



# THE ALMA PARTNERSHIP



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In one of Earth's driest deserts,  
a gentle rain is falling.

To people thirsty for insights into the origins of galaxies, stars, planets, and life, millimeter and submillimeter wavelength light, raining down from space, is a rare and precious natural resource. So, from around the world, they have gathered here to collect and channel it.

Already, the Atacama Large Millimeter/submillimeter Array (ALMA) is deeply irrigating the fields of astronomy. New insights are sprouting, and scientists anticipate record crops.

The invisible light that ALMA collects is vital to our understanding of the Universe. The challenges of harnessing it are enormous. United by the bond of human curiosity, an international coalition among people on four continents has collaborated to build the most powerful ground based observatory in history. Each region's contributions are vital to ALMA's success.









# CHILE

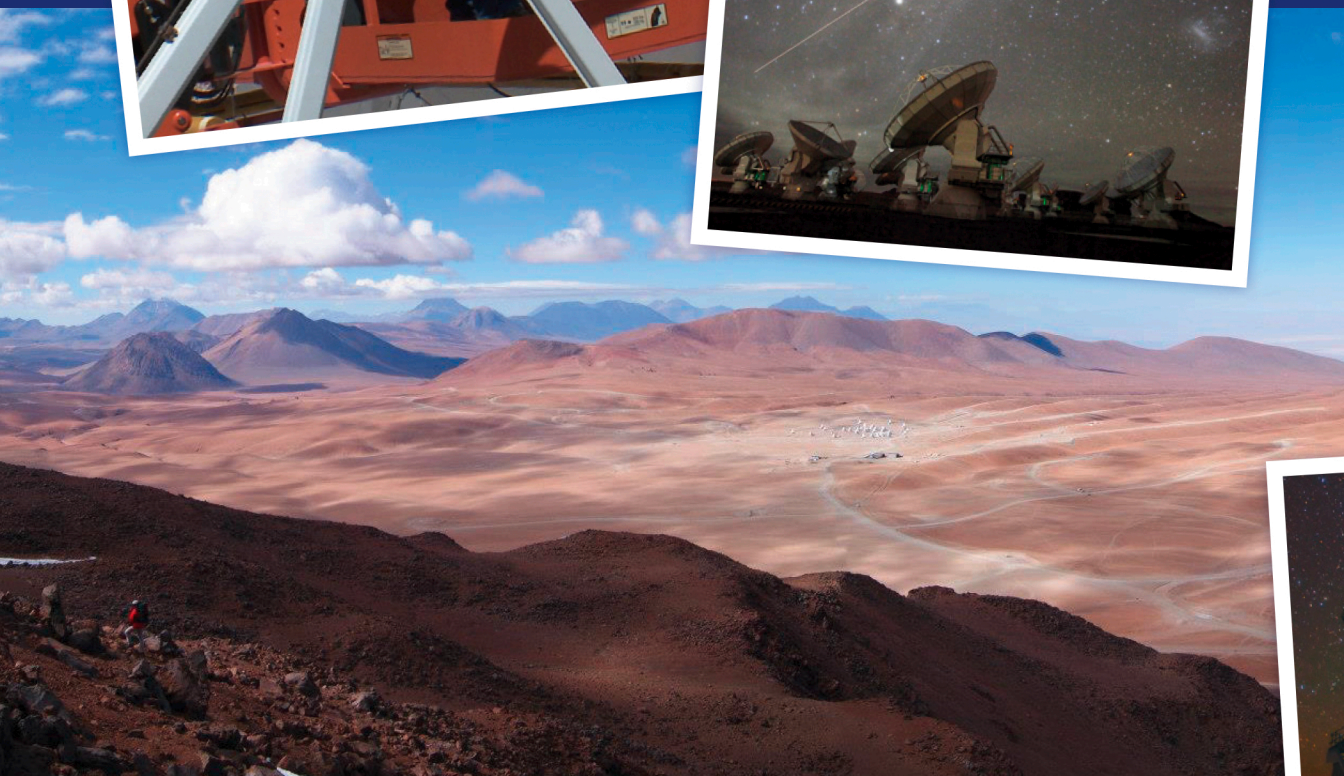
## CONTRIBUTION: A WORLD-CLASS SITE



When a telescope must be some sixteen kilometers across, and sit above most of our atmosphere's precipitable water vapor, there are only so many places it can go. The Chajnantor Plateau in the northern Chilean Andes is one such place, and it is ideal for ALMA.

Designated by the Chilean government for this important scientific use, the ALMA site is amazingly high and dry. Equally important, it is accessible, with infrastructure in place for the provision of food, water, fuel, and transportation.

