**GBT Support Scientist Duties**

**(aka the GBT Support Staff Bible)**

**Maintained by the GBT Support Staff**

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# Contents

# 1 Introduction

The job of support scientist for the Green Bank Telescope involves a work flow that is complicated when compared to most other positions within the NRAO.   Support scientists are asked to: work on a broad range of the observatory's operational activities; provide scientific and technical leadership within the observatory for new instrumentation, software, and algorithms; work closely with other divisions in developing, testing, and implementing complicated systems; provide round the clock support to our observers and technical staff; create user documentation; and promote the observatory's EPO activities. We often act as an astronomer's primary interface with the observatory, much like a customer support hotline.  In order for us to maintain the skills necessary to perform our support roles, we are also asked to involve ourselves in forefront research projects and keep ourselves up to date on the research done elsewhere in our various specialties.

In a broad sense, the support group exists to promote the scientific productivity of the Green Bank Telescope.   As with other NRAO staff, members of the GBT support staff are also asked to promote the Green Bank Observatory, the NRAO, radio astronomy, astronomy, and science in general.  Our duties to promote the science of the GBT extends over all areas -- from helping influence the quality and breadth of the proposals that are submitted, through providing a rewarding observing experience, to helping observers maximize the production of papers using GBT results.

GBT Science Support staff play two crucial roles – Project "Friend" and "On-Duty"  (on-call) support scientist.  A Project Friend (or "Contact" Scientist) is assigned to each accepted proposal. The role of the Friend is to watch over the proposal throughout its entire life-cycle.  The Friend cannot be expected to be available when every one of their projects is on the telescope.  Instead, when a project is on the telescope, support becomes the responsibility of the On-Duty Scientist.  The On-Duty Scientist's primary responsibility is to provide real-time assistance as necessary during the observing process (e.g. assisting when a telescope fault occurs).   In short, real-time observing support and on-site training is carried out by the On-Duty person, while project preparation and post observing support is the responsibility of the Friend.  There are overlaps between these roles, and this document delineates these duties in addition to providing general expectations of GBT support staff.

# 2 Time Devoted to GBT Support Work

Each individual in the GBT support group will be allocated a certain percentage of their time to support work and usually some percentage of their time to project work and scientific research.  The percentages will differ from person to person and even from quarter to quarter throughout the year. Around Jan 1, April l, July 1, and Oct 1, support staff members may be informed by their supervisor how their time has been re-allocated between their various tasks for the upcoming quarter.   Each person should record the time they actually spend on support, project work, and science in their weekly time report using the appropriate ETK codes.   Since the emergency of support work can easily overwhelm

our good intentions of working on projects, the weekly time reports allow us to determine the true costs of support and properly estimate how much of our time is left for research and project work.

All support staff are 'exempt', meaning we are not paid overtime and we work an average of 40 hours per week.   NRAO has no official policy with regards to 'comp' time.  An integral part of our job is to be called in to assist an observer or technical staff member at any hour of the day and during weekends. The system of 'contact' and 'on-duty' assignments is a good compromise for providing sufficient support while reducing the impact of support to our lives outside of work.

We realize that there will be times when problems will inadvertently stack up to the point where no single individual can provide sufficient support and maintain a reasonable quality of life.   For example, back-to-back problems or support tasks that would keep one awake for more than 16 contiguous hours. Or times when an unforeseen personal issue has come up that prevents one from attending to his or her support responsibilities. If the desired change is less than a few hours or if the need is not critical, you should first try to negotiate a trade of time or responsibility with another support staff member and inform the Head of Science Operations (HOSO) [Toney Minter]  (and the operators if you are On-Duty) of the change.  If your need is critical or extends beyond a few hours, you should immediately involve the HOSO to help find someone in the support group who can temporarily help reduce your workload.

All support staff members are asked to keep current on the "Absences" web pages the days they expect they will be away from work, either because of vacation, business trips, and doctor visits.   The Absences web page is located at

https://staff.nrao.edu/wiki/bin/view/GB/AbsencesCalendar

# 3 Proposal Process

## 3.1    Call for Proposals

Calls for proposals occur twice a year.  The February call is for proposals that will be scheduled during the B semester (Aug 1 – Feb 1).  The August call is for the A semester (Feb 1-Aug 1).  Approximately one month before the call announcement notices will be sent out to astronomers via the NRAO enews.

https://science.nrao.edu/about/enews

Support staff are asked on occasion to help formulate the call for proposals or prepare memos, web pages or articles that astronomers will need to create observing plans for their proposals.  Staff will also be called upon to help debug the latest versions of the proposal submission tool, the sensitivity calculator, the mapping planner, and so on.

Support staff may be contacted by potential proposers asking for advice, etc. concerning their proposals. The support staff are expected to help these potential proposers.  The support staff should never suggest that they be added to the proposal – the proposers should extend the invitation if a staff member is to join a proposal.   The support staff should be familiar with:

- The call for proposals
- The proposal process:

https://science.nrao.edu/observing/proposal-types/peta

- The NRAO Proposal Submission Tool:

http://my.nrao.edu/

- The GBT Proposer's Guide: https://science.nrao.edu/facilities/gbt/proposing/GBTpg.pdf
- The GBT Sensitivity Calculator:

https://dss.gb.nrao.edu/calculator-ui/war/Calculator_ui.html

- The GBT Mapping Planner:

http://www.gb.nrao.edu/GBT/setups/mapplan.html

- The GBT RFI environment:

http://www.gb.nrao.edu/IPG/rfiarchivepage.html

### 3.2    Technical Reviews

A few weeks after the close of each call, support staff and other NRAO staff are asked to perform technical reviews of the submitted proposals.  Usually, you will receive an email stating that the Proposal Submission Tool (PST) is ready for the review process.  You will have to log into the PST to find which proposals you will review. Guidelines, deadlines, and instructions on how to review proposals also will be distributed.  Large proposals are given in-depth reviews, as your instructions will describe.

