

NRAO



National Radio Astronomy Observatory



Atacama Large Millimeter/submillimeter Array
Expanded Very Large Array
Robert C. Byrd Green Bank Telescope
Very Long Baseline Array



ALMA Development and Studies in NA



North American ALMA Science Center

Al Wootten

Atacama Large Millimeter/submillimeter Array

Expanded Very Large Array

Robert C. Byrd Green Bank Telescope

Very Long Baseline Array

Development Studies Call Nov 2011



ALMA Development

- Outline
- How an ALMA Development Plan is established.
 - Board-approved July 2011 Development Principles presents plan
 - Initiates ALMA Development Steering Committee (ADSC) (ALMA Deputy Director L. Ball, W. Wild, M. McKinnon, S. Iguchi, R. Hills), formed Oct 2011.
 - Illustration of whole process
- Progress in NA
 - Call for Studies of upgrades issued 2011 Nov 22.
 - The output of the studies will be detailed science requirements, design, cost and timeline for NA ALMA upgrades
 - These studies will be combined with plans advancing in EU, EA and JAO to produce a coherent ALMA Development Plan for ALMA

Scope



- Key principle: ***program must be driven by science***
- Program focus
 - Delivery of tangible improvements to ALMA
 - Alternatively, to fund ALMA-targeted R&D that may lead to improvements
- Projects could be:
 - New additions to the array
 - Extension of existing capabilities (more sensitivity, wider bandwidth, improved image quality)
 - Improvements to existing systems resulting in improved availability
 - Improved infrastructure reducing risk, increased availability, eased or decreased operations cost.
- Includes significant enhancements to software
 - Improved infrastructure that reduces risks, increases availability, makes operations easier/less expensive
- Timescale for project completion in the range of 3-5 yrs



Governance

- Executives
 - Gather input from community-based discussions and proposals and from regional science advisory committees
 - Present proposals to the ALMA Director
 - Contribute to the program according to their share in funding of ALMA operations
 - Oversee or carryout development projects within their regions
- ALMA Director
 - Coordinates the development program funded and implemented by Executives
 - Suggests projects from array operations experience
 - Submits a proposal for development projects for prioritization and approval by the ALMA Board with concurrence of the Directors
- Development program will be conducted in manner similar to that of the construction project: Cost-based as agreed by ADSC and approved by the Board

Development Studies in Context

- Regional discussions overseen by Executives generate initiatives
- Targeted exploratory research or feasibility **studies** at Executives
 - Includes assessment of opportunities for collaboration
 - Budget line in Ops Plan amounts to ~10% of Development Program
 - Calls for Development Studies on 2-3 yr timescales anticipated
- Executives present **proposals** to ADSC, taking into account JAO recommendations
 - ALMA Science Advisory Committee (ASAC), drawing on its regional knowledge and scientific expertise, advises ADSC
 - ADSC takes input, recommends prioritization to ALMA Director
- ALMA Director submits proposal for **ALMA Development Program**, with suggested prioritization, to Directors Council for concurrence and to ALMA Board for approval

Life Cycle of Approved Projects

- Assigned Executive assigns Project Manager
 - Reports to Executive on cost, progress, schedule, compliance with specifications
 - Management and commissioning costs met from relevant Executive's Development funds
 - ADSC oversees overall implementation of the Program and projects within it.
- Project Managers report to ADSC on technical scope, compliance with science requirements, and status of budget and schedule
- ALMA Director to appoint ALMA Development Program Manager
 - Works with Executive PMs to ensure compliance with ALMA standards of construction and safety, interfaces, scientific objectives, coordinate implementation
 - Acts as ADSC Executive Secretary
- ALMA Director can recommend termination of a project on advice of ADSC if major cost overruns, schedule delays or inability to meet specifications occurs.

Next Steps: Toward an ALMA Development Program

- ASAC
 - Commented on Principles document as input for possible future revision
 - Updates its report from 2008-2009 on development priorities for ALMA
- ALMA Deputy Director drafts Terms of Reference for ADSC
- ADSC forms, considers input from Executives studies, develops straw plan for an integrated ALMA Development Program for consideration by Executives and Board.

ALMA Development/NA



- Process began with March 2011 Workshop to collect response and ideas for a Call for Development Studies patterned after the earlier ESO Call
 - Many topics discussed, from 31-45 GHz 'Band I' receiver to superTHz 'Band II' receiver, upgrades to existing bands (see presentations)
- Good response resulted in a refined draft Call, distributed to other entities among the NA partners and to NSF
- A Software Development Workshop was held at NRAO 12-14 Oct 2011
 - A set of ideas for software applications resulted that will enhance the science output from ALMA (see presentations)



Parallel Studies

- Event Horizon Telescope links major mm observatories
 - Strong science case includes imaging of SgrA*, other AGN
 - Clear technical path to implementation
- ALMA phasing for VLBI is one element
 - Endorsed by ALMA Board, US Decadal survey
 - Increases resolution by x2, sensitivity by x10.
 - A project involving NA universities, Eu (MPIfR, IRAM, APEX, JCMT) and EA (ASIAA and NAOJ)
 - Sought separate funding from NSF MRI program
 - Favorably reviewed
 - Funding approved, meeting in Tucson 2012 Jan 18-20
 - Schedule calls for ALMA system availability ca 2014-2015

Current NA Timeline

- Call for Studies issued 2011 Nov 22
 - Includes hardware: see March Workshop link
 - Software: see Oct Workshop link
- Evaluation early 2012 by external-to-NRAO committee
- Kick-off for Studies early 2012

Current Studies at other ALMA partners

- ESO
 - ALMA Band 5 completion
 - Upgrade of Band 9 cartridges from DSB to SSB
 - EHT/VLBI
- EA
 - 'Band 11' receivers
 - EHT/VLBI
- JAO
 - Landline for data from OSF \leftrightarrow SCO (currently microwave)
 - Power generating system upgrade

Dates!

- **Important Dates**
- Event Release of Call for Study Proposals November 21, 2011
- [Informational Meeting & Telecon](#) November 29, 2011
- Deadline for [Notice of Intent](#) December 6, 2011
- Deadline for Proposer's Questions January 16, 2012
- Closing Date February 12, 2012
 - Review of Proposals
 - NSF
- Notification Date March 1, 2012
- Validity Date of Proposals November 15, 2012
- Study Completion Date December 31, 2012

The Atacama Large Millimeter/sub-millimeter 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.



