in the future.

Dynamic Scheduling

We applaud the plans for dynamic scheduling test runs in Fall 2006. The scheduling block software (Astrid) seems to be mature enough to allow queue observing to proceed. We encourage the solicitation of user feedback during the testing and shake-down period so that the GBT is optimally used and meets user needs. Transparency in the dynamic scheduling decision-making process is also important, and we stress the importance of having firm preset lifetimes for projects in the dynamic queue. We are encouraged to see the GBT staff seeking to learn from the experiences of other facilities that have already tackled this issue, and we are curious about how NRAO plans to implement dynamic observations: will observers be required to do all observations, or will the Astrid

blocks be used to their full potential and be run in-house for simple programs? It seems like a reasonable approach would be for GBT staff to check out and run scheduling blocks in a manner similar to VLA operations unless observers specifically request to do their own observing or have non-standard observing modes.

1.4. ALMA

The UC was very pleased to hear of the National Science Board's approval of the rebaselined ALMA. The technological progress that has been made on the antennas, receivers, and correlator is also good news. We are generally positive about negotiations to include Taiwan in ALMA_NA, although its impact on users was unclear.

ALMA User Support

The organization of the North American ALMA Science Center was discussed and the UC heard about a proposed "beyond ARC" Science Development Division that would encompass projects such as advanced user support, user grants, professional development, postdocs and students. We feel that support for the Science Development Division is critical if ALMA is to be attractive and accessible to the wide cross-section of US astronomers who hope to use it, and we encourage NRAO to pursue vigorously, and develop fully, the proposed Science Development Division.

NRAO staff also introduced the idea of a User Grants program for ALMA, which would provide supporting funds to be awarded along with successful observing proposals in the way that is now familiar to users of satellite telescopes. While the UC would be happy to see an additional \$10M for astronomy, this suggestion produced a great deal of discussion but little consensus. It would be helpful to have a program for smaller grants because they can be an excellent way for younger scientists to get research programs going before they are well enough established to get the regular NSF grants. But while connecting observing time with supporting funding improves the chances that the proposed science will actually be accomplished, such funding has not been shown to necessarily improve the

quality of the science. Furthermore, some UC members expressed concern over larger numbers of proposals and more acrimonious battles with those whose projects are declined, if telescope proposals were to be associated with support funds.

The UC questioned how much user support will be offered to foreign users who get their observing time through NRAO's Open Skies policy. For the benefit of both NRAO staff and the foreign users, we recommend that a plan be developed to address the issue. Given the international stature of ALMA and its anticipated large user base, we also recommend that NRAO ensure that the membership of the Users Committee includes a significant number of potential ALMA users.

ALMA and EVLA

Given that NRAO is looking forward on very similar timescales to the operation of two complementary interferometers, ALMA and EVLA, it would clearly be beneficial to the users if both instruments used as much common software as possible. This will be especially important for software that is used directly by observers such as the proposal submission tool and schedule block generator, reduction pipelines and archive. Presumably common software would also benefit NRAO in terms of software and user support and having users who can use both instruments without an additional learning curve. The UC requests that next year we be given a more detailed progress report on the status of ALMA software and pipelines.

There was also concern about the likely impact of grants associated with ALMA observations on the EVLA, if the EVLA did not have a similar program. We note that such grant programs associated with new facilities were a recommendation of the last decadal review, and the EVLA may also be regarded as a new facility. Thus while the UC generally endorses the idea of such tied grants programs, we remain concerned about the impact of such an ALMA program on the rest of the NSF astronomy budget.

1.5. CDL

The Central Development Laboratory's ongoing efforts in modeling, device characterization, design, fabrication, and test of components for receivers are seen as a key to maintaining the NRAO's scientific and technological infrastructure. The research and development efforts in low-noise SIS and HFET technologies have enabled imaging systems with significant and wide ranging scientific impact. Sustained support for the CDL's numerous research efforts—spanning but not limited to such topics as detectors, electromagnetics, and correlators—cannot be understated. Maintenance of these technical capabilities is seen as a necessity in managing the life cycle of the observatories scientific instrumentation assets. The importance of looking beyond the project at hand and make adequate future investments is crucial to the observatory's long term health.

