



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

Cycle 8 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

I.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 Institute of Astronomy and Astrophysics (ASIAA) in Taiwan.

ALMA Operations are led on behalf of Europe by ESO, on behalf of North America by the 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 ALMA Observatory. 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 and strategic studies (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 FY2020 program cycle (Cycle 8). 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 “*Study Proposal Template*”, 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 Cycle 8 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.

Study topics of particular interest are set forth in APPENDIX A. While Proposers are encouraged to align their interests with these goals, they should not be construed as hard constraints. Novel ideas for new or enhanced scientific capabilities are welcome.

I.2 CURRENT PROGRAM STATUS

The North American ALMA Development Program [webpage](#) contains an archive of previously completed Projects and Studies.

SECTION 2.0 CYCLE 8 CALL FOR STUDY PROPOSALS

2.1 CYCLE 8 CALL RELEASE DATE

The release date for the Cycle 8 Call for Study Proposals is **December 19, 2019**. The period of performance for funded Studies will run from the award date October 1, 2020 to no later than September 30, 2021.

2.2 PROPOSALS FROM NRAO EMPLOYEES

Prospective NRAO Proposers must use the [New Ideas Notification Form](#) on the NRAO PMD Webpage. The New Ideas Notification Form must be submitted and approved by the Director before proceeding with preparation of a formal Study Proposal. Prospective NRAO Proposers are encouraged to prepare and submit the New Ideas Notification Form as soon as possible.

NRAO Proposers will follow the standard PMD proposal development process, and the proposal document set must be approved by the Director's Office, AUI, and NSF.

2.3 NOTICE OF INTENT

Prospective Proposers are requested (but not required) to submit a **Notice of Intent no later than March 16, 2020**. Please communicate your intent, and intended proposal category, online, by going to the [Cycle 8 webpage](#). Submitting a *Notice of Intent* will ensure that Proposers are included in the mailing list for replies to Proposers' questions and other correspondence related to the Cycle 8 Call for Study Proposals. **A Proposer's Notice of Intent is non-binding.**

2.4 CYCLE 8 PROPOSAL DEADLINE

The deadline (closing date) is **May 01, 2020**. Proposals received after the deadline may be rejected, at NRAO's sole discretion. Requests to postpone the deadline will not be considered.

2.5 ELIGIBILITY

NRAO welcomes proposals or expressions of interest from members of the North American ALMA Operations partnership and their at-large, radio astronomy communities.

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.

The Principal Investigator need not be an astronomer.

2.6 FUNDING

Award pool – a total of one million two hundred fifty thousand U.S. dollars (\$1250k) is available for funding Cycle 8 Studies. As a guideline, the NRAO expects to fund multiple Studies. No individual Study will be funded in excess of two hundred fifty thousand U.S. dollars (\$250K). Applicants may contribute funds from independent sources, combine them with solicited Study funds, and thereby pursue more aggressive goals.

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.

2.7 AMENDMENTS TO THE CYCLE 8 CALL FOR STUDY PROPOSALS

NRAO reserves the right to issue amendments to the present Call for Study Proposals at any time prior to the Deadline for the submission of Proposals (May 01, 2020.) Any such amendment will be communicated to all Prospective Proposers that have submitted a *Notice of Intent*.

2.8 VALIDITY DATE OF CYCLE 8 STUDY PROPOSALS

A proposal submitted to this Call for Study Proposals shall bind the Proposer to the contractual terms, conditions and total cost presented therein, until September 30, 2021; i.e., no amendments to the Proposal within this period of time will be accepted without the express consent of the NRAO.

2.9 CLARIFICATION OF STUDY PROPOSALS

NRAO reserves the right to ask Proposers for clarifications of their Proposal(s) during the evaluation period through electronic mail. Proposer responses, addressed to almadevelopment@nrao.edu, must be received within three (3) business days of dispatch of the request, if no other period is stated.

2.10 AMENDMENT, WITHDRAWAL OR RESUBMISSION OF STUDY PROPOSALS

Requests for amendment, withdrawal or resubmission of the Proposal will be granted if the Proposer can complete the associated action before the Deadline.

2.11 INTELLECTUAL PROPERTY MANAGEMENT

Confidentiality of NRAO Information - Release of confidential ALMA documentation and drawings may be requested by the Proposer and will be contingent upon execution of a *Mutual Non-Disclosure Agreement* available for review at the [Cycle 8 webpage](#) (refer to the “Post Award Documents” table.)

Confidentiality of Proposer Information - Proposers may wish, in connection with work contemplated under the Proposal, to disclose confidential information to NRAO personnel. To protect the confidentiality of such information, a Proposer may ask NRAO to enter into a *Mutual Non-Disclosure Agreement*.

Intellectual Property (IP) Rights - Proposers’ IP rights pertaining to technical data, copyrightable material, patents, and utilization of subject inventions are subject to the terms of the NRAO’s standard *Subrecipient Agreement* and any negotiated amendments thereto.