Each support staff member is expected to have enough general knowledge to be able to provide a technical review for any general proposal.  Proposals that are more advanced or which require advanced expertise may be assigned to reviewers who are specialists in the field of concern.  If you are an investigator on a proposal, someone else will be asked to provide the review.  We try to keep the number of proposals each person is supporting throughout the proposal life cycle in proportion to the fraction of time an individual is supposed to devote to support.

### 3.3    Proposal Ratings

The Time Allocation Committee (TAC) meets in April/May, and October/November, about two to three months after the deadline for a call for proposal.  The committee uses our technical reviews, the scientific panel reports, and estimates of the available time in the next semester to determine which proposals will be accepted.  "A" rated proposals will be active for one year and it is expected that we should be able to complete these proposals within that time period; "B" proposals are expected to get a significant fraction of their time; "C" proposals will only get time if the schedule allows; "N" and "N*" proposals will not receive time.   For accepted proposals, the level of support is independent of project ranking.   On-site observers are given priority by the DSS regardless of ranking, and on-site B and C-ranked programs are often scheduled before "A"-ranked projects with remote observers.

## 4 Project Contact Support Tasks

The HOSO will assign each accepted proposal a contact person.  When you are assigned to be a contact person for a project, you will watch over the project until the project finishes the last step in its life

cycle.   Support scientists can familiarize themselves with the projects by referring to observing details of the proposals which are stored at /home/groups/gbtscisupport.   If your travel plans, other work responsibilities, or other extenuating circumstances are such that you will not have sufficient time to work as a project's contact, it is your responsibility to inform the HOSO who will then try to find a substitute contact person.   A complete project check-list of required support tasks is provided in Appendix A.   The tasks for the contact scientists are summarized in the following sub-sections.

## 4.1 Pre-Observation  Support

The first responsibility of the contact person is to initiate a conversation with the proposal's investigators a few weeks before the semester begins.   The scope of the conversation depends upon the observer's prior GBT experiences and their experiences with other radio telescopes.   For frequent GBT observers, the conversation might be just an email stating that you are the contact for their project and are available if they need any help in preparing for their observations.  For new observers, the conversation will be more extensive and may require multiple emails, sometimes phone calls, and often support staff helping create observing files.

Through this conversation, the contact person must be sure the observer is prepared before the project sessions are enabled within the DSS.   Some of the key documentation links are:

- The user's guides for observing and data reduction:
  https://science.nrao.edu/facilities/gbt/observing/GBTog.pdf
- The observing policies:
https://science.nrao.edu/facilities/gbt/observing/policies

- The policy governing remote observing.  If this is a student project, emphasize that students are to be accompanied by a senior scientist for their first observing sessions.
  https://science.nrao.edu/facilities/gbt/observing/remote-observing-with-the-gbt
- The rules on dynamic observing.  Point them to the URLs containing our schedules and the high-frequency forecasts (if applicable).
https://science.nrao.edu/facilities/gbt/schedules/dynamic

https://dss.gb.nrao.edu/schedule/public/

http://www.gb.nrao.edu/~rmaddale/Weather/AllOverviews.html

You should determine if the users will observe remotely or visit on-site.   For new observers, it has been our experience that they should be on site for at least two observing sessions before they should attempt remote observing.     After initial contact has been made, the Friend should coordinate any visits by the Observers. Observers should be informed to make reservations through the Business Office System (BOS) and work with the Green Bank Receptionist (Jessica Taylor) on logistics.  It is important to keep the HOSO informed about visiting astronomers, given that he makes up the receiver schedule. The Friend should inform Observers of the receiver schedule (and updates, https://dss.gb.nrao.edu/receivers ) and work with the Observers and HOSO to schedule their visit when the desired receiver(s) are available.  The Friend must inform the relevant On-Duty scientist(s) in advance of the visit, so that they are aware of the on-site observers and can plan accordingly.

The initial emails should set the tone that you are here to make sure the users have an enjoyable, productive observing run.   You need to determine the correct balance of providing the relevant information for their project without overwhelming them with too much detail.   The follow-up emails will quickly progress into the more technical aspects of their projects, such as how to calibrate, how often to point, etc. and most often culminates in an exchange of observing scripts.  It's sometime useful to send new users a template Astrid scheduling block, configuration file, and catalog file.

Before observing begins, the contact must be sure that the observer's scheduling blocks, catalogs, observing strategy, calibration and reduction plans are correct.  If the contact person is not familiar with the methods needed to carry out the program, it is their responsibility to learn and pass this information along to the users.   In some cases, it might not be possible to have all the observer's preparation done until they arrive in Green Bank.    In these cases, the contact person may need to work with the users on-site to prepare them for their observations, or hand off some of these duties to the on-duty scientist under rare circumstances.   In all cases, it is the responsibility of the contact person to inform the on-duty support person of what might be required of them for projects with visiting on-site users.  Communication between the users, the project friend, and the On-Duty support scientist(s) is key to ensuring that nothing falls through the cracks.

There are periods during the summer when there will not be an assigned on-duty support person.  During such times it is the responsibility of the contact to make sure the needs of the observer are meet.  If the contact is not available during such times then the contact is responsible for arranging another person to work with the project and to notify all involved of who will be substituting for the contact during their absence.

## 4.2 Post-Observation  Support

The contact person's responsibilities continue even after the end of observing.  We can expect that observers will contact us to discuss their data, algorithms, calibration, etc.  Since post observing issues are not usually time critical, one can prioritize supporting upcoming or on-going activities over post observing support.  Nevertheless, response time should be kept to under a week whenever possible.