The UC commends NRAO's involvement with the university instrumentation community. The UC sees this interaction a potential means of fostering innovative radioastronomy instrumentation concepts while simultaneously training the next generation of students, scientists, technologists, and engineers. The Caltech Ka-band continuum receiver and U-Penn Array are excellent examples of leveraged technologies outside of the Observatories technology assets which has the potential to significantly impact the imaging capabilities. The importance such partnerships may increase under the current budgetary trends.

The UC acknowledges the importance of the Observatory Technical Council (OTC) recent efforts to prioritize resource allocation under the present funding environment. As stated in the OTC's five year

plan, the NRAO research and development portfolio has been “reduced to practically zero” and top level engineering talent has been diverted from research efforts. The UC sees internal reinvestment and pursuit of external funding in this area as a key to maintaining the Observatory’s leadership in enabling cutting edge scientific inquiry as well as creating a vibrant environment that will allow the Observatory to attract, challenge, and retain a creative and demographically diverse research talent.

The OTC stated areas with high priority, namely NbTiN films for SIS mixers above 600GHz, investigation of the noise and stability properties of novel and state-of-the-art HFET and HBT structures, large focal plane arrays, electromagnetic simulation, wide bandwidth receiver components, and advanced digital correlators are seen as vital to the technological well-being of the Observatory and are wholeheartedly endorsed by the Committee. In this light, we are happy to hear of the recent appointment of R. Fisher as the Observatory-wide Technical Coordinator. It is our hope that leadership in this position will foster greater communication between the NRAO sites, enable the maximum benefit to be derived from the available technical resources within the observatory as well as provide guidance for external ventures. The UC perceives the identification of sufficient resources to enable exploration of forward-looking and innovative concepts as a significant challenge that must be addressed directly by NRAO, and we look forward to hearing about progress toward finding these funds at future meetings.

As ALMA and EVLA proto-typing efforts draw to a close, a reservoir of engineering and development talent will become available. In pursuing an SKA demonstrator it is recommended that the approach broadly accommodate the community’s views regarding of the capabilities of the next-generation facilities. Innovative technical leadership should be encouraged in the identification and demonstration of enabling technologies which can significantly impact the resources required for the system and definition of achievable performance within proposed cost. This fall’s proposed Green Bank Instrumentation Workshop is seen as a commendable venue which will facilitate directed discussions between scientist and engineers from the observatory and the community at large regarding developments in focal plane technology.

2. Observatory-wide initiatives

2.1. e2e

As in the past, the UC is very supportive of NRAO’s goals to have an Observatory-wide coordinated effort to support a whole suite of end-to-end (e2e) data services. The UC was pleased that this organizational unit is now being led by both a scientist and an experienced outside manager and has a number of dedicated FTEs to work on these important Observatory-wide goals. The UC recognizes that the e2e unit was reorganized only a month prior to our meeting, and therefore could not present a full progress report on its many activities. However, the frequent reorganization of e2e in recent years has made it difficult to assess the effectiveness of the e2e initiative in advancing the “One Observatory” idea and increasing the efficiency of the distribution of NRAO personnel and resources toward its highest priorities. We encourage NRAO to stabilize e2e under the current organizational model, allowing the e2e initiative to address urgent NRAO needs for Observatory-wide tools to support the upcoming EVLA and ALMA. We further request an interim status report, perhaps in December 2006 or January 2007, regarding the development and planned deliveries of aips++/CASA to support EVLA and ALMA users.

Observatory-Wide Archive

The UC is pleased with the efforts so far to get the VLA archive on line and accessible by the astronomical community at large. The online data archive also commendably includes the GBT archive (non-pulsar data), but the archive is not clearly linked to from the GBT web pages and a number of members on the UC had no idea that any GBT archive data was available online. We also applaud and encourage the efforts by Lorant Sjouwerman to get an “image archive” pipeline working for standard VLA data. This is a real demonstration of the power of the e2e project! However, this particular project appears to be severely limited in terms of staff resources, and appears to lack a plan or schedule for release of either the pipeline software, or an image archive. The wide appeal and leveraging power of a large VLA image archive merits further planning, and the devotion of at least a student or data-aide to assist with these efforts.

