Management and Operation of the National Radio Astronomy Observatory (NRAO)

PROGRAM SOLICITATION
NSF 14-568

National Science Foundation

Directorate for Mathematical & Physical Sciences
Division of Astronomical Sciences

Letter of Intent Due Date(s) ***(required)*** (due by 5 p.m. submitter's local time):

September 04, 2014

Full Proposal Deadline(s) (due by 5 p.m. submitter's local time):

November 25, 2014

IMPORTANT INFORMATION AND REVISION NOTES

Informational Site Visit

For representatives of potential proposing organizations, NSF intends to conduct site visits to NRAO headquarters and the Central Development Laboratory in Charlottesville, Virginia; to the Very Large Array and support facilities in Socorro, New Mexico; to the ALMA headquarters in Santiago, Chile; and to the ALMA site near San Pedro de Atacama, Chile. The visits are expected to take place in July and August 2014, prior to the required submission of Letters of Intent, and will be guided and managed by NSF staff. This will be an opportunity for potential proposers to view the buildings, facilities and equipment, and to acquire information relevant to the development of a proposal. Attendees will be responsible for their own expenses.

Eligible organizations that are interested in submitting a proposal and wish to send representatives to one or more of the site visits should email the Cognizant Program Officers no later than June 30, 2014.

Any proposal submitted in response to this solicitation should be submitted in accordance with the revised *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) (NSF 16-1), which is effective for proposals submitted, or due, on or after January 25, 2016.

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Management and Operation of the National Radio Astronomy Observatory (NRAO)

Synopsis of Program:

Proposals are solicited to manage and operate facilities of the National Radio Astronomy Observatory (NRAO) through a cooperative agreement with the National Science Foundation (NSF). NRAO is a Federally Funded Research and Development Center (FFRDC) that conceives, designs, builds, operates, and maintains world-class radio telescopes used by scientists from around the world to study virtually all types of astronomical objects, from bodies in our own Solar System to galaxies in the distant Universe. NRAO operates the Karl G. Jansky Very Large Array (VLA) near Socorro, New Mexico; North American contributions to the international Atacama Large Millimeter/submillimeter Array (ALMA) located in Chile; and associated development laboratories, including a Central Development Laboratory (CDL) in Charlottesville, Virginia. Management and operation of two other NRAO facilities, the Robert C. Byrd Green Bank Telescope and the Very Long Baseline Array, are under consideration separate from this solicitation.

The Awardee will work closely with NSF and the scientific community to ensure that NRAO continues to support, sustain, and advance frontier science as enabled by unique research capabilities and as promoted through a culture of excellence. In cooperation with NSF and within available resources, the Awardee will plan and execute a viable, coherent, and inclusive program to support multi-user research and education, consistent with the objectives and priorities of the scientific community. The Awardee will manage facilities and equipment provided by NSF and by domestic and international partners, will provide additional facilities and equipment as necessary to fulfill the proposed programmatic scope, and will provide support and technical personnel to manage NRAO as a well-integrated facility to support research and education. The Observatory is a multi-user resource; as such, a significant portion of the NRAO research and education program should be carried out in collaboration with its stakeholder communities.

Proposals should describe how the proposing institution(s) would provide observing capabilities and scientific data;

enable a competitive research program and an integrated program of education, training and outreach; maintain instruments, facilities and infrastructure; manage and develop a skilled and diverse workforce; and establish appropriate partnerships with universities, industry, private organizations, and the international community to support the NRAO mission.

The successful proposal will be awarded as a cooperative agreement for NRAO management and operations starting on 1 October 2016 for a duration of ten years contingent on the availability of funds and the successful outcome of regular management reviews. As necessary, the Awardee will define and execute a budgeted, scheduled, and tracked project plan to manage any transition from the current to the proposed model of NRAO management and operations. The transition period will commence with a transition award, under this cooperative agreement, on or after 1 April 2016 and conclude no later than 6 months thereafter.

Cognizant Program Officer(s):

Please note that the following information is current at the time of publishing. See program website for any updates to the points of contact.

- Philip J. Puxley, ALMA Program Officer, 1045 S, telephone: (703) 292-7835, email: ppuxley@nsf.gov
- Elizabeth A. Pentecost,1030 S, telephone: (703) 292-4907, email: epenteco@nsf.gov

Applicable Catalog of Federal Domestic Assistance (CFDA) Number(s):

- 47.049 --- Mathematical and Physical Sciences

Award Information

Anticipated Type of Award: Cooperative Agreement

Estimated Number of Awards: 1

Anticipated Funding Amount: $862,657,000

over a ten-year period, beginning in FY 2017, pending availability of funds.

Eligibility Information

Who May Submit Proposals:

Proposals may only be submitted by the following:

- Universities and Colleges - Universities and two- and four-year colleges (including community colleges) accredited in, and having a campus located in, the US acting on behalf of their faculty members. Such organizations also are referred to as academic institutions.
- Non-profit, non-academic organizations: Independent museums, observatories, research labs, professional societies and similar organizations in the U.S. associated with educational or research activities.
- For-profit organizations: U.S. commercial organizations, especially small businesses with strong capabilities in scientific or engineering research or education.

Who May Serve as PI:

There are no restrictions or limits.

Limit on Number of Proposals per Organization:

There are no restrictions or limits.

Limit on Number of Proposals per PI or Co-PI:

There are no restrictions or limits.

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

- **Letters of Intent:** Submission of Letters of Intent is required. Please see the full text of this solicitation for further information.
- **Preliminary Proposal Submission:** Not required
- **Full Proposals:**
  - Full Proposals submitted via FastLane: NSF Proposal and Award Policies and Procedures Guide, Part I: Grant Proposal Guide (GPG) Guidelines apply. The complete text of the GPG is available electronically on the NSF website at: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpg.
  - Full Proposals submitted via Grants.gov: NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov Guidelines apply (Note: The NSF Grants.gov Application Guide is available on the Grants.gov website and on the NSF website at: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantsgovguide)

B. Budgetary Information

- **Cost Sharing Requirements:**

Inclusion of voluntary committed cost sharing is prohibited.

- **Indirect Cost (F&A) Limitations:**

  Not Applicable

- **Other Budgetary Limitations:**

  Other budgetary limitations apply. Please see the full text of this solicitation for further information.

C. Due Dates

- **Letter of Intent Due Date(s)** ***(required)*** (due by 5 p.m. submitter's local time):

  September 04, 2014

- **Full Proposal Deadline(s)** (due by 5 p.m. submitter's local time):

  November 25, 2014

Proposal Review Information Criteria

Merit Review Criteria:

National Science Board approved criteria. Additional merit review considerations apply. Please see the full text of this solicitation for further information.

Award Administration Information

Award Conditions:

Additional award conditions apply. Please see the full text of this solicitation for further information.

Reporting Requirements:

Additional reporting requirements apply. Please see the full text of this solicitation for further information.

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I. INTRODUCTION

The National Science Foundation (NSF) is authorized by the National Science Foundation Act of 1950, as amended, to initiate and support basic and applied scientific research and to initiate and support programs to strengthen scientific research potential. To achieve these goals, NSF supports facilities that provide research capabilities in various scientific disciplines. One such facility, the National Radio Astronomy Observatory (NRAO), provides world-class services and facilities to support research and education in

radio astronomy.

NRAO is presently headquartered on the University of Virginia campus in Charlottesville, Virginia. Major observing facilities currently include the international Atacama Large Millimeter/submillimeter Array (ALMA) located in Chile; the Karl G. Jansky Very Large Array (VLA) located near Socorro, New Mexico; the Robert C. Byrd Green Bank Telescope (GBT) located at the Green Bank Observatory in West Virginia; and the Very Long Baseline Array (VLBA), with antennas at ten sites in Hawaii, St. Croix, and across the continental United States. NRAO also operates a Central Development Laboratory (CDL) in Charlottesville that provides technology and expertise in supporting current and future radio astronomy instrumentation.

NRAO is currently managed through a cooperative agreement with Associated Universities, Inc. (AUI). The National Science Board (NSB) has adopted the principle that NSF awards should be competed to assure the best use of NSF funds for supporting research and education (NSB-08-12). Through this program solicitation, NSF's Division of Astronomical Sciences (AST) requests proposals for the management and operation of NRAO, as defined herein, through a cooperative agreement beginning on or after 1 April 2016 and continuing for up to ten years of operations following a transition period of up to six months. The award for NRAO management and operations will commence on 1 October 2016.

In 2012 the NSF Directorate for Mathematical and Physical Sciences (MPS) conducted a Portfolio Review of all AST-supported facilities, programs, and other activities. The Review report recommended significant adjustments to the MPS/AST research portfolio, including divestment of some major telescope facilities, in order to maintain the most compelling scientific program within constrained budgets. ALMA and VLA were given high priority, while GBT and VLBA were among the facilities recommended for divestment. To sustain the scientific and operational synergies of ALMA and VLA, while allowing flexibility in pursuing operational and management models and partnerships for GBT and VLBA, NSF separated GBT and VLBA from the management competition for NRAO (NSF 13-074). Hence, this program solicitation invites proposals for the management and operation of an NRAO comprising ALMA, VLA, and associated support functions and development laboratories. Management and operation of Green Bank Observatory and of VLBA are not components of this solicitation and are under separate consideration. Services currently provided by Green Bank and VLBA staff and facilities in support of the scope described herein should not be assumed to be available to any proposer.

II. PROGRAM DESCRIPTION

A. Description of the National Radio Astronomy Observatory

NRAO is a Federally Funded Research and Development Center (FFRDC) that conceives, designs, builds, operates, and maintains world-class radio telescopes used by scientists from around the world to study virtually all types of astronomical objects, from bodies in our own Solar System to galaxies in the distant Universe.

NRAO provides a national science and technology resource in the field of radio astronomy. NRAO's mission is to:

- Maintain and operate facilities to support, sustain, and advance radio astronomy for the benefit of the scientific research community;
- Acquire, analyze, archive, and disseminate data from NRAO facilities;
- Develop instruments and techniques as necessary to support NRAO-enabled research in partnership with scientists from related sectors, including academia, industry, government, and the international community;
- Develop and maintain a skilled and diverse workforce as necessary to support radio astronomy;
- Provide integrated and effective education and training programs that utilize the knowledge and discoveries made at NRAO and that strengthen education and public awareness of radio astronomy and related engineering and technology;
- Develop and sustain appropriate partnerships with universities, industry, private organizations, and the international community to enhance NRAO's scientific productivity and educational impact.

In this solicitation, NRAO may be considered to consist of several components as described in the following sections: ALMA; VLA; CDL and other development laboratories; and associated administration and management functions. The budget targets under this award in FY 2017 are $43,250,000 (ALMA), $29,500,000 (VLA), and $2,500,000 (development laboratories), for a total of $75,250,000. Administration and management costs are included in these amounts. In order to ensure appropriate financial and management oversight and tracking, it is envisioned that the award will be made as one cooperative agreement with two separate cooperative support agreements, one for ALMA and the other for VLA plus development laboratories. The cooperative agreement will be the umbrella agreement of the awards and the cooperative support agreements will cover specific terms and conditions for ALMA and VLA plus development laboratories.

Information on the current status of NRAO, inclusive of VLA, ALMA, and associated support functions and development laboratories, is contained within the following documents that will be made available through an NSF-maintained Resource Library:

- The current NRAO Annual Progress Report and Program Operating Plan,
- The current cooperative agreement and cooperative support agreements for the management and operation of NRAO, and
- A detailed list of property for which the current Awardee is responsible.

Additional documents describing specific aspects of NRAO are referenced in the following sections. Access to the Resource Library will be provided to proposing organizations upon request to the Cognizant Program Officers. Any additional materials and information relating to this solicitation, including NSF responses to frequently asked questions and requests for information, will be made available through the Resource Library as appropriate.

