

# 2022 NRAO/GBO Users Committee Report

## July 26-28, 2022, Hybrid – Zoom / in-person at NRAO-CV Site

### NRAO Overview:

With the global situation still very challenging the observatories should be applauded for successful smooth running of operations, with no impact on telescope time available to users. As usual the science highlights presented were amazing (e.g. EHT SgA\* image, radar image of the Moon) a fact reflected in strong mentions for observatory facilities in both the astronomy and planetary decadal reports. We appreciate the *continued running of the UC meeting with effective hybrid options*, as well as a clear *focus on accessible hybrid science meetings for the user community*.

The committee remains concerned about the struggles the observatories report in recruiting, with what looked like an increase in open positions over the last year. Understaffing is having an impact on users (as a concrete example, we note the slow processing rates for high quality images, presented by VLASS as partly due to under-staffing). We reiterate our recommendations from last year to *continue to support and develop pandemic era work models, such as long-term options for remote work available to all suitable positions*, to bring top talent to the observatory and better support the users.

We commend the observatories for the inflation driven pay raise they implemented this past year, but remain concerned that NRAO wages are not competitive with industry standards in software, engineering, and data science roles, and that this impacts recruitment. We repeat our advice from 2021 that NRAO should *continue to explore ways to make positions more appealing, if not by higher wages, through other benefits*. For example, one could allow for some fractional time to be spent on personal education or side projects of personal interest related to the observatory. Such a model may also accelerate innovation and interdisciplinary collaboration.

Meanwhile a message of the need for budget belt-tightening was made clear following a few years of strong development. We encourage the observatories to be *open with the users about choices which have to be made on prioritizing/de-prioritizing projects* due to budget constraints, or any other cuts which have to be made which might impact users.

We were impressed with the efforts being made to increase the user base, and train the next generation of radio astronomers via programs like RADIAL, NINE and the REU program in Chile. While in the 2021 report the UC commended the observatories for expansions in Diversity, Equity and Inclusion (DEI) efforts, it was notable in this meeting that the presenters were overwhelmingly white and male. While we acknowledge the potential role of small number statistics in this, it hints at a concern for the pipeline to leadership for students entering radio astronomy fields. We encourage the observatories to *continue the good efforts on DEI, and to add an emphasis on work towards improving the diversity of people in tenured/tenure-track and leadership roles*.

## ALMA Operations:

The User's Committee commends the ALMA operations team on its continued scientific productivity and its handling of the ongoing impacts of the Covid-19 pandemic. It is wonderful to see Band 9 results making their way into the literature and a suite of new large programs underway in the first Covid-era cycle. We particularly commend the ALMA observatory for their communication with the user community during the pandemic: Tony Remijan's town halls were informative and well attended, so much so that it might be worth *considering continuing to offer NAASC town halls going forward as a way to help keep the community informed of new developments, capabilities, ALMA status, and the roadmap, for example*. Users with time conflicts and in distant time zones would also find it helpful if such webinars were recorded and provided online as much as possible.

The UC is extremely supportive of the move toward joint proposals (JP) with other facilities. We encourage NRAO to announce opportunities for JPs well in advance of any JP deadlines to allow the user community plenty of time to prepare for this new opportunity. UC members raised a number of questions about the JP process: how duplications will be handled in the context of JPs, how ESO limits on non-member countries will factor into North American access to JP opportunities, whether it will apply to specific instruments like GRAVITY with VLTi, and how scheduling will work within the ALMA queue. After successful rollout of the initial JPs, the UC *recommends broadening the wavelength coverage of facilities with JP agreements with ALMA*, but we fully support the choice to prioritize JWST and VLA as the highest-priority JP partners. If there are opportunities for the community to give feedback as the MOUs are still in draft phase, it could be helpful to solicit questions and comments about the move to JPs from the user community.