In general the UC feels that more work is needed on developing a general archiving policy across Observatory. Issues of how (and whether) to archive current pulsar GBT data, and how one would manage the huge volume of data from the EVLA correlator, indicate that some planning now is advisable to maximize the efficiency of limited resources in an era of increasing data complexity and size. An Observatory-wide archiving plan should cover the use of archival GBT data for a wider community as well as use of archival EVLA/VLBA data as the VLA/VLBA user base evolves into the EVLA/VLBA user base, and should interface these archives with those planned for ALMA. The UC recognizes that several versions of the policy may need to be considered, scaling to different levels of potentially available (employee and hardware) resource levels. For next year’s meeting, the UC requests an update on progress toward a general, all-facility archiving policy for new NRAO data.

Software for EVLA/ALMA

A concrete discussion and description of aips++/CASA was notably absent from this year’s presentations. This issue again seems to be a key one for the Observatory’s ability to support EVLA, and eventually, ALMA. We were concerned that details of the progress on CASA was not illustrated to us in the presentations. The UC feels that software packages which carry out data calibration, imaging, and analysis are incredibly powerful and flexible tools for working with both single dish and interferometric data and most of us rely on these packages (like AIPS) to produce our scientific results. We understand that work is ongoing, but many of the UC felt that we were not given enough information to assess basic facts about aips++/CASA: (1) what is the timescale for transition from aips++ to CASA (2) when will it be “ready” in some form for the general user community to work with it, even in some simple standard modes? (3) what are its capabilities and advantages over existing packages, (e.g., AIPS)? (4) what are the plans for dealing with the volume of data from the EVLA correlator/wide bandwidths? (5) What support for mosaicking and combining single dish and interferometer data exist? The UC also feels that it is crucial for the user community to get familiar with, debug, and contribute to CASA as it is developed and improved through whatever methods are most practical.

For next year’s UC meeting, we would like to request a focused discussion on CASA, with a concrete progress report, which demonstrates the current capabilities of the software, tests using real data, and illustrates the interface between the software and scientists. We hope that there will be an available CASA requirements document (addressing things like handling the new correlator data and mosaicking algorithms), a plan for releases and milestones, and an active demonstration of data processing in CASA for all interested committee members (i.e., perhaps over lunch).

Interfacing with the User Community

The UC is pleased to see that NRAO is making a global effort, through the e2e unit, to put forward a “One-Observatory” model for interfacing with the full user community, including both the experienced users as well as the novice users that NRAO is hoping to attract during the next few exciting years.

To this end, the UC recommends the following specific efforts for e2e:

1. Critical assessment of the organization and effectiveness of the portions of the NRAO website devoted to astronomer resources, and coordination with planned high-priority EPO efforts to renovate the NRAO website.
2. Requests for feedback from users on recent NRAO developments to assist in the overall assessment of what users’ priorities and needs are; for example, Joan Wrobel’s post-deadline Proposal Submission Tool survey is a good example of this kind of feedback request and illustrates that the Observatory is interested in involving users in new developments. Similar polls could be assembled to see how well other user needs (such as more advanced, post-observation software or more comprehensive archive search capabilities) are being met.
3. More active use of scientific and operations metrics as a means of tracking the efficiency of science output. One suggestion to update this process at NRAO is that resources now allocated to (rapidly obsolescing) hardcopy preprint archives at the NRAO Library could be diverted to electronic tagging of NRAO-related publications. Excellent advice and models are available (e.g., HST or Chandra) for tagging and tracking of future publications, and (secondarily) for backfilling ADS with NRAO identifiers for NRAO-related refereed journal publications.

These efforts could result in a more complete picture on the effectiveness and changing priorities of e2e than can be achieved from anecdotal feedback, while at the same time providing the opportunity to update users on new developments.

