

ATACAMA LARGE MILLIMETER/SUBMILLIMETER ARRAY

ALMA Construction Project Progress



Figure 1. The first VertexRSI pedestal assembly travels by truck across northern Chile to the ALMA Operations Support Facility.

Having already traveled thousands of miles by land and sea from Kilgore, Texas in the United States to the port of Antofagasta in northern Chile, the pedestal assembly of the first ALMA VertexRSI production antenna departed Antofagasta for the Operation Support Facility (OSF) on April 20, 2007, escorted by local police. Other elements of the telescope, including the backup structure and the invar cone that joins the pedestal assembly and the backup structure, had already arrived at the OSF.

At 03:15 p.m. on April 27 at the ALMA OSF, the crane hangers were removed and the first VertexRSI pedestal assembly stood atop its foundation adjacent to the Vertex hangar. That evening, the first southern hemisphere starlight fell upon an ALMA production antenna.

The second VertexRSI antenna is poised to follow as its pedestal is being assembled in Kilgore, Texas. This second antenna will be erected inside the recently completed VertexRSI site erection facility.

A trio of Mitsubishi antennas will arrive within the next few weeks in Antofagasta from Osaka, Japan. Their assembly will then begin at the Mitsubishi laydown area at the OSF.



Figure 2. The first ALMA production antenna at the OSF: the VertexRSI pedestal stands on its pad to the right of the partially assembled backup structure, and in front of the VertexRSI site erection facility.

The third type of antenna, from the AEM consortium, will be delivered to the OSF next year and assembled at the AEM laydown area. Work on construction of this facility has begun and will be completed by the end of June.

On March 10, 2007, a ceremony celebrated the completion of the roof structure on the OSF technical facility building. Held in the nascent OSF warehouse, the crowd of workers and others heard speeches from the Mayor of San Pedro de Atacama, Sandra Berna, and others. The facility, which will host about 100 people during operations, consists of three main buildings: the technical building, hosting the control center of the observatory; the antenna assembly building, including four antenna foundations for testing and maintenance purposes; and the warehouse building, including mechanical workshops. The warehouse should be available later this year, and the whole building is slated for completion by January 2008.

At the 16,400 foot elevation Array Operations Site, the Technical Building construction has been finished (Figure 4). The building now has temporary power and Internet connections and is being readied to receive the first quadrant of the ALMA correlator later this year.



Figure 3. During the celebration of the completion of the OSF warehouse roof, members of the local community joined ALMA and others as a pachamama or “payment to the Earth” ceremony was held, in which harmony is sought. Photo: R. Simon.

The design of the antenna array configuration (Figure 5), and the road and fiber network interconnecting the antenna foundations, has been completed, and bids to build this critical infrastructure have been received.

In Santiago, staff growth has exceeded the capacity of the Joint ALMA Observatory (JAO) headquarters in Las Condes. Plans are proceeding for construction of the permanent headquarters next to ESO in Vitacura. Temporary space has been secured at the University of Chile Department of Astronomy quarters at Cerro Calan.

The ALMA Board held its first meeting of the year in Tokyo at the National Center of Sciences of Japan. Dr. Yoshiro Shimura, President of the National Institute of Natural Sciences (NINS), welcomed the Board members to Tokyo with remarks on the bright future of ALMA. The Master Agreements for ALMA Goods and Services between North American partners and ESO, and the



Figure 4. The Technical Building at the Array Operations Site.

National Astronomical Observatories of Japan were signed in March and May, providing the detailed framework for construction of ALMA.

At the ALMA Test Facility (ATF), adjacent to the NRAO Very Large Array in New Mexico, equipment needed to test and verify performance of the ALMA production antennas has been proven. A holography system and an optical pointing telescope, items critical for the preparation of the antennas, were accepted and shipped to the OSF. During the coming months, the ATF will concentrate on radio pointing, installation of preproduction electronics and the two station correlator.