Support staff should suggest that observers fill out observers comment sheets, http://www.gb.nrao.edu/php/obscom/obscomments.php
once a project is completed or closed.  It is the contact's responsibility to respond to comments from the projects they are supporting.   The current repository of observers comments is located at http://www.gb.nrao.edu/internal/obscom/history.  We should respond to all observers' comments within a week or two.  Responses can be a request for more information or a detailed response.  In many cases, the response can be a simple acknowledgment of the observer's comment.  It is also the contact's responsibility to bring the observer's comments to the attention of other staff members or divisions whenever this is deemed necessary.  The response to the observers' comments may also involve gathering responses from other members of the staff (for example: the computing or software groups).   The comment sheets are a very important way for us to have a sense of how observers feel about their experiences observing with the GBT and how they want us to develop the technology of the GBT.  Comments cover the cafeteria food, through software tools, RFI or weather problems, to the

chairs in the control room.  Also important to this assessment of the 'GBT experience' is your conversations and emails with observers, your personal impressions when working with observers, or your personal experiences when you are observing with the GBT or other telescopes.

Six months (and 12 months, and as needed) after the end of the project, the contact scientist should follow-up and ask about the status of the project, whether a paper has been written or published on the work, and to ask if the work is worthy of a press release.  The conversation would indicate that we remain concerned about the success of their project.  It offers an opportunity for observers to ask for our help without them initiating the conversation.   The conversations would be a way we can gather information on the defects in our systems that were not realized until after the end of the observing.  A six-month reminder that we are interested in their publication also might be enough to inspire procrastinators.    Post observing conversations will provide us information that we can use to promote to the astronomical community the science capabilities of the GBT.  For example, we'll more easily maintain a complete publication list for GBT results and could help expedite the generation of press releases.

## 5  On-Duty Support Assignments

We have divided support responsibilities into contact and On-Duty assignments in order to improve the lifestyle of the support staff.  The large number of projects that are scheduled each week ensures that a contact will have a project on the telescope almost every week.  The contact cannot be expected to be available when every one of their projects is on the telescope.  Instead, when a project is on the telescope, support becomes the responsibility of on-duty support person.   This division of the support responsibilities requires close communication between the on-duty and contact scientists.   The on-duty scientist should keep the contact scientist in loop to their interactions and communications with the observers.   A complete project check-list of required support tasks is provided in Appendix A.   The tasks for the on-duty scientists are summarized here.

When a project is on the telescope, the brunt of the support work falls on the shoulders of the On-Duty support scientist who is expected to be On-Duty for the full duration of their shift.   The On-Duty support scientist should be available on-site to interact face-to-face with visiting astronomers as needed.    The On-Duty person should try to be either in their office or at their home residence – that is, somewhere that an observer or operator could call.  It is the On-Duty person's responsibility to inform the operator whenever they will be unavailable for more than an hour.   The On-Duty support scientist is expected to respond to a phone call from the operator or an observer within an hour and be at a location with sufficient internet capabilities to carry out a VNC session to help diagnostic problems as needed. Potentially, the on-duty scientist may be requested to come into the control-room unexpectedly and should be able to respond on site within 1 hour, unless prior arrangements and/or permissions have been given by the HOSO.  The On-Duty person should keep the operator informed if they will be available at a different phone number than the operator expects.     It is the On-Duty person's responsibility to find another staff member to cover for them whenever they  will be unavailable for much more than an hour.  The On-Duty person should inform the HOSO if something unexpected comes up that would prevent one to be On-Duty for a full shift.

The support staff will meet every ten to fourteen weeks to set the On-Duty assignments.  Assignments are usually in units of 'shifts' that are 12 hrs long and start at 6 AM or 6 PM.  Shifts are arranged into 'blocks' that are either 4 or 3 days long (Tues – Sat, Sat – Tues during the winter and Thur-Mon during the summer).  Weekend blocks (in the winter) are shorter since these days are considered more valuable to our personal lives.  The number of blocks assigned depend upon the fraction of time allocated for on support work.  If an unexpected change in our other activities or personal lives require a change in the support schedule, the support staff member should try to negotiate a trade of time with another support staff member.  The support person should seek out the HOSO if the support person cannot negotiate a change in schedule.  The support person is responsible for changing the Wiki page (https://science.nrao.edu/facilities/gbt/schedules/gbt-support-scientist-schedule) where our on-duty support schedule is maintained.  If the change involves more that a couple of shifts, the support person should inform the HOSO and telescope scheduler of the change.

The on-duty person should introduce themselves to any on-site observers and maintain daily contact with the observers.  While the observer is on-site, but prior to their actual observing time, the on-duty scientist should provide new observers with observing training.  The on-duty scientist can demonstrate Astrid in "monitor only mode, to explain the User Interface and Status Displays. They can also "play back" existing observations from a similar project, to demonstrate the Real-Time Display, including the processing of pointing, focus and AutoOOF observations.

Even if there are no problems, the on-duty person should try to visit the operator every day or two to get a feel for what has been happening with recent observing.   The on-duty person is also responsible for any general requests for support that come from operators or other staff members.  Based on the DSS schedule of activities,  the on-duty person should determine if and when they might be called upon for any scheduled work.  For example, will one be needed during an upcoming PTCS run, a receiver commissioning session?  The on-duty person should confer with the project manager for an activity or the HOSO if there are any questions about the responsibility of the on-duty person towards an upcoming activity.

The on-duty person should be pro-active with regards to problems encountered during his or her shifts.  This includes seeking out staff members who need to be informed of the problem or can help resolve a problem.  For example, informing the RFI group of interference that was encountered during a project.  The on-duty support person will need to judge if a problem requires sending out a message on one of the e-mail exploders (Sec. 12)  The on-duty person should share their experiences and any workarounds with their fellow support staff either through emails or the weekly support meeting.

## 6   Project Work

Telescopes are never stagnant and are always in the processing of being developed, subsystems commissioned, new techniques deployed, and so on.  From our numerous conversations with observers, our research experiences, and our sense of the needs of the astronomical community, we have the scientific background to help set and prioritize the short and long term goals for the observatory.  Since we also have significant technical expertise, we will be called upon to lead, support or consult on many of the projects that are the NRAO's priority.  Each support staff member should make it clear to their

supervisor what projects they are interested in working on.  Support scientists should try to keep themselves involved in at least one highly visible project if they have an interest in promoting their careers.   Project work is an integral part of our jobs.