The UC raised two final minor points: *(1) As the synthesis imaging school undergoes changes to location and schedule, the UC recommends coordinating with other GBO/NRAO activities to avoid overlap. (2) Efforts to expand the user base are appreciated, and especially in the context of rising ALMA oversubscription rates, the UC recommends tracking the persistence of new PIs (i.e., the rate at which they re-propose).*

## GBO Operations:

The UC commends the GBO for their well-thought out approach to GBT maintenance needs over the next four years. One noted highlight is the pilot project to use professional painters for GBT projects, which appears to have worked out extremely well.

News of the new capabilities from the upcoming ultra-wide receiver were among the highlights of the US public radio astronomy portfolio. The UC agrees with the observatory management that this receiver will be in great demand by a large swath of the user community, and likely help to attract new users.

On the science support side, the news about the data center building and its imminent completion was very impressive. Such a facility has been talked about for many years and it will be a huge boost to the GBT's legacy and accessibility and will likely lead to a great interest from new users upon its release to the community. The plans for establishing the archive seem very sensible and the UC encourages the observatory to engage the community between now and the 2025 goal of full completion. The UC also commends GBO for the continued operation of their Observer Training Workshops, which provide an immense value to the community.

During the discussions, the UC learned about the status of the Laser Antenna Surface Scanning Instrument (LASSI) on the GBT. Current limitations seem to be absolute calibration and problems of feed arm wobbling in high winds. An upgrade to LASSI that would enable realtime use and allow more high frequency time is needed. This is currently under investigation by a GBO taskforce. The UC supports this need and the approach being taken.

## **Recommendations**

For the data center, the UC recommends long-term archiving in a readily exchangeable format (e.g. FITS) as opposed to an internal format. While this will require additional development, the end result will be more accessible to a broader community.

The UC recognizes that GBO is interested in identifying and emphasizing the areas in which the GBT provides unique capabilities. We recommend, however, that GBO view “overlapping” capabilities at other observatories as opportunities to explore for collaborative or complementary work rather than as “competition” with the GBT. CHIME is an excellent example. GBO is hosting one of the CHIME outriggers currently under construction. There seems to be an excellent opportunity to more closely work with the CHIME team and provide support at GBO that would facilitate greater user capabilities and collaboration in the future. Related to this is the recommendation that GBO explore more collaborations with non-radio facilities (e.g. NICER) that could lead to increased demand for GBT time in the future.

The UC recommends that GBO further expand and advertise the availability of operator-driven observations for the GBT, especially in the context of widening access and reducing barriers to entry. Getting user input on this process is essential, and we encourage the observatory to poll its community to get input on this (perhaps in the context of a larger survey that includes other recommendations in this report, as well as other questions they would like to ask) in advance of the upcoming AAS winter meeting. Related to this survey is to get input from the community on the priorities for GBO for the next decade. We heard about the possible deployment of the 40-beam phased array feed ALPACA during the presentations and understand that this would take at least 2 years from now to realize. It wasn't clear, however, how much of a priority this was for GBO or its users.

The UC recommends that GBO create an expanded framework for training GBT remote observers that allows for certification of remote observers without the need to physically travel to Green Bank. In addition, the UC recommends that GBO consider providing additional funds for

those that do choose to travel to GBO either for the Observer Training Workshops or individual training sessions to cover the cost of travel as well as on-site expenses for those that have a demonstrated need. The UC believes this may help address barriers to access, which may currently be discouraging usage of GBT by scientists at institutions with lower resource levels and/or institutions far from West Virginia.

The UC commends the GBO (and the NRAO) teams on their thorough analysis of proposal outcomes (as discussed elsewhere). The UC would like to request, in the context of better understanding potential barriers to access to GBO facilities, that a study be undertaken to describe the historical distribution of proposal submissions (and proposal acceptance rates) at the institution level and at a regional, geographic level. We would appreciate the results of this study being presented in the GBO report to the committee in 2023.

## VLA/VLBA Operations:

The committee notes several impressive scientific results that include the transient discovery with VLASS, results from the VLA X-proposal local group survey, the 43 GHz blazar survey with the VLA, and the VLBA results on PSR J1537+1155.