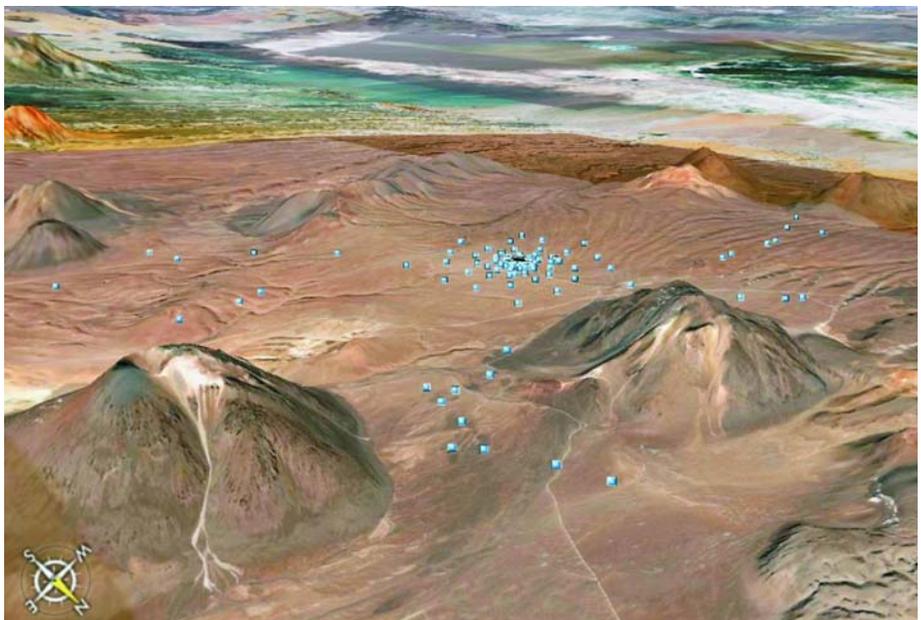


Figure 5. The ALMA array configuration stretches across the Array Operations Site.

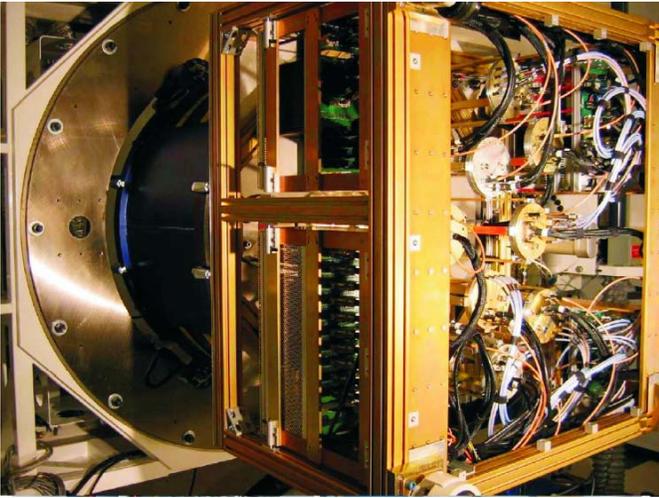


Figure 6. The ALMA Front End package, incorporating the dewar, receiver cartridges, and oscillators is now under test at the NTC. In this view, the panels are removed. This package will be installed on the first antenna at the OSF in fall 2007.

By late summer, interferometry will be a focus of efforts there.

The two-station correlator was built at the NRAO Technology Center (NTC) to replace the prototype correlator that has been in New Mexico for several years with a current design. At the Front End Integration Center at the NTC, the first ALMA Front End (receiver package and associated electronics) has undergone beam shape measurements for the first four ALMA frequency bands.

The Science group developed a new version (v2.0) of the Design Reference Science Plan (DRSP). The goal of the ALMA DRSP is to provide a prototype suite of high-priority projects that could be carried out in 3–4 years of full ALMA operations. The DRSP serves as a quantitative reference for developing the science operations plan, performing imaging simulations, software design, and other applications within the ALMA project. Since v1.1 was released, Japan has joined the project, enhancing ALMA's capabilities. DRSP v2.0 expands v1.1 to include science that takes advantage of these expanded features.

