

# A Guide to the North American ALMA Regional Center and the NAASC

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[www.almascience.org](http://www.almascience.org)

## User Support:

For further information or to comment on this document, please contact your regional Helpdesk through the ALMA User Portal at [www.almascience.org](http://www.almascience.org). Helpdesk tickets will be directed to the appropriate ALMA Regional Center at ESO, NAOJ or NRAO.

## Revision History:

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## Contributors



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# 1 Introduction

This document describes services provided to the observing community by the North American ALMA Science Center (NAASC), which is operated by the National Radio Astronomy Observatory (NRAO) in Charlottesville, Virginia, in collaboration with Canada's National Research Council – Herzberg Institute of Astrophysics (NRC-HIA) and the Academia Sinica Institute of Astronomy and Astrophysics (ASIAA) in Taiwan. The NAASC supports the science use of ALMA by astronomers in North America and Taiwan and supports research and development for future ALMA upgrades.



Figure 1: NRAO Headquarters and location of the NAASC

The following websites provide additional information on ALMA and the NAASC, and connect users to resources and tools they will need to use the telescope.

The ALMA Science Portal

<http://almascience.nrao.edu>

The NAASC website

<http://science.nrao.edu/facilities/alma>

The ALMA Helpdesk, which is also linked from the Science Portal and the NAASC website

<http://alma-help.nrao.edu>

The Canadian ALMA website

<http://www.almatelescope.ca>

The Taiwanese ALMA website

<http://alma.asiaa.sinica.edu.tw>

## 2 About ALMA

The Atacama Large Millimeter/submillimeter Array (ALMA) enables transformational research into the physics of the cold universe, where the sky is dark in the visible part of the spectrum but shines brightly at (sub)millimeter wavelengths. ALMA is a global collaboration involving partners in North America, Europe, and East Asia, in cooperation with the Republic of Chile. The telescope is being built in the Chajnantor plain of the Chilean Andes, 5000 m above sea level. When completed in 2013, the telescope will have 66 high-precision antennas, providing unprecedented sensitivity and imaging the sky at resolutions as fine as 0.005". ALMA will operate at frequencies between 30 GHz and 950 GHz.

An "Early Science" observing period is currently underway and provides astronomers the opportunity to use the telescope while it is still under construction. Early Science Cycle 0 began on September 30, 2011. Proposals for Early Science Cycle 1 will be due on July 12, 2012, and Cycle 1 science observations will begin in January, 2013. Even during Cycle 0, the telescope's capabilities are substantial. Cycle 0 observations use at least sixteen 12-meter antennas, and Cycle 1 observations will have access to at least thirty two 12-meter antennas, nine 7-meter antennas from the ALMA Compact Array (ACA), and two 12-meter total power antennas for zero spacing (single dish) observations. Observations during Cycles 0 and 1 can make use of four receiver bands, covering select frequencies between 84 GHz and 720 GHz. More details on the capabilities of ALMA during Early Science are given in the Proposer's Guide, available at the ALMA Science Portal website.

## 3 Organization and Role of the ARCs and the NAASC

Being an international facility, ALMA will serve a worldwide community of astronomers. To interface with the geographically distributed user community, the three partners have established ALMA Regional Centers, or ARCs. They are the North American ARC (NA ARC), based in Charlottesville, VA; the East Asian ARC (EA ARC), based in Mitaka, Japan; and the European ARC (EU ARC), based in Garching, Germany. The ARCs are staffed by scientists with expertise in radio astronomy, millimeter/submillimeter astronomy, and interferometry, and their purpose is to work with the community of astronomers to maximize the scientific productivity of the telescope. The NA ARC is part of the NAASC, concentrating on internationally agreed core ALMA functions.

Each astronomer who uses ALMA is assigned a single ARC for user support at the time they register with the ALMA Science Portal. Astronomers in North America, Japan, or Europe are assigned to that region's ARC. Astronomers from Taiwan can select to use either the NA ARC or the EA ARC. Astronomers elsewhere in the world can select any one of the three ARCs.

