

The Signing of the ALMA Trilateral Agreement

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The first Atacama Large Millimeter/sub-millimeter Array (ALMA) Agreement between ESO and the US National Science Foundation (NSF) entered into force on 25 February 2003, following various earlier approaches and contacts between different radio astronomy projects, and as a result of the visionary key decision to join the strengths and efforts of the North American, East Asian and European projects in Chile. Japan, through the National Institutes of Natural Sciences (NINS), formally joined the construction project a year later.

Since then, ALMA has developed tremendously. Sixty-six antennas have been built and commissioned, and now populate the Chajnantor Plateau in northern Chile. All the antennas are equipped with, and supported by, cutting-edge technologies, hardware and software; upgrades and the opening of more frequency bands continues to enhance the capabilities. All the necessary infrastructure, buildings and roads on the ALMA site and in Santiago have been constructed and — last, but surely not least — the technicians, engineers, scientists and administrative staff from all over the world and with many different cultural backgrounds have learnt to work together for the good of the project. The last remaining milestone — the Residencia — is in an advanced state of construction and due to be occupied later this year. There have already been more than three years of science observations — resulting

in stunning discoveries, with more still being revealed.

Quite naturally for a project of this size and complexity, matters have evolved considerably from the early days when the ink of the first signatures on the agreement was not even dry. Also quite naturally, the initial agreements no longer fully reflect the current *modus operandi* of ALMA. NINS is now fully committed to ALMA operations, the ALMA Director's Council was created while other committees were disbanded, and ALMA has moved on from being a construction project to operations, and is on its way to a steady state. The ALMA parties ESO, NINS and NSF thus decided to review the high-level agreements and consolidate them in a single consistent agreement — the Agreement Concerning Operations of ALMA — which was signed in Tokyo on 15 December 2015.



Figure 1. Signing of the ALMA Trilateral Agreement in Tokyo on 15 December 2015, by the three representatives of the ALMA partners. Left to right: Tim de Zeeuw, ESO Director General; Katsuhiko Sato, NINS President; F. Fleming Crim, NSF Assistant Director.

Text of the Speech by the ESO Director General, Tim de Zeeuw, at the Signing of the ALMA Trilateral Agreement

President Satoh, Professor Hayashi, Dr. Crim, distinguished colleagues and friends from NAOJ, NSF and ESO.

It is a pleasure to say a few words on behalf of ESO at today's ceremony, which marks the next phase in the intercontinental ALMA project, namely the signature of the Trilateral Agreement governing the operational phase, which sees all three Partners, NINS, NSF and ESO on an equal footing.

It is just over thirty years ago since the IAU Symposium 115, entitled Star-forming Regions, took place in the Hotel Metropolitan here in Tokyo in November 1985. The topic and timing were related to the coming online of the Nobeyama 45-metre telescope and interferometer, both of which were world-leading at the time. My wife Ewine and I were postdocs, and we participated in the Symposium. It was our first direct and very positive encounter with Japanese astronomy. The visit to the Nobeyama Radio Observatory was one of the highlights of the entire week!

In preparation for today's event, I looked again at the published proceedings from that Symposium, and discovered not only a detailed list of participants, but also three photos showing nearly everyone who attended. Amazingly, quite a few are here today! Many others also had key roles in making ALMA become a reality, or became leaders in other areas of astronomy! The cast included three future IAU Presidents (amongst whom of course Norio Kaifu), two Directors of NRAO (Paul Vanden Bout and Fred Lo), the first ALMA Director (again Vanden Bout), all three chairs to date of the ALMA Proposal Review Committee (Neal Evans, Anneila Sargent and Françoise Combes), members and chairs of the ALMA Board (Evans, Sargent, Ewine van Dishoeck, Shoken Miyama, Hideyuki Kobayashi, Masahiko Hayashi), future Directors General of NAOJ, NINS and ESO, the former Gemini and STScI Director and current AURA President (Matt Mountain), as well as many others.

Ewine and I subsequently attended the IAU General Assembly in Delhi and then took a tour of Rajasthan together with a few US colleagues and a small group of Japanese astronomers led by Kaifu, and



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including Masatoshi Ohishi and Hiroko Suzuki, who sadly passed away too soon.

In the years that followed, plans were made on three continents for a next generation facility, with much increased resolution and sensitivity. This naturally led to the idea of a large interferometer on a very high site, with the best high-frequency receivers that can be built. The power of a radio interferometer goes up with the square of the number of antennas, so by combining the individual plans in East Asia, North America and Europe into the worldwide ALMA partnership it was possible to build a much more powerful facility at an affordable cost.

Building the array in northern Chile on Chajnantor, half-way up into space, with the strong support of the Chilean government, was a fairly natural step for NSF, which funds optical observatories in Chile, and certainly for ESO, which operates the La Silla Paranal Observatory there. But Chile is very far away from where we are today. I admire the commitment of our Japanese and East Asian colleagues for taking the bold step to go for the best site worldwide and join ALMA.

ALMA construction was started as a bilateral project between NSF and ESO, and Japan joined soon after via bilateral agreements with each. This was a key step as it enabled ALMA to become a truly transformational facility. It also strengthened the partnership and enriched it with an additional scientific community and culture. Of course it also projected Japan straight into the global arena, building on the success of Nobeyama and of the Subaru Telescope on Hawaii.

Figure 1. Night-time operations of ALMA on the Chajnantor Plateau.

As ALMA construction proceeded, it became clear that it would be very useful to replace the three bilateral agreements by a single Trilateral Agreement governing operations, which would take into account the experience gained during construction.

The development of the Trilateral Agreement was performed by a small group, consisting of Masa Hayashi and Satoru Iguchi for NAOJ/NINS, Dana Lehr and Phil Puxley for NSF, and the former Council President Xavier Barcons, Nikolaj Gube and myself for ESO. Nikolaj was the main keeper of the document and garnered credit from all involved. I am pleased he is here today, and want to express my thanks to him and all others in the team for the very constructive spirit in which the Trilateral Agreement was written, which has further increased the level of trust between the Partners.

The ALMA conference which took place in Tokyo last year demonstrated that the dream of a truly transformational facility for astronomy has become a reality. I am certain that the power and efficiency of the facility will continue to increase in the years to come. It is a testimony to the visionary and motivated individuals who laid the groundwork more than three decades ago, and turned it onto a reality. Who could have thought this in 1985 when many of us met during IAU Symposium 115 as young astronomers!