- The committee commends the NRAO on getting several physical issues sorted out at both the VLA site and the VLBA Kitt Peak site, on having a high quality maintenance plan, on the emergency handling system, and on having clear actions on-going and planned for issues such as the MOJAVE flux density issue.
- The committee commends the continued development of commensal plans such as realfast, eLWA, VLITE, and COSMIC-SETI and *encourages the observatories to continue and expand these efforts especially as a way for growing and recruiting new talent.*
- The committee supports the decision to wait until after the VLA/VLBA-to-ngVLA transition committee reports to decide about a new X-class call.
- The committee is enthusiastic about the VLBA CASA guide, and *strongly recommends continued development of VLBA casa tutorials for a larger variety of science user cases as VLBA/CASA development continues to progress.* We commend the creation of a new position for VLBA support in response to last year's UC recommendations.
- The committee commends the work that is going into the VLA calibrator monitoring program and *strongly encourages a timely integration into the VLA calibration pipeline.* We especially commend and *encourage the plan to use this work to provide ability to the pipelines to use resolved sources.*
- The committee is enthusiastic about the joint VLA/ALMA proposal opportunity coming up and recommends collecting user data to assess the enthusiasm of the larger user base. We also commend implementation of the hybrid format for the synthesis imaging and

other workshops. *The committee notes the importance of strongly encouraging in-person attendance especially for training new talent in data reduction.*

- If staffing permits, we *recommend running a pilot program for users to get near-real time correlation of their data using the fiber linked data.* This could be offered as a shared risk option, and only to users anticipating looking at very bright, rapidly evolving sources at first. It may be useful both scientifically for specific projects, and as a pilot for ngVLA operations.

## Data Management and SRDP:

The committee commends the observatory staff for having been responsive to the recommendations made last year, and for writing the CASA paper.

We have the following recommendations for the near future:

- 1) *We encourage NRAO to implement all key functions of the old archive system into the new system, and to canvas a broad cross-section of the community with suggestions for additional features that should be included.*
- 2) *We encourage NRAO to do a better job marketing the fact that (1) it maintains a separate archive of ALMA data and (2) that the AUDI system exists. Based on the fact that many committee members were unaware of the system it is likely that despite efforts made to advertise, information about it has spread slowly throughout the community.*
- 3) *A few features of the new archive's user interface could be improved. The default when first loading up the page is to search by words in the proposal title, not by coordinates, and it takes a click to get the coordinate search function to pop up. Search by source name does not appear to be linked to SIMBAD lookup.*

In addition, the observatory staff asked for recommendations about how to improve the talent development pipeline for algorithmic and software work. The committee suggests that that can be done either via the Reber fellowship program or a new fellowship program. Some number of fellowships should be designated for this purpose, and ideally, there would be a *clear pathway for people undertaking this program into postdoctoral and/or permanent staff positions at the observatory to help assuage the concerns among junior scientists that major software development work can be a career dead-end.*

## VCLASS Status:

The committee was pleased to see that the data collection for the VLA Sky Survey (VCLASS) is proceeding on-schedule and producing exciting science, and that the third-epoch was approved and will begin soon. The committee also commends the team for making quicklook images available soon after observations are taken, and for their progress towards automating some stages of the

data analysis pathway for single-epoch imaging. The strategy of making provisional products available in a timely manner where possible while solutions to the long-term computational and data-processing challenges are being prepared and/or implemented was endorsed by the committee.

Despite this progress, concerns were raised that the survey data analysis is still proceeding more slowly than is generally expected for a time-domain project, especially one of this scale and prominence. While making quicklook products available on a one-month timescale is probably adequate for most science given the slow nature of the survey, most users would prefer a faster preparation period and there appear to be no inherent technical reasons why this could not be achieved. More concerning was the timeframe for completion of the survey's final data products, which was stated to be a decade or more. Such a slow rollout risks much of the science being rendered obsolete by new facilities (including the ngVLA) that come online during the interim.