The NAASC is located at NRAO Headquarters, on the Grounds of the University of Virginia (UVa), and a short walk from the UVa Department of Astronomy. The NRAO and UVa Astronomy share colloquia, journal clubs, and lunch talks. Several NAASC staff have joint or adjunct appointments at UVa. A listing of NAASC staff, including research interests, is available here:

<http://science.nrao.edu/alma/ALMApeople/people.shtml>

The key services provided by the NAASC to the North American astronomical community include:

- Organizing ALMA workshops and tutorials
- Hosting and supporting NRAO “Community Days” events and webinars
- Hosting ALMA sessions at national and international conferences, such as AAS meetings
- Helping to prepare and distribute the Call for Proposals and other user documentation
- Assisting users with the preparation and submission of ALMA proposals
- Helping users prepare their scheduling blocks, the observing scripts used to control the telescope
- Hosting visits by ALMA observers to assist with data reduction and analysis
- Maintaining a local copy of the ALMA data archive and operating a copy of the ALMA data processing pipeline
- Staffing the ALMA Helpdesk
- Developing user-oriented observing and analysis tools, such as the spectral line catalog (Splatalogue), and the CASA-based observing simulator (*sim\_observe* and *sim\_analyze*)
- Providing opportunities for student funding, and page charge support for U.S. investigators
- Organizing and hosting ALMA-themed science meetings
- Supporting future development of the telescope
- Helping investigators with education and public outreach activities

## 4 Essential Resources

### 4.1 The ALMA Science Portal

The Science Portal is the primary access point to ALMA for all science users. The website is:

<http://almascience.nrao.edu>

At the Science Portal, users can:

- Access the Call for Proposals, the Proposer’s Guide, the Technical Handbook, the Early Science Primer, and other documentation
- Download the Observing Tool, the software used to prepare and submit ALMA proposals
- Search and access public data from the science data archive
- Access “Knowledgebase” articles from the Helpdesk
- Access software tools and documentation, including a sensitivity calculator, the ALMA Observation Support Tool, and Splatalogue
- Get an overview of ALMA’s scientific capabilities during Full Science operations

Astronomers can also register with the Science Portal. Indeed, every astronomer who intends to submit an ALMA proposal, or appear on one as a co-investigator, must register. Once registered and logged in, users at the Science Portal will be able to:

- Submit tickets to the Helpdesk
- Use the Project Tracker (currently under development) to follow the status of observations in the queue

- Access their proprietary data from the archive (also a future capability)

## 4.2 The NAASC Website

The NAASC website provides up-to-date news and information of particular use to North American ALMA users. The website is: <http://science.nrao.edu/facilities/alma>

At the NAASC website, users get information on:

- ALMA and NAASC news and events
- Tutorials on ALMA's capabilities and proposal preparation
- Workshops on ALMA data processing and analysis
- Financial support for travel and publications
- Visiting the NAASC
- Student and postdoc programs
- Education and outreach activities
- NAASC staff

## 4.3 The Helpdesk

The ALMA Helpdesk is the main user resource for getting help. The Helpdesk is a website that can be accessed from the Science Portal, from the NAASC website, or directly at: <http://alma-help.nrao.edu>

The Helpdesk includes a library of "Knowledgebase" articles that address a number of common issues and questions. To submit a ticket, users must first log in. As the user types a question, knowledgebase articles are searched in real time and relevant articles are presented as the question is being typed. If the user does not find an answer in the articles suggested, the user can submit the ticket. While it is necessary to log in before submitting a ticket, users can browse and search the knowledgebase articles without logging in.

Helpdesk staff will make every effort to respond to tickets promptly. During normal operations, users can expect a response within 2 business days. During the week prior to a proposal deadline, extra staff will be assigned to the Helpdesk and every effort will be made to address time-critical questions in a rapid manner.

