



NORTH AMERICAN ARC
ALMA Regional Center

North American
ALMA Science
Center



Development Upgrades of the Atacama Large Millimeter/submillimeter Array (ALMA)

Call for Study Proposals

This Call is to invite proposals to conduct studies of ideas that may be further developed and implemented in a subsequent funding cycle. The primary aims of this Call for Study Proposals are to:

- encourage the flow of development ideas from the North American ALMA community into the ALMA Development Program Plan;
- support the development of conceptual and detailed designs by the North American ALMA community for possible future inclusion in the ALMA Development Program Plan; and
- support ALMA-relevant, long-term research and development by the North American community.

The completed Studies will be used, together with similar studies from the other ALMA partners, to prepare and implement the ALMA Development Plan. Limited funding is available from NRAO to support North American-based studies and will be allocated on a competitive basis. Studies partly or fully supported from external sources are also solicited and, if presented, will be considered in the preparation of the ALMA Development Plan.

SECTION 1.0 ALMA DEVELOPMENT PROGRAM

1.1 PROGRAM DEFINITION

The Atacama Large Millimeter/submillimeter Array (ALMA), an international astronomy facility, is a partnership of Europe, North America and East Asia in cooperation with the Republic of Chile. ALMA is funded in Europe by the European Organization for Astronomical Research in the Southern Hemisphere (ESO), in North America by the U.S. National Science Foundation (NSF) in cooperation with the National Research Council of Canada (NRC) and the National Science Council of Taiwan (NSC), and in East Asia by the National Institutes of Natural Sciences (NINS) of Japan in cooperation with the Academia Sinica (AS) in Taiwan.

ALMA construction and operations are led on behalf of Europe by ESO, on behalf of North America by the National Radio Astronomy Observatory (NRAO), which is managed by Associated Universities, Inc. (AUI), and on behalf of East Asia by the National Astronomical Observatory of Japan (NAOJ). The Joint ALMA Observatory (JAO) provides the unified leadership and management of the construction, commissioning and operation of ALMA. The JAO coordinates the ALMA Development Program, its' goal being to effectively manage the technological evolution of the ALMA facility. Periodically, solicitations ("calls") are issued by each of the international partners to identify and fund development initiatives ("upgrades") which will enhance the performance of the ALMA facility. The implementation of ALMA upgrades will be assigned on a competitive basis.

Upgrade priorities are science-driven, and are established by the collective input from the ALMA Science Advisory Committee (ASAC), the ALMA Development Steering Committee (ADSC), and their respective subcommittees. Upgrades typically progress through three successive phases of development, and correspond to an increasing level of technology readiness. The principal phases are:

- a. conceptual study (including scientific justification, specification, and outline costing);
- b. prototype/pre-production; and
- c. full production and implementation.

The North American ALMA partnership typically funds conceptual studies (hereafter referred to as "Studies") every year. Prototype/pre-production and full production initiatives (hereafter referred to as "Projects") are typically funded every two (2) years. Calls for Projects will be governed by, and conducted through, a different (albeit similar) process. All members of the North American ALMA partnership, and the North American radio astronomy community at-large, are invited to participate in the ALMA Development Program.

In this context, this Call solicits Study proposals for the FY2016 program cycle. Applicants may answer this Call by requesting full (or partial) support to conduct a Study or by stating their intention to submit an ALMA upgrade study based on existing work, perhaps funded from other sources. NRAO/AUI will oversee this process on behalf of the North American partnership. This document, together with the accompanying "*Conditions Governing the Call for Study Proposals*" provides all information required to prepare and submit a Study Proposal.

In the context of this Call, goals are expressed as general capabilities, and the content of a Study Proposal should represent a potential solution to one, or more, of these goals.

The FY2016 Call for Study Proposals seeks to enhance, or develop new means to, the following general capabilities:

- sensitivity,
- angular resolution,
- field of view,
- spectral coverage,

- simultaneous frequency coverage,
- imaging quality,
- accuracy of amplitude,
- accuracy of phase,
- accuracy of polarization,
- flexibility, and
- usability.

