

NRAO PROGRESS REPORT FY 2007

North American ALMA Science Center (NAASC)

Accomplishments and Highlights in FY 2007

The main activities at the North American ALMA Science Center (NAASC) were developing the global ALMA operations plan and the North American plan for the NAASC. Major operations milestones were reached with the submission in Q4 2006 of the NAASC proposal to the NSF and the global ALMA operations plan (AOP) to the ALMA board.

Before submission to the NSF, the NAASC plan underwent a number of internal reviews including Canadian participation and a major external review by the North American ALMA Science Advisory Committee (ANASAC). The Operations Working Group (OWG), led by John Hibbard on behalf of the Joint ALMA Office (JAO), developed the AOP. The NSF committee and members of the OWG made visits to the JAO office in Santiago, and to the ALMA site.

In Q1 2007 major reviews of the ALMA operations plan were held by an international committee, and the NAASC plan by an NSF committee at the end of February near NSF headquarters in Arlington VA. February 27 and 28 saw presentations by the international operations working group. The international panel presented a verbal summary to the attendees at the end of these two days. On March 1 the NAASC/NRAO staff presented the details of North American ALMA operations and presented the NAASC plan on the third day. The NSF panel gave their summary report to the NRAO Director and the NSF at the end of the day.

The overall reaction of both the international and North American panels was that ALMA has a more mature and better delineated operations plan than any other ground-based observatory and that the basic assumptions and plan are well founded and justified. It was pointed out that the WBS Excel spread-sheet developed by Hibbard and the OWG is a powerful tool for guiding ALMA operations development and for making real-time adjustments to the plan based on construction project milestones. This WBS has been transferred to the JAO.

Both panels emphasized the importance of the Full Science support functions to fully realize the scientific promise of ALMA. The NSF panel emphasized that the NRAO needs to be prepared for early science to ensure that we deliver the capabilities promised at the appropriate time. They also emphasized the need for adequate user support, both in terms of software and manpower, in order to assist astronomers in the use of the advances and complexities of ALMA.

A final written report from the NSF panel reviewing the NAASC plan was submitted to AUI/NRAO in Q2 2007, with a written response by AUI/NRAO sent to the NSF in Q3. Successful completion of these reviews represents a major milestone for ALMA operations and the NAASC. Passing these reviews gives the funding agencies a road map for long-range operations funding and sets the direction for the transition from construction to operations.

Other goals from the 2006 program plan

Canadian involvement in ALMA operations

Canadians participated in development of the NAASC plan through telecoms and a face-to-face meeting, in all the preliminary reviews of the ALMA operations plan, and in the major external

review in Q1 2007. A new Memorandum of Understanding with Canada for ALMA operations is being drafted at the Hertzberg Institute of Astrophysics. It will be discussed and completed in the first quarter of FY2008.

Software testing, data analysis software

The NAASC continues to support 3.75 FTE of CASA programmers to develop ALMA user software (see the CASA report).

NAASC staff also participated in extensive software testing, including:

- A major (ALPHA) test of the CASA software (written report by D. Shepherd)
- ALMA pipeline software testing (written report by Wilson)
- Testing the ALMA simulator
- Testing the ALMA Observing Tool
- Testing in preparation for the CASA BETA release in Q4 2007

Participation of NAASC staff in this testing is meant to ensure readiness of the software for early science, as well as familiarize the NAASC staff in use of the software. NAASC Scientist Crystal Brogan was appointed the ALMA CASA sub-system scientist in July of 2007. Crystal ensures that CASA development works towards ALMA priorities, and arranges NAASC testing of the offline software.

Work with E2E on Archive and VO tasks.

An end-to-end (E2E) working group has been established at the NRAO with NAASC participation to keep track of progress on user-related software at the NRAO and to coordinate among NRAO projects such as the EVLA and ALMA (see contribution by E2E).

Database construction

Work continues on the “Splatalogue” spectral-line catalog. Over the last several months the catalog has seen major improvements from the overall use and functionality to data reliability. Frank Lovas from the National Institute of Standards and Technology worked very closely with Anthony J. Remijan, the North American Chair of the ALMA Working Group on Spectral-Line Frequencies. They added more than 229,000 new lines to the catalog, of which over 2000 have been found in astronomical environments. Special search filters were added to the database to reduce the confusion from known atmospheric species and from large molecular species that could not be identified without a dedicated search. This spectral-line catalog is the most complete database of molecular transitions from mm to submm wavelengths.