ALMA's role in the search for and study of exoplanets and planetary systems has been developed at a number

of scientific conferences over the past years. In December 2006, the NSF-NASA-DOE Astronomy and Astrophysics Advisory Committee (AAAC) established an ExoPlanet Task Force (ExoPTF) as a subcommittee to advise NSF and NASA on the future of the ground-based and space-based search for and study of exoplanets, planetary systems, Earth-like planets, and habitable environments around other stars. A white paper describing ALMA's role in this endeavor was submitted to the ExoPTF. The ExoPTF will recommend a 15-year strategy to detect and characterize aspects of exoplanets and planetary systems. *ALMA Memo No. 475* addresses this topic.

A. Wootten and S. Cabezón

North American ALMA Science Center

The NSF and ALMA Board reviews of the North American ALMA Science Center and the ALMA operations plan are complete, and written reports from the review panels, as well as the response to these reports by NRAO/AUI, have been submitted to the NSF and the ALMA Board. For a summary of the overall findings of these panels, see the April 2007 NRAO *Newsletter*. The coming year will see the implementation of the operations plan, and the first positions for NAASC staff who will participate in ALMA commissioning and science verification will be advertised fall 2007.

The NAASC staff have also participated in ALMA software testing, including testing of the ALMA pipeline, the CASA-PY post-processing software, the CASA user interface. Software testing and documentation will be a major task for the NAASC in the coming two years, preparing for ALMA Early Science in 2010.

The ALMA North American Science Advisory committee held monthly telecons, with issues discussed including: the operations reviews, the potential for a ALMA Users Grants program, and the ASAC charges. The ANASAC is evolving toward a formal charge and response format, parallel to that of the ASAC. The 2nd annual NAASC Science Workshop *Transformational Science with ALMA: Through Disks to Stars and Planets* was held in Charlottesville,

June 22–24, 2007 (see article on page 32). Community interest in attending the workshop has been very positive and we plan to hold an ALMA workshop with a different focus every year. Stay tuned for next year's topic!

NAASC staff visited the Spitzer Science Center and the Chandra X-ray Center to discuss Science Center operation and user support. Also, NAASC staff gave talks on the scientific potential and current status of

ALMA at various institutions. If your institution is interested in having a NAASC staff member visit and discuss ALMA, please contact me at ccarilli@nrao.edu.

Finally, Frank Lovas (NIST) will spend a month in Charlottesville this summer, helping NAASC staff further develop a molecular spectral line database ("Spatalogue", see the April 2007 *Newsletter* article).

Chris Carilli

2nd Annual North American ALMA Science Center Workshop



The 2nd Annual North American ALMA Science Center Workshop was held June 22-24, 2007 at the National Radio Astronomy Observatory headquarters in Charlottesville, VA, USA on the topic of *Transformational Science with ALMA: Through Disks to Stars and Planets*. Eighty participants from around the world attended, including a number of graduate students and post-docs. A wide range of excellent disk-related presentations were made, kicked off by an inspiring keynote talk by Anneila Sargent (Caltech) who discussed the importance of both “evolution” (expanding and refining what we currently know) and “revolution” (completely new techniques and ideas) to advance the field. The workshop engendered many productive and insightful discussions of the opportunities to both evolve and revolutionize the fields of protostellar, protoplanetary, and debris disks that will be afforded by the

unprecedented angular resolution and sensitivity of ALMA. The workshop included a reception sponsored by the NRAO Director at the NRAO Technology Center (NTC), tours of the North American ALMA Front End Integration Center, and a workshop dinner hosted by the University of Virginia Astronomy Department.

The workshop presentations, notes from the discussions, program, and list of participants are posted at the workshop website <http://www.cv.nrao.edu/naasc/disk07/>.

For the success of this workshop we are greatly indebted to all of the NRAO headquarters and NTC staff who helped with the preparations and tours, as well as the Local and Scientific Organizing Committees.

Crystal Brogan