## 5 Getting Help from the NAASC at Each Step of Your Project

The NAASC provides user support through all stages of an ALMA project, from learning the telescope's capabilities through the publication of results.

### 5.1 Learning about ALMA: Documentation, Workshops, and Community Days

Preparing for an ALMA project begins with learning the telescope's capabilities and learning the tools needed to design observations, prepare proposals, and submit proposals. The NAASC provides user documentation, including "Observing with ALMA: A Primer for Early Science," at the Science Portal.

The NAASC organizes regional workshops in the USA and Canada to promote ALMA to the astronomical community and describe the tools needed to write proposals. These workshops have focused on

preparation for Early Science proposals and observing, and feature talks on the telescope's capabilities, mm/submm interferometry observing techniques, and the tools required to design effective ALMA observations. Attendees learn to use the Observing Tool, the software used to prepare and submit observing proposals. They also learn about CASA tasks for simulating ALMA observations. Future workshops can be arranged in response to the level of interest from the user community.

In addition to the workshops described above, the NAASC supports NRAO "Community Days" events, which are one or two day workshops that can be organized and hosted by university groups or research institutes, or can be tied to other scientific meetings or workshops. In preparation for Cycle 1, the NRAO will host a Community Day Event in Charlottesville on June 11-12, 2012. The talks will be broadcast live as a webinar that will be open to registered participants. At the webinar, NRAO astronomers will describe the capabilities of ALMA in Cycle 1, the Jansky VLA, and the GBT, and will describe how to prepare proposals for each of these telescopes. Recorded versions of the talks will be available after the workshop concludes. Details for registration and connection to the webinar are available at the following link:

<https://science.nrao.edu/science/meetings/nrao-cde>

The NAASC also supports NRAO splinter sessions and training events at AAS meetings. These events promote all NRAO observing facilities, and include a focus on the tools needed to prepare effective proposals. NAASC staff describe ALMA capabilities, NAASC support services, and ALMA user tools. The training provided at Community Days and AAS events covers many of the topics presented at the NAASC-hosted workshops, and includes hands-on work focused on the Observing Tool and an introduction to CASA data reduction.

The NAASC also hosts periodic data reduction workshops that describe how to calibrate and image ALMA data using CASA.

Visit the NAASC website for an up-to-date list of workshops, Community Days, and training events, or visit the workshops page directly at: <https://science.nrao.edu/facilities/alma/community1>

Registration is required for these events, and is available on the website.

## **5.2 Proposal Preparation**

A Call for Proposals is issued prior to each scheduling period. The Call and supporting documents are made available on the Science Portal. These documents describe the capabilities of the telescope for the upcoming cycle and the policies and procedures for submitting proposals.

ALMA proposals are prepared using the ALMA Observing Tool, an application that can be downloaded from the Science Portal. Proposals must include a scientific and technical justification, a list of targets and frequencies to be observed, and details such as sensitivity and angular resolution required to meet the science goals. The Observing Tool includes a sensitivity and exposure time calculator. Users must be registered with the Science Portal to submit proposals with the Observing Tool.

NAASC staff are available to help users learn the Observing Tool and prepare proposals. We emphasize here that the Observing Tool is used not only to assemble and submit the scientific and technical justifications, but also to design and fully specify the observations, so users are encouraged to become familiar with the

Observing Tool well in advance of the proposal deadline. The Helpdesk is the primary resource for those seeking assistance. It may be possible to arrange face-to-face assistance at the NAASC for particularly challenging projects.

The CASA tasks *sim\_observe* and *sim\_analyze* allow users to simulate an ALMA observation of a target based on a model with a given source structure and brightness. These tasks also help one to understand how different antenna configurations and track durations affect an observation. More information on simulations is available at the CASA and casaguides websites:

<http://casa.nrao.edu>

<http://casaguides.nrao.edu>

The ALMA Observation Support Tool (OST) provides another method of simulating ALMA observations. The OST provides a web interface through which the user can specify observing parameters and upload a FITS file with a model image, or select a model image from a pre-existing library. The OST is available on the Science Portal.