The committee makes the following recommendations to accelerate the science of this keystone NRAO project:

1. The primary reasons for the slow roll-out of data products appear to be resource limitations. NRAO should consider increasing support for staff and computation devoted to VLASS.
2. The VLASS is one of several ongoing or planned time-domain radio surveys, and these other surveys are encountering similar data analysis challenges. The committee recommends increasing communication with these ongoing projects to explore potential synergies (algorithms, computational methods, or even shared resources).
3. It may be possible to find out-of-the-box solutions for fast analysis of new data: for example, UV subtraction to identify transient candidates without computationally-costly imaging, or the use of "citizen science" review for some low-level QA tasks that currently are done by observatory staff.

The committee specifically recommends that NRAO set an explicit goal to finalize all VLASS data products prior to the scheduled start of ngVLA operations in 2029 (and ideally sooner than that), and to investigate means of making the Epoch 3 data products available on timescales of 1 week or less after observations if possible.

## Proposal/Observing/Data Reduction Software:

The committee has the following commendations:

- Overall, the committee is pleased with the reported progress and design of the Telescope Time Allocation (TTA) tools. While we recognize that the project is a bit behind schedule, it is clear that the care and attention being paid to make a holistic, scalable, adaptable, and modular system that is robust to future challenges and unforeseen new requirements is worth taking the needed time.

- The committee is especially pleased with the plans to automate the generation of valid default inputs for the VLA Observation Preparation Tool (OPT). The committee notes that the OPT is perhaps the single greatest barrier to users of the VLA (current and potential), but that with the advent of the ngVLA, there is little reason to invest resources into a major overhaul of the OPT. Thus, we wish to again highlight what we see as the very high promise/value of the TTA tools in generating default OPT inputs for the bulk of general users, and hope that the development teams see this feature deployed in the near future.
- The committee is very happy to see the acknowledgement that timely support for Apple (Mac) users, both in Operating System (OS) compatibility and also from a hardware (Apple Silicon Processors) standpoint, is critical for our community.

We have the following recommendations:

- The committee strongly recommends that procedures and requirements surrounding joint proposals with other facilities should be communicated broadly and at the earliest possible date to the user community. This includes a thorough description of the logistical aspects of the process (non-standard page limits, what kind of technical justifications will be required for the secondary facility, etc.), how much observing time will be available in what modes and under what constraints, and how the review process will be conducted (including scientific, technical, and TAC review levels).
- The committee recommends that the software development teams think critically about continuing to develop CASA and other software under the RedHat Enterprise (RHEL) infrastructure. Non-enterprise RedHat OS ceased development in 2007, and a substantial portion of NRAO users operate using Ubuntu or CentOS, often with no option to use RHEL. Recognizing the complexity of this problem, the committee strongly recommends that NRAO immediately begin the process of implementing a wholesale shift to a more widely used operating system, and in the short-term, we recommend that NRAO explore stop-gap measures to ensure compatibility with these systems. Related, the committee wishes to emphasize the critical need to continue to provide timely support for the evolving Apple (Mac) hardware and software landscape.
- The committee recommends that GBO make every effort to move away from IDL and GBTIDL for data processing. The committee recognizes that GBO provides access to computing resources that somewhat mitigates licensing barriers, and commends GBO for that service. However, the community has moved on from IDL and this legacy code is increasingly presenting barriers to entry for new users. The committee recommends GBO investigate in the short-term whether GBTIDL can be easily ported to GDL (GNU Data Language), an Open-Source IDL alternative. The committee also recommends that GBO immediately begin the transition to Python for all user-facing needs. The committee suggests GBO explore options such as the Google Summer of Code for

securing extra personnel for this implementation burden.

- The committee recommends that, broadly speaking across all development efforts for user-facing tools (including the ALMA Observing Tool, Telescope Time Allocation Tools, Archival Access, etc.) that undo functionality be incorporated as core functionality. The committee is concerned that substantial community time and resources have been lost due to the lack of these features in even relatively new tools (e.g. the ability to restore a deleted science goal in the ALMA OT).