A.1 Overview of ALMA

ALMA is supported by an international partnership, comprising the U.S. and its partners Canada and Taiwan (hereinafter "North America" or NA), the European Southern Observatory (ESO), and Japan and its partner Taiwan (hereinafter "East Asia"), to construct and operate an interferometric radio telescope array in Chile. ALMA consists of fifty 12m antennas in an extended array, provided by NA and ESO, plus twelve 7m antennas and four 12m antennas in a compact array, provided by Japan. ALMA is located in the Chilean high desert near San Pedro de Atacama at an altitude of 5000m and can operate at frequencies from 80 to 900GHz. ALMA construction is due to be substantially completed in 2014, and Early Science observations commenced in 2011.

ALMA enables transformational research into the physics of the cold Universe, regions that are optically dark but shine brightly in the millimeter/submillimeter portion of the electromagnetic spectrum. ALMA provides one to two orders of magnitude improvement over previous facilities in all areas of millimeter- and submillimeter-wave observations, including sensitivity, angular resolution, and image fidelity.

ALMA is a general-purpose facility. Within the broad range of science accessible with ALMA, the top-level objectives include imaging the redshifted dust continuum and molecular line emission from evolving galaxies as early as a redshift of z~10 (500 million years after the Big Bang), determining the chemical composition and dynamics of star-forming gas in normal galaxies like the Milky Way but at a redshift of z~3 (75% of the way across the Universe), and measuring the gas kinematics in young disks in nearby molecular clouds and detecting the tidal gaps induced by planet formation.

International agreements establish the terms under which the ALMA partnership operates and define the roles of the ALMA Board, the regional funding authorities, their Executives, and the Joint ALMA Observatory (JAO). The ALMA Board acts as a supervisory and regulatory body responsible for exercising oversight and budgetary and policy control. The regional funding authorities (the "Parties") have each designated an Executive to carry out and manage tasks and responsibilities on behalf of the Parties. ESO serves as its own Executive. The East Asian ALMA Executive is the National Astronomical Observatory of Japan (NAOJ). The Awardee will function as the NA ALMA Executive.

The JAO, staffed by the Executives and headed by the ALMA Director, provides the unified leadership and management of ALMA operations, maintenance, and development. JAO headquarters are located in the Santiago Central Office (SCO) on ESO property in Santiago, Chile. The ALMA Director is appointed by, and reports to the ALMA Board, and can be employed by any of the Executives. The ALMA Director meets with the Directors of the Executives, or their designates, in the Director's Council to coordinate activities among the Executives and the JAO. The necessary scientific and technical interactions and support of the respective regional user communities occur through ALMA Regional Centers (ARCs) operated and managed by the Executives. NRAO provides the NA ARC.

The Resource Library includes the current International Agreements: between NSF and ESO (the ALMA "bilateral agreement") for construction and operation; among NSF, ESO and the National Institutes of Natural Sciences (NINS) of Japan (the ALMA "trilateral agreement") for construction; between NSF and the National Research Council (NRC) of Canada for construction and operation; and between NSF and the National Science Council (NSC) of Taiwan, as the designated representatives of the American Institute in Taiwan and the Taipei Economic and Cultural Representative Office, for construction. A fully trilateral International Agreement for ALMA Operations among NSF, ESO, and NINS/NAOJ is under development and intended to be effective from January 2015.

The Resource Library also includes bilateral management agreements between the NA Executive and ESO, and between the NA Executive and NAOJ, which describe the manner in which the Executives work together to realize ALMA, as well as the agreement between NRC Herzberg and NRAO/AUI that further describes the contributions by NRC Herzberg to NA ALMA operations. An ALMA land concession was granted by the Government of Chile to the NA Executive and ESO through a limited liability company established in Chile for that purpose. AUI's ownership interest in that company may be conveyed to a successor organization with ESO's consent. A fully trilateral management agreement, paralleling the new trilateral International Agreement for ALMA Operations, is planned to be developed and effective in 2015.

In addition to employing international staff at the JAO, the Parties have designated the NA Executive to be the sole employer of the local staff in Chile on behalf of the partnership. The Parties may jointly agree to change this designation. The NA Executive supports the JAO in employment functions and contract and procurements in Chile, and provides the legal representation of the NA partners to the Republic of Chile. Each ALMA Executive remains solely legally responsible for its own employees.

A.2 Components of North American ALMA Operations

NA ALMA operations may be considered to consist of four elements: (a) a share of core operations in Chile, (b) core technical and NA user community support at the NA ARC, (c) a share of the facility and technical development program, and (d) enhanced user support, technical concept studies, and education and public outreach.

As an international project, the scope and budget for these elements are constrained by the partnership as broadly outlined in the following table and described further below:

Element of Scope	Scope and Budget Proposal Responsibility	Management Responsibility
(a) Core operations in Chile	JAO and Executives	JAO
(b) Core NA technical and user support	JAO and NA Executive	NA Executive
(c) NA development program	JAO and NA Executive	NA Executive
(d) NA enhanced user support, technical studies, education and outreach	NA Executive	NA Executive

Through the ALMA Board, the Directors Council, and other international partnership forums, the NA Executive and NRAO have the opportunity to contribute to evolution of the scope and distribution of the budget among the operations elements.

Elements (a) through (c) have been identified by the ALMA partnership as a common set of functions necessary to support operation, maintenance, development, and scientific use of the facility. They are funded by each international partner in proportion to their participation in the project (37.5%, 37.5% and 25% for North America, Europe and East Asia, respectively). Together, these elements form the core ALMA Operations Plan (AOP) which is under the approval authority of the international ALMA Board. The ALMA Parties and ALMA Board have recognized that there will continue to be a maturing of the Operations Plan as experience is gained with the facility. The support functions in element (d) were separated from the AOP and the approval authority of the ALMA Board because those services vary and are provided and funded via disparate routes, not necessarily through the Parties and Executives, in the different regions.

The ALMA Director is responsible for managing day-to-day operations in Chile (element a) within the approved budget.

NRAO is responsible for offsite (outside of Chile) operations activities (elements b and c) under the coordination of the ALMA Director. The budget for elements (a) through (c) is developed annually by the ALMA Director and the Executives under guidance provided by the AOP and the Parties, and is presented to the ALMA Board for approval.

NRAO is responsible for execution of the NA user support and maintenance plans. Offsite user support (element b) includes support for the international observing proposal process, assistance for individual observers in the preparation of their observations, access to the raw and processed data through a NA mirror archive, an on-line helpdesk, and a visiting observer program. Offsite technical support (element b) includes high-level maintenance and repair of the hardware and software delivered to ALMA by the NA Executive. The requirements for this element are described in the current AOP and in statements of maintenance principles and maintenance plans, all of which are included in the Resource Library.

A science-driven program of technical and facility upgrades and the development of new capabilities is recognized as important to maintain ALMA as a state-of-the-art facility for millimeter/submillimeter astronomy. NRAO is responsible for oversight of projects conducted under the NA development program. A statement of development principles is included in the Resource Library. NRAO periodically issues solicitations for development projects which may be conducted within or outside NRAO and in partnership with

domestic and international institutions. There are three NA development projects currently underway: a phased-ALMA capability as the high-sensitivity component of a mm-wavelength Very Long Baseline Interferometry (VLBI) network, contributions to the ESO-led Band 5 (163-211GHz) receiver project, and a high-bandwidth fiber-optic link between the ALMA site and the city of Calama.

For reference, the ALMA Board-approved (calendar year) 2013 budget for elements (a) through (c) is $68,330,000 of which the NA share is $25,623,750. To this NA share NRC Herzberg (Canada) contributed approximately $1,100,000 and in-kind operations support. The NA development program budget is planned to ramp up from about $2,200,000 in 2013 to a steady-state level of about $5,700,000 in 2015. However, as the cost of Chilean operations and maintenance and support needs may evolve and fluctuate, for example due to exchange rates, the specific budgets for the individual elements are tensioned within the overall envelope.

Element (d) may encompass a variety of activities such as support for NA user community data processing; science and technical workshops; tutorials and educational resources for users; postdoctoral and student programs; and an education and public outreach program. In addition, NRAO periodically issues solicitations for development concept studies in order to seed the primary development program. As with the primary development program, these studies may be conducted within or outside NRAO. NRAO is responsible for their oversight. The scope of element (d) activities is constrained by the available budget and tensioned against the budgets for Chilean operations, technical and core user support, and the development program. Subject to these constraints, it is envisioned that the budget for element (d) activities will be approximately 20% of the total.

The overall budget target under this award for the NSF-supported component of FY 2017 NA ALMA operations is $43,250,000, which includes all aspects of management and operations (elements a through d) and excludes support from NA partners. The cost of providing power (generated on-site at ALMA) is yet to be finalized in steady-state operations but is recognized to be larger than envisioned in the AOP. The additional cost of power is provided for within this overall NA budget.

For the purposes of proposal preparation only, the FY2017 ALMA budget target of $43,250,000 may be allocated between the four elements of scope as follows: (a) core operations in Chile $19,750,000; (b) core NA technical and user support $11,000,000; (c) NA development program $4,500,000; (d) NA enhanced user support, technical studies, education and outreach $8,000,000.

A.3 Overview of the VLA

The VLA is the world's leading centimeter-wavelength radio telescope. It consists of twenty-seven 25m antennas in a Y-shaped reconfigurable array located on the Plains of San Agustin, fifty miles west of the headquarters and support facilities at the Pete V. Domenici Science Operations Center (DSOC) in Socorro, New Mexico. Originally constructed in the 1970s, the VLA completed a major overhaul in early 2013 including a new suite of 1-50GHz receivers, a digital data collection and transmission system, a flexible wide-bandwidth correlator provided by NRC Herzberg, and a financial contribution from the National Autonomous University of Mexico (UNAM). The improvement over previous performance is up to a factor of 10 in continuum sensitivity and coarsest frequency resolution, and a factor of 1000 or more in finest frequency resolution and the number of frequency channels. Full science operations were initiated in January 2013. Development and scientific commissioning of advanced correlator modes is continuing.

The VLA is a general-purpose facility, providing observing capabilities complementary to ALMA and explicitly addressing four primary science themes: measuring the strength and topology of cosmic magnetic fields; imaging young stars and massive black holes in dust-enshrouded environments; following the rapid evolution of energetic phenomena; and studying the formation and evolution of stars, galaxies and active galactic nuclei. Annually the VLA receives about 500 observing proposals from over 1000 users. Approximately 200 refereed papers are published with VLA data each year.

The VLA Visitor Center houses educational exhibits, a small theater, and a gift shop.

The Resource Library includes the close-out report from the expanded VLA construction project and a summary of maintenance, upgrade, and enhancement plans.

A.4 Components of VLA Operations

Funding for the VLA under this award encompasses all aspects of management and operations. These include the scientific, technical, and administrative functions necessary to maintain, operate, and develop the array and its infrastructure, to support the user community, and to conduct an education and public outreach program. As with ALMA, the VLA is intended to be a telescope usable by all astronomers, not just interferometry experts. Most astronomers use the telescope remotely. User support activities include conducting an observing proposal and time allocation process; assisting users with observation preparation and data processing; and data quality control, access, and archiving. As constrained by the available budget, user support activities may also include science and technical workshops, tutorials and educational resources for users, and postdoctoral and student programs.

The budget target under this award for FY 2017 VLA operations is $29,500,000.

A.5 NRAO Development Laboratories

The operating facilities are supported and enriched by associated development laboratories. A Central Development Laboratory (CDL) is currently located in Charlottesville, Virginia, with other development activities located in Socorro, New Mexico.

The development laboratories provide technical expertise for the maintenance and repair of the existing instrumentation and conduct a science-driven program of research and development in critical technologies needed for the next generation instrumentation and facilities. The technologies include signal processing, digitization of receiver systems, cryogenic phased array feeds, cluster computing, and parallel processing of large datasets and data processing algorithms. Technology development is conducted in close partnership with the astronomy community in universities and institutes in the U.S. and abroad.

The budget target under this award in FY 2017 for the development laboratories is $2,500,000, excluding work performed for ALMA (described in A.2). Funding for major development projects would need to be sought separately from eligible NSF programs such as the Mid-Scale Innovations Program in Astronomical Sciences, or from other funding sources.