### 5.3 Preparing Your Observations

ALMA proposals are reviewed for scientific and technical merit, and the outcome of these reviews are emailed to the investigators. Projects eligible for scheduling are assigned a Contact Scientist, a member of the NAASC staff who provides a single point of contact for all issues related to project support. The Contact Scientist works with the project team to review observing strategies and prepare scheduling blocks. After the observations are made, the Contact Scientist can assist with questions related to data reduction. Most interaction happens through the Helpdesk. For particularly complex observations, users may arrange a visit to the NAASC to prepare the observations.

Observers do not travel to Chile or elsewhere to take part in the observations. ALMA observations are scheduled dynamically, taking into account the weather conditions, instrument status, availability of the targets, proposal ranking, and so on.

### 5.4 Reducing Your Data

The challenge posed by storing and processing ALMA data is formidable. The NAASC will host a copy of the ALMA data archive and the NAASC site will serve as the primary data access point for North Americans, and will provide a backup of the archive in Santiago. Upon completion of the observations and initial data processing, investigators are notified and given instructions on how to download their data.

ALMA data will be processed initially using data reduction scripts. For each project, the raw data, the processed data, and the scripts will be provided to the observing team. NAASC staff will also provide a set of reference images to the observing team as part of their data package. However, because of the complexity of the calibration and data reduction schemes, users will get the best results by refining the scripts and reprocessing the data themselves, with assistance from NAASC staff, if desired.

The NAASC has computers with ample resources to reduce ALMA data, including powerful desktops and a cluster machine. Users are encouraged to visit the NAASC to use these computing resources and get help with their data processing. Initially, remote access to data reduction computers at the NAASC will not be

available. On the NAASC website there are recommendations for computing hardware required to process ALMA data outside of the NAASC, including benchmarking of example desktop systems. See: <https://science.nrao.edu/facilities/alma/community1/naasc-hardware-recommendations>

The primary software package used to process ALMA data is CASA. The CASA website is: <http://casa.nrao.edu>

Note in particular the *casaguides* link available from this site. The *casaguides* site provides a collection of data reduction recipes and step-by-step processing and analysis examples.

A data reduction pipeline is currently in development but is not yet available to the user community. The pipeline will be run in Santiago, and a copy will run in Charlottesville on the NAASC computing cluster.

## 5.5 Visiting the NAASC

The NAASC welcomes short-term visits to Charlottesville from investigators of successful ALMA Early Science programs for expert assistance with processing and analyzing their ALMA data. Visits for data reduction are expected to last about a week. Student visitors must be accompanied by an experienced investigator, usually their academic advisor. Visitors will have access to an office and a computer to process their data. Investigators on accepted projects can apply to the NAASC for assistance with travel expenses. To request a visit, send a ticket to the Helpdesk using the “Face to Face Support” category. More details are available at: <http://science.nrao.edu/alma/visitors-shortterm.shtml>

## 5.6 Publishing Your Results

The NAASC provides financial support for page charges according to the NRAO policy. If requested, NRAO will pay 100% of the page charges for authors at U.S. institutions when the publication reports observations made with ALMA (or any NRAO telescope). The paper may report either original observations made by the authors, or original research made with archival data. Details on the page charge support policy are here: <http://www.nrao.edu/library/pagecharges.shtml>

## 5.7 Promoting ALMA Science

The NAASC sponsors ALMA-themed science conferences on roughly an annual basis. A listing of previous ALMA conferences and information on upcoming conferences is available at the following site: <http://science.nrao.edu/alma/workshops.shtml>

NAASC activities and ALMA results are publicized in the NRAO eNews and the ALMA newsletter:

<http://science.nrao.edu/enews>

<http://www.almaobservatory.org/en/outreach/newsletter>

The NAASC is also involved in community outreach through special ALMA sessions at American Astronomical Society and Canadian Astronomical Society meetings. At these sessions we provide attendees with highlights of recent ALMA science, describe the current status of ALMA, and give updates on the proposal submission and data processing tools.