SECTION 3.0 VIABILITY OF PROPOSALS

3.1 STUDY CATEGORIES

The North American ALMA Development Program seeks to maintain a portfolio of Studies that 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 Cycle 8 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 reliability, 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. Varying levels of detail will therefore be appropriate for the Studies.

SECTION 4.0 PREPARATION OF CYCLE 8 STUDY PROPOSALS

The Study Proposal shall be composed in accord with the *Study Proposal Template* available at the [Cycle 8 webpage](#) (refer to the “*Study Proposal Documents*” table). **Proposals that do not make use of, or conform to the format and conventions of this template will not be considered.**

Even if financial support is not requested for the Study, financial data (contributions in kind) must be included in order to assess all Proposals fairly in the context of the ALMA Development Plan.

The Study Proposal shall not exceed twenty (20) pages in length. Curriculum Vitae and Appendices are excluded from the page count.

SECTION 5.0 SUBMITTAL OF CYCLE 8 STUDY PROPOSALS

Submit the completed Cycle 8 Study Proposal (**with signatures**), in “.pdf” format, online at the [Cycle 8 webpage](#) (refer to the “*Submitting a Cycle 8 Study Proposal*” section.)

SECTION 6.0 EVALUATION OF CYCLE 8 STUDY PROPOSALS

6.1 EVALUATION PROCESS

Evaluation will be conducted by a committee of non-NRAO reviewers with the technical input of disinterested persons familiar with ALMA technical matters (reference **Figure 1**). The membership of the Review Committee will be determined by NRAO management, with the consent of the National Science Foundation. Members of these groups who are involved in competing proposals will be recused from judging their own, or closely related, proposals.

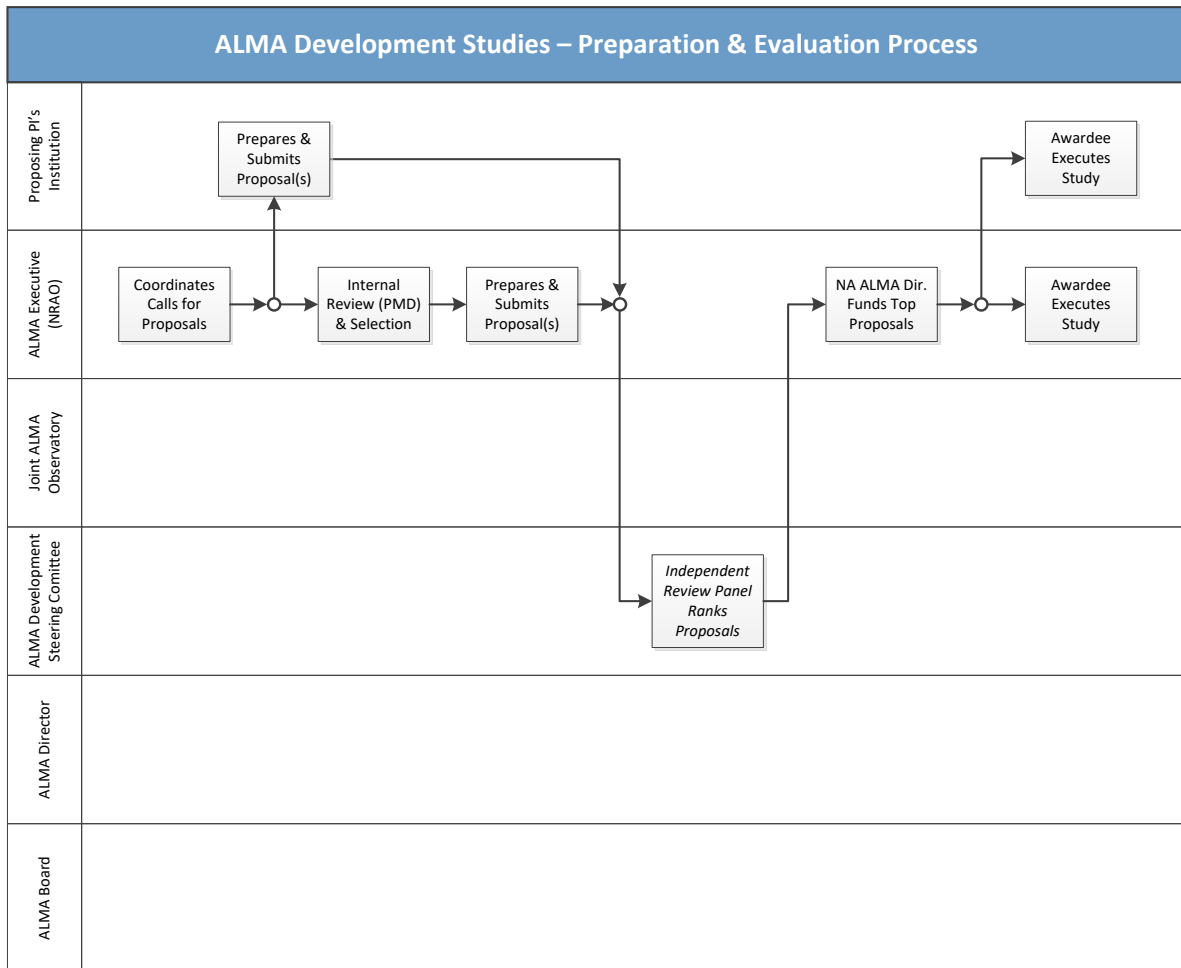


Figure 1: ALMA Development Studies – Preparation & Evaluation Process.