To further lower barriers to new or novice users, the UC encourages NRAO to pursue the following e2e-identified projects as high-priority efforts: (1) An image archive searchable by a tool like the current NRAO Advanced Query Tool. (2) A single web portal with all the tools necessary to propose for all NRAO facilities. (3) Unified user interface and support structures across EVLA, VLBA, GBT and ALMA. (4) Unified, user-friendly GUI-based data processing (via CASA) and example threads where appropriate and possible (e.g., for some subset of “standard” observing like centimeter continuum observations).

2.2. Observing programs

Large/Legacy Proposal Allocation

The Users Committee (UC) supports the allocation of a larger fraction of NRAO observing time to Large/Legacy proposals. The existing upper limit of 50% of observing time in any one LST range would nominally appear to protect the availability of some observing time for smaller projects, and for this reason we encourage NRAO to maintain some comparable LST-dependent limit. The UC also encourages NRAO to announce which LST ranges are traditionally oversubscribed or undersubscribed in any call for proposals which includes Large projects, so that proposers are aware of all constraints that could affect the likelihood of success.

The UC makes no additional recommendations on the fraction of total time to be available to Large projects; it is difficult to quantify the ideal fraction of total observing time with the information available, and a range of criteria are considered most relevant by different committee members. In extended discussions on this topic, we found that roughly equal numbers of committee members were comfortable with NRAO granting fully 50% of the total time allocation to Large projects, as compared

to the number who preferred allocating a maximum of ~30% of the total time to Large projects. In particular, some members expressed concern that a large fraction may prevent NRAO from serving the full range of science typically served by smaller proposals. We request that NRAO report at the next UC meeting on the Large proposal allocation in the 2006 cycle, as well as the fraction expected to be allocated in the near future.

The UC further encourages NRAO to move to a schedule where Legacy proposals are considered early enough in the calendar year for successful investigators to apply for individual NSF grants to support their projects. In 2006, we encourage NRAO to consider an August deadline for Legacy projects, in order to return results to proposers by early October. For future years, the UC recommends that Legacy proposals be considered at the June deadline.

The UC welcomes the consideration of alternate configuration schedules for the VLA that will reduce the impact of large proposals on the overall time availability while releasing personnel and resources toward progress on the EVLA (e.g., in the case of an extended schedule for a given configuration). More generally, the UC recommends that NRAO implement simultaneous review of all proposals for time allocations to multiple NRAO facilities; in particular, Large/Legacy project proposals may provide a useful testbed for reviewing multi-facility proposals. Multi-facility proposals are not expected to constitute more than a small percentage of all Large proposals, but simultaneous review of such proposals allows all science to be judged in competition, and allows comprehensive evaluation of science and technical justifications.

Proposals and Scheduling

Potential changes to the current NRAO proposal process were discussed at this year's meeting. There was a clear consensus that this topic was important for users, but there is a large range in opinions about what is best. Some members expressed a preference for moving to a system with a single yearly deadline for all NRAO telescopes while others felt that the current system meets the needs of the NRAO and the users well and should not be changed. The primary advantages of moving to a single yearly deadline would be that it could allow NRAO to re-configure the VLA (and EVLA) based on proposal pressure and it would allow face-to-face referee panel meetings on the yearly proposals. This type of referee panel meeting might help NRAO to better judge the relative quality of large and small proposals as well as multi-facility proposals.

On the other hand, there was significant concern that the single yearly deadline would be detrimental to students using the NRAO facilities due to the single-shot chance at getting a project approved where a missed deadline would mean a large delay. Multiple deadlines per year provide more freedom for all proposers (and students in particular) to cycle through the referee/revision/resubmission stage of a project without a large penalty, while at the same time allowing more frequent opportunities to utilize new or enhanced equipment or respond rapidly to a changing scientific climate. Furthermore, it should be acknowledged that NRAO facilities are groundbased observatories, and as such observations are subject to seasonal effects. Indeed, nearly all ground-based observatories have at least 2 proposal cycles per year, and it was noted that the current cadence of VLA proposal deadlines and array configurations allow the periods of nighttime and low humidity observing to cover different ranges in RA in a democratic way.