While Proposers are encouraged to align their interests with these goals (general capabilities), they should not be construed as hard constraints. Novel ideas for new or enhanced scientific capabilities are welcome.

1.3 CURRENT PROGRAM STATUS

The first North American ALMA Development Program cycle began in FY2012. Six (6) Studies were funded and two Studies were accepted on a “no cost” basis; i.e. work is performed and provided as an “in kind” contribution. Three of the six (3 of 6) funded Studies were internal (North American ALMA partnership) awards; the other three (3) were external awards to various academic institutions. All of the funded completed at the end of FY2013 (September 30, 2013).

The Second North American ALMA Development Program cycle began in FY2014. Six (6) Studies were funded. Three of the six (4 of 6) funded Studies were internal (North American ALMA partnership) awards; the other three (3) were external awards to various academic institutions. Three of the funded completed in December 2014 while three seek no cost extensions to complete their studies.

The North American ALMA Development Program seeks to maintain a portfolio of Studies that balances internal and external awards, technology readiness, cost, and risk.

SECTION 2.0 CALL FOR FY 2016 STUDY PROPOSALS

The release date for the FY2016 Call for Study Proposals is March 16, 2015. The period of performance for funded Studies will run from the award date (August 30, 2015) to no later than September 30, 2016 (approximately one year).

Proposers are requested to submit a **Notice of Intent by May 17, 2015.**

The closing date is June 12, 2015. Proposals received after the closing date may be rejected, at NRAO’s sole discretion.

Further details are can be found in the “Conditions Governing the Call for Study Proposals” (available at <https://science.nrao.edu/facilities/alma/alma-development-2015/call-for-proposals-study> refer to the “Proposal Documents” table).

2.1 ELIGIBILITY

NRAO welcomes proposals or expressions of interest from members of the North

American partnership and the at-large, North American radio astronomy community (U.S. Canada and Taiwan). Collaborative efforts are encouraged.

Proposers who do not require financial support to complete the Study are also invited to respond to this Call. If no support is requested, the final Study will be subject to review in the same manner as funded proposals before being considered for inclusion in the ALMA Development Plan.

2.2 FUNDING

Award pool – a total of one million U.S. dollars (\$1.0M) is available for funding Studies during the FY2016 Development Program cycle (subject to the FY2015 Federal Budget and allocation of funds). As a guideline, the NRAO expects to fund several Studies. No individual Study will be funded in excess of two hundred thousand U.S. dollars (\$200K).

Disclaimer - the entirety of available funds will not necessarily be awarded; acceptance of the Study proposal and granting an Agreement for the Study does not imply that the upgrade will be implemented at the Observatory as part of the ALMA Development Plan. Nor, if selected as part of the Development Plan, will the institution or consortium which carried out the Study be automatically selected to undertake the next phase of the development process.

SECTION 3.0 VIABILITY OF PROPOSALS

3.1 STUDY CATEGORIES

The North American ALMA Development Program seeks to maintain a portfolio of Studies that also balances development of:

- a. **advanced techniques** – for example, advanced data processing/analysis tools, advanced calibration methods, or innovative observing modes;
- b. **advanced hardware** – for example, advanced receiver cartridge components, cryogenic cooling apparatus, or test and measurement equipment; and
- c. **advanced software** – for example, advanced user interfaces, data reduction and analysis routines, or data imaging routines.

The FY2016 Call does not emphasize, or prefer, one Study category over another.

3.2 STUDY PROPOSAL CONTENT

Viable proposals will define an approach, or approaches, to new or enhanced scientific capabilities of the ALMA Observatory. The manner of approach may be direct (by enabling new science) or indirect (e.g., by improving operations efficiency or calibration accuracy). The Call does not identify specific science cases to be addressed by the Study, nor does it include a set of technical specifications. These topics must form part of the proposal itself.

Potential Studies may vary enormously in terms of scientific gain, technical maturity, difficulty, cost, and timescale. Very different levels of detail will therefore be appropriate

for the Studies. In any case, the Study Proposal (Proposal Form and Study Plan combined) should not exceed twenty (20) pages in length.