Chile has a long and proud history of sharing its unmatched, spectacular skies with the world. The Chilean people and government are friendly and welcoming to international astronomy, and hundreds of Chileans now support the ALMA endeavor across the spectrum of scientific, engineering, management, and support roles.





# EUROPE

SHARE IN ALMA'S CONSTRUCTION COST: 37.5%



Europe's participation in ALMA is managed by Europe's ALMA partner, the European Southern Observatory (ESO) on behalf of its fifteen member states (Austria, Belgium, Brazil, Czech Republic, Denmark, Finland, France, Germany, Italy, the Netherlands, Portugal, Spain, Sweden, Switzerland, United Kingdom). ESO manages contributions of technology and expertise coming from numerous European university, research and technology centers.

Europe's major contributions to the ALMA project include:

- 25 of ALMA's 12-meter dish antennas
- The ALMA Antenna Transporters (Otto and Lore)
- Antenna Water Vapor Radiometers
- Roads from the entrance gate to the Operation Support Facility (OSF), and from the OSF to the Array Operation Site (AOS)
- The OSF Technical Building
- The permanent power supply (turbine generators)
- The ALMA Residencia (visitor living quarters, under development)
- Band 7 receiver cartridges
- Band 9 receiver cartridges
- Front End Power Supplies
- Front End Cryostats
- Front End integration
- Back End components and Optical-Digital Transmission System
- Tunable Filter Bank Cards for the 64-Antenna Correlator
- AOS Antenna Pads and Interfaces
- Software
- Support for European ALMA users via 7 European ALMA Regional Center nodes





# EAST ASIA

SHARE IN ALMA'S CONSTRUCTION COST: 25%



East Asia's participation in ALMA is managed by the National Astronomical Observatory of Japan (NAOJ) on behalf of Japan and Taiwan. The work is funded by the East Asian ALMA partner, the National Institutes of Natural Sciences (NINS) of Japan, in cooperation with the Academia Sinica (AS) in Taiwan.

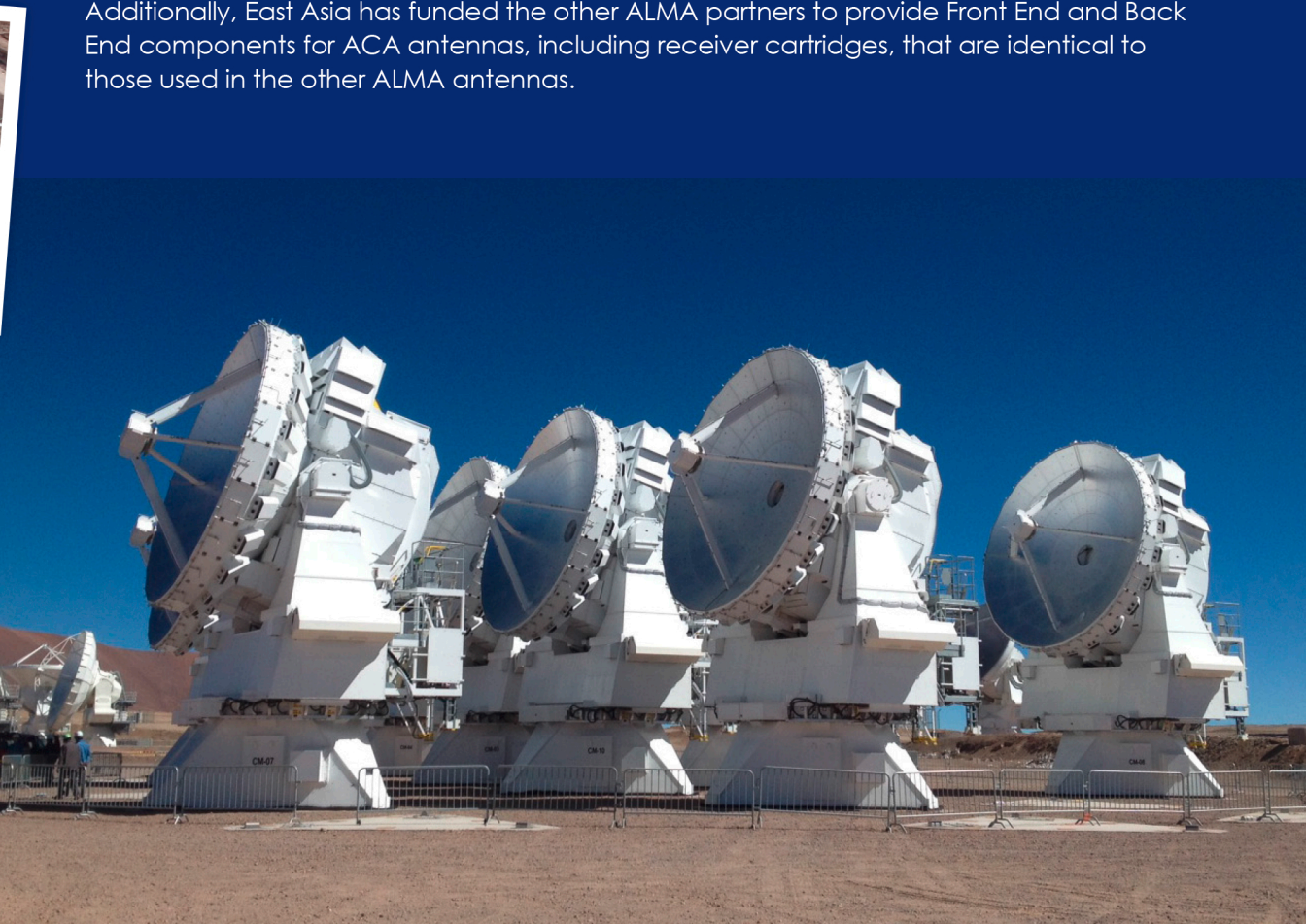
Entering the ALMA partnership in 2004, East Asia brought a powerful new capability to ALMA in the form of the Atacama Compact Array (ACA), which provides ALMA with a critical capability for observing the emission from extended, diffuse clouds of gas and dust in space.