The Observatory landscape is changing significantly as its facilities become more powerful and more complex, and yet resources are increasingly scarce. The UC strongly encourages NRAO to consider changes to the current proposal review system which maximize the efficiency with which existing resources are used, while maintaining breadth and quality in the science pursued with Observatory facilities. Furthermore, the UC encourages the NRAO to iterate with the community in determining the most suitable system.

Cooperative Observing

The UC is pleased that scientists are making good use of the synergy with Chandra. The high (about 1/3) success rate is higher than the average Chandra proposal acceptance rate, but this probably reflects proposal quality and impact rather than a tendency to want to giveaway ‘free’ NRAO time. Coordinated Chandra observations in particular seem to be successful.

The UC is concerned that only 2 proposals joint with Spitzer have been received to date. Given that observatory’s limited lifetime, and the strong science overlap in several topics, we feel that special effort is needed to increase the interest of Spitzer proposers in NRAO capabilities. The NRAO presence at the workshop “Making the Most of the Great Observatories” in late May 2006 may help. It should be simple enough also to craft an announcement advertising the availability of time on NRAO facilities a couple of months before the Spitzer deadline, which the SSC might be kind enough to disseminate to their electronic announcement list.

While the scientific radio/optical links may not be so obvious, the absence of a Joint program with the first NASA Great Observatory, HST, is puzzling, unless there have been few requests for such opportunities. The UC requests a review of this option.

GLAST potentially presents new opportunities and challenges for NRAO cooperative programs. GLAST sees most of the sky at a sweep, so there is little motivation for coordinating observations. However, since GLAST will require large radio monitoring programs of sources such as AGN and pulsars spanning many years, we recommend that, before GLAST is launched, NRAO makes clear to the community whether such programs should be proposed through the existing large project option (e.g. as is the case now for GRB afterglows and radio supernovae), or whether special arrangements need to be made to accommodate the significant ground-based component of GLAST science.

2.3. Scientific and Academic Affairs

The UC is pleased to see many efforts in outreach to the wider astronomy community—from newsletters and calendars to traveling Jansky Fellows. This should go far in advertising NRAO’s capabilities and successes. As the NRAO restructures its WWW pages, we ask that links to opportunities and services for the community be easy to find, for both scientific and E/PO information. Additional information that still needs to be gathered is a list of NRAO-related publications, which can be tracked by requiring authors to add specific AAS_{TeX} facility keyword to their manuscripts or ADS entries. Electronic tagging and tally of NRAO-related publications is also mentioned as a priority in the e2e section of our UC report.

We share NRAO’s enthusiasm for outside-user instruments and other opportunities for collaboration with university groups. we encourage the NRAO to create a program of Invited Visiting Fellows specifically for the EVLA transition. In addition to an open call for applications, we recommend that this program target specific scientists whose scientific interests and technical skills can help make the EVLA productive as quickly as possible. The NRAO might consider requiring/funding a service role for such visitors. In addition, a carefully worded statement of this opportunity could be used as a selling point for attracting Jansky Fellows with an eye toward the needs of the EVLA commissioning phase (e.g., software beta testing, instrumentation verification, data analysis, etc).

Student internships also appear to be a productive way to enable collaborations with non-NRAO scientists and train the next generation of NRAO users, similar to the NASA Graduate Student Fellowship Program. To continue, this program should be formalized with an open application process.

We welcome the NRAO's steps towards formulating a policy on a Galactic supernova, or similar one-time event. The draft that has been shown to us (dated December 7, 2005) looks very reasonable. Our only comment on this document is that the text does not make clear just what constitutes such a one-time event. While not all possibilities can be predicted, some discussion of this is warranted. For example, would a supernova in M31 fall into this category? And will the next magnetar giant flare be categorized as a one-time event, or only if bright radio emission is detected? In any case, we encourage NRAO to put in place a formal policy based on this draft as soon as possible.