The Education and Public Outreach (EPO) team at NRAO will select a number of successful Early Science projects for publicity and work with the investigators to develop the press release and other outreach products. In addition to providing expertise and advice on outreach activities, the EPO team can work with investigators to develop images and other visuals to promote science results.

## 6 Working with the Community to Improve ALMA

The NAASC encourages involvement from the user community to develop and improve ALMA. Through the NRAO visitor program, the NAASC offers financial support for approved long-term visits that can range from a few weeks to several months. NRAO particularly encourages long-term visits that could lead to new and innovative instrumentation on ALMA and visits to develop innovative new software or techniques. Full details on the visitor program are available on the NAASC website:

<https://science.nrao.edu/facilities/alma/visits>

Also, the NAASC periodically invites proposals from North American entities for studies or projects for potential inclusion in the ALMA Development Plan. The primary aims are:

- To give groups in North America the opportunity to propose ALMA upgrades that may later be implemented as part of the ALMA Development Plan
- To support the development of conceptual and detailed designs for ALMA upgrades, and
- To encourage relevant long-term research and development

Information on past and future calls for development proposals can be found at this site:

<https://science.nrao.edu/facilities/alma/alma-development-cfp>

## 7 Student Support

The NAASC supports student involvement in ALMA through the NRAO student programs. NRAO has a Summer Student Program aimed at introducing undergraduate and graduate students to forefront research. A Student Observing Support Program funds graduate students working on accepted NRAO projects, including eligible ALMA proposals. Additionally, a graduate Pre-Doctoral Program is available to give students the opportunity to conduct thesis research at NRAO sites under the supervision of an NRAO scientist. Details on the student programs are available at:

<http://science.nrao.edu/opportunities/studentprograms.shtml>

## 8 Addresses for the NAASC, NRC-HIA, and ASIAA

The North American ALMA Science Center  
520 Edgemont Rd.  
Charlottesville, VA 22903  
USA

Phone: 434-296-0211

Directions: <http://science.nrao.edu/alma/edgemont.shtml>

National Research Council  
Herzberg Institute of Astrophysics  
5071 West Saanich Road  
Victoria, BC V9E 2E7  
Canada

Phone: 250-363-0001

Directions: <http://www.nrc-cnrc.gc.ca/eng/locations/directions/victoria.html>

Institute of Astronomy and Astrophysics, Academia Sinica.  
11F of Astronomy-Mathematics Building, National Taiwan University  
No.1, Roosevelt Rd, Sec. 4 Taipei 10617, Taiwan, R.O.C.