## ngVLA:

The committee is impressed with the progress of the ngVLA project. We congratulate the NRAO and ngVLA team for the high ranking and endorsement of the project in the Astro2020 Decadal Review. We note the submission of the MREFC candidacy proposal to the NSF, and the successful Technical Conceptual Design Review, with requirements baselined, both important steps forward in developing the design. We commend the ngVLA for efforts towards growing the radio community and holding special sessions at key conferences. We specifically commend Karen Prairie for the organization of the ngVLA virtual meetings. We encourage the NRAO to continue to actively engage the broader radio community, including use cases outside the SWG topics. It is important to emphasize that certain types of non-thermal science such as pulsars at very high and/or variable dispersion measure, flat spectrum synchrotron emission, masers, and high angular resolution studies of even steep spectrum synchrotron emission, and not just thermal imaging, are enabled by ngVLA. The “thermal imaging on milliarcsecond scales” tagline has perhaps slowed the rate of growth of interest in ngVLA among people in these communities. We encourage the ngVLA to keep looking for capabilities that users assume will be there and to keep the door open for science use cases as late as possible. *We recommend that the ngVLA team considers mitigation strategies if funding is delayed or schedule slips occur.*

## GB Development:

The committee is impressed by the large number of instruments being developed at the GBO. We commend GBO for reworking the ALPACA project for GBO and provide strong support for the importance of carrying radar work post Arecibo. The pilot image of the Moon was an amazing proof of principle for the system. We commend GBO for on-going effort (e.g. town hall at Winter AAS 2023) in engaging in dialogues with the community regarding use cases and priorities of future instruments and recommend continuing similar effort. However, the committee suggests **further increasing the communication plan through the use of asynchronous forums** for example by reaching out to a wider community, talking to visiting scientists, and by soliciting formal calls for proposals / white papers similar to what ngVLA has done, in order to broaden the reach.

The solar system radar is a key development to continue given the lack of capability lost with Arecibo. The committee notes that currently there is no radar expert on the UC. *We recommend recruiting a panel member with radar expertise be invited to join the committee.*

Currently, many of the instruments under development at GBO appear to be community driven by small numbers of users. The UC would like to suggest that GBO consider a different approach where scientific use cases are identified by GBO in consultation with a broad community base and then technical expertise is sought to build the hardware. This can potentially lead to the development of receivers that serve a wider scientific interest.

The construction of the NSF funded data center is another highlight of GBO development. The UC would like to see more information regarding the data policy (e.g. proprietary period) regarding open-sky, NANOGrav, and any other externally funded observations which will be stored in the center. GBO is keen to get more input regarding data structure and access for the pulsar data, which is a very sensible thing to do given that pulsar data will take up the majority of the data center volume and we encourage GBO to (continue to) engage in conversation with the pulsar community about what level of data compression, if any, is tolerable.

## ALMA Development:

The Users Committee was impressed and excited to hear about the ALMA development plans and progress for the Wideband Sensitivity Upgrade (WSU). The Committee enthusiastically endorses the facility proposals for expanded IF bandwidth, updated receiver packages, the TALON correlator, and all of the associated infrastructure developments. Once the ALMA Board has considered the proposed correlator upgrade, we recommend that NRAO (ideally coordinated with other ALMA executives):

- (1) Continues and expands a purposeful public information campaign to familiarize the community with the technical details and (more importantly) the scientific potential of the WSU (building on the illuminating, concrete examples presented to the Committee during the meeting), as part of the preparatory work for establishing community input associated with an ALMAx10 project office;
- (2) Solicits community feedback on current and future ALMA commissioning efforts – especially before the transition from commissioning new and existing modes to establishing the WSU – to better understand how the potentially evolving scientific priorities of the community can optimize the constraints imposed by the WSU commissioning phase. One specific example could be prioritizing control software testing and development to facilitate the ALMA subarray capabilities.

