



# Atacama Large Millimeter Array

## Interface Control Document

*Between:*

AOS Facilities

*And:*

Ancillary Calibration Devices

ALMA-20.01.04.00-90.05.13.00-A-ICD

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**ALMA Project**  
**Interface Control Document**  
*Between: AOS Facilities*  
*And: Ancillary Calibration Devices*

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## Change Record

Version	Date	Affected Section(s)	Change Request #	Reason/Initiation/Remarks
A	2003-11-30	all		First draft
	2004-09-23	all		Second draft
	2007-08-28	all		Third draft
	2008-08-26			EDM comments addressed
	2010-07-13	all		Central shelter replaced by central tower and associated elements.
	2010-10-11			Respond to review comments. Clarify responsibilities. Add LPS and grounding.




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## 1 Description

### 1.1 Purpose

To monitor observing conditions and provide atmospheric information for observatory operations, the ancillary calibration devices described in *Specification of Ancillary Calibration Devices* [RD 02] will be installed at the AOS. These devices include meteorological instruments and other site characterization equipment. This ICD defines the interfaces between this equipment and the facilities at the AOS.

### 1.2 Scope

This ICD specifies the electrical and mechanical interfaces between the ancillary calibration devices and the AOS facilities. These facilities include:

- 8 meteorological towers,
- Central station with meteorological tower and adjacent shelter and concrete pad for ancillary equipment

### 1.3 Responsibilities

The Science IPT is responsible for the specification, purchase, and installation of the ancillary calibration devices and associated equipment, and infrastructure as described below.


The Site IPT is responsible for providing facilities at the AOS with adequate space, electrical power, and mechanical support for the ancillary calibration devices. Communications cabling is to be provided as described here-in. No lighting or cooling requirements for Site IPT are envisaged as part of this ICD.

Responsibilities for individual items are noted in the text.

## 2 Related Documents and Drawings

### 2.1 ADs

AD 01	ALMA Safety Manual	ALMA-10.08.00.00-011-C-MAN
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AD 02	ALMA Environmental Specifications	ALMA-80.05.02.00-001-B-SPE,
AD 03	Standard for Plugs, Socket-outlets, and Couplers.	ALMA-80.05.00.00-004-D-STD,
AD 04	Conditions, Rules and Regulations applicable to Contractors working at the Atacama Large Millimeter/submillimeter Array (ALMA) Sites	ALMA-10.00.00.00-004-C-PRO

## 2.2 RDs

RD 01	ALMA Weather Instrumentation Specification	SCID-90.03.00.00-101-A-SPE,
RD 02	Specification of Ancillary Calibration Devices	SCID-90.05.13.00-001-A-SPE,
RD 03	ALMA atmospheric temperature profiler specifications	SCID-90.03.00.00-011-A-SPE,
RD 04	ALMA Project Book, Chapter 14 SITE CHARACTERIZATION AND MONITORING	
RD 05	ALMA ADE Instrument Group AOS Weather Stations including Central Weather Station Statement of Work	SCID-20.00.00.00-0039-A-SOW
RD 06	Risk Analysis for AOS Weather Stations	SCID-20.00.00.00-0041-A-REP

## 3 Central Weather Station


### 3.1 Description and location

The ancillary calibration devices will be installed either in, on, or adjacent to a central equipment station or on the meteorological tower. No additional ancillary calibration devices will be installed in or on the AOS Technical Building. Site shall provide the tower and its mounting and two concrete pads for the Central Station. Science IPT shall provide the Central Station Shelter, its installation at the AOS, and all of its contents and wiring to include the HVAC. The Site IPT shall provide anchor points on the concrete pads, and grounding as described below.<sup>1</sup>

Near the center of the array, a meteorological tower shall be erected and a shelter installed to hold the equipment. This tower shall meet the following requirements:

Location on ALMA construction grid	7453050 N 627696 E (m) <sup>1</sup>
Orientation	Long dimension EW parallel to prevailing wind
Maximum equipment mounting height	15 m
Capacity at maximum height	20 kg

<sup>1</sup> At this writing, the location of the mast has been identified, the mast and concrete pads installed, see Figure 1. There is a requirement for a clear line of site to the east and west for the oxygen sounder.