A.6 NRAO Administration and Management

Administration and management is currently based in Charlottesville, Virginia, with some cross-observatory as well as local functions performed at the NRAO sites. The administration and management activities include business services, procurements, human resources, environment, safety and health, site management, and the office of the Director.

Funding for all administrative and management functions is provided for within the budget targets stated for ALMA, the VLA, and the development laboratories.

B. Description of Awardee Responsibilities

B.1 Core Expectations

As the NRAO managing organization, the Awardee will work closely with NSF and the scientific research community to ensure that, within available resources, NRAO supports, sustains, and advances frontier science as enabled by NRAO's unique research capabilities and as promoted through a culture of excellence. The Awardee will be accountable for fulfilling the NRAO mission through a visionary strategy that capitalizes on the federal investment to serve the scientific community and to promote world-class research and education. The NRAO program should embody the NSF Vision: *a Nation that creates and exploits new concepts in science and engineering and provides global leadership in research and education.*

The Awardee will be responsible for the overall management and performance of NRAO, including the infrastructure, instrumentation and staff, and for maximizing the benefits to the scientific research community within available resources through a strategically planned scope of activities. In discharging these responsibilities, the Awardee will ensure that NRAO maintains its character as a multi-user facility that enables first-rate research conducted by its user community.

In cooperation with NSF and within available resources, the Awardee will plan and execute a viable, coherent, and inclusive program of multi-user research and education, consistent with the objectives and priorities of the scientific community. The Awardee will manage facilities and equipment provided by NSF and by domestic and international partners; will provide additional facilities and equipment as necessary to fulfill the proposed programmatic scope; and will provide expert support and technical personnel to manage and operate NRAO as a well-integrated, forefront facility for research and education. The Observatory is a multi-user resource; as such, a significant portion of the NRAO research and education program should be carried out in collaboration with its stakeholder communities.

NSF intends that NRAO should serve as an exemplar of management excellence. The Awardee will be expected to meet the highest standards for service and delivery to the scientific community and to demonstrate proactive and effective approaches to planning, performance management, and workforce management. The Awardee will ensure that NRAO operates with integrity and transparency while maintaining quality and responsiveness in administration and management.

B.2 Statement of Work

Overall Management Concept

The Awardee will define and implement a management approach that will provide vision, leadership, and service to manage NRAO as a vibrant, community-serving, multi-user facility for research and education. Models and approaches for observatory management should be consistent with the prioritized goals of the scientific community (as articulated in community-based reports such as the astronomy and astrophysics Decadal Survey), with the needs of the NRAO user community, and with the requirements described in this solicitation. Organizational structures for NRAO management and operations may include the establishment of new institutions, corporations, or consortia, provided that the proposing organization(s) provide materials in support of the financial capability of the Awardee(s), as required in Section V.B.

Consistent with the proposed vision, goals, and objectives for NRAO, the Awardee will establish and maintain an effective governance and advisory structure to provide guidance, advice, and oversight for all NRAO activities. The Awardee's advisory structure should enable diverse representation from all sectors served by NRAO, and should include mechanisms to assess and advise on all aspects of NRAO, including large facility management and operations, research, education and outreach, technical capabilities, data management, project management, and human resources and workforce development.

The Awardee will establish processes within a structured framework for budgeting, planning, review, and performance management, including the development and use of appropriate mechanisms to measure, assess, and improve organizational performance in all functional areas. The Awardee's planning and performance management processes will provide transparency to NSF and to NRAO stakeholder communities of NRAO's activities and achievements versus established plans, milestones, and objectives.

As appropriate, the Awardee will develop partnerships or arrangements, for example with universities/colleges, national laboratories, research museums, private sector research laboratories and observatories, industry, state and local government laboratories, and international collaborations, that enable NRAO to attain its strategic goals. Partner institutions may invest intellectual or other resources in NRAO activities and work collaboratively with the Awardee and NSF to ensure that NRAO fulfills all aspects of its mission. The Awardee is responsible for planning, operating, and managing all NRAO activities, including contributions provided by partnering organizations.

Programs using NRAO resources, including non-NSF-funded activities, must be consistent with the NRAO mission and complement and enhance activities funded and approved by NSF. Voluntary committed cost sharing is prohibited.

The Awardee is responsible for complying with all applicable laws of the location in which it operates. Accordingly, proposers should seek their own counsel regarding the laws of Chile. As a starting point, proposers should familiarize themselves with Chile law No. 15,172 and No. 17,318 and consider conducting provisional consultations with an appropriate representative of the University of Chile. Other laws with which proposers should also familiarize themselves include, but are not limited to, Chile laws regarding labor and employment.

Specific Duties

The Awardee will:

- Define and implement a management approach that provides vision, leadership, and service to manage NRAO as a forefront, community-serving, multi-user research and education facility.
- Conduct all aspects of NRAO management and operations with integrity and transparency, in a cost-effective manner according to current best practices, and in full compliance with all relevant laws and regulations.
- Establish and maintain an effective governance and advisory structure to provide guidance, advice, and oversight for all NRAO activities, consistent with the Awardee's articulated vision, goals, and objectives.
- Develop and employ effective mechanisms for engaging NRAO's full range of stakeholders to ensure that NRAO's facilities, services, and programs best reflect the evolving needs and priorities of its users.
- Articulate to all stakeholders a strategic plan for NRAO that sustains and advances a vibrant program of NRAO operations consistent with the long-term goals of the scientific research community.
- Implement a consistent, integrated, and resource-based planning process for NRAO, documented through: the strategic plan; a long-range plan that implements the strategic plan on a five-year time horizon; and an annual program operating plan.
- Develop and implement appropriate mechanisms, including both qualitative and quantitative performance measures, for assessing and continuously improving the performance of NRAO and of the Awardee's execution of responsibilities.
- Seek and implement strategic partnerships with U.S. universities, federal, non-federal, and international entities that will enhance the scientific capabilities and support available to NRAO's stakeholder communities.
- Support research programs of other federal agencies that may wish to utilize NRAO facilities or staff through approved interagency funding agreements with NSF.

Manage complementary programs supported by sponsors other than NSF as appropriate to supporting the NRAO mission.
- Function as the NA Executive in accordance with ALMA international agreements; affirm to the Parties that it has immunities, prerogatives, privileges, and facilities in Chile, granted by the Government of Chile, in all matters relevant to the ALMA international agreements and in particular in matters arising out of the employment of the local staff in Chile.

Science and Facility Planning

The Awardee will define a scientific program for NRAO that demonstrates responsiveness to community-based scientific objectives, an innovative vision built on existing and potential capabilities of NRAO, a well-defined scope of high-priority activities, and a credible plan for establishing the necessary resources to support the proposed suite of activities.

As defined by the proposed science program, the Awardee will ensure that NRAO has sufficient facilities and internal or external scientific and technical expertise to (1) support outside users, (2) help guide decisions relating to current and future instrumentation and observing modes, (3) develop and maintain data acquisition and data processing software, (4) develop and implement policies and strategies for data accessibility and data archiving, and (5) validate data through on-going research programs.

The Awardee will ensure that observing time is available on a competitive basis to qualified scientists after evaluation of research proposals on the basis of scientific merit, of the capability of the instruments to do the work, and of the availability of the telescope(s) during the requested time.

The Awardee will ensure that partnership agreements, which may dedicate blocks of user time in exchange for financial, personnel, or other in-kind contributions to NRAO, are both consistent with the NRAO mission and justified in their overall benefits to the NRAO user community and to the broader scientific research community.

Specific Duties

The Awardee will:

- Develop, articulate, and execute a competitive, prioritized, and inclusive science program of user-driven research enabled by NRAO that reflects the mission, core values, and goals articulated in the NSF Strategic Plan, and that demonstrably furthers the community-based research goals articulated by the scientific disciplines served by NRAO.
- Provide through the NRAO staff, facilities, and services the support necessary for the conduct of proposal-driven research by the NRAO user community, as judged through appropriate merit review mechanisms.
- Provide upgrades, enhancements, and new services, as required and within available resources, to ensure community access to state-of-the-art facilities and user support.
- Develop and incorporate new capabilities, instruments, techniques, and software for astronomical observations, data analysis, and data utilization that exploit NRAO facilities and that encourage the development of astronomical researchers with instrumentation knowledge, experience, and interest.

Organization and Operations

The Awardee will be responsible for staffing, operating, and managing NRAO to ensure that on-site instruments and facilities are available for use in support of high-priority scientific research conducted by qualified scientists. To this end the Awardee will implement its strategic plan for maintaining a viable, community-driven scope of observatory operations and will employ mechanisms for reviewing and scheduling user access through an open process that minimizes conflicts of interest and demonstrates NSF core values of merit review.

The Awardee will locate, or relocate, and maintain facilities for observatory support functions. The Awardee will maintain all parts of the NRAO infrastructure that are necessary to meet the proposed operations activities, to enable the attainment of program objectives, and for the safety and security of staff and visitors. The Awardee will be responsible for budgeting, scheduling, and tracking comprehensive safety, environmental compliance, and maintenance plans for all parts of the NRAO infrastructure, including plans, as appropriate, to remove or dispose of those parts of the infrastructure deemed unnecessary for the proposed level of operations.

Additionally, the Awardee will be responsible for managing radio frequency interference (RFI) and frequency licensing and certifications. The Awardee must maintain a vigilant awareness of the radio frequency environment of NRAO telescopes through a program of RFI monitoring, and to the extent possible take all appropriate steps to mitigate the impact of such signals on the observational mission of NRAO. The Awardee will cooperate with NSF's efforts to shape national and international regulations and policies for the purpose of maintaining a manageable RFI environment in which to conduct NRAO science operations.

The Awardee will provide a data management plan that describes the acquisition, analysis, archiving, and accessibility of all NRAO data, including the definition of proprietary periods and appropriate cyberinfrastructure and cybersecurity to meet the proposed scope of user community support.

Specific Duties

The Awardee will:

- Implement a business plan for the management and operation of NRAO that adheres to best practice standards for managing the general operations and workforce of a complex scientific organization.
- Staff, manage, operate, administer, maintain, and develop NRAO within available resources and in accordance with strategic, long-range, and annual program operating plans approved by NSF.
- Maintain all parts of the NRAO infrastructure necessary to enable the proposed operations activities and for the safety and security of staff and visitors.
- Integral to both annual and long-range planning for NRAO, define and implement comprehensive plans for safety, environmental compliance, and infrastructure maintenance, renewal, and disposition.
- Build, operate, maintain, and advance NRAO observational capabilities, computational infrastructure, and databases; make these available to the scientific user community while ensuring that the primary criterion for their utilization is the scientific merit of the proposed research as judged by appropriate, merit-based review processes.
- Serve as stewards of high-quality scientific data on behalf of the user community, through maintenance, enhancement, and curation; provide and maintain a data management plan and cybersecurity plan that describe the acquisition, analysis, archiving, and accessibility of all NRAO data, including the definition of proprietary periods and appropriate cyberinfrastructure and cybersecurity to meet the proposed scope of user-community support.
- Monitor and mitigate RFI at NRAO observational facilities; manage frequency licensing and certifications; cooperate with NSF to shape national and international regulations and policies relevant to electromagnetic spectrum management and to NRAO science operations.
- Transfer developed technology to the U.S. Government and to the private sector as appropriate.
- Work mutually with the other ALMA Executives to achieve excellent and efficient operations of ALMA; exercise leadership

and responsibility for assigned tasks in cooperation with the other Executives and the ALMA Director.
- Delegate the necessary authorities to the ALMA Director to act on behalf of the NA Executive within legal constraints and in accordance with ALMA international agreements.
- Receive, track, and maintain records of NA ALMA contributions; forward such records with appropriate evaluations to the ALMA Director to enable him/her to fulfill all reporting requirements to the Director´s Council and to the ALMA Board.
- Carry out the decisions of the ALMA Board and of the Director´s Council.
- Issue contracts for goods and services upon request of the ALMA Director.
- Ensure that all ALMA equipment and infrastructure can be examined by the Parties upon reasonable request, including at times before it has been made available to ALMA and accepted by the JAO.
- Report regularly to the ALMA Board at all times when in the judgment of the Executives such reporting is warranted.
- Establish, manage, and operate the ALMA Regional Center providing NA Offsite Operations Activities for ALMA.