- (3) Solicits community input on science use cases that can bolster support for pushing toward the “stretch” goals in the WSU development plans (reaching toward 4x the IF bandwidth at a 100 m/s channel spacing).

## Proposal Outcomes and Statistics:

A proposal summary for NRAO observatories (VLA, VLBA, GBT, GMVA) was presented for semester 22B including submission metrics. Additionally, statistics for mitigating gender bias were provided. *We commend NRAO's efforts to report and track these statistics on gender.* It was mentioned other axes of demographics are being tracked now, but none of those were presented here.

The panel recognized the efforts made by the observatories to collect demographic information and discussed potential solutions to consider including: mandatory annual demographics updates (could be aligned with proposal submission), refresh all user demographics with the implementation of the new TTA, and delays on proposal submission if incomplete team data.

The committee strongly encourages NRAO to prioritize implementation of Dual Anonymous Proposal Review (DAPR) as quickly as is feasible, even if it requires stopgap measures as the system is updated. Postponing DAPR for implementation with the new Telescope Time Allocation (TTA) tools suite seems far too delayed. DAPR has been a primary recommendation from this committee for a number of years and should be implemented as soon as possible. The potential complexity of early implementation is recognized, however, the significance of implication and visibility to the community should be a priority.

Joint proposals for NRAO facilities as well as other external observatories (including JWST) are now being offered for future cycles and we commend this effort and hope NRAO considers additional facilities in the future. The complexity and effort involved in this is recognized by the committee.

Multi-cycle proposals are being offered for NRAO facilities. Metrics on tracking proposal success through multiple semesters would be informative on the success of these programs as well as a TAC-to-TAC reviews to consider consistency for prioritization from one panel to the next.

Distributed Peer Review is still fairly new and continued efforts to monitor this program are encouraged. Some oversight is needed to ensure there is programmatic balance in the highest ranked proposals, as having a proposal reviewed by mostly non-experts, and then not discussed, can lead to grades being skewed to the mean. We recommend ALMA consider using a high level review committee to ensure that proposals in niche areas are being treated fairly .

### Recommendations:

- Dual Anonymous Peer Review should be implemented prior to the new TAA tools due to the anticipated delay in roll out of ~2 years. This has been prioritized for multiple

facilities and NRAO should consider the significance this may hold for proposal outcome as well as the visibility and recognition to the user community.

- Strongly encourage tracking additional metrics beyond gender and continuing to present these data to the community. This should extend beyond the primary investigator and include details of the entire proposal team.
- Monitoring the success of multi-cycle proposals with quantitative metrics and potentially collecting details of TAC-to-TAC reviews would provide useful insight for this opportunity.
- Continue monitoring the Distributed Peer Review process and consider providing some oversight to ensure programmatic balance.

## Time Domain Astronomy:

The field of time-domain astronomy (broadly defined) is becoming an increasingly large component of NRAO science, a trend which is poised to continue with the upcoming commissioning of the Rubin Observatory within the next few years. NRAO facilities have long been world-leading in this field, with the first-ever FRB localization representing one of the most important discoveries in all of astronomy over the past decade. The committee acknowledges and commends the observatory for facilitating these discoveries. The improvements to ALMA scheduling over the past few years that now routinely enable triggered proposals to get on-sky within hours of trigger and conduct cadenced follow-up is particularly noteworthy for such a complex instrument.

While acknowledging these successes, the committee notes that there are many ways for the observatory to improve their facilities to make the systems more flexible for time-domain science in order to reduce the burden on users and NRAO staff alike. As this is the first report by the committee on this topic, and because the committee represents only a fraction of time domain users, we emphasize that our recommendations below (except the first) should be seen as provisional.