# 7  Science Research

As stated previously, each support person can have a different allocation of his or her time for their own science research.  Because of the immediacy of support work, the urgency of problems, it is sometimes hard to give oneself the time to do research.  If interested in maintaining an active research program, each individual must take responsibility in preserving as much of their research time as possible without compromising their support work.   While we will attempt to foster the research careers of young scientists and postdocs, you are responsible for your own research and career.

Although the staff has no direct advantage in getting telescope time, we recommend that you consider writing proposals to NRAO telescopes, and in particular the GBT.  Observing with the GBT provides a perspective that will help your support efforts.  Your support experience also means that others will be asking you to be on GBT proposals.  One advantage of these collaborations is that they promote relationships between NRAO and universities.   Nevertheless, it is your research time and you need to decide whether or not observing with the GBT satisfies your personal research goals.

# 8  Interactions with Other Divisions

Support staff routinely work closely with the computing, electronics, engineering, operations, and software divisions and will interact with the business office.

### 8.1 Operations

Once observing starts, operators are the first line of communication between the observers and staff.  They talk with observers much more than we do and, so, can have a better sense of observer's experiences.  They debug a fair fraction of a user's problems and only call out other staff members when the problem is beyond their experiences.   Operators try to reduce lost time by balancing the time it would take for them to debug and fix a problem with the time it would be needed to call in a staff member.  Operators need to be a jack-of-all-trades with regards to the telescope's myriad technologies.  They need good communication skills with observers.  In many ways, the scope of their job within the NRAO comes closest to that of the scientific support staff.

Support staff provides a fair amount of the knowledge that operators need for debugging problems.  We should be proactive in finding ways to make them more self-reliant; to make their jobs easier; to promote ways they can communicate better with observers.   We need to be proactive in getting the opinions of operators so that we can better judge what observers need from the observatory.  Operators are invited to the weekly support meetings as a forum for operators and support staff to discuss what happens in the control room.  All of us should make short visits to the control room – once every day or two for those who are on duty, and once a week for the rest of us – for a friendly chat with the operator.

## 8.2 NRAO Science Users Services (SUS)

Starting in FY14 the management structure for NRAO user-support will transition from primarily "site-base" to an NRAO-wide SUS group structure that will be managed by group leads organized by specific tasks.   Project friend tasks, face-to-face assistance, helpdesk support, and user documentation all fall under the responsibility of the SUS.   On-duty assignments such as receiver check-outs, on-call support, dealing with GBT hardware and/or software issues fall under GBT science operations.   As GBT support scientists you are all part of the SUS group and may be requested to carry out SUS related duties outside of your normal GBT support role.

## 8.3  GBT Software Development, Electronics and Structural Engineering

Support staff interacts with the software, engineering, and electronic divisions as part of any project work we have been assigned.  We will also interact with them when there are problems with some telescope component.  We should familiarize ourselves with who supports what telescope components so that we can help expedite the debugging of a hardware problem.  We are expected to work with software and hardware engineers in debugging problems, providing feedback on the health of a device, provide suggestions on how to improve subsystems so as to either increase the telescope's productivity or reduce our operational inefficiencies.

Support staff should familiarize themselves with Green Bank's use of "Modification Requests" (MR's). (See the "Modification and Project Request Information" section at https://safe.nrao.edu/wiki/bin/view/GB/Software/WebHome.)  MR's are used to track a task through its lifecycle -- from setting requirements through sponsor testing and release.  Support staff will sometime be assigned the responsibility of sponsoring an MR, writing an MR, providing comments to someone else's MR, and providing support in testing the final product.   One stage of the life cycle of an MR requires a review by the "Change Control Committee (CCC)."   The CCC makes sure that the work or product of an MR will not have a detrimental impact on some other part of the GBT system.  The CCC will occasionally call upon support staff members to provide a written review of an MR's impact on the GBT system.  Many of the MR's will be discussed at the Monday GBT Support Staff meetings.

## 8.4  Computing

The Computing Division provides the computing resources that the observers and we need.  A few days before a new observer visits, the contact person should make sure the observer has a local account. The contact person should also make sure the observers are aware of our computer usage policy. Obtaining computing accounts for visiting observers outside of normal business hours may be difficult. The contact person should obtain any necessary accounts needed from the computing division during normal business hours.  The computing staff will give you a form with the account information to pass along to the observer.  This form should be given to the On-Duty person or an operator if the contact will not see the observer before the account is needed.  Given enough lead-time, the observer can contact the computing staff via phone to obtain an account while preparing for their observing at their home institution.

Some observers will come to Green Bank for observing and will be using our Residence Hall, cafeteria and our visitor's offices.  Observers may ask us about how one signs up for a room, where to find our housing policies, the hours for the cafeteria, availability of local restaurants and shopping.   Much of this information can be found at https://science.nrao.edu/facilities/gbt/practical-information-for-astronomers#Visitors .  We should familiarize ourselves with the locations on the Web that contain this information.  We should also bring to the attention of the business office any comments and suggestions from observers that might improve an observer's stay.

## 9  Interactions with Observers

Throughout the life-cycle of a project, support scientists should maintain an attitude that they are providing suggestions based on their technical knowledge, their familiarity with the GBT, and their experience with past observing projects.  We should ensure that the observers always consider that they are in control of their experiment, that they are making all the critical decisions, and that they are ultimately responsible for the success of the project.

On extremely rare occasions, the contact or on-duty support person will not be able to convince an observer away from an observing technique or strategy that the support person feels will be detrimental to the observer's project.  In these cases, search out the opinions of the HOSO and other support staff in order to justify this fear.  Often, the observer will be more receptive if they hear suggestions from more than one member of the support staff.  On rare occasions, we will have to watch quietly as observers exercise their prerogative and use an inferior observing technique.

Observers are almost always respectful and appreciative of the support staff.  On rare occasions, working with observers may become unpleasant.  Sometimes, observers will ask for much more effort or time from a support staff member than is usually required.  Sometimes observers become frustrated with their projects, are having bad luck with hardware or the weather, or don't appreciate our observing tools.  Observers will sometimes take out their frustrations on the local staff.

