

Chapter 1

Introduction

1.1 The Observatory

The Astronomy Radio Observatory (ARO) 12 Meter Telescope is a general purpose radio astronomical observatory that supports spectral line and continuum observations in the atmospheric windows at 3mm and 2mm wavelengths. The facility is located on Kitt Peak, Arizona, approximately 50 miles southwest of Tucson. The Observatory was constructed in 1967 by the [National Radio Astronomy Observatory](#), with an original surface diameter of 36 feet (11 meters). In 1982, the surface and backup structure were replaced with a 12m diameter reflector. Table 1.1 lists basic information on the observatory site and telescope.

The ARO operates the telescope as a university facility, with approximately 20% observing time open for use by competent outside observers. Proposals are accepted before two deadlines each year and are evaluated by a panel of anonymous referees (see §1.2 for more information on proposal submission). The telescope is open for use from approximately September 15th to July 15th each year. From late July through the middle of September the prevailing weather pattern precludes observations at millimeter wavelengths and the telescope operation is shut down. Extensive overhauls, telescope upgrades and major maintenance are done during the summer shutdown period.

The 12 Meter Telescope is one of two observatory units operated by the ARO. The ARO is administered by Steward Observatory, the astronomy department of the University of Arizona. Operations of the 12 Meter Telescope are managed by the Director who, with the Assistant Scientists, also handles the scheduling of the instrument. The Associate Director should be contacted with regard to general matters of operations policy.

Additional visitor information, including maps, lodging fees and names of specific staff members responsible for operation of the telescope can be found on the ARO Home Page at <http://aro.as.arizona.edu/> This information can also be found in the companion document, *Visitors' Guide to the ARO 12m Telescope*.

Table 1.1: Telescope and Site Characteristics

Site				
	East Longitude:	-111°	36'	53.00475"
	North Latitude:	+31°	57'	12.000"
	Elevation:	1894.5 meters		(6215.8 feet)
Telescope				
	Primary Reflector Diameter:	12.0 meters		
	Focal Ratio (f/D)			
	Prime Focus:	0.42		
	Cassegrain Focus:	13.8		
	Surface Accuracy:	75 μ m rms		
	Mount:	Elevation over Azimuth		
	Slew Rate:	68°/minute		
	Pointing Accuracy:	5" rms		
	Elevation Limit:	15°		
	Enclosure:	Tracking astrodome with movable door 12m Telescope.		

1.2 Observing Proposals

1.2.1 Proposal Preparation

All proposals should include a completed 12m Observing Application Cover Sheet. The body of the proposal must include:

1. A concise scientific justification for the project (Do not exceed 1000 words);
2. An estimate of the observing time required.
3. Frequencies and source coordinates to be observed.

As a proposer, you should insure that the project is within the capabilities of the telescope, both in terms of available equipment and the sensitivities and integration times required. The telescope and receiver parameters and system sensitivities given in §3.3 will be of use in estimating the required integration times. The most up-to-date information on these parameters can be found in the companion document *The ARO 12m Telescope Equipment and Calibration Status* and on the ARO Home Page <http://aro.as.arizona.edu/>.

The 12m management imposes no hard rules as to the maximum or minimum lengths of observing programs. A typical 12m observing run lasts 3 or 4 days of either partial or around-the-clock time.

Table 1.2: Proposal Submission Deadlines

Deadline	Observing Period
January 1	April to mid-July
July 1	mid-September to December 31
October 1	January 1 to March 31

Requests for more than 5 days of time usually receive close scrutiny by the referees and scheduling committee. If only a specific LST range is required, you should request only that range.

For any proposal period, the Scheduling Committee always receives more proposals than can be scheduled; the requested time often exceeds the available time by factors of 2 to -4. For this reason, you should prepare proposals with care.