Community relations and the ANASAC

The ANASAC remains the primary means of communication between the NAASC and the User community. The ANASAC was reorganized to have a more formal charge-and-response format parallel to that of the ASAC for the ALMA Board. This format ensures that high-priority issues are discussed, with formal reporting and responses. The first major charge to the ANASAC was to review the NAASC plan prior to submission to the NSF and to consider in detail user-related issues such as the ALMA grants program. ANASAC input to the NAASC plan was invaluable. Regular ANASAC telecoms are held.

NAASC members participated in the organization of, and made presentations at, the successful Pan-ALMA science meeting in Madrid in Q4 2006. NAASC members also made ALMA-related presentations at the AAS. Talks on ALMA status and ALMA science were made by NAASC staff at many U.S. and international institutions.

The NAASC workshop "Transformational Science with ALMA: Through Disks to Stars and Planets" was held in June 2007. There were about 80 participants. This meeting continued the successful series of scientific workshops begun in 2006 to promote and refine the scientific use of ALMA. Special thanks to C. Brogan for organizing this interesting meeting.

See: <http://www.cv.nrao.edu/naasc/disks07/>

UVa Foundry

AlN tunnel junctions: UVML made their first AlN (aluminum nitride) tunnel junctions. They had excellent I(V) quality at high current density (30,000 A/cm²), about 3 times that of an Nb/Al-AIOx/Nb junction of the same I(V) quality.

Mixer design for 900 GHz: The design of an SIS mixer for ~1 THz requires a refinement of the previous design rules. We have been working with UVML to determine the smallest conductor width and spacing that can be produced reliably with their latest fabrication procedures. The current design study indicates that an extension of the successful ALMA Band 6 mixer design will be feasible using the latest design rules with AlN tunnel barriers and NbTiN conductors.

An additional expense in FY2007 over the program plan was \$100k towards a Hot Deposition System. This will provide a marked improvement in SIS mixer performance. Depositing superconductive films onto a hot (600-800 °C) substrate provides significantly higher band gap energy and lower resistivity, thus resulting in lower RF losses when compared to the current "cold" (20-30 C) deposition process. The improved performance is essential to meet the ALMA project performance characteristics and technical specifications. The total cost of the system will be ~\$350k, and will be cost-shared between the NAASC, NTC, and UVa.

Education and Public Outreach

ALMA EPO was well represented at international (e.g. IAU), and national (e.g. AAS) meetings by NRAO EPO officers. The advertisement for the first ALMA-specific EPO staff, matrixed to the NRAO EPO division, has been distributed. For more details, see the EPO section.

Personnel

Staffing of the NAASC was relatively constant during FY 2007. The Head Office includes Chris Carilli and John Hibbard. Partial support was added for a Business manager and an administrative assistant. Crystal Brogan remains the only NAASC staff scientist. The NAASC continued support for 3.75 CASA programmers.

	NAASC Milestone	Original Date	Revised Date	Completed
1	Start Operations Budget	01/2006		01/2006
2	NAASC Operations plan internal review	10/2006		10/2006
3	NAASC ops plan review by AUI/NRAO DO	10/2006		10/2006
4	Submit NAASC proposal to NSF	10/2006		10/2006
5	Submit ALMA Operations plan to Board	10/2006		11/2006
6	AOP presentation to the ALMA Board in Madrid	11/2006		11/2006
7	Participate in ObsTool Test 4	01/2007		01/2007
8	NSF panel ALMA site visit	01/2007		01/2007
9	ALMA Operations plan sent to external reviewers	01/2007	02/2007	02/2007
10	International review of AOP	02/2007		02/2007
11	NSF Review of NAASC Plan	03/2007		03/2007
12	ALMA external S/W testing – CASA ALPHA	10/2006	03/2007	03/2007
13	Participate in Pipeline Test 4	01/2007	03/2007	03/2007
14	Respond to NSF budget questions	03/2007		03/2007
15	Transfer AOP document and budget to JAO/Smeback	04/2007		04/2007
16	Spectral-line catalogue—organize working group, first meeting in Charlottesville, Spring 07	04/2007		04/2007
17	Respond to NSF panel report	04/2007		04/2007
18	Science center visits – CXC, SSC	05/2007		05/2007
19	2 nd NAASC Science workshop – Protoplanetary Disks	06/2007		06/2007
20	Participate in CASA Alpha-patch testing	06/2007		06/2007
21	Visit by Lovas to help resolve molecular species for splatalgoue	07/2007		07/2007
22	Antenna 1 AIV Receive at OSF	08/2007		08/2007
23	ANASAC Face-to-Face	08/2007		
24	Participate in ObsTool Test 5	08/2007		
25	NAASC offline software testing prior to beta release	09/2007		
26	ARC manager meeting at ESO	09/2007		
27	Participate in Director's ALMA program review	09/2007		
28	New NAASC science workshop 2008 – topic and SOC	09/2007		