Phone: +886-2-3365-2200

Directions: <http://www.asiaa.sinica.edu.tw/guide/transport.php>

## 9 Map of the Area Near NRAO Headquarters and the NAASC

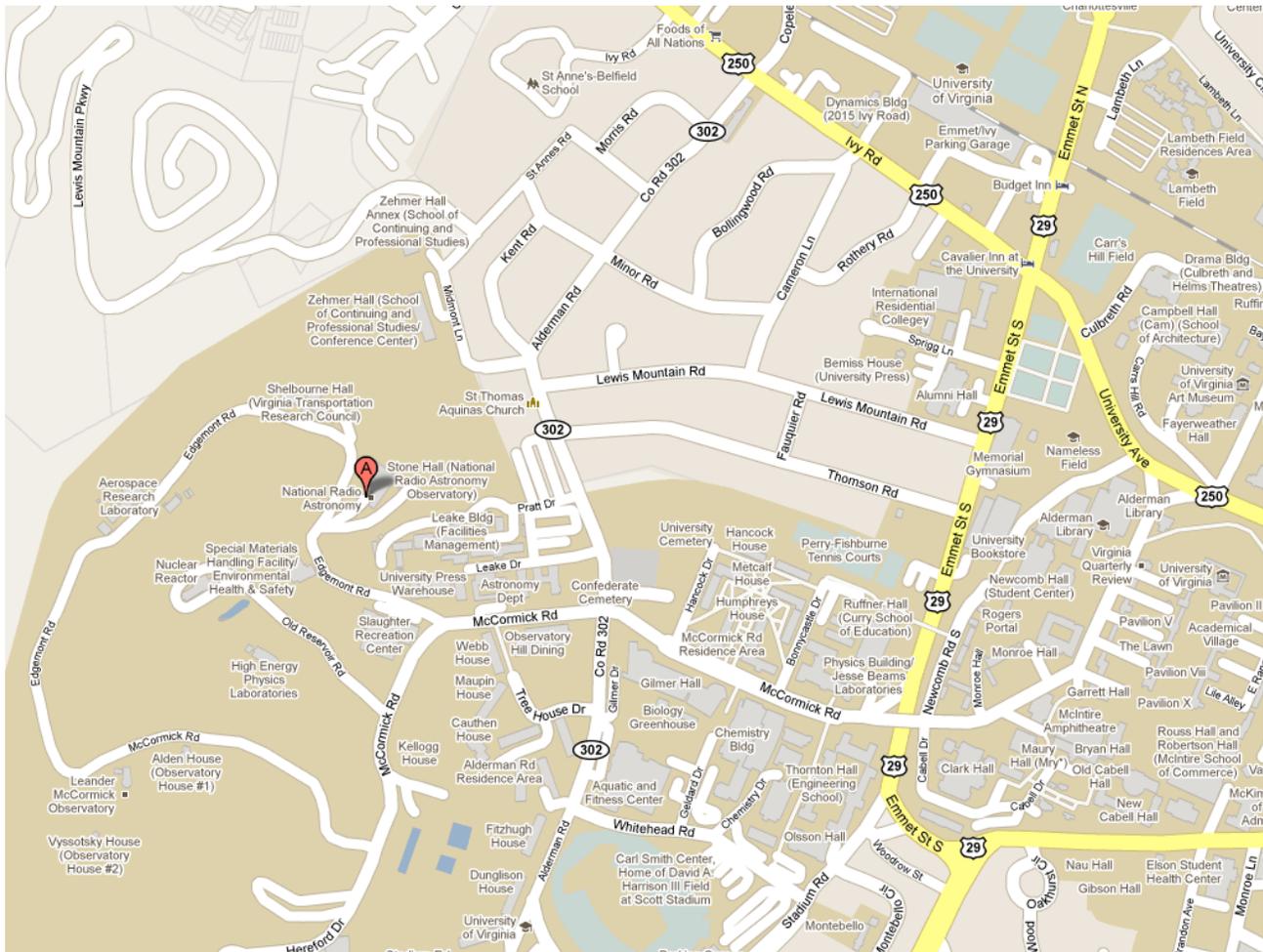


Figure 2: NRAO headquarters and the NAASC are located by the red marker labeled "A"



The Atacama Large Millimeter/submillimeter Array (ALMA), an international astronomy facility, is a partnership of Europe, North America and East Asia in cooperation with the Republic of Chile. ALMA is funded in Europe by the European Organization for Astronomical Research in the Southern Hemisphere (ESO), in North America by the U.S. National Science Foundation (NSF) in cooperation with the National Research Council of Canada (NRC) and the National Science Council of Taiwan (NSC) and in East Asia by the National Institutes of Natural Sciences (NINS) of Japan in cooperation with the Academia Sinica (AS) in Taiwan. ALMA construction and operations are led on behalf of Europe by ESO, on behalf of North America by the National Radio Astronomy Observatory (NRAO), which is managed by Associated Universities, Inc. (AUI) and on behalf of East Asia by the National Astronomical Observatory of Japan (NAOJ). The Joint ALMA Observatory (JAO) provides the unified leadership and management of the construction, commissioning and operation of ALMA.