1.2.2 Proposal Submission and Refereeing

Twelve meter telescope scheduling operates on a trimester system, with proposal submission deadlines and their corresponding observing periods listed in Table 1.2. The intention of the 12m proposal system is to insure that the projects granted telescope time are of current interest and that all proposals receive a prompt scheduling decision. Proposals should be sent to the Cathi Duncan at cathi@as.arizona.edu. Information regarding electronic submission of proposals can be found on the *ARO Home Page* http://aro.as.arizona.edu/proposal_submission_information.htm. After receipt by the Director's office, the proposals are assigned a reference number and are sent to a panel of five referees who are anonymous to the proposer and to each other. The referees rank the proposal as to scientific merit and feasibility of achieving the scientific goal, recommend what percentage of the requested observing time should be granted, and make any comments they feel are pertinent. On the basis of the referees' rankings and comments, the 12m Scheduling Committee selects the proposals to be scheduled. A report of referees' comments and the disposition of the proposal is sent to the proposal's contact authors, usually within 6-8 weeks after the deadline. Proposals are considered for two consecutive trimester periods. On a proposal's second consideration, it will be in competition with new proposals received for that period. If a proposal is not selected on its second consideration, it will be declared inactive and generally will not receive any further consideration for telescope time. The 12m Scheduling Committee will notify proposers as to the disposition of their active proposals after each selection process. After any evaluation of a proposal, the authors may submit an amended version of the proposal to address referees' remarks or to otherwise strengthen the proposal. The proposal will be re-refereed for the next available period. Investigators are also free to withdraw a proposal and resubmit it as a different proposal.

1.2.3 Proposal and Observing Propriety

Observers are expected to confine their observations to those described in their refereed proposal. It is absolutely essential that observers consult with the Director or Associate Director and obtain their approval before altering scheduled observing programs. Approval for changes can be granted under those circumstances that do not lead to an infringement on work proposed by others, and when the changes are in keeping with the spirit of the original, refereed proposal. These rules are fundamental to the integrity of the observing system at ARO and are taken very seriously by the management.

1.3 Observatory Policy

1.3.1 Staff Responsibilities

The following is the responsibility of the ARO staff:

- To insure that the equipment needed for your observations is available and installed at the telescope.
- To tune the receiver to the desired frequency.
- To provide sound telescope pointing.
- To provide fundamental telescope calibration parameters - efficiencies, beam widths, gain curves - at standard observing frequencies.
- To provide advice on observing strategies, if requested.

1.3.2 Observer's Responsibilities

As the visiting observer, you have the responsibility for proper supervision of all aspects of the observing program. This includes:

- Providing to the ARO staff, well in advance of the time scheduled, a full description of the equipment needed for the observations as well as a complete list of frequencies to be observed. Usually this information is included on the proposal cover sheet.
- To verify the telescope pointing and fine-tune it as needed.
- To obtain all calibration and other receiver/telescope parameters necessary for data reduction. This can be done either by adopting or scaling the ARO-provided information from standard frequencies, and/or by making the appropriate

measurements. In either case, proper data calibration is your responsibility, not ARO's.

- To inform the ARO staff, before the observing period has ended, about the types of data to be written on an export media, and the format of that media.

In addition, you are requested to provide feedback on the observing run via the "Observer's Comment Sheet", available at the telescope and on the ARO Home Page.

1.3.3 Maintenance and Repairs

One period approximately every 10 days is assigned to preventive maintenance and routine system tests. If during a scheduled observing period a catastrophic failure of the instrument occurs which results in a loss of data, observations will be stopped and the ARO technical staff will attempt to repair the equipment. In less serious cases where data-taking continues but where the quality of the data is not optimal, it is your responsibility to decide whether or not you wish to give up telescope time so that repairs can be made. Only the ARO Director or Associate Director can make the decision to interrupt scheduled operations to make nonessential repairs.

1.3.4 Sharing Telescope Facilities with Other Observing Teams

Since living quarters and workspaces at the telescope are limited, you should leave the mountain as soon as possible at the end of your run, allowing, of course, for a reasonable period of rest. If you wish to continue the reduction of your data sets, you should do so at the ARO Tucson office. When two or more observing teams are sharing observing time, the team currently observing has priority to all telescope facilities, including computer usage. The other observing teams should endeavor to stay out of the control room and not interfere in any way with the ongoing observations. Unless one group of observers is declared the "prime observer" on the telescope schedule, equipment changes needed for a program will be done at the beginning of that program's time.