6.2 EVALUATION CRITERIA

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

- alignment with the ALMA Development Roadmap ([AEDM 2018-017-O](#));
- 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 that balances risk across the entire portfolio);
- strength of the scientific team supporting the Study;
- level of support guaranteed by collaborating institutions (if applicable); and
- budgeted cost of the Study.

6.3 NO INFORMATION (“BLACK OUT”) DURING EVALUATION PROCESS

NRAO staff will not respond to questions about proposals or proposal status during the evaluation and selection period. NRAO reserves the right to eliminate from the evaluation any Proposer contravening this provision.

6.4 RESULTS AND NOTIFICATION OF AWARD AGREEMENT

Proposers will be informed, in writing, of the result of the Cycle 8 Call for Study Proposals no later than August 14, 2020. Decisions will be made in consultation with, and the consent of, the National Science Foundation. Rejection decisions cannot be appealed, and NRAO will not enter into correspondence on decision rationale.

SECTION 7.0 CONTRACTUAL REQUIREMENTS

7.1 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-1519126, entitled “Management and Operation of the National Radio Astronomy Observatory (NRAO)”, a Cooperative Agreement awarded to Associated Universities, Inc. by the National Science Foundation for the period April 1, 2016 to September 30, 2026. 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 the [Cycle 8 webpage](#) (refer to the “Post Award Documents” table).

7.2 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 the [Cycle 8 webpage](#) “Post Award Documents” table). This Agreement is subject to 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).

7.3 REPRESENTATIONS AND CERTIFICATIONS

The principal Institution associated with each selected Proposal will be required to complete a *Representations & Certifications Form* (available for review at the [Cycle 8 webpage](#) “Post Award 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.

7.4 PURCHASE ORDERS

A single Purchase Order (PO) will be issued for each selected Study. The PO number will be the subaward number and should be referenced on all invoices. NRAO will reimburse the Offerer based on invoices submitted not more often than monthly for allowable costs. The Offerer shall commit to perform the Statement of Work (approved Study Proposal) in accordance with first-class trade practices and within the prescribed time limits. Requests for no-cost extensions will be considered on a case-by-case basis.

SECTION 8.0 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.

8.1 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. There is no required format for this feedback; however, it must be in writing and at a minimum address cost, technical, and schedule performance as well as address ongoing risks. One possible format is a simple slide, commonly known as a “4-Square”. Each quadrant of a 4-Square Progress Report addresses a specific aspect of Study performance (reference **Figure 2**, below). A 4-square PowerPoint template is available from the ALMA Development Program Manager.

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 2: “4-Square” Progress Report Format.

8.2 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 NRAO’s intent to publish the Closeout Report as a Memo in either the ALMA Memo Series or in the North American ALMA Science Center (NAASC) Memo Series.

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

- a discussion of relevant findings during the study;
- 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 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.

SECTION 9.0 QUESTIONS PERTAINING TO THE CYCLE 8 CALL FOR STUDY PROPOSALS

An informational meeting will be held in Charlottesville, Virginia on Thursday January 16, 2020 at 2:00 pm Eastern Standard Time. Interested parties may attend via teleconference, videoconference, or in person, and are requested to communicate their intention to participate (preferably by close of business on January 03, 2020) to the North American ALMA Development Program at almadevelopment@nrao.edu.

Please submit questions concerning the present Call for Study Proposals, including any request for documentation referred to in this document, to the North American ALMA Development Program at almadevelopment@nrao.edu by April 13, 2019.

Questions shall, where possible, make reference to the specific section(s) of the solicitation document (“*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*” [webpage](#).

SECTION 10.0 CYCLE 8 SCHEDULE SUMMARY - STUDIES

Milestone	Date	Reference Section
Release of Call for Study Proposals	2019 December 19	Section 2.1
Informational Meeting	2020 January 16	Section 9.0
Notice of Intent	2020 March 16	Section 2.3
Proposer’s Questions Submitted <i>no-later-than</i>	2020 April 13	Section 9.0
Proposal Deadline	2020 May 01	Section 2.4
Notification of Awards	2020 August 14	Section 6.4
Study Start Date	2020 October 01	Section 2.1
Study Completion Date (General Study)	2021 September 30	Section 2.1

APPENDIX A

STUDY TOPICS OF PARTICULAR INTEREST TO THE NA ALMA PARTNERSHIP

1. Larger bandwidths and improved receiver sensitivity: enabling gains in speed.
2. Longer baselines: enabling qualitatively new science.
3. Increasing wide field mapping speed: enabling greater mapping efficiency.
4. Phased array feeds: enabling a wider field of view and improved efficiency.
5. Improvements to the ALMA Archive: enabling gains in usability and impact for the Observatory.