Human Resources, Workforce and Diversity

The Awardee will recruit, retain, develop, and support an expert scientific, engineering, technical, and administrative staff, consistent with the NSF strategic goal of cultivating a world-class, broadly inclusive science and engineering workforce. Proposing organizations may consider the retention of, and may propose as Key Personnel, NRAO staff currently employed by Associated Universities, Inc.

NSF anticipates that an active scientific staff will be necessary to support the telescopes and the external user community. Within available funding, the Awardee will justify, support, and monitor a level of internal research activity that is commensurate with providing expert operational and user support.

As the NA Executive is currently designated as solely responsible for employment of the local staff in Chile on behalf of the ALMA partnership, the Awardee will be required to offer employment to all extant local staff members, subject to agreement by the ALMA partnership.

As a national resource for research and education, NRAO offers significant potential to enable the participation of traditionally underrepresented and underserved communities in the mission of the Observatory and to strengthen the growth of an inclusive scientifically and technically trained workforce. The Awardee will demonstrate leadership in employing best practices for broadening participation in science and engineering at all levels within NRAO's activities.

Specific Duties

The Awardee will:

- Attract, employ, support, and advance a high-quality and diverse scientific, engineering, technical, and administrative staff, as necessary to support the NRAO mission within the proposed programmatic scope, and that demonstrably supports the community-based research and education carried out at NRAO.
- Manage the NRAO staff according to current best practices in human resources management and in full compliance with all relevant laws, regulations, and agreements.
- Provide the NRAO staff with continued training, career advancement, and performance assessment to maintain quality and relevance in its professional skills and expertise.
- Support the education and development of the future workforce for astronomical sciences including, in particular, those groups that are underrepresented in the U.S. workforce for science, technology, engineering, and mathematics.
- As required for ALMA operations in Chile, employ and administer all JAO local staff and the JAO international staff assigned to the NA Executive.
- As sole employer of the JAO local staff in Chile on behalf of the ALMA partnership,
    - ensure that all decisions having financial consequences are consistent with the budget planning projections of the JAO and the other Executives and inform the ALMA Director about those decisions;
    - comply with and conform to the requirements of Chilean labor legislation;
    - coordinate with the ALMA Director on all interactions with the Chilean Government on issues related to the local staff;
    - coordinate with the ALMA Director and other ALMA Executives on all policy matters concerning employment including staffing levels, recruitment process, employment and working conditions, remuneration and social security, health and safety, and training;
    - accept full and exclusive liability for payment of any and all contributions or taxes which are measured by wages, salaries, or other remuneration paid to the local staff under the contracts of employment or which arise by virtue of their employment and which are imposed by the Government of Chile or its agency;
    - provide regular reports to all Parties, Executives, and the ALMA Director regarding significant developments concerning local staff.

Education and Outreach Plan

The Awardee will articulate and conduct a vigorous, coherent program of education, public outreach, and community development activities that utilizes the knowledge and discoveries made at NRAO and that strengthens education and public awareness of radio astronomy and related engineering and technology. To promote and support these activities, the Awardee will establish and develop strategic alliances with appropriate local, national, and international organizations to build on existing programs, institutions, and infrastructure and to develop innovative approaches to increase NRAO's educational and media impact. The Awardee will promote opportunities across NRAO for effective and inclusive educational experiences, such as mentored student involvement in NRAO research and development activities, an engaging public outreach and visitor program, and professional development programs for educators in K-12, undergraduate, and graduate education. The Awardee will be responsible to develop and implement an innovative, integrated program of research and education that builds on NRAO's scientific and organizational strengths to advance NSF strategic goals.

Specific Duties

The Awardee will:

- Integrate research and education through a strategic, expert-led program of education and public outreach that leverages and emphasizes the unique contributions of NRAO and that is incorporated fully into NRAO planning and operations.
- Develop organizational partnerships to enhance the design, impact, and reach of NRAO education and outreach activities.
- Identify and meet the needs of researchers and educators in contributing to improving teaching and learning in pre-college, undergraduate, graduate, and postdoctoral education.
- Work with NSF in a cooperative effort to inform the public about NRAO facilities, programs, and accomplishments through press releases and other public media and announcements.
- Actively support the NSF strategic goal of cultivating a world-class, broadly inclusive science and engineering workforce and expanding the scientific literacy of all citizens.

Transition Plan

The Awardee will define and execute a budgeted, scheduled, and tracked project plan to manage any transition from the current to the proposed model for NRAO management and operations of VLA, ALMA, and associated support functions and development laboratories. The transition period will commence with a transition award on or after 1 April 2016 and conclude no later than 6 months thereafter. The award for NRAO management and operations will commence on 1 October 2016. If applicable, during the transition period the Awardee will coordinate and cooperate with the incumbent to the extent necessary to facilitate uninterrupted support for NRAO and will accept transfer of responsibility for relevant property and equipment.

Specific Duties

The Awardee will:

- Prepare and effectively implement and track a project execution plan ("transition plan"), approved by NSF, which details all transition activities from inception of award to the acceptance of full responsibility for management and operation of NRAO.
- Facilitate uninterrupted support of observatory operations throughout the transition period, in cooperation with NSF and the incumbent.
- Prepare to assume responsibility for NRAO operational functions as transferred from the incumbent according to the proposed and NSF-approved transition plan and schedule.
- Manage the identification, communication, assessment, prioritization, and mitigation/remediation of risks associated with transition activities.
- Prepare and implement a communication and reporting structure to inform all participants and stakeholders of transition activities and of progress relative to the transition plan.

C. General Information

For additional information on NRAO (inclusive of VLA, ALMA and associated support functions and development laboratories), the NRAO management competition, NSF practices and policies, and access to the Resource Library, please contact the Cognizant Program Officers.

Proposing organizations should review documents that are being made available through the NSF-maintained Resource Library, including:

- The current NRAO Annual Progress Report and Program Operating Plan,
- The current cooperative agreement and cooperative support agreements for the management and operation of NRAO, and
- A detailed list of property for which the current Awardee is responsible.

Additional documents describing specific aspects of NRAO are referenced in the Program Description and are available in the Resource Library.

Access to the Resource Library will be provided to proposing organizations upon request to the Cognizant Program Officers. Any additional materials and information relating to this solicitation, including NSF responses to frequently asked questions and requests for information, will be made available through the Resource Library as appropriate.

Informational Site Visit

For representatives of potential proposing organizations, NSF intends to conduct site visits to NRAO headquarters and the Central Development Laboratory in Charlottesville, Virginia; to the Very Large Array and support facilities in Socorro, New Mexico; to the ALMA headquarters in Santiago, Chile, and to the ALMA site near San Pedro de Atacama, Chile. The visits are expected to take place in July and August 2014, prior to the required submission of Letters of Intent, and will be guided and managed by NSF staff. This will be an opportunity for potential proposers to view the buildings, facilities and equipment, and to acquire information relevant to the development of a proposal. Attendees will be responsible for their own expenses.

Eligible organizations that are interested in submitting a proposal and wish to send representatives to one or more of the site visits should email the Cognizant Program Officers no later than June 30, 2014.

III. AWARD INFORMATION

The successful proposal will be awarded as a cooperative agreement, with separate cooperative support agreements for non-ALMA and ALMA activities. These agreements are expected to have a ten-year duration for operations contingent on the successful outcome of regular reviews of facility operations, research and education activities, and management performance.

NSF funding for NRAO operations and management is anticipated at an initial level of $75,250,000 in FY 2017 and with a profile that adopts, for planning purposes only, an escalation of 3.0% per annum:

FY 2017	$75,250,000
FY 2018	$77,508,000
FY 2019	$79,833,000
FY 2020	$82,228,000
FY 2021	$84,695,000
FY 2022	$87,235,000
FY 2023	$89,852,000
FY 2024	$92,548,000
FY 2025	$95,324,000
FY 2026	$98,184,000

The profile adopts an escalation factor derived from consideration of projections for inflation factors for U.S. wage earners and including the complexities of planning operating costs in Chile with Chilean inflation and legal requirements for employee salary increases. The escalation is intended to maintain a constant level of purchasing power.

The profile is for planning purposes only. Actual annual funding increments will be determined on the basis of annual program

operating plans submitted by the Awardee to NSF and approved by NSF and the ALMA Board, subject to the availability of appropriated funds and to the performance of both the Awardee and NRAO.

In this solicitation, NRAO may be considered to consist of several components as described in the following sections: ALMA; VLA; CDL and other development laboratories; and associated administration and management functions. The budget targets under this award in FY 2017 are $43,250,000 (ALMA), $29,500,000 (VLA), and $2,500,000 (development laboratories), for a total of $75,250,000. Administration and management costs are included in these amounts. In order to ensure appropriate financial and management oversight and tracking, it is envisioned that the award will be made as one cooperative agreement with two separate cooperative support agreements, one for ALMA and the other for VLA plus development laboratories. The cooperative agreement will be the umbrella agreement of the awards and the cooperative support agreements will cover specific terms and conditions for ALMA and VLA plus development laboratories.

The overall budget target under this award for the NSF-supported component of FY 2017 NA ALMA operations is $43,250,000, which includes all aspects of management and operations and excludes support from NA partners. For the purposes of proposal preparation only, the FY 2017 ALMA budget target of $43,250,000 may be allocated between the four elements of scope as follows: (a) core operations in Chile $19,750,000; (b) core NA technical and user support $11,000,000; (c) NA development program $4,500,000; (d) NA enhanced user support, technical studies, education, and outreach $8,000,000.

To support any transition from the current to the proposed model of NRAO management and operations, NSF will fund additional, appropriate transition costs through a cooperative support agreement with the Awardee for a transition period of up to six months preceding the ten year award period for operations. Relevant transition activities include, but are not limited to, interviewing and hiring personnel, assigning subcontracts, relocating observatory support functions, transferring data and property, obtaining permits and licenses, and developing management agreements with the other ALMA Executives. During this transition period, the Awardee will have appropriate access to NRAO and ALMA personnel and facilities.

IV. ELIGIBILITY INFORMATION

Who May Submit Proposals:

Proposals may only be submitted by the following:

- Universities and Colleges - Universities and two- and four-year colleges (including community colleges) accredited in, and having a campus located in, the US acting on behalf of their faculty members. Such organizations also are referred to as academic institutions.
- Non-profit, non-academic organizations: Independent museums, observatories, research labs, professional societies and similar organizations in the U.S. associated with educational or research activities.
- For-profit organizations: U.S. commercial organizations, especially small businesses with strong capabilities in scientific or engineering research or education.

Who May Serve as PI:

There are no restrictions or limits.

Limit on Number of Proposals per Organization:

There are no restrictions or limits.

Limit on Number of Proposals per PI or Co-PI:

There are no restrictions or limits.

Additional Eligibility Info:

Collaborative proposals submitted simultaneously from multiple organizations requesting separate awards (as described in GPG Section II.D.4.b) will not be accepted. Proposals for the management and operation of NRAO may be submitted by U. S. academic institutions, non-profit organizations, for-profit organizations, or consortia thereof, subject to the qualifications outlined in the Grant Proposal Guide (GPG).

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

Letters of Intent *(required)*:

Each proposing organization must submit a Letter of Intent through FastLane.

Letters of Intent will be used by NSF to ensure that the appropriate expertise is available for participation in the review and selection process, to foresee potential conflicts of interest, and to anticipate special award conditions that may be necessary to accommodate the proposed organizational and governance structure. The Letter of Intent is a statement of a proposer's preliminary plans; the senior personnel, collaborating or partnering organizations, and proposed plans may change between submission of the Letter of Intent and submission of the Full Proposal.

Full Proposals may be submitted only by organizations that have submitted a Letter of Intent by the due date.

Letter of Intent Preparation Instructions:

Complete submission of a Letter of Intent (LOI) requires two separate components that must each be submitted prior to the LOI due date.