We must be mindful that the observer is the customer, that we are 'customer support', and that the customer is always 'right'.   Yet, since we are always working with multiple observers and have other work responsibilities, we must balance the needs of the individual 'needy' or frustrated observer with our other goals.   Whenever we feel that a stressful relationship with an observer is developing, we should inform discreetly the HOSO or, in the worse cases, the site director as soon as possible.  Support staff should always try to remain civil with an abusive observer and, if that is not possible, the staff member should excuse him or herself and seek the immediate assistance of the HOSO.

## 10  Interactions with the Astronomical Community

Most of us will be involved in the typical astronomer activities of referring papers, committee work, etc.  These activities should be deemed as a way for us to promote radio astronomy and the NRAO.   We should also try to use other venues for promoting the science of the GBT.  This includes presenting papers or colloquia that are meant to inform astronomers on the capabilities of the GBT and how

astronomers might want to use our instruments.  We should volunteer to staff the NRAO's booth at meetings.  We should seek out collaborators from other institutions; visit other institutions to see what they might have to offer the NRAO.  The NRAO may be able to provide travel support for these activities that may or may not come out of our research travel allowances.  It is important to balance these activities with our other responsibilities.  Support staff members should inform the HOSO and their supervisors if they have an idea for promoting the GBT's science, or want to take advantage of an upcoming event.  If the opportunity requires, the head of EPO might also need to be involved.

# 11 Recurring Meetings

There are a number of recurring meetings that support staff need to attend or need to be aware of.

## 11.1 Weekly Operations Meeting

At 10 AM on Fridays, all the support staff are expected to attend the weekly operations meetings where project managers and division heads summarize events and activities for the last week and present plans for the following few weeks.  This meeting provides a forum for interaction among all divisions in Green Bank.

## 11.2  Weekly Commissioning and Resource Calendar Coordination Meetings

On Mondays, usually at 9 AM, telescope operations or the HOSO will chair meetings where we try to coordinate all the requested activities for upcoming maintenance days, to schedule when maintenance will happen, and to schedule and coordinate our non-maintenance use of the telescope (e.g., our commissioning activities).

Anyone who has an activity for a maintenance day should add his or her request to the resource calendar on Fridays.  If that is not possible, one should attend the Monday meeting to submit the request.  One of the goals of the weekly meetings is to negotiate the resolution of any conflicts with maintenance activities.

Anyone who has an activity that requires telescope time on non-maintenance days must realize that we desire to have the total time required for these inserted into the telescope schedule at least six months to eleven months in advance.  This is so that we can estimate the amount of telescope time available for new proposals at the TAC meeting.  The telescope scheduler will send out a call in December/January and August for our estimated requests for telescope time for the trimester that follows the call.  Since the telescope is highly oversubscribed, we really need to avoid any tendency to ignore these calls.  One goal of the Monday meetings is to ensure the best use of the telescope's time, in light of the fact that the needs might have changed since they were submitted.

It is not possible to foresee all required telescope tests one year in advance.  When an un-anticipated test is needed, a request should be sent to the GBT scheduler.  The GBT scheduler and the HOSO will work with you to schedule the test time.

## 11.3 Weekly Support Discussion

We hold weekly meetings where we will share the experiences from the previous week's observing.  We will also use the meeting as a way to spread our expectations for the coming week, as a forum for the

contact and the on-duty support person to talk about upcoming projects.  Operations will send a representative to the meetings so that we can get an operator's perspective.   We will also cover observing techniques or the developments we'd like to see to the telescope's subsystems during this meeting.

Usually every twelve or thirteen weeks, we will determine the on-duty support assignments for the next three months.  In preparation for the meeting, support staff should ensure that they have updated their entries into the "Absences" web pages.

### 11.4  Monthly GBT-Sci Meeting
We hold monthly meetings for all the GBT scientists, which include those who do not formally carry out GBT support duties.   In these meetings updates are given in many different areas that are of interest to the scientists.

### 11.5 Quarterly Resource Allocation Meetings
Most support staff will not be invited to attend the resource allocation meeting. Rather, this meeting is where supervisors and project managers negotiate how staff time will be divvied up between our various operational and project work.   Meetings are held near the end of Dec, March, June, and Sept. Those of us who did not attend the meeting should expect to be informed of how our time has been allocated.

### 11.6  Science Lunch and Coffee, Colloquia, Journal Club and Workshops
To keep ourselves involved in research, we are expected to attend on a regular basis various scientific gathering.   Each individual must decide whether or not the immediacy of support or project work has to take precedence over attending a particular function.  For example, we should excuse ourselves if attending a meeting will incur the loss of telescope time.

### 11.7 "Single Dish School"
The NAIC and the NRAO hosts a "Single Dish" school every other summer, alternating between hosting the school in Arecibo or in Green Bank.   The goals of the school are to educate mostly graduate students the techniques of single-dish radio astronomy.  Support staff will be asked to provide lectures or mentoring to the students.  One should see the school as a unique, highly effective outreach opportunity that promotes radio astronomy, the NAIC and the NRAO, and the science performed by our telescopes.

## 12 E-mail  exploders
There is a number of e-mail exploders that support staff will need to subscribe to (gbtinfo, gbsci), or send messages to (e.g., gbipg).  To subscribe to exploders, visit http://listmgr.cv.nrao.edu/mailman/listinfo.

### gbtinfo

To be used for general topics and announcements only (e.g., maintenance will be… We have released version such and such….). The audience is rather extensive and includes most of the technical local staff plus many others from other sites, including various levels of management.

The exploder is also used to inform staff of problems or workarounds that need to be widely advertised, or pleas that someone should look into an issue. The exploder is meant for items whose relevance does not warrant a phone call but rather something that needs to get to its audience on a time scale of a day. For example, "OD4 is acting up. We were able to observe by whittling the whatshisname. We've informed Jane Engineer but the problem can't be fixed until next week. Until then, I suggest…"

An excellent use of this exploder is to report a problem that occurred in the middle of the night and you want someone (but you aren't know sure who) to look into the problem as soon as work starts. Such reports should be as detailed as possible.