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In addition to weather monitoring instruments, of which there are several, this central station will host a number of instruments unique to it. None of the instruments nor their installation will be provided by Site IPT. These unique instruments include but are not limited to :

1. Atmospheric temperature profiler
2. Infrared (10  $\mu\text{m}$  all-sky camera)
3. 11.2 GHz Phase monitoring interferometer (300m E-W baseline)
4. Tipping radiometer (225 GHz or 183GHz) or a spare Water Vapor Radiometer
5. Broadband Emission Monitor (*e. g.* Fourier Transform Spectrometer)
6. Ozone Monitor

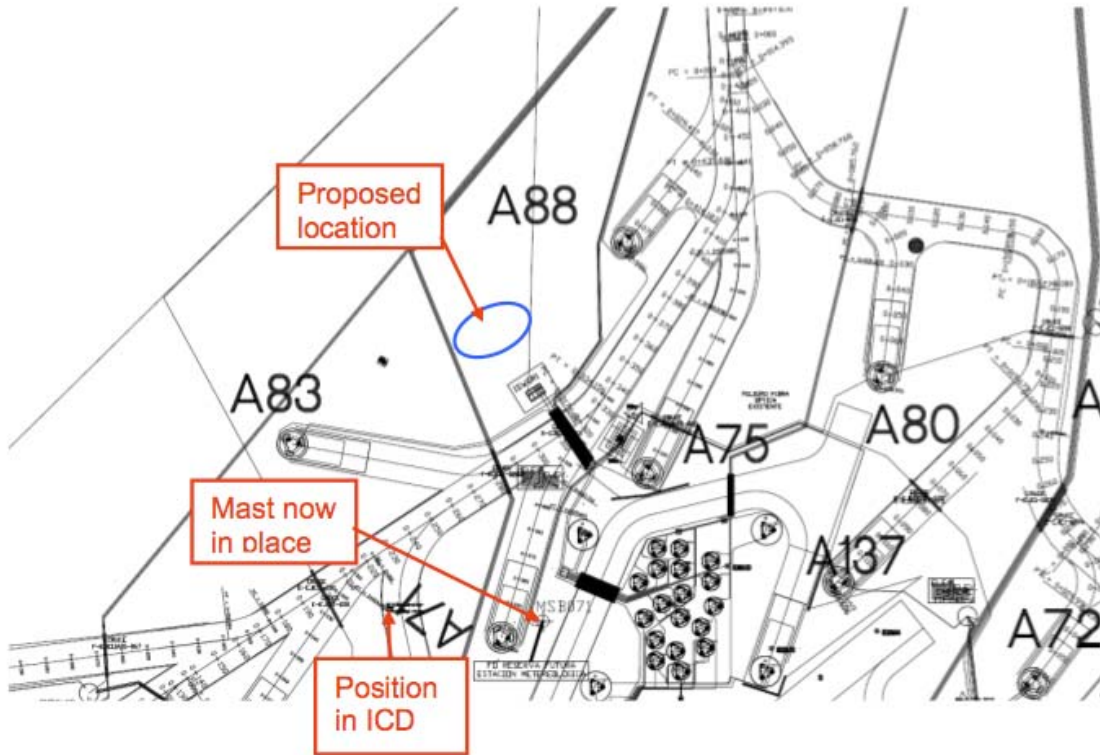
Of these, versions of numbers three and four are (or were, in the case of the tipper) currently deployed at the site characterization containers. Numbers five and two are desirable but are not in the current budget. The profiler needs a concrete foundation, the details of which are given in the specification document SCID-90.03.00.00-011-A-SPE (concrete pad size adjusted 2010/07/12):

“The profiler system shall be supplied with a tripod or similar base structure that can be bolted to a level concrete pad approximately  $2.0\text{ m} \times 2.0\text{ m}^2$  in size. The concrete pad shall be level to 5 mm and the base structure shall provide a mechanism for leveling of the instrument to the required accuracy as necessary. The bolt holes on the base structure shall accept metric-sized bolts. ”

The instrument requires a clear line of site to the east and west.