FastLane LOI Component-Via Fastlane, submit the following LOI information:

- Project Title
- Synopsis (a brief abstract of maximum 2,500 characters of plain text)
- Point of Contact for NSF Inquiries
- Project PI Information
- Participating Organizations

Submission of this component via FastLane will produce an **LOI ID** that must be included in the PDF LOI Component described below.

PDF LOI Component-Via an email to the Cognizant Program Officers, submit a document of no more than 8 pages in Portable Document Format (PDF) that addresses the following:

- a description of the proposed organizational and governance structure for the NRAO managing organization, including the identification of all collaborating and partnering institutions and their roles in the managing organization;
- a list that identifies full names and affiliations of proposed Key Personnel, including all PIs, co-PIs, and senior personnel;
- a description of the organization's overall management concept for NRAO;
- a description of the strategic vision for the organization's fulfillment of the NRAO mission;
- a brief synopsis of the organization's proposed approach to conducting business in Chile;
- a description of the major elements of the organization's transition plan and estimated resources needed for assuming management of NRAO;
- a brief synopsis of the past performance history of the organization.

The PDF document should include the FastLane **LOI ID** in a running header and must be consistent with NSF Grant Proposal Guide formatting guidelines (NSF GPG Section II.B).

When submitting a Letter of Intent in response to this Program Solicitation please note the conditions outlined below:

- Submission by an Authorized Organizational Representative (AOR) is required when submitting Letters of Intent.
- Other Participating Organizations are allowed
- Submission of multiple Letters of Intent is not allowed

Full Proposal Preparation Instructions: Proposers may opt to submit proposals in response to this Program Solicitation via Grants.gov or via the NSF FastLane system.

- Full proposals submitted via FastLane: Proposals submitted in response to this program solicitation should be prepared and submitted in accordance with the general guidelines contained in the NSF Grant Proposal Guide (GPG). The complete text of the GPG is available electronically on the NSF website at: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpg. Paper copies of the GPG may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from nsfpubs@nsf.gov. Proposers are reminded to identify this program solicitation number in the program solicitation block on the NSF Cover Sheet For Proposal to the National Science Foundation. Compliance with this requirement is critical to determining the relevant proposal processing guidelines. Failure to submit this information may delay processing.
- Full proposals submitted via Grants.gov: Proposals submitted in response to this program solicitation via Grants.gov should be prepared and submitted in accordance with the NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov. The complete text of the NSF Grants.gov Application Guide is available on the Grants.gov website and on the NSF website at: (http://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantsgovguide). To obtain copies of the Application Guide and Application Forms Package, click on the Apply tab on the Grants.gov site, then click on the Apply Step 1: Download a Grant Application Package and Application Instructions link and enter the funding opportunity number, (the program solicitation number without the NSF prefix) and press the Download Package button. Paper copies of the Grants.gov Application Guide also may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from nsfpubs@nsf.gov.

By submission of the proposal, the organization has determined that the proposed activity is administratively manageable. NSF may request a revised proposal, however, if it considers that the project is so complex that it will be too difficult to review or administer as presented.

Due to the complexity of the proposals being submitted, use of FastLane to prepare and submit proposals is strongly encouraged.

The Full Proposal shall conform to the guidelines specified in the NSF Grant Proposal Guide or the NSF Grants.gov Application Guide, except where detailed below.

Proposers are reminded to review procedures under "Proprietary or Privileged Information" in Chapter 1, Section D.3 of the GPG and to mark only such information, including patentable ideas, trade secrets, privileged or confidential commercial or financial information, disclosure of which might harm the proposer, with the appropriate legend such as, "The following is (proprietary or confidential) information that (name of proposing organization) requests not be released to persons outside the Government, except for purposes of review and evaluation." Please also see the section entitled "Privacy Act and Public Burden Statements" below.

The following information is required for the Full Proposal:

PI/co-PI Information - This should follow the standard GPG or NSF Grants.gov Application Guide guidelines.

Cover Sheet - A cover sheet must be submitted and electronically signed by an Authorized Organizational Representative for all full proposals.

Project Summary - This section should provide a one-page summary of the key points of the proposal and should be understandable to a scientifically or technically literate lay reader. This section must follow the standard GPG or NSF Grants.gov Application Guide guidelines. Proposals that do not separately address both NSF merit review criteria (Intellectual Merit and Broader Impacts) within the one-page Project Summary will be returned without review.

References Cited - This section should follow the standard GPG or NSF Grants.gov Application Guide guidelines.

Biographical Sketches - A résumé, limited to 2 pages, should be provided for the PI, each co-PI, and other Key Personnel. At a minimum, each résumé should include a description of the individual's education and professional preparation, academic/professional appointments, products, and synergistic activities as required in GPG Section II.C.2.f.i.(a)-(d). GPG guidelines on order and format of this section of the proposal do not apply.

Budget - See the instructions in Section B, below.

Current and Pending Support - This section should follow the standard GPG or NSF Grants.gov Application Guide guidelines.

Facilities, Equipment and Other Resources - This section should follow the standard GPG or NSF Grants.gov Application Guide guidelines.

Supplementary Documentation - Except as specified in this solicitation (e.g., the required transition plan and other required appendices) and in the GPG (see Section II.C.2.j), special information and supplementary documentation must be included as part of the Project Description (or as part of the budget justification), if it is relevant to determining the quality of the proposed work. Exceptions include, but are not limited to, documentation of collaborative arrangements of significance to the proposal through letters of commitment; the required submission of a Data Management Plan; and the required submission of a Postdoctoral Researcher Mentoring Plan for each proposal that requests funding to support postdoctoral researchers.

Single Copy Documents - Information for the two items below should be entered via the Single Copy Documents section in Fastlane as "Additional Single Copy Documents." This information is required by NSF for determining conflicts of interest in the review process. The information includes the names of Project Personnel and the names of Collaborators and other Individuals with Conflicts.

- ***Project Personnel***: Provide the full names and affiliations of the PI, each co-PI and all other Key Personnel, as well as department heads and other members of the management team.
- ***Collaborators/Individuals with Conflicts of Interest*:** Provide the names of all persons, participants and affiliates with potential conflicts of interest as specified in Section II.C.2.f.i.(e) of the GPG. For each person, enter the first name, last name, and institutional affiliation(s). For each person listed on the project personnel list include all co-authors/editors and collaborators (within the past 48 months); list all graduate advisors and advisees; list individuals who would act as external advisory committee members for NRAO; list all subcontractors who would receive funds through the award.

In the Single Copy Documents section in Fastlane, each proposing organization must also provide a **Financial Capability** statement, as described in Section V.B below.

Project Description (including Results from Prior NSF Support) - This section of the Full Proposal should contain the information specified in the GPG and below, in the order listed, and be limited to no more than 100 pages. Where noted below, necessary resource material may be marked separately as an Appendix to the proposal and submitted as Supplementary Documentation (see below). Such material is not subject to, or included in, the 100-page limit.

The Project Description should address the proposing organization's scientific, technical, administrative, and managerial qualifications to operate NRAO, including a description of relevant prior experience in managing and operating complex scientific/technical organizations. The Project Description should demonstrate how the proposing organization would efficiently and effectively fulfill each of the Awardee responsibilities articulated in Section II of this solicitation, including the following (1-7):

1. Overall Management Concept

Discuss the proposing organization's strategic vision and management approach to fulfilling the NRAO mission. Describe the nature and role of the managing organization, including governance and advisory structures for NRAO, and provide a detailed plan for each of the following:

- Employing effective mechanisms for engaging NRAO's primary stakeholders at all levels to ensure that the facilities, services, and programs best reflect the evolving needs and priorities of stakeholder science communities;
- Developing and implementing an NRAO strategic plan that is reassessed and maintained in response to ongoing community input and emerging needs;
- Developing annual program and long-range plans for NSF review that would present the objectives, plans, and priorities for NRAO, including scientific, technical, managerial, and operational aspects;
- Processes for budgeting, planning, review, and performance management within a structured framework, including establishing and implementing effective performance management for both the managing organization and NRAO;
- Implementing strategic partnerships with U.S. universities/colleges, federal, non-federal, and/or international entities that would enhance the overall scientific and support capabilities available to the entire community;
- Establishing and conducting business in Chile; and
- Achieving buy-in of NRAO vision and goals from stakeholders and employees.

Proposals should describe the nature of any planned collaborations or partnerships and the added value to the observatory and to NSF-supported science. The commitment of collaborating or partnering institutions should be demonstrated through letters of commitment, memoranda of agreement, or other supporting documents (submitted as Supplementary Documentation, see below) that indicate the potential roles of partners and their intent to commit to the partnership. Proposals should carefully justify plans for collaborations or partnerships in which multiple institutions take on substantive roles in supporting, managing, or operating NRAO. Voluntary committed cost sharing is prohibited.

2. Science and Facility Planning

Provide an initial five-year (FY 2017-21) long-range plan for NRAO, showing how the managing organization would develop and execute a prioritized program of services, facilities, and user-driven research that would support and enhance the astronomical and related scientific communities. Identify the major research instruments to be made available to the observing community and the primary scientific objectives that drive the programmatic scope of the long-range plan. The plan must explain how the management of NRAO would be directed toward accomplishing scientific objectives and how the priorities for these objectives would be determined. Include sufficient detail for reviewers to evaluate how work would be accomplished and identify the resources to be used.

Describe the measures that would be employed to ensure that the NRAO strategic plan and the long-range plan would optimally continue to meet the needs of NRAO's primary stakeholders, as well as the types of opportunities and/or information that would be made available to help ensure equitable access among the scientific research community. The long-range plan must include details of how NRAO's ongoing core programs and existing commitments would be sustained and supported during the initial period of the agreement, or managed through strategic changes during the Transition Plan and subsequent award period. Describe the integration of projects within NRAO and the multidisciplinary mix needed to achieve the goals articulated in the long-range plan, and discuss how any significant barriers would be overcome.

3. Organization and Operations

Describe the proposed approach for staffing, operating, and managing NRAO, including details for each of the following:

- Organizational structure for the managing organization and NRAO, including detailed staffing plans, roles, and lines of authority, communications, and accountability. Describe the management and oversight of each facility and of each significant program area.
- Organization, management and oversight of the ALMA offsite (outside of Chile) operations activities (ALMA operations elements b, c and d as described in Section II.A.2), including NA user support, maintenance, and the NA development program. Proposal of specific development items for ALMA is outside the scope of this solicitation.
- Providing the space and equipment necessary for effective performance (in coordination with NSF), including the proposed locations and facilities for observatory support functions;
- Providing strategic logistics support for short- and long-term science initiatives;
- Operating and maintaining advanced observational facilities in support of NSF-funded science in full compliance with all applicable laws and regulations;
- Plans for implementing and monitoring compliance with relevant environmental regulations, risk management, and health and safety;
- Mechanisms for reviewing and scheduling user access through a process that demonstrates NSF core values of merit review;
- A data management plan that describes the acquisition, analysis, archiving, and accessibility of all NRAO data, including the definition of proprietary periods and adequate cyberinfrastructure, connectivity, and cybersecurity to meet the proposed scope of user community support; and
- Plans for managing radio frequency interference (RFI) and frequency licensing and certifications.

Include a clear, specific discussion of how the proposed organizational, operational, and staffing model is aligned with both the strategic vision for NRAO and the initial long-range plan of science and education activities to be supported by NRAO.