1. NRAO should provide a wide-reaching forum for general community input on time-domain science. An official survey sent by e-mail to prospective users soliciting input on areas of potential improvement would likely be the best mechanism for this, but NRAO may also want to solicit input on the issue at future town-hall meetings or via panels (particularly with regards to questions of prioritization, scheduling, and proposal-handling which affect the entire user base).
2. DDT proposals have provided a valuable mechanism for conducting cutting-edge science on valuable science targets. However, some concerns were expressed that the increasing rate of DDTs may be overburdening staff at some facilities. NRAO should confirm if this is the case and (if so) implement solutions to streamline the DDT process and/or encourage more proposers to use triggered proposals through the regular cycle versus relying on DDTs where possible. Some specific recommendations to consider: (i) Open a special DDT submission mode for very small amounts of time in standard observing modes that does not require a full review (e.g., a basic web-form with a one or two paragraph science justification that could be immediately approved by the director), (ii) Ensure that triggered proposals are accepted at a scheduling priority appropriate to the timescales relevant for the proposed science. This could be achieved, for instance, by devoting a specific block of A-rank time each semester exclusively for triggered projects. (iii) Remind SRP/TAC members of the DDT burden when reviewing triggered proposals: rejecting a proposal at this stage may cause

the proposers to rely on the DDT mechanism instead, increasing the burden on NRAO. (iv) Make zero proprietary period the default for DDT proposals and require users to justify a non-zero proprietary time, but given point (5) below, this should be considered in order to avoid a race to publication.

3. The current OPT is unwieldy and the SB review procedure can slow down responses to urgent targets, particularly over weekends. In the short term, the observatory should consider solutions to “pre-approve” SBs, to automate SB checking/approval, and/or to support out-of-hours SB approval in certain cases. In the longer term the TTA tool under development provides an opportunity for making SB setup much easier and more efficient for all users, but it was not clear to the committee if its current concept will naturally accommodate time-domain science. The TTA tool should be sure to support the rapid generation of ready-to-execute SBs by the user during the semester when a new target is discovered, not just at the start of the semester based on what is submitted in the proposal.

4. The observatory should continue to investigate mechanisms to enable rapid-response interrupt science (which displaces an existing observation to observe an extremely urgent target of opportunity in a mostly or fully automated way) on NRAO facilities.

5. The observatory could be more flexible about the (common) scenario when multiple teams with similar triggered proposals wish to observe the same target. These cases are likely to be complex, and it would be better to consult the relevant users directly and allow them to propose a resolution before instituting a one-size-fits-all policy. Making all data available to all triggering teams as a universal policy has (in some previous cases) triggered unfriendly competition and led to duplication of data-reduction effort.

6. The committee was intrigued by the possibility of adapting the 20m telescope at Green Bank as a flexible time-domain facility for fast response and/or monitoring of rapidly-evolving targets. These applications are likely to be limited in practice, particularly in L-band which is heavily confusion-limited, but may find novel use cases. The committee recommends (i) soliciting general user feedback on potential uses of this facility if it were made available for rapidly-triggered observations, and (ii) considering the potential impacts for existing users (such as teaching programs) if the primary receiver was changed from L-band to X-band.

## Community Access to NRAO Computing Resources:

As a national observatory, the NRAO is uniquely placed to build and support the radio astronomy community. We see that the NRAO values that role in the way it uses its computing and software development resources to support a variety of services (archive, SRDP, CARTA, remote processing). This variety is difficult to develop and maintain, but critical to support diverse use cases in the community. The NRAO should be commended for supporting a diverse set of tools.

- The committee sees two specific kinds of user as important drivers of NRAO planning and strategy:
  - **traditional** (e.g., observing PI) – These users are struggling with analysis of large data sets (esp. from ALMA).

- **non-expert** (e.g., multiwavelength) – These users are too scared to look at NRAO data and probably assume they need a “radio expert” to do their multiwavelength science. This is a huge untapped audience for NRAO data.
- The committee was impressed by the User Driven Imaging of ALMA data and looking forward to seeing VLA SRDP in a similar way. This, in addition to batch processing and CARTA, serves **both traditional and non-expert users** well.
- Unfortunately, the availability of AUDI surprised several committee members, as did the availability of <http://data.nrao.edu>. The diversity of tools required to serve all users presents a discovery problem (not uncommon in the field!). *Recommendation: NRAO should consider a landing page with a simplified, high-level organization of services provided to the community (e.g., <https://irsa.ipac.caltech.edu/frontpage/>).*
- The **traditional users** are more likely to use interactive CASA, remote processing, and data reduction visits. Supporting these services is tedious, but critical to many users, especially from smaller institutions and underserved communities. The committee appreciates the effort put into these services and encourages continued investment.
- **Non-expert users** will be well served by future development toward relocatable processing and VO support (scriptable interfaces).