Detailed instructions on how to prepare and submit a Study Proposal are set forth in the Study Proposal Form, the Study Plan template, and in the document “*Conditions Governing the Call for Study Proposals*”. All of these resources are available at <https://science.nrao.edu/facilities/alma/alma-development-2015/call-for-proposals-study> (refer to the “Proposal Documents” table).

3.3 SELECTION CRITERIA

Selection of Proposals will be made using an evaluation matrix (or “scorecard”) based on the following criteria:

- alignment with 2030 Pathway to developing ALMA;
- strength of the scientific case for the proposed ALMA upgrade concept;
- quality of the upgrade conceptual design;
- technology readiness (the aim is to support a range of upgrades including both those which can be implemented rapidly and those requiring longer-term research and development);
- strength of the consortium organization (if applicable);
- qualifications of key personnel;
- technical expertise, past experience and technical facilities in the Institutes taking part in the Study;
- assessed level of risk inherent in the proposed design (the aim is to support a range of upgrades including both those which are judged to be low risk, high reward and those judged to be high risk, high reward); and
- strength of the scientific team supporting the Study.

SECTION 4.0 CONTRACTUAL REQUIREMENTS

4.1 FEDERAL FUNDING ACCOUNTABILITY AND TRANSPARENCY ACT (FFATA) COMPLIANCE

Each successful Proposer (hereafter referred to as the “Offerer”) will be a subrecipient to Federal Award number AST-0836064, entitled “*Management and Operation of the National Radio Astronomy Observatory FY 2010-2015*”, a Cooperative Agreement awarded to Associated Universities, Inc. by the National Science Foundation. The Federal Award is identified under Code of Federal Domestic Assistance (CFDA) number 47.049, Mathematical and Physical Sciences, for R&D.

Subrecipients awarded twenty-five thousand dollars U.S. (\$25K) or more (likely all Subrecipients) will be required to complete a *Federal Funding Accountability and Transparency Act (FFATA) Subrecipient Profile Questionnaire* so NRAO can report subaward information to the FFATA Subrecipient Reporting System (FSRS) website, in accordance with the FFATA Act of 2006, the associated 2008 amendment, and the OMB Memorandum dated August 27, 2010.

The *FFATA Subrecipient Profile Questionnaire* is available for review at <https://science.nrao.edu/facilities/alma/alma-development-2015/call-for-proposals-study> refer to the “Supporting Documents” table).

4.2 TERMS AND CONDITIONS

The principal Institution associated with each selected Proposal will be required to engage with the NRAO by means of a *Subrecipient Agreement* (available for review at <https://science.nrao.edu/facilities/alma/alma-development-2015/call-for-proposals-study>; refer to the “Supporting Documents” table). This Agreement is subject to Article 8.a.4 of the current and future NSF Cooperative Agreement Financial & Administrative Terms and Conditions (CA-FATC) and as such, requires Subrecipients to follow the Federal laws, regulations, and provisions of the Federal Award. Subrecipients will also be bound by supplemental requirements imposed by the NRAO (and negotiated amendments thereto).

4.3 REPRESENTATIONS AND CERTIFICATIONS

The principal Institution associated with each selected Proposal will be required to complete a Representations & Certifications Form (available for review at <https://science.nrao.edu/facilities/alma/alma-development-2015/call-for-proposals-study>; refer to the “Supporting Documents” table). The completed form will represent and certify that the information provided (topics listed below) is current, accurate, and complete:

- labor surplus area status,
- type of business organization,
- Taxpayer Identification Number (TIN),
- Regular Dealer-Manufacturer classification,
- business size and type classification,
- Standard Industrial Classification (SIC) code, and
- compliance with other, miscellaneous Federal Acquisition Regulations.

The completed form becomes a part of the Purchase Order.

4.4 PURCHASE ORDERS

A single, fixed-price, Purchase Order (PO) will be issued for each selected Study. The PO will establish delivery and payment schedules; the latter based upon a mutually agreeable set of progress milestones. The Offerer shall commit to perform the Statement of Work (approved Study Proposal) in accord with first-class trade practice and within the prescribed time limits. Requests for no-cost extensions will be considered on a case-by-case basis.