The exploder should not be used for extended conversations. Messages should be as factual as possible – no flames or soap boxing.

### gbsci

The gbsci exploder has as its main audience the Green Bank astronomers. Feel free to use this exploder to inform our astronomers of any topic you feel is worthy of their attention. One possible use by the support staff is to get opinions on algorithms, to query the experiences of others, etc.

### gbtops

The gbtops exploder has the limited audience of the GBT operators. Support staff members traditionally are not members of the exploder. Use this exploder for messages that are dedicated to the operations group.

### gbsus

The gbsus exploder includes those listed in gbsci as well as others associated to GBT Science Users Services group. Helpdesk, GBT user support, and other SUS activities for Green Bank are discussed here.

### scistaff

NRAO-wide scientific staff. Observatory wide announcements of interest to the scientific staff are sent to this exploder.

## Other exploders

Individual projects may have their own exploders. Subscription is sometime limited. Subscribe to these exploders if you have some involvement or interest in the project.

## Guidelines as to when to explode, when not to

Exploders should not be used for flames or for promoting ones opinions. All exploders can have members that you might never realize. Sometimes what one might deem as news could be construed as

criticism of a group or of a piece of hardware or software.  If there is any doubt as to how your email will be interpreted, use direct emails to the staff members you wish to contact.  Such emails can be promoted to the exploder if the recipients and you agree that a wider audience is needed.

## 13  Operator Logs

Support staff should try to develop the habit of reading daily or weekly the operator's logs.  Logs can be read at http://gbrescal.gb.nrao.edu/opslogs/opslogs.dbw.  Or, send the HOSO a note if you like to get a daily or weekly email that contains the logs.  It's sometimes very helpful to read the logs that were written during a problem you were helping circumvent.  Operators sometimes have a hard time putting into words what has gone on in the control room.  You can suggest to the head operator changes that should be made to the log.  Or, discuss with the operator how he or she might better represent similar problems.

## 14 Helpdesks

There are several help desks that are used by our staff at Green Bank.  The NRAO wide help desk is at https://help.nrao.edu/.   This helpdesk for is for the users of NRAO facilities, and is used for general user inquiries, proposal questions, observing inquiries, and for data reduction.    As a GBT support staff member, you also have a staff helpdesk account (https://help.nrao.edu/staff/) where you can respond to tickets and answer questions from our users.   You may be assigned helpdesk tickets in your area of expertise.   The NRAO-GB computing division maintains its own helpdesk system (http://helpdesk.gb.nrao.edu/cgi-bin/wreq/req).  This helpdesk system is used at Green Bank to request new computer accounts or report computer issues (selection: helpdesk),  to inquire about GBT scheduling or to report issues with the DSS (selection: helpdesk-dss), for issues related to the BOS (selection: helpdesk-bos), or other software issues (selection: helpdesk-gbtsoft).

The contents of reports to the help desk should follow the same principles that govern exploders.  Reports should be factual, as detailed as possible, uncritical, and free of personal opinions.

## Appendix A:  List of Support Duties and Expected Level of Support

Depending on the experience of the observers and the type of experiments being carried out, the level of support can vary significantly.   To assist the HOSO in dividing up support tasks fairly among the staff and to help guide the support scientists in the expected level of support, we broadly classify observers based on their experience as follows:

- If the project has Remote Observer(s), and this is a continuation of an existing project, or the Remote Observer(s) are known to be familiar with this type of observation, they are considered Expert. An Expert is expected to execute all phases of their proposal with only minimal interaction needed with the Support Staff.
- If the project has Remote Observer(s), but they are carrying out observations in a new mode, with a new instrument, or it is unclear if they are expert users, they are considered Experienced.
- If the project has no Remote Observer(s), the Observers are considered Novice.  The Friend will inquire whether they are new observers, and if so inform them they should visit Green Bank to

carry out their observations. Novice users will require extra attention and interactions with the support staff.

- If the project is carrying out a new mode of observation and/or using new equipment that has not been fully commissioned (e.g., shared-risk), then the level of support required for many of the tasks will need to be determined on a case-by-case basis ("Special-Mode" in Table 1).

## A.1 Table 1: Summary of Support Scientist Observer Support Duties

| Number | What | Who? | Special-Mode | Expert | Experienced | Novice |
|--------|------|------|--------------|--------|-------------|--------|
| P1 | Initial Contact | Friend | S | S | F | F |
| P2 | Observing Strategy | Friend | S | N | S | F |
| P3 | Calibration Strategy | Friend | S | N | S | F |
| P4 | Reduction Strategy | Friend | S | N | S | F |
| P5 | Source Catalogs | Friend | N | N | S | F |
| P6 | Configuration Scripts | Friend | S | N | S | F |
| P7 | Observing Scripts | Friend | S | N | S | F |
| P8 | Calibration Scripts | Friend | S | N | S | F |
| P9 | Reduction Scripts | Friend | S | N | S | F |
| P10 | Travel Assistance | Friend | S | S | S | F |
| P11 | DSS Project Observers | Friend | S | S | F | F |
| P12 | DSS Sessions Enabled | Friend | S | S | F | F |
| P13 | DSS Blackout Dates | Friend | S | S | F | F |
| P14 | DSS Special Parameters | Friend | S | S | F | F |
| P15 | Onsite Training | On-Duty | N | N | S | F |
| P16 | Real-Time Support | On-Duty | S | S | F | F |
| P17 | Qualifying Observers | On-Duty | N | N | N | F |
| P18 | Post Observing Support | Friend | S | S | F | F |

F: Full support required
N: Normally, no support required
S: Some support required

Table 1 provides only an initial estimate to the level of the expected support on various tasks.   Based on their interactions with the users, the contact and on-duty support scientists should use their best judgment on the level of support that is actually needed for each project.

## A.2 Project Checklist
This list provides a brief summary of the duties required at each stage of a project, roughly in the order in which they are normally executed. In the following sections, the support scientist should judge the level of support needed by "special mode" on a case by case basis, although Table 1 gives a rough indication.

