ESOcast Episode 51: All Systems Go for Highest-altitude Supercomputer		

00:00 **[Visuals start]** **[Narrator]** 1. One of the most powerful supercomputers in the world has now been fully installed and tested at its remote, high altitude site in the Andes of northern Chile. This marks one of the major remaining milestones toward completion of ALMA, the Atacama Large Millimeter/submillimeter Array. The ALMA correlator turns ALMA's many antennas into one giant telescope.		**Images:** Correlator ALMA at Chajnantor

00:37 **ESOcast intro** 2.This is the ESOcast! Cutting-edge science and life behind the scenes at ESO, the European Southern Observatory.		ESOcast introduction

00:57 **[Narrator]** 3. ALMA is the most elaborate ground-based telescope in history and is composed of an array of 66 dish-shaped antennas. Its supercomputer, or correlator, is a component of crucial importance. For ALMA to work, the faint celestial signals collected by each antenna must be combined with those from every other antenna. The correlator's processors will continually combine and compare the data from up to 64 of the antennas in the ALMA array, which are separated by up to 16 kilometres, enabling the antennas to work together as a single, enormous telescope.		ALMA at Chajnantor Animation: ALMA with single dish superimposed

01:50 **[Narrator]** 4. The ALMA correlator has over 134 million processors and performs up to an unbelievable 17 quadrillion operations per second. That is 17 thousand million million! The correlator was built specifically for this task, but the number of calculations per second is comparable to the performance of the fastest general-purpose supercomputers in the world. This unique processing challenge needed innovative design, both for the individual components and for the overall architecture of the correlator.		Animation suggesting calculations taking place in the computer with superimposed number. Correlator footage

02:37 **[Narrator]** 5. The initial design of the correlator, as well as its construction and installation, was led by the US National Radio Astronomy Observatory, the lead North American partner in ALMA. The correlator project was funded by the US National Science Foundation, with contributions from ESO. As the European partner in ALMA, ESO also provided a key part of the correlator: an entirely new and versatile digital filtering system, conceived and built in Europe, was incorporated into the initial NRAO design. The University of Bordeaux designed and built a set of 550 state-of-the-art digital filter circuit boards for ESO. With these filters, the light that ALMA sees can be split up into 32 times more wavelength ranges than in the initial design, allowing astronomers to flexibly “slice and dice” the spectrum of light.		ALMA antennas or correlator ESO HQ outside shot Bordeaux SD footage ALMA antennas

03:48 **[Narrator]** 6. As well as enormous technical challenges in building the correlator, the extreme location of the system was also a factor. The correlator is housed in the ALMA Array Operations Site Technical Building, the highest-altitude high-tech building in the world. At 5000 metres altitude, the air is thin, meaning that twice the normal airflow is necessary to cool the supercomputer. The thin air also makes it impossible to use spinning computer disk drives, as their		ALMA at Chajnantor AOS Correlator room

read/write heads rely on a cushion of air to stop them crashing into their platters. Furthermore, the correlator had to be designed to withstand earthquakes, which are common in this region.		

04:44 **[Narrator]** 7. ALMA began science observations in 2011 with a partial array of antennas. A section of the correlator was already in use to combine the signals from these antennas, but now the full system is complete, ready for ALMA to begin observations with a larger number of antennas.		ALMA antennas

05:10 **[Narrator]** 8. The successful installation of the new supercomputer marks an important step toward the completion of ALMA in the near future. By using the array's unparalleled observational power, scientists will gain new insights into the hidden wonders of the Universe.		ALMA antennas Celestial images

05:40 **[Outro]**		ESOcast is produced by ESO, the European Southern Observatory. *ESO, the European Southern Observatory, is the pre-eminent intergovernmental science and technology organisation in astronomy designing, constructing and operating the world's most advanced ground-based telescopes.*

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