East Asia's major contributions to the ALMA project include:

- Four 12-meter ACA dish antennas
- Twelve 7-meter ACA dish antennas
- ACA Antenna Pad Interfaces
- Front End Integration
- Band 4 receiver cartridges
- Band 8 receiver cartridges
- Band 10 receiver cartridges
- ACA Back End components, including oscillators and Optical-Digital Transmission System
- ACA Correlator
- Software
- Support for East Asian users via the East Asian ALMA Regional Center



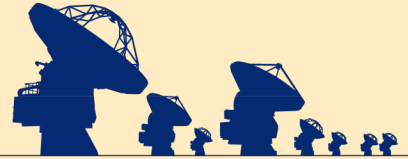
Additionally, East Asia has funded the other ALMA partners to provide Front End and Back End components for ACA antennas, including receiver cartridges, that are identical to those used in the other ALMA antennas.





# NORTH AMERICA

SHARE IN ALMA'S CONSTRUCTION COST: 37.5%



North America's participation in ALMA is coordinated, on behalf of the United States, Canada, and Taiwan, by the National Radio Astronomy Observatory (NRAO), which is managed by Associated Universities, Inc. (AUI). The work is funded by the North American ALMA partner, the US National Science Foundation, in cooperation with the National Research Council of Canada (NRC) and the National Science Council of Taiwan (NSC).

North America's major contributions to the ALMA project include:

- 25 of ALMA's 12-meter dish antennas
- The AOS Technical Building
- Roads at the AOS
- AOS power distribution and fiber optic networks
- Optical Pointing Telescope (used in antenna testing)
- 5 Nutators (used for fast switching between observed source and sky for subtraction of sky noise)
- Front End Servicing and Handling Vehicles
- Band 3 receiver cartridges
- Band 6 receiver cartridges
- Local Oscillator assemblies and other components for all receiver bands
- Front End Components
- Front End Integration
- Back End Oscillators and other components
- The 64-Antenna Correlator
- Software
- Employer of Joint ALMA Observatory local staff
- Support for North American and Chilean users via the North American ALMA Science Center







*ALMA, an international astronomy facility, is a partnership of Europe, North America and East Asia in cooperation with the Republic of Chile.*

#### *Credit for Photography*

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AOS Panorama: C. Padilla, NRAO/AUI/NSF  
Men Working on Antenna: M. Pingry, NRAO/AUI/NSF  
Satellite Passing Over AOS: C. Padilla, NRAO/AUI/NSF  
AOS from a Distance: P. Carrillo, ALMA (ESO/NAOJ/NRAO)  
OSF Building: C. Padilla, NRAO/AUI/NSF  
Transporters: C. Padilla, NRAO/AUI/NSF  
ALMA at Night: ESO/B. Tafreshi  
12-meter Antennas: ALMA (ESO/NAOJ/NRAO)  
Compact Array: ALMA (ESO/NAOJ/NRAO)  
ALMA Technician: C. Padilla, NRAO/AUI/NSF  
Front End Servicing Vehicle (FESV): C. Padilla, NRAO/AUI/NSF  
Array at AOS: C. Padilla, NRAO/AUI/NSF*