## JVLA&VLBA->ngVLA Transition:

The Users Committee commends NRAO for swift action in setting up a community-led Transition Advisory Committee to provide community feedback on transition options, and an Internal Technical Analysis Team to support the Committee. The TAG is charged with identifying key scientific opportunities, relevant stakeholders, transition options, and metrics. The TAG has a year to carry out this work, and is charged to produce a prioritized list of transition options. The Technical Analysis Team will quantify costs and impacts to ongoing science operations of the various options proposed. The TAG is to complete this work in a year, and to provide a report in Q3 FY23, with the goal of having a final Transition Plan completed by mid 2024.

NRAO suggests that the TAG membership is meant to represent all stakeholders, and the Users Committee commends them on the selected membership. However, the Users Committee is concerned that the TAG, carefully chosen as it was, may not incorporate the full range of community views. *The UC strongly recommends that there should be **multiple** opportunities for the TAG to share its ongoing work with the larger community, and for the TAG to collect feedback from the larger community.* These could include, for example, town halls/listening sessions at AAS or DPS meetings, regular community Webinars, virtual community meetings, and a dedicated website soliciting input in the form of science-based input such as white papers. It is crucial to get the buy-in and support of the larger science community for this transition plan. If funding for the project is delayed or cut, an invested community will be vital for maintaining project momentum and for sustained support. *We recommend that the draft transition plan should be posted for review for 90 days, and that community reactions should be broadly solicited, widely shared, and possibly incorporated into the final plan.* There should be adequate time to incorporate this feedback without delaying the beginning of the transition.

*The Users Committee also suggests that the TAG should consider and rank alternate transition paths against the possibility that funding is delayed or that schedule is delayed.* If funding doesn't materialize on the desired timescales, have alternate user transition paths. NRAO should not close / decommission faster than the new build schedule progresses. We also suggest regular, broadly targeted outreach to the larger community about how the TAG's activity is progressing, and continued similar outreach from NRAO about how the transition work is going after the TAG has completed its work.

## 2022 NRAO/GBO Users UC Membership

**Sean Andrews**, *Harvard-Smithsonian Center for Astrophysics* (2026) ANASAC  
**Alessandra Corsi**, *Texas Tech University* (2024)  
**Meredith Hughes**, *Wesleyan University* (2023) ANASAC/ASAC  
**Melodie Kao**, *University of California, Santa Cruz* (2025)  
**Casey Law**, *California Institute of Technology* (2022)  
**Duncan Lorimer**, *West Virginia University* (2025)  
**Thomas Maccarone (Chair)**, *Texas Tech University* (2023)  
**Karen Masters**, *Haverford College* (2025)  
**Brett McGuire**, *Massachusetts Institute of Technology* (2025) ANASAC  
**Stefanie Milam**, *NASA/GSFC* (2024) ANASAC/ASAC  
**Susan Neff**, *NASA/GSFC* (2022)  
**Cherry Ng**, *University of Toronto* (2026)  
**Jennie Paine**, *University of Colorado Boulder* (2026)  
**Daniel Perley**, *Liverpool John Moores University* (2026)  
**Alexandra Pope**, *University of Massachusetts Amherst* (2023) ANASAC/ASAC  
**Erik Rosolowsky**, *University of Alberta* (2023) ANASAC/ASAC  
**Kazushi Sakamoto**, *Academia Sinica Institute of Astronomy & Astrophysics* (2024) ANASAC  
**Melissa Soriano**, *NASA Jet Propulsion Laboratory* (2025)