4. Human Resources, Workforce and Diversity

Describe the proposed techniques for recruiting and developing an expert scientific, engineering, technical, and administrative staff, consistent with the NSF strategic goal of cultivating a world-class, broadly inclusive science and engineering workforce. Proposing organizations may identify specific individuals for key staffing positions, or present clear plans for seeking and hiring highly qualified individuals for those positions. Include details of the following:

- Personnel qualifications, to include appropriate expertise in the multiple sciences and professions required to support the NRAO mission and the proposed programmatic scope;
- The organization's minimum qualifications for all managerial and supervisory positions should be provided in an Appendix;
- Résumés for the PI, each co-PI, and other Key Personnel should be provided in the Biographical Sketches section of the proposal (see above). Résumés for other personnel who would occupy key positions, and be specified in the awarded agreement, may be provided in an Appendix. The submission of résumés for additional qualified personnel is encouraged as appropriate. Attached in an Appendix, a signed letter of commitment for a minimum initial duration of twelve months should be provided by each individual named as Key Personnel;
- Policies and practices to be employed in recruiting, developing, managing, and evolving an expert scientific, technical, and administrative staff with the skill sets appropriate for a national scientific multi-user facility that is subject to annual funding appropriations;
- Strategy for the recruitment, development, and retention of staff from underrepresented groups, including people with disabilities, and the promotion of diversity among the workforce, students, and researchers; and
- The approaches to be taken (e.g., the relative proportions of permanent and temporary positions, use of visiting scientist posts, cooperative education and/or student placements, level of internal research efforts) to ensure that NRAO supports a sufficiently stable, expert workforce, while encouraging vigor and innovation through its personnel policies.

5. Education and Outreach Plan

Provide a vibrant, innovative and inclusive plan for education and outreach that is closely integrated with the programs and activities described in the science and facility plan. As stated in the Awardee expectations, the education and outreach plan should engage the public and develop the Nation's intellectual talent—including groups underrepresented in the sciences, technology, engineering, and mathematics—in the conduct of NRAO research and education activities.

Include details of involvement in international, national, regional, and local programs; development of strategic partnerships; the use of visitor facilities; and the promotion of diversity in NRAO education and outreach activities. The education and outreach plan should articulate clear goals and objectives, as related to the NRAO mission and to the science and facility plan, and identify the resources and expertise necessary to achieve them. The plan should identify mechanisms for formative and summative assessment of educational programs and a strategic vision for attaining the stated goals.

6. Transition Plan

To manage any transition from the current to the proposed model for NRAO management and operations of VLA, ALMA, and associated support functions and development laboratories, proposing organizations may be funded for an initial transition period of up to six months preceding the ten-year operations award. If a new Awardee is selected to operate NRAO, the incumbent will cooperate with the successor to the extent necessary to facilitate uninterrupted support for NRAO during the transition period and will provide transfer of legal rights to relevant property and equipment.

All proposing organizations should provide, as a Supplementary Document not to exceed 25 pages, a detailed transition plan, budget, and budget justification for a transition period of up to six months.

The transition plan must include, at a minimum:

- A proposed duration, schedule, and plan for critical transition activities from inception of award to the acceptance of full responsibility for management and operation of NRAO;
- Estimated resource needs for the transition period;
- Plans for recruitment, orientation, and training;
- Plans for changes to staffing, facilities, and/or operational modes;
- A plan to acquire office infrastructure and manage the transfer of assets, inventory, commitments, plans, and documents;
- The proposed approach to conducting business in Chile including acquiring all necessary legal certifications and approvals;
- Identification of assumptions and risks that underlie the transition plan; and
- Plans for communication and reporting to transition participants and stakeholders.

7. Other Supporting Materials

Within the 100-page limit of the Project Description, the proposing organization may provide additional material that it believes will be of assistance in evaluating the proposal but that does not fit into any of the defined sections above.

B. Budgetary Information

Cost Sharing:

Inclusion of voluntary committed cost sharing is prohibited.

Other Budgetary Limitations:

Proposing organizations may include a fixed annual management fee in their proposed budget, and must include a brief justification for the fee in the budget justification. The management fee must be clearly identified as such.

Budget Preparation Instructions:

The full proposal should include a budget for each year of the ten-year operational period (FY 2017-26) proposed. The first-year budget should total $75,250,000. Each subsequent year should be escalated by 3% per year. FastLane and Grants.gov will automatically provide a cumulative budget.

The proposal should provide all staffing and budgeting information needed to describe how the organization would fulfill the Awardee responsibilities in Section II of this solicitation. Requested budget amounts for each year of the proposal should reflect the level considered necessary to perform the NSF-funded activities described in the proposal. Proposers should also be cognizant of budget constraints implied by the estimated funding levels provided under Section III.

A budget justification, not to exceed 20 pages, should be submitted in support of the budgets for the first five years only and shall be in sufficient detail and with stated basis of estimate to show how the proposer reached the amounts specified in the budget. NSF anticipates performing a detailed cost analysis of the successful proposal budget.

Enter the anticipated total level of subcontract support on line G5, Subawards, of the FastLane budget or line F5 of the R&R Budget Form in Grants.gov. Full proposals require the inclusion of separate budgets for subcontracts that exceed $250,000 per year. For subcontracts that would be less than $250,000 year, include the costs in the aggregate on the subaward line in the budget.

All proposing organizations must also provide a detailed budget for a transition period of up to six months preceding the award for full NRAO operations. This information must be provided in an Appendix labeled **Transition Budget** and submitted as Supplementary Documentation. The budget must be presented in the same style with all applicable budget line items as for the budget for each year of the proposal. If a new Awardee is selected to manage and operate NRAO, the incumbent will cooperate with the successor to the extent necessary to facilitate uninterrupted support for NRAO during the transition period and will provide transfer of legal rights to relevant property and equipment.

The transition budget should not include non-renewal costs of the incumbent, including medical insurance, severance pay, or other costs incurred by the incumbent under the current cooperative agreement, including costs related to the nonrenewal of subcontracts. If a new operator is selected, the incumbent may submit to NSF costs related to the cooperative agreement non-renewal, and these costs will be considered separately.

In an Appendix labeled **Financial Capability,** entered via the Single Copy Documents section of FastLane under "Additional Single Copy Documents," proposing organizations must provide the following in support of the organization's financial condition and capability:

- A detailed structure and plan for implementing and monitoring business systems and internal controls for financial management and accounting, property standards, equipment standards, procurement standards, reporting, and records management.
- Total compensation plan setting forth proposed salaries and fringe benefits for professional employees, with supporting information such as recognized national and regional compensation surveys, and studies of professional, public, and private organizations used in establishing the total compensation structure.
- If available, the organization's annual audited financial statements (e.g. Balance Sheet, Profit and Loss Statement, and Annual Reports) for the three most recent fiscal years and/or other documentation to clearly explain its current financial strength and resource capability.
- A current indirect cost rate proposal and supporting financial data. If the organization's indirect cost rates have been approved by another Federal agency, provide copies of such agreements. NSF does not participate in or contribute to the cost of Independent Research and Development (IR&D) and such costs shall bear a proportionate share of overhead and G&A costs; therefore, IR&D costs should be excluded from indirect expense pools and included in the appropriate distribution bases. If the organization has no IR&D costs, a statement to that effect should be included with the indirect cost rate proposal;
- A current Cost Accounting Standards Board (CASB) Disclosure Statement or Cost Policy Statement.

Organizations that have not previously received NSF awards should review the NSF Prospective New Awardee Guide http://www.nsf.gov/pubs/policydocs/pnag/nsf1162.pdf for additional guidance in preparing their budget submission.

C. Due Dates

- **Letter of Intent Due Date(s)** ***(required)*** (due by 5 p.m. submitter's local time):

  September 04, 2014

- **Full Proposal Deadline(s)** (due by 5 p.m. submitter's local time):

  November 25, 2014

D. FastLane / Grants.gov Requirements

For Proposals Submitted Via FastLane:

To prepare and submit a proposal via FastLane, see detailed technical instructions available at: https://www.fastlane.nsf.gov/a1/newstan.htm. For FastLane user support, call the FastLane Help Desk at 1-800-673-6188 or e-mail fastlane@nsf.gov. The FastLane Help Desk answers general technical questions related to the use of the FastLane system. Specific questions related to this program solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this funding opportunity.

For Proposals Submitted Via Grants.gov:

Before using Grants.gov for the first time, each organization must register to create an institutional profile. Once registered, the applicant's organization can then apply for any federal grant on the Grants.gov website. Comprehensive information about using Grants.gov is available on the Grants.gov Applicant Resources webpage: http://www.grants.gov/web/grants/applicants.html. In addition, the NSF Grants.gov Application Guide (see link in Section V.A) provides instructions regarding the technical preparation of proposals via Grants.gov. For Grants.gov user support, contact the Grants.gov Contact Center at 1-800-518-4726 or by email: support@grants.gov. The Grants.gov Contact Center answers general technical questions related to the use of Grants.gov. Specific questions related to this program solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this solicitation.

Submitting the Proposal: Once all documents have been completed, the Authorized Organizational Representative (AOR) must submit the application to Grants.gov and verify the desired funding opportunity and agency to which the application is submitted. The AOR must then sign and submit the application to Grants.gov. The completed application will be transferred to the NSF FastLane system for further processing.

Proposers that submitted via FastLane are strongly encouraged to use FastLane to verify the status of their submission to NSF. For proposers that submitted via Grants.gov, until an application has been received and validated by NSF, the Authorized Organizational Representative may check the status of an application on Grants.gov. After proposers have received an e-mail notification from NSF, Research.gov should be used to check the status of an application.

VI. NSF PROPOSAL PROCESSING AND REVIEW PROCEDURES

Proposals received by NSF are assigned to the appropriate NSF program for acknowledgement and, if they meet NSF requirements, for review. All proposals are carefully reviewed by a scientist, engineer, or educator serving as an NSF Program Officer, and usually by three to ten other persons outside NSF either as *ad hoc* reviewers, panelists, or both, who are experts in the particular fields represented by the proposal. These reviewers are selected by Program Officers charged with oversight of the review process. Proposers are invited to suggest names of persons they believe are especially well qualified to review the proposal and/or persons they would prefer not review the proposal. These suggestions may serve as one source in the reviewer selection process at the Program Officer's discretion. Submission of such names, however, is optional. Care is taken to ensure that reviewers have no conflicts of interest with the proposal. In addition, Program Officers may obtain comments from site visits before recommending final action on proposals. Senior NSF staff further review recommendations for awards. A flowchart that depicts the entire NSF proposal and award process (and associated timeline) is included in the GPG as Exhibit III-1.

A comprehensive description of the Foundation's merit review process is available on the NSF website at: http://www.nsf.gov/bfa/dias/policy/merit_review/.

Proposers should also be aware of core strategies that are essential to the fulfillment of NSF's mission, as articulated in *Investing in Science, Engineering, and Education for the Nation's Future: NSF Strategic Plan for 2014-2018*. These strategies are integrated in the program planning and implementation process, of which proposal review is one part. NSF's mission is particularly well-implemented through the integration of research and education and broadening participation in NSF programs, projects, and activities.

One of the strategic objectives in support of NSF's mission is to foster integration of research and education through the programs, projects, and activities it supports at academic and research institutions. These institutions must recruit, train, and prepare a diverse STEM workforce to advance the frontiers of science and participate in the U.S. technology-based economy. NSF's contribution to the national innovation ecosystem is to provide cutting-edge research under the guidance of the Nation's most creative scientists and engineers. NSF also supports development of a strong science, technology, engineering, and mathematics (STEM) workforce by investing in building the knowledge that informs improvements in STEM teaching and learning.

NSF's mission calls for the broadening of opportunities and expanding participation of groups, institutions, and geographic regions that are underrepresented in STEM disciplines, which is essential to the health and vitality of science and engineering. NSF is committed to this principle of diversity and deems it central to the programs, projects, and activities it considers and supports.

A. Merit Review Principles and Criteria

The National Science Foundation strives to invest in a robust and diverse portfolio of projects that creates new knowledge and enables breakthroughs in understanding across all areas of science and engineering research and education. To identify which projects to support, NSF relies on a merit review process that incorporates consideration of both the technical aspects of a proposed project and its potential to contribute more broadly to advancing NSF's mission "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense; and for other purposes." NSF makes every effort to conduct a fair, competitive, transparent merit review process for the selection of projects.