SECTION 5.0 DELIVERABLES

The precise deliverables will vary between Studies, depending on such factors as:

- scientific justification: specific (e.g., a new receiver band) or generic (e.g., a calibration technique applicable to all observations);
- whether the Study is hardware or software oriented;
- technology readiness level (maturity);
- scope and scale of the Study; and
- cost.

In all cases, intermediate Progress Reports and a Closeout Report are required. The Purchase Order will clearly define the associated deliverables and delivery schedule.

5.1 PROGRESS REPORTS

Monthly feedback is required from the Study Principal Investigator in order for the NRAO to fulfill its' management responsibilities, and to fulfill its' obligations to the National Science Foundation Program Manager. This feedback shall be provided in a simple, one (1) page document, commonly known as a "4-Square". Each quadrant of a 4-Square Progress Report addresses a specific aspect of Study performance (reference Figure I.0, below).

Cost Performance: <i>actuals versus budget & explanation of variance(s).</i>	Technical Performance: <i>any technical issue(s) impeding Study progress.</i>
Schedule Performance: <i>work accomplished versus work planned (% complete).</i>	Risk Management: <i>threats to Study success and mitigating action plan.</i>

Figure I.0; **"4-Square" Progress Report Format.**

The NRAO will complete the Cost Performance quadrant and the Principal Investigator will complete those quadrants shaded in "blue". A Progress Report template and detailed instructions on how to complete the Progress Report will be made available in a separate document.

5.2 CLOSEOUT REPORT

A Closeout Report is required at the conclusion of the Study. The Principal Investigator is expected to produce documentation that will enable evaluation of scientific and technical specifications, technology readiness level, implementation timeline (assuming follow-on Project funding), and approximate implementation costs. It is our intent to publish the closeout report as a Memo in either the ALMA Memo Series or in the

NAASC Memo Series

The Closeout Report shall include, at an appropriate level of detail:

- quantitative analysis of the key scientific drivers of the proposed upgrade, whether specific or generic, supported by simulations (where possible) and including comparisons with baseline ALMA capabilities;
- a proposed Technical Specification;
- a conceptual design, supported by appropriate analysis;
- a discussion of interfaces with the current configuration of the ALMA system and, if relevant, any new requirements;
- a proposed Consortium structure (if applicable) for the detailed design and implementation of the upgrade, with information on the expertise and facilities at the different member institutes or industrial partners;
- a preliminary estimate of upgrade cost (labor, materials & services, and travel);
- a proposed Project schedule (prototype/pre-production or production); and
- Identification of technical and programmatic (schedule and cost) risks and a recommended risk mitigation plan.

Additional elements may be appropriate depending on the type and scope of the upgrade. A Closeout Report template and detailed instructions on how to complete the Closeout Report will be made available in a separate document.

SECTION 6.0 QUESTIONS RELATING TO THE FY2016 CALL FOR STUDY PROPOSALS

An [informational meeting](#) will be held in Charlottesville, Virginia on March 25, 2015. Interested parties may attend via telecon, videocon, or in person, and are requested to communicate their intention to participate (preferably by close of business on May 15, 2015) to the North American ALMA Science Center at <mailto:almainfo@nrao.edu>.

Please submit questions concerning the present Call for Study Proposals, including any request for documentation referred to in this document, to the [ALMA Helpdesk](#) [use Knowledgebase: *Development Program*] by June 12, 2015. Queries will be directed to, and answered by, appropriate persons unassociated with this Call.

Questions shall, where possible, make reference to the specific section(s) of the solicitation document (“*Call for Study Proposals*”, and/or “*Conditions Governing the Call for Study Proposals*”) requiring clarification. When answering, NRAO will forward replies, together with the questions received, to all Proposers who have submitted a Notice of Intent. Replies will also be posted to the “*Frequently Asked Questions*” page on the NRAO website [<https://science.nrao.edu/facilities/alma/alma-development-2015/frequently-asked-questions-faq>].