**P1 Initial Contact**

At least two weeks before the start of each observing semester, Friends are expected to log in to the Dynamic Scheduling System (DSS) and determine which projects have been assigned to them. The Friend will then contact each Observing Group and provide them with initial guidance. Friends should use email and phone if necessary, and be pro-active in making the initial contact. The Friend duties at this stage are as follows:

- All Users: Read the project disposition letter, to see whether there are any specific constraints which have been placed on the proposal (e.g. only allowed to observe specific sources). Remind the Principal Investigator (PI) to ensure that their sessions, including windowed and fixed sessions, are correct.
- Expert: Remind the PI to specify the DSS Project Observers (P11 – see later sections), enable the DSS sessions (P12), set DSS black-out dates (P13) and set any DSS special parameters (P14). Provide them with the standard documentation links, and volunteer to provide assistance as necessary. Inquire whether the Observer(s) plan to visit Green Bank, or observe remotely.
- Experienced: Provide the Observer(s) with the standard documentation links, and work with them on all aspects of the Project Checklist (Appendix A). Ask if they plan to visit, or plan to carry out their program remotely. If the Observer(s) do not plan to visit, the Friend may need to be proactive on following up on enabling DSS sessions (P12) and setting black-out dates (P13).
- Novice: The Friend should inform the Observer(s) that they should come to Green Bank for their observations. The Friend should provide the Observers with the standard documentation links. Before their visit, work through all sections of the Project Checklist (Appendix A.2). Again, some aspects of this (especially final configuration of Observing Scripts) may need to be worked-out face to face, but it is most effective to have a good basis of these before the Observer(s) arrive.

**P2 Observing Strategy**

The Observer will have to plan how to execute their observations. This will include whether these are pointed or mapping observations, what switching scheme to employ, and so on. The Observer will be required to determine the integration times required to reach the desired signal-to-noise; how to break this integration time up into individual observations; in the case of mapping observations, what map parameters to use; and so on. Low frequency Observers need to be cognizant of the RFI environment. High frequency Observers need to be aware of the weather constraints. These types of issues are covered by planning the general Observing Strategy.

- An expert user should be capable of planning their observing strategy unassisted.
- An experienced user should be expected to understand all of the concepts involved, but might need assistance e.g. in selecting some appropriate parameter values.
- A novice user may need to be educated in the concepts themselves, as well as how to choose appropriate strategies.

**P3 Calibration Strategy**

This topic covers everything necessary to ensure the Observer has well-calibrated data. In some simple cases (generally at low frequency) it may be simple enough to routinely perform point and focus

observations, and periodically observe a standard calibrator. At high frequencies, the Observer may need to perform "Out-Of-Focus" Holography  (via the AutoOOF procedure); the 4mm receiver requires specific calibration observations, and so on. These types of issues are covered by the Calibration Strategy.

- An expert user should be capable of planning their calibration strategy unassisted.
- An experienced user should be expected to understand all of the concepts involved, but may need to be informed of receiver-specific calibration approaches, if they have not used that particular receiver in advance.
- A novice user will need to be guided through all aspects of calibration.

## P4 Reduction Strategy

This topic covers everything necessary to allow the Observer to reduce their data. In simple cases, where precise calibration is not a major concern, it may be enough to run the data through the GBT spectral or mapping pipelines. MUSTANG and the CCB have their own analysis paths; the 4mm receiver has some added complexity, and some types of observation (for example, polarization observations) have complex data reduction requirements. Current GBT real-time data displays are quite limited, so it is important that the Observer becomes conversant with the appropriate data reduction steps before their observations, so that they can analyze their data in near real time. These types of issues are covered by the Data Reduction Strategy.

- An expert user should be capable of reducing their data unassisted.
- An experienced user should be expected to understand all of the concepts involved, but may need to be brought up to speed on the latest versions of software, and any new developments since their previous visit.
- A novice user will need to be guided through all aspects of data reduction.

## P5 Source Catalogs

GBT source catalogs are powerful, flexible, and are fairly well documented.   Most observers should be able to set up their source catalogs unaided, but support should be provided as needed.

## P6 Configuration Scripts

Configuration scripts are subsets of the observing scripts which deal with the configuration of the Receiver / IF / LO / Backend chain. They take the form of a character string with simple keyword = value pairs. Many keywords are quite generic (e.g. velocity frame, velocity definition), but many are GBT and/or device specific.

- An expert user should be capable of defining their configuration scripts unaided
- An experienced user will be familiar with the general concepts, but may need to be assisted in setting keyword/value pairs for new instruments.
- A novice user will need to be guided through every step of the configuration process.

### P7 Observing Astrid Scripts

Observing scripts deal with those aspects of the observing process which involve commanding the antenna to move, and the backends to acquire data. Astrid has a number of scan types (observing primitives) such as OnOff, RaLongMap, and so on, which may be used to build up observations. Since Astrid includes a python interpreter, all the power of python (such as for loops, if blocks) may be used to build up sophisticated observing scripts.

- An expert user should be capable of defining their observing scripts unaided.
- An experienced user will be familiar with astrid, and the general concept of observing scripts, but may need to be assisted in setting up a script appropriate to this particular observation.
- A novice user will need to be guided through every aspect of setting up observing scripts.

### P8 Calibration Astrid Scripts

As well as their science data, for properly calibrated results Observers will need to perform a variety of calibration observations. These will include pointing and focus checks, observations of standard calibrators, and so on. Some observing schemes will have rather more complex calibration requirements (so-called "AutoOOF" observations for high frequency observing, "spider scans" for polarization measurements and so on).

- An expert user should be aware of the necessary calibration steps and how to command these through Astrid.
- An expert user will need to be informed of any receiver or observing mode dependent calibration strategies, and how to execute these through Astrid
- A novice user will need to be guided through every aspect of creating calibration scripts.