2.4. User support

As the NRAO continues to bring significant new observational facilities online, the importance of user support remains paramount. The NRAO needs to be very proactive in advertising the availability and capabilities of EVLA and other facilities, and in making them straightforward to use. While bringing new users online to the system requires staff resources, building broader use and support in the general astronomy community for all NRAO facilities is an important part of keeping the NRAO successful.

Immediate user support issues include the need for early assessment of how astronomers will use EVLA and how: specifying observational parameters, handling the data stream, data pipelines and archiving, and user "hand-holding" for both experienced (though no one will be experienced with EVLA!) and new radio astronomers. Software availability and documentation are key issues; the UC has outlined concerns about these in other sections. User issues are important enough that the staff may consider diverting resources from other projects if it appears that users outside of the NRAO will not be able to use their observations in a timely fashion. An ungraceful debut of the EVLA may be seen as a poor augury for the NRAO's role in ALMA.

As a more general issue, the UC recommends better user support for data reduction and instrument use at all NRAO facilities. In our discussions we rhetorically asked whether or not the NRAO could identify ways in which ALMA resources can be shared/used to facilitate support for other telescopes also. This may already have been considered at the appropriate level, and we advise caution in of trying to create a single solution to all problems, at the detriment to solving them effectively individually.

Summer Aperture Synthesis Imaging schools are traditionally an important entry for new students to radio astronomy, and we urge continued support. The UC heard little about this program; while it is clearly popular, the UC would like more information in order to see that the school's quality remains high. In particular, please assess whether this year's change of venue was a success. These workshops may need to be expanded to a larger pool of users in the future: can this be accommodated? Is there a way in which the efficacy of these workshops can be assessed, so that we are sure that we are reaching the right users with the right topics and level of instruction?

It is clear that low staffing is affecting NRAO operations, particularly for the GBT and VLBA, and we also note that staff salaries are not keeping pace with comparable facilities. NRAO is fortunate to have such a dedicated and talented staff, but the UC is concerned that they are continually being spread more thinly. Loss of staff may be particularly disruptive during these challenging phases of expansion. We realize that the Observatory management is aware of the problem, but are concerned that the matter is not being given sufficient weight. We recommend an active and forward-looking policy toward hiring new staff, and in particular suggest identifying and recruiting on a fast track to permanent positions those postdocs who show greatest promise.

2.5. EPO

The public outreach commitment of NRAO has improved greatly over the past few years. NRAO seems to have a greater exposure, especially in the context of ALMA and the image contest. The committee saw two main areas that are in need of further improvement, the web page and the exposure of EVLA. We were encouraged to hear that professional help has been hired to help with the web page and look forward to improvement in terms of accessibility of material and appearance. More talks about EVLA at meetings and institutions, as well as general exposure through the web page, visitor centers and brochures are needed so both the public and astronomical community realizes the extensive new capabilities of the VLA. Sending an astronomer to talk specifically about the EVLA capabilities at key subject-based conferences (not the AAS) may be helpful. Beyond the EVLA, but for radio astronomy publicity in general, a coordinated effort with other radio observatories may help to ensure invited review talks focusing on radio astronomy are presented at national and international meetings.

The introductory “hands on” materials for students on the NRAO website are excellent means of public outreach, and expanding this resource through web links and suggestions from users would be valuable. In the same vein, pages to place RFI considerations within the context of every day life are seen as opportunity to educate the public about the use of our finite spectral resources (note: link on RFI page to “Interference and Radioastronomy”, by Thompson, Gergely and Vanden Bout is broken). One might also consider expanding D. Finley’s discussion of technologies which have benefited from synergistic interaction with or were developed for radio astronomy by compiling a list or photo montage of specific examples from instrumentation medicine, environmental monitoring, imaging processing, defense, metrology, satellite navigation, etc. Similarly, a list of discoveries from archive data could be useful in explaining the importance of these assets to a scientifically literate, but non-expert, audience.