1. Merit Review Principles

These principles are to be given due diligence by PIs and organizations when preparing proposals and managing projects, by reviewers when reading and evaluating proposals, and by NSF program staff when determining whether or not to recommend proposals for funding and while overseeing awards. Given that NSF is the primary federal agency charged with nurturing and supporting excellence in basic research and education, the following three principles apply:

- All NSF projects should be of the highest quality and have the potential to advance, if not transform, the frontiers of

knowledge.
- NSF projects, in the aggregate, should contribute more broadly to achieving societal goals. These "Broader Impacts" may be accomplished through the research itself, through activities that are directly related to specific research projects, or through activities that are supported by, but are complementary to, the project. The project activities may be based on previously established and/or innovative methods and approaches, but in either case must be well justified.
- Meaningful assessment and evaluation of NSF funded projects should be based on appropriate metrics, keeping in mind the likely correlation between the effect of broader impacts and the resources provided to implement projects. If the size of the activity is limited, evaluation of that activity in isolation is not likely to be meaningful. Thus, assessing the effectiveness of these activities may best be done at a higher, more aggregated, level than the individual project.

With respect to the third principle, even if assessment of Broader Impacts outcomes for particular projects is done at an aggregated level, PIs are expected to be accountable for carrying out the activities described in the funded project. Thus, individual projects should include clearly stated goals, specific descriptions of the activities that the PI intends to do, and a plan in place to document the outputs of those activities.

These three merit review principles provide the basis for the merit review criteria, as well as a context within which the users of the criteria can better understand their intent.

2. Merit Review Criteria

All NSF proposals are evaluated through use of the two National Science Board approved merit review criteria. In some instances, however, NSF will employ additional criteria as required to highlight the specific objectives of certain programs and activities.

The two merit review criteria are listed below. **Both** criteria are to be given **full consideration** during the review and decision-making processes; each criterion is necessary but neither, by itself, is sufficient. Therefore, proposers must fully address both criteria. (GPG Chapter II.C.2.d.i. contains additional information for use by proposers in development of the Project Description section of the proposal.) Reviewers are strongly encouraged to review the criteria, including GPG Chapter II.C.2.d.i., prior to the review of a proposal.

When evaluating NSF proposals, reviewers will be asked to consider what the proposers want to do, why they want to do it, how they plan to do it, how they will know if they succeed, and what benefits could accrue if the project is successful. These issues apply both to the technical aspects of the proposal and the way in which the project may make broader contributions. To that end, reviewers will be asked to evaluate all proposals against two criteria:

- **Intellectual Merit:** The Intellectual Merit criterion encompasses the potential to advance knowledge; and
- **Broader Impacts:** The Broader Impacts criterion encompasses the potential to benefit society and contribute to the achievement of specific, desired societal outcomes.

The following elements should be considered in the review for both criteria:

1. What is the potential for the proposed activity to
    a. Advance knowledge and understanding within its own field or across different fields (Intellectual Merit); and
    b. Benefit society or advance desired societal outcomes (Broader Impacts)?
2. To what extent do the proposed activities suggest and explore creative, original, or potentially transformative concepts?
3. Is the plan for carrying out the proposed activities well-reasoned, well-organized, and based on a sound rationale? Does the plan incorporate a mechanism to assess success?
4. How well qualified is the individual, team, or organization to conduct the proposed activities?
5. Are there adequate resources available to the PI (either at the home organization or through collaborations) to carry out the proposed activities?

Broader impacts may be accomplished through the research itself, through the activities that are directly related to specific research projects, or through activities that are supported by, but are complementary to, the project. NSF values the advancement of scientific knowledge and activities that contribute to achievement of societally relevant outcomes. Such outcomes include, but are not limited to: full participation of women, persons with disabilities, and underrepresented minorities in science, technology, engineering, and mathematics (STEM); improved STEM education and educator development at any level; increased public scientific literacy and public engagement with science and technology; improved well-being of individuals in society; development of a diverse, globally competitive STEM workforce; increased partnerships between academia, industry, and others; improved national security; increased economic competitiveness of the United States; and enhanced infrastructure for research and education.

Proposers are reminded that reviewers will also be asked to review the Data Management Plan and the Postdoctoral Researcher Mentoring Plan, as appropriate.

Additional Solicitation Specific Review Criteria

For this solicitation, the following additional and specific review criteria will be used in the evaluation of proposals.

For **Full Proposals**, reviewers will be asked to identify and analyze the following:

- Strengths and weaknesses of the proposed approach, and qualifications of the managing organization, to fulfill the Awardee responsibilities identified in Section II;
- Opportunities and potential benefits that the proposed approach presents for NRAO;
- Risks to the future success of NRAO in the proposer's approach that are not satisfactorily addressed; and
- Cost reasonableness and cost efficiency of the proposed approach.

Reviewers will consider the following specific criteria in each of the areas below, as well as the integration of these areas into a coherent and viable management and operations plan for NRAO.

1. Overall Management Concept

Reviewers will consider:

- the quality, relevance, and extent of the proposing organization's strategic vision for fulfillment of the NRAO mission;
- the outcomes of the proposing organization's prior experience in managing complex scientific/technical organizations;
- the viability of the organization's management strategy to maintain and develop NRAO's position as a world-class, multi-user facility;
- the proposed role of the managing organization in relation to NRAO, NRAO stakeholders, and NSF;
- the extent and quality of the plan to engage NRAO's multi-user community in planning, research, education, and development of relevant instruments and technology;
- the suitability, credibility, and risks of proposed partnerships and their added value to NRAO and to NSF-supported science,

education, and outreach;
- the applicability of proposed methodologies for identifying, estimating, and prioritizing future requirements, including demonstrated awareness of potential directions of the relevant sciences and responsiveness to stated needs and ambitions of the user community;
- the adequacy of the proposed methods and processes for budgeting and planning in a complex organization; and
- the sufficiency and potential efficacy of the proposed methodology for measuring, assessing, and improving the performance of both the managing organization and NRAO.

2. Science and Facility Planning

Reviewers will consider:

- the degree to which the proposed scientific programs, services, priorities and technical capabilities reflect the needs of NRAO stakeholder communities and utilize the unique research capabilities of NRAO;
- the scope, feasibility, and innovation of the planned activities;
- the ability to respond to and prioritize evolving scientific and engineering needs and opportunities in the community;
- the suitability of proposed mechanisms to ensure broad and equitable access to NRAO among the relevant scientific research communities; and
- the extent to which the plan targets critical goals relevant to the NRAO strategic vision, identifies challenging scientific and technical questions or barriers to be overcome, proposes high-quality research emphases to address the stated goals, and reflects appropriate and effective use of resources.

3. Organization and Operations

Reviewers will consider:

- the correspondence of the proposed approach with available funding and with the organization's strategic vision for fulfillment of the NRAO mission;
- the feasibility, relevance to NRAO stakeholders, and potential for success of the proposed approach, including:
    - organizational structure, inclusive of staffing plans, roles, lines of authority, communications and accountability, and alignment with proposed research and education activities,
    - organization, management, and oversight of ALMA offsite operations,
    - location of observatory support functions,
    - provision of space and equipment,
    - mechanisms for user access,
    - logistics support for scientific initiatives,
    - data management and information technology,
    - management of radio frequency interference,
    - technology transfer,
    - environmental compliance,
    - risk management, and
    - maintenance, safety, and security of systems and facilities.

4. Human Resources, Workforce and Diversity

Reviewers will consider:

- the adequacy and appropriateness for fulfilling the NRAO mission of the organization's identified key personnel, proposed labor categories and qualifications, employment policies, and level of internal research effort;
- the viability of the proposed approach for employee performance management in sustaining a motivated workforce aligned with current organizational needs; and
- the suitability and potential for success of the proposed methods for recruitment and retention, invigorating and developing the workforce, promoting diversity and inclusion at all levels in the organization, and infusing best practices in NRAO human resource management.

5. Education and Outreach Plan

Reviewers will consider:

- the extent and quality of the proposed education and outreach programs, their potential for success, and the resulting impacts on identified target audiences;
- the appropriateness of proposed organizational partnerships and their potential to enhance the design, impact, and reach of NRAO education and activities;
- the relevance of the proposed plan to engage and develop intellectual talent, including groups underrepresented in the sciences, mathematics, and engineering, in the conduct of NRAO research, education, and operational support activities;
- the effectiveness of the plan to engage local, regional, national, and international audiences in NRAO activities and the extent to which the knowledge and discoveries made at NRAO will be used to strengthen public awareness of NRAO-related science; and
- the adequacy of the proposed plan to assess and improve NRAO education and outreach activities as based on defined goals and objectives.

6. Transition Plan

The Transition Plan will be evaluated to assess the proposing organization's ability to assume full responsibility for the management and operation of NRAO upon completion of the transition period without degradation of high-quality services, research efforts, and facilities.

7. Other Supporting Materials

Materials provided in this section will be considered by reviewers to help form an overall impression of the proposal in relation to the Awardee responsibilities identified in Section II.

Budget and Financial Review

NSF will assess the proposing organization's budgetary and financial information as requested under Section V.B of this solicitation. The organization will be assessed for the adequacy of its internal accounting and operational controls (including human resources, property control, and procurement systems), potential for attracting and retaining qualified employees from within relevant labor markets, and the adequacy of its financial resources for managing NRAO. The proposed fee (if any) and proposed direct and indirect

rates will be evaluated for reasonableness and potential impact on funding available for science and related activities. The impact of rates and any proposed fee will be evaluated relative to other organizations' proposed rates and fees.

The business evaluation will be used to help inform the Program Officers' recommendation for award.

B. Review and Selection Process

Proposals submitted in response to this program solicitation will be reviewed by

Ad hoc Review and/or Panel Review, or Reverse Site Review.

The panel review will have access to the ad hoc reviews, and with its own deliberations will formulate an overall evaluation of each proposal. The reviewers will include experts in all areas of consideration as identified in the Additional Solicitation-Specific Review Criteria, including individuals experienced in the management of complex scientific and technical organizations. Following external review, strengths and weaknesses of each proposal as identified by the reviewers will be further evaluated in formal meetings of the proposing organizations with the Cognizant Program Officers and other NSF staff.

Reviewers will be asked to evaluate proposals using two National Science Board approved merit review criteria and, if applicable, additional program specific criteria. A summary rating and accompanying narrative will generally be completed and submitted by each reviewer and/or panel. The Program Officer assigned to manage the proposal's review will consider the advice of reviewers and will formulate a recommendation.

After scientific, technical and programmatic review and consideration of appropriate factors, the NSF Program Officer recommends to the cognizant Division Director whether the proposal should be declined or recommended for award. NSF is striving to be able to tell applicants whether their proposals have been declined or recommended for funding within six months. The time interval begins on the deadline or target date, or receipt date, whichever is later. The interval ends when the Division Director accepts the Program Officer's recommendation.

A summary rating and accompanying narrative will be completed and submitted by each reviewer. In all cases, reviews are treated as confidential documents. Verbatim copies of reviews, excluding the names of the reviewers, are sent to the Principal Investigator/Project Director by the Program Officer. In addition, the proposer will receive an explanation of the decision to award or decline funding.

In all cases, after programmatic approval has been obtained, the proposals recommended for funding will be forwarded to the Division of Acquisition and Cooperative Support for review of business, financial, and policy implications and the processing and issuance of a grant or other agreement. Proposers are cautioned that only a Grants and Agreements Officer may make commitments, obligations or awards on behalf of NSF or authorize the expenditure of funds. No commitment on the part of NSF should be inferred from technical or budgetary discussions with a NSF Program Officer. A Principal Investigator or organization that makes financial or personnel commitments in the absence of a grant or cooperative agreement signed by the NSF Grants and Agreements Officer does so at their own risk.

VII. AWARD ADMINISTRATION INFORMATION

A. Notification of the Award

Notification of the award is made to *the submitting organization* by a Grants and Agreements Officer in the Division of Acquisition and Cooperative Support. Organizations whose proposals are declined will be advised as promptly as possible by the cognizant NSF Program administering the program. Verbatim copies of reviews, not including the identity of the reviewer, will be provided automatically to the Principal Investigator. (See Section VI.B. for additional information on the review process).