1.3.5 Observations Under Poor Weather Conditions

There are a variety of weather conditions, which can endanger the safety of the telescope. It is the responsibility of the telescope operator to take appropriate action if any of the conditions listed below occur.

1.3.5.1 High Winds

- If the wind exceeds 15 mph, observations will be restricted to those quadrants where the telescope drive motor currents are not excessive.
- If the steady wind, or the average of gusty wind, exceeds 35 mph, the dome door must be closed. Observations can be continued through the side of the dome.

- For winds above 45 mph, the dome door must be positioned 180° from the direction of the wind and held fixed. Observations can continue through the side of the dome, but the dome cannot be moved.
- If the wind exceeds 55 mph operations must cease and the telescope must be placed in the service position with the stow pins in place.

1.3.5.2 Moisture Accumulation In or On the Dome

If there is fog in the dome, or if moisture is condensing on the antenna or equipment, the dome door will be closed. Observations can continue through the side of the dome. If there is a build-up of snow/ice on the dome, the accumulated snow/ice must be cleared from the dome door before observations can resume.

1.3.5.3 Sun on the Dish

The pointing and focus of the dish can be seriously affected if the sun is allowed to shine on the surface of the dish or the feed support legs. If accurate pointing is desired, care must be taken to keep the sun off the dish. To avoid excessive heating of the feed legs, the prime focus regions, and the cables to the prime focus, the dish will not be pointed to within 15 degrees of the sun. The projected distance between the sun and a position on the sky defined as (AZ_{obj}, EL_{obj}) is given by the following equation:

$$\cos(D_{obj}) \equiv \cos(90 - EL_{\odot})\cos(90 - EL_{obj}) + \sin(90 - EL_{\odot})\sin(90 - EL_{obj})\cos(AZ_{obj} - AZ_{\odot}) \quad (1.1)$$

1.3.5.4 Observations Using Emergency Power Generators

The telescope and dome have three sources of electric power - the commercial source and two power generators. Observations can continue as long as at least two of the sources are operational. If only one source of power is available, the dome door must be closed.

1.3.5.5 Safety Rules

The following safety rules obtain at the 12 Meter Telescope site. We expect all observers and visitors to the site to read and abide by these rules.

1. The Telescope Operator on duty is the only person allowed to operate the telescope.
2. Observers are not to be on the telescope unless the duty operator has specifically authorized them to be there.
3. Safety chains and rails have been installed at the entrance to the observing rooms. They are there to prevent you from walking into any possible pinch points or dangerous areas.

4. Do not stand in the red areas because parts of the telescope and dome that move in those areas could injure you severely.
5. Do not touch the yellow curtains around the inside wall of the dome. Behind them are exposed 480-volt power lines.
6. Please abide by all printed and posted safety rules such as “No Smoking” and “Do Not Enter This Area” posters, etc.
7. Only the telescope operator or other qualified ARO employees are allowed to operate the manlift. Observers may ride in the manlift if authorized to do so by the duty operator.
8. Hard hats are required for all persons in the dome area if someone is working above or in the manlift. The hats are located on the wall just outside of the observing room door.
9. When walking outside to the dormitories or the lab at night, please be sure to carry a flashlight. You may encounter steps, drop-offs, or hungry wild animals.
10. The consumption of alcoholic beverages or illegal drugs is absolutely forbidden in the lab and telescope/control room areas.
11. Ice, rocks, and rock slides are frequently a hazard on the roads and walkways. Cattle and horses cross Highway 386 and several have been hit. Please drive and walk carefully.
12. Please drive very slowly and carefully in all NOAO and ARO parking or road areas. Pedestrians, including small children seem to leap out at cars on a regular basis.
13. A more complete list of safety rules and recommendations is available in the observers’ lounge and from the telescope operator. You might find it interesting reading, although not required.