### P9 Reduction Scripts

As noted, simple GBT observations may be processed by the appropriate data reduction pipeline. More complex observations will require custom analysis through GBTIDL, or through the other analysis packages (e.g. the MUSTANG data analysis pipeline, PRESTO, and so on). In most cases, it will be most effective to automate various aspects of the data reduction process by writing data reduction scripts.

- An expert user will be expected to be conversant with all aspects of creating data reduction scripts.
- An experienced user will need assistance in customizing data reduction scripts to their particular observing configuration.
- A novice user will require assistance through all aspects of creating data reduction scripts.

### P10 Travel Plans to Green Bank

New users are expected to travel to Green Bank to receive training in how to observe with the GBT. On-site observers get a "boost" in the DSS scheduling algorithm, so there is an incentive for all observers to visit. Finally, Observers may wish a quiet location to perform initial data reduction, interact with GB support scientists, and so on. Since Green Bank is rather remote, travel to the site is slightly more complex than is typically the case; Green Bank offers a shuttle service to local airports.

It is important to keep the HOSO informed about visiting astronomers, given that he makes up the receiver schedule. The Friend should inform Observers of the receiver schedule (and updates) and work with the Observers and Head of GBT Science Support to schedule their visit when the desired receiver(s) are available. It is also important to check the projects LST range, since that range may already be occupied by fixed or windowed projects. It is also preferable if possible to schedule their visit when the Friend is also the On-Duty Scientist, to minimize unnecessary handoffs. If this is not possible, the Friend should inform the relevant On-Duty Scientist in advance of the visit, so that they are aware the Observers are on-site. The Friend should arrange to have a computing account created for the Observer before their visit; the Observer will then pick up the account information sheet from the Friend or On-Duty Support Scientist.

- Expert users should be familiar with relevant travel procedures.
- Experienced users should simply be reminded of the procedures via the provision of appropriate web links.
- Novice users should be informed that they must travel to Green Bank, and informed of the relevant DSS algorithms. Assistance in making travel plans should be provided as needed.

### P11 DSS Project Observers
The DSS system requires that each observing project designate one or more Project Observers. The mechanism to do this is quite straightforward.

- For expert and experienced users, the Support Scientist should simply check that Project Observers have been designated.
- For novice users, the Support Scientist should provide links to the relevant documentation, and then ensure Project Observers have been designated.

### P12 DSS Sessions Enabled
Observing sessions must be enabled in the DSS before they will be eligible to be scheduled. This is a straightforward process.

- For all observers, the Support Scientist should ensure that the project has enabled sessions.

### P13 Black-out Dates
The DSS allows Project Observers to specify black-out dates; dates when they will not be available to observe. The process for specifying black-out dates is straightforward.

- For all observers, the Support Scientist should remind the project team to set their black-out dates appropriately.

### P14 DSS Special Parameters
The DSS has some "special parameters" which may be used to fine-tune the likelihood of a project being scheduled. For example, the DSS support team can enter a session-specific factor ("xi") that effectively elevates the score for a particular session in marginal opacity conditions. PIs must make a request to the GBT scheduler to have DSS special parameters set.

- Expert users will be aware of the DSS special parameters, and may request them to be set appropriately.
- Experienced and Novice users may not be aware of the DSS special parameters; the Support Scientist should alert the Observer to the possibility of using them if it seems appropriate for their project.

### P15 Pre-Observing Training

While the Observer is on-site, but prior to their actual observing time, the On-Duty Scientist should provide Novice Observers with observing training. In exceptional circumstances, this might be provided by a shared VNC session, but face-to-face is much preferred. During this time, the On-Duty Scientist can demonstrate Astrid in "monitor only mode, to explain the User Interface and Status Displays. They can also "play back" existing observations from a similar project, to demonstrate the Real-Time Display, including the processing of pointing, focus and AutoOOF observations. Finally, in extremely complex cases, the On-Duty Scientist might request the software group to run an observing script through the observing simulator.

The On-Duty Scientist should also ensure the Novice Observer has enough familiarity with the appropriate data reduction tools so that they can monitor the quality of their observations in real time.

### P16 Real-Time Support

Ideally everything will have been prepared in advance, and the main responsibility during the observing process will be to assist the Observer and Telescope Operator in the case of any telescope faults. At this stage, support will be provided by the current On-Duty Scientist, rather than the Friend. Duties expected of the On-Duty Scientist at this stage are as follows:

- Expert: The On-Duty Scientist will check in with the Telescope Operator on a daily basis, and that should be enough to gather any feedback provided by an expert user.
- Experienced: The On-Duty Scientist should contact the Observer(s) before their scheduled observing time, to confirm that the Observer is prepared and ready for observations, and ask if they need any assistance.
- Novice: The On-Duty Scientist should check in with the Observer(s) as for an experienced user, but also be present in the Control Room at the start of observing to assist with any problems. New observers will need to be added to the Astrid observing list by the operator.

In all cases, the On-Duty Scientist is expected to assist with any problems which might occur during the observing process.

### P17 Qualifying Observers

After a Novice Observer has observed for one or two sessions, the On-Duty Scientist can recommend to the Head of GBT Science Support that the Observer be qualified for Remote Observing. This implies the On-Duty Scientist believes that the observer has a good grasp of the observing process, and can continue unassisted. As part of this process, the On-Duty Scientist should ensure that the observer has the appropriate remote observing software (VNC) installed and configured correctly.

## P18 Post-Observing Duties

The Support Scientist's duties continue even after the end of observing. We can expect that observers will call to discuss their data, algorithms, calibration and so on. In addition Green Bank has developed some initiatives intended to ensure science results are published in a timely fashion. Duties expected of the Support Scientist at this stage are as follows:

- Expert Users: Request that they fill in an Observer Comments sheet. Be prepared to answer questions on data analysis, calibration, etc, although these are only likely to occur if there were problems during the observing run. After six months, contact the Principal Investigator, and inquire after the progress of the project, including whether any results have been published. Inquire whether the results are worthy of a press release.
- Experienced Users: As for Expert Users, with the possibility that more assistance may be requested.
- Novice Users: As for Experienced Users, with the possibility that more assistance may be requested.