2.6. Spectrum Management

Spectrum management is (unfortunately) an area that requires constant vigilance and very frequent updating, both of information acquired from RFI surveys and observers and on the policy front. The “Latest News” section of the main spectrum management page is an excellent resource and should be maintained. The prominent location of RFI resources on the NRAO web pages is excellent, and site-specific information is now easily accessible. The online spectrum management pages for the VLA, the VLBA and the GBT typically have useful monitoring information, but plots tend to be a few years old. We suggest that, as human resources permit, spectrum survey data be updated frequently in actively changing bands using either test time or observer data (this is particularly appropriate for the GBT).

In general, the information and resources for users continues to improve. It is clear that NRAO has a strong commitment to both RFI mitigation and the policy side of spectrum management and has allocated personnel to represent the interests of the radio astronomy users community in this serious environmental issue.

The ALMA Radio Quiet Zone is a remarkable achievement. If the new rules in Chile are enforced, then the ALMA RQ zone will be an incredible asset (and not just for ALMA). NRAO has taken a laudably proactive approach to RFI at ALMA, and we hope that this continues. The Llano de Chajnantor/San Pedro de Atacama region of Chile, while currently remote and undeveloped, has seen dramatic changes in the past decade, such as installation of power lines and street lights in San Pedro, natural gas pipelines across the Andes from Argentina, increased air traffic, and the installation of RF

transmitters and repeaters on the plateau. Taking a pro-active approach to spectrum management and education now in the early years of the region's development can prevent serious interference problems for ALMA operations in the future.

The spectrum management at GBT shows positive developments in outreach and education and local and regional RFI mitigation. With the departure of Rick Fisher, is there any continuing work on RFI mitigation either during or after observations? Spectrum management is part of the comprehensive long-term plan for the GBT, but there seems to be a gap in the short term plans. The UC also has concerns that user data is not feeding back into the local RFI knowledge base, although positive steps have been taken in this direction, as outlined in the GB RFI progress reports in the online RFI management wiki. The UC is also concerned that new users (and often proposal referees) are often in the dark (so to speak) about the RFI situation at GBT. Since the GBT proposal submission tool requires users to input frequencies and velocities of target sources, perhaps RFI alerts could be incorporated into the tool. Finally, the transition to digital television remains a concern. While some decisions are made by bodies in which the NRAO has no opportunity for input, we encourage NRAO to be vigilant in considering possible options for mitigation, such as correlation with a second antenna or working with transmitters to switch off when not broadcasting.

For the next Users Committee Meeting

The Users Committee particularly thanks the Observatory for its continuing openness to considering the recommendations of the members of this committee as representatives of the user community. Furthermore, the UC is pleased that the NRAO has adopted a general plan of short presentations and extended discussion periods for our annual meetings. Members of the UC found both the scheduled discussion periods, as well as the informal discussions held over lunch and dinner, particularly valuable. We encourage NRAO to minimize the scheduled responsibilities of Observatory staff during Users Committee meetings, in order to maximize the number of opportunities for UC members to talk with Observatory staff.

The opportunity to have all active members present for this year's meeting can be attributed to the timely selection of new UC members and beginning a dialog on the meeting schedule early in the calendar year. We encourage the NRAO to work closely with the 2007 UC Chair to achieve similar success next year. We also appreciated the option to have all review materials available electronically, and recommend that this be a regular option in future years.

Finally, we request that the UC be informed of significant developments, such as feedback from the NSF Senior Review and major steps in the development and organization of projects such as CASA, in a timely manner between meetings, in order to be able to fully reflect on their significance in the limited time available at face-to-face Users Committee meetings. In particular, we request an interim report on the status of CASA before next year's meeting, and a teleconference with NRAO after the Senior Review recommendations are released.

Members of the 2006 NRAO Users Committee

Robert Becker
Geoff Bower (2007 Chair-elect)
Scott Chapman
Tracy Clarke
Jeremy Darling
Erica Ellingson
Gary Fuller
Bryan Gaensler
Paul Green
Luis Ho
J. Michael Hollis
Rob Ivison
Henry Kobulnicky
Stanly Kurtz
Cornelia Lang
Mary Putman
Evan Skillman
Dan Stinebring
Michele Thornley (2006 Chair)
Edward Wollack
Lisa Young