B. Award Conditions

An NSF award consists of: (1) the award notice, which includes any special provisions applicable to the award and any numbered amendments thereto; (2) the budget, which indicates the amounts, by categories of expense, on which NSF has based its support (or otherwise communicates any specific approvals or disapprovals of proposed expenditures); (3) the proposal referenced in the award notice; (4) the applicable award conditions, such as Grant General Conditions (GC-1)*; or Research Terms and Conditions* and (5) any announcement or other NSF issuance that may be incorporated by reference in the award notice. Cooperative agreements also are administered in accordance with NSF Cooperative Agreement Financial and Administrative Terms and Conditions (CA-FATC) and the applicable Programmatic Terms and Conditions. NSF awards are electronically signed by an NSF Grants and Agreements Officer and transmitted electronically to the organization via e-mail.

*These documents may be accessed electronically on NSF's Website at http://www.nsf.gov/awards/managing/award_conditions.jsp?org=NSF. Paper copies may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from nsfpubs@nsf.gov.

More comprehensive information on NSF Award Conditions and other important information on the administration of NSF awards is contained in the NSF *Award & Administration Guide* (AAG) Chapter II, available electronically on the NSF Website at http://www.nsf.gov/publications/pub_summ.jsp?ods_key=aag.

Special Award Conditions:

The award associated with this solicitation will be a cooperative agreement, not a standard grant or a contract. Individual cooperative support agreements will be issued under the terms and conditions of the overall agreement. Any special requirements not stated herein will be negotiated at time of award.

Programmatic Terms and Conditions: The cooperative agreement(s) awarded as a result of this competition will be administered by

the NSF Division of Astronomical Sciences. The following measures will be employed in providing oversight for the cooperative agreement:

- Review of quarterly and annual reports, program plans and performance measures;
- Review of facility operations, research and education activities, and management performance. The initial management review will occur within the first four years of the award;
- Site visits annually, or as necessary;
- Virtual and face-to-face meetings with Key Personnel, as necessary.

Financial and Administrative Terms and Conditions: Costs to be reimbursed in accordance with 2 CFR 220 -- Cost Principles for Educational Institutions, 2 CFR 230 -- Cost Principles for Nonprofit Organizations, or Federal Acquisition Regulation (FAR) Part 31, as applicable.

The Awardee will be required to submit to a Business Systems Review at least once during the initial four years of the award.

Standard cooperative agreement terms and conditions, including supplements for managers of NSF-sponsored Federally Funded Research and Development Centers, are available at: http://www.nsf.gov/awards/managing/co-op_conditions.jsp?org=NSF. Specific terms and conditions will be negotiated at time of award.

C. Reporting Requirements

For all multi-year grants (including both standard and continuing grants), the Principal Investigator must submit an annual project report to the cognizant Program Officer at least 90 days prior to the end of the current budget period. (Some programs or awards require submission of more frequent project reports). Within 90 days following expiration of a grant, the PI also is required to submit a final project report, and a project outcomes report for the general public.

Failure to provide the required annual or final project reports, or the project outcomes report, will delay NSF review and processing of any future funding increments as well as any pending proposals for all identified PIs and co-PIs on a given award. PIs should examine the formats of the required reports in advance to assure availability of required data.

PIs are required to use NSF's electronic project-reporting system, available through Research.gov, for preparation and submission of annual and final project reports. Such reports provide information on accomplishments, project participants (individual and organizational), publications, and other specific products and impacts of the project. Submission of the report via Research.gov constitutes certification by the PI that the contents of the report are accurate and complete. The project outcomes report also must be prepared and submitted using Research.gov. This report serves as a brief summary, prepared specifically for the public, of the nature and outcomes of the project. This report will be posted on the NSF website exactly as it is submitted by the PI.

More comprehensive information on NSF Reporting Requirements and other important information on the administration of NSF awards is contained in the NSF *Award & Administration Guide* (AAG) Chapter II, available electronically on the NSF Website at http://www.nsf.gov/publications/pub_summ.jsp?ods_key=aag.

As described below, the Awardee will be required to provide annual management reports and quarterly and annual reports for all NRAO programs, inclusive of VLA, ALMA, and all associated support functions and development laboratories, along with other reports as may be required by NSF. Under the Government Performance and Results Act (GPRA), NSF is required to report on the Federal Performance Goals for Facilities. Any and all facilities with an annual budget exceeding a specific threshold must report on their operations activities; and any and all construction/upgrade projects that exceed a total project cost of a specific threshold must report on their construction/upgrade activities. Therefore, the Awardee will be required, upon request of the cognizant NSF program officer, to submit annual reports related to the GPRA performance goals. This may include the collection and submission of specific data related to the NSF GPRA requirements.

The Awardee shall submit an *Annual Management Report* that describes its performance, separate from that of the facility, against the expectations and statement of work and including performance measures as proposed. This report will be considered as the Annual Report in Research.gov, and the NSF Program Officer's approval of this report will be required prior to issuance of scheduled funding for the next fiscal year.

The Awardee shall submit a *Strategic Plan*, updated approximately every three years, that describes the vision, goals, and objectives for NRAO during the period of the cooperative agreement and in the longer term.

The Awardee shall submit an annual *Program Operating Plan* (POP) for NSF review for each upcoming fiscal year. The POP shall describe the principal activities to be undertaken during the year and include milestones, objectives, targets, deliverables, financial and staffing plans, maintenance plans, key decision points, and anticipated risks and mitigation plans. The POP will serve as a basline for assessing variances between planned and actual activities and for identifying and managing emerging risks and opportunities.

The Awardee shall submit annually a *Long Range Plan* (LRP) that describes the principal activities to be undertaken during the five-year period subsequent to the POP, in order to support the objectives of the Strategic Plan. The LRP will be based on budget guidance provided by NSF.

An *Annual Program Report* for the prior fiscal year shall be submitted for NSF review after the end of each fiscal year. The report shall describe progress against the POP based on milestones, objectives, targets, and deliverables. The report will highlight scientific, technical, and other achievements; describe notable decisions and outcomes; provide financial data, including program income and spending; and present metrics of time allocation, telescope usage, data management, and publications, as well as other performance measures as proposed. Progress on infrastructure maintenance and renewal shall be discussed. Significant variances between planned and actual activities and outcomes shall be described.

Quarterly Status Reports should summarize interim progress during the preceding quarter against the POP and highlight scientific achievements, significant variances between the planned and actual activities, risks and proposed mitigation plans, and ongoing metrics as identified for the Annual Program Report. The quarterly status reports will be in the form of briefings to NSF with the written material from the briefings submitted through Research.gov. The briefings should be held approximately 45 days after the end of a quarter.

In its role as employer of the local staff in Chile, the Awardee shall provide regular reports to the ALMA parties, other Executives, and the ALMA Director regarding significant developments concerning local staff matters.

Early in the transition period, the Awardee will be required to provide a full project execution plan ("transition plan") based on the schedule, budget, and plan described in the proposal. The Awardee shall submit reports no less frequent than monthly on the

status, budget, schedule, and any variances of progress in executing the transition plan.

VIII. AGENCY CONTACTS

Please note that the program contact information is current at the time of publishing. See program website for any updates to the points of contact.

General inquiries regarding this program should be made to:

- Philip J. Puxley, ALMA Program Officer, 1045 S, telephone: (703) 292-7835, email: ppuxley@nsf.gov
- Elizabeth A. Pentecost, 1030 S, telephone: (703) 292-4907, email: epenteco@nsf.gov

For questions related to the use of FastLane, contact:

- FastLane Help Desk, telephone: 1-800-673-6188; e-mail: fastlane@nsf.gov.

For questions relating to Grants.gov contact:

- Grants.gov Contact Center: If the Authorized Organizational Representatives (AOR) has not received a confirmation message from Grants.gov within 48 hours of submission of application, please contact via telephone: 1-800-518-4726; e-mail: support@grants.gov.

IX. OTHER INFORMATION

The NSF website provides the most comprehensive source of information on NSF Directorates (including contact information), programs and funding opportunities. Use of this website by potential proposers is strongly encouraged. In addition, "NSF Update" is an information-delivery system designed to keep potential proposers and other interested parties apprised of new NSF funding opportunities and publications, important changes in proposal and award policies and procedures, and upcoming NSF Grants Conferences. Subscribers are informed through e-mail or the user's Web browser each time new publications are issued that match their identified interests. "NSF Update" also is available on NSF's website.

Grants.gov provides an additional electronic capability to search for Federal government-wide grant opportunities. NSF funding opportunities may be accessed via this mechanism. Further information on Grants.gov may be obtained at http://www.grants.gov.

Related Programs:

Sources of Additional Information:

National Radio Astronomy Observatory:

http://www.nrao.edu

National Science Foundation Strategic Plan:

http://www.nsf.gov/pubs/2014/nsf14043/nsf14043.pdf

National Science Foundation, Astronomical Sciences:

http://www.nsf.gov/div/index.jsp?div=AST

National Science Foundation, Mathematical and Physical Sciences:

http://www.nsf.gov/dir/index.jsp?org=MPS

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NSF funds research and education in most fields of science and engineering. It does this through grants and cooperative agreements to more than 2,000 colleges, universities, K-12 school systems, businesses, informal science organizations and other research organizations throughout the US. The Foundation accounts for about one-fourth of Federal support to academic institutions for basic research.

NSF receives approximately 55,000 proposals each year for research, education and training projects, of which approximately 11,000 are funded. In addition, the Foundation receives several thousand applications for graduate and postdoctoral fellowships. The agency operates no laboratories itself but does support National Research Centers, user facilities, certain oceanographic vessels and Arctic and Antarctic research stations. The Foundation also supports cooperative research between universities and industry, US participation in international scientific and engineering efforts, and educational activities at every academic level.

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The National Science Foundation has Telephonic Device for the Deaf (TDD) and Federal Information Relay Service (FIRS) capabilities that enable individuals with hearing impairments to communicate with the Foundation about NSF programs, employment or general information. TDD may be accessed at (703) 292-5090 and (800) 281-8749, FIRS at (800) 877-8339.

The National Science Foundation Information Center may be reached at (703) 292-5111.

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- **Location:** 4201 Wilson Blvd. Arlington, VA 22230
- **For General Information** (NSF Information Center)**:** (703) 292-5111
- **TDD (for the hearing-impaired):** (703) 292-5090
- **To Order Publications or Forms:**

  Send an e-mail to: nsfpubs@nsf.gov

  or telephone: (703) 292-7827
- **To Locate NSF Employees:** (703) 292-5111

PRIVACY ACT AND PUBLIC BURDEN STATEMENTS

The information requested on proposal forms and project reports is solicited under the authority of the National Science Foundation Act of 1950, as amended. The information on proposal forms will be used in connection with the selection of qualified proposals; and project reports submitted by awardees will be used for program evaluation and reporting within the Executive Branch and to Congress. The information requested may be disclosed to qualified reviewers and staff assistants as part of the proposal review process; to proposer institutions/grantees to provide or obtain data regarding the proposal review process, award decisions, or the administration of awards; to government contractors, experts, volunteers and researchers and educators as necessary to complete assigned work; to other government agencies or other entities needing information regarding applicants or nominees as part of a joint application review process, or in order to coordinate programs or policy; and to another Federal agency, court, or party in a court or Federal administrative proceeding if the government is a party. Information about Principal Investigators may be added to the Reviewer file and used to select potential candidates to serve as peer reviewers or advisory committee members. See Systems of Records, NSF-50, "Principal Investigator/Proposal File and Associated Records," 69 Federal Register 26410 (May 12, 2004), and NSF-51, "Reviewer/Proposal File and Associated Records," 69 Federal Register 26410 (May 12, 2004). Submission of the information is voluntary. Failure to provide full and complete information, however, may reduce the possibility of receiving an award.

An agency may not conduct or sponsor, and a person is not required to respond to, an information collection unless it displays a valid Office of Management and Budget (OMB) control number. The OMB control number for this collection is 3145-0058. Public reporting burden for this collection of information is estimated to average 120 hours per response, including the time for reviewing instructions. Send comments regarding the burden estimate and any other aspect of this collection of information, including suggestions for reducing this burden, to:

Suzanne H. Plimpton
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