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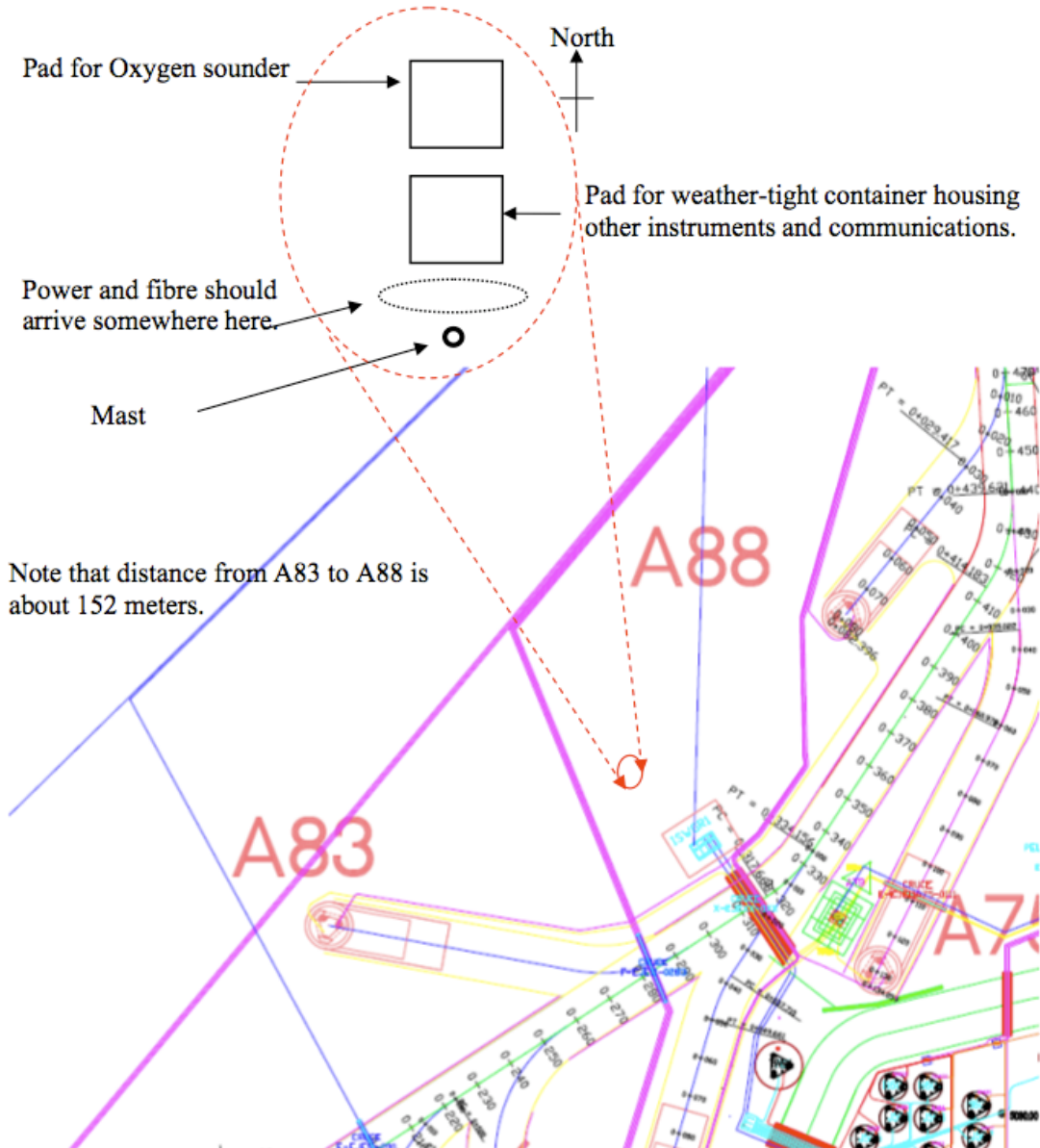
<sup>2</sup> At this writing, a pad has been installed with dimensions of 3x1.65m and Richard Hills has given e-mail approval.



**Figure 1** Location of central weather station (blue). Proposed western end of 11.2 GHz phase monitoring interferometer (300m east-west baseline, too large for this figure) is just west.


### 3.2 Oxygen Sounder (proposed atmospheric temperature profiler)

Details for the pad foundation are given earlier. The configuration should be as shown in Figure 2, which is intended to be roughly to scale. Site is not responsible for providing nor installing the oxygen sounder.



**Figure 2 Diagram for Oxygen Sounder Location**



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### 3.3 Electrical Power for the Central Station Shelter

All ancillary calibration devices shall operate from 230 VAC, 50 Hz single phase power and the equipment connected to the shelter shall consume not more than 20A. Although the equipment power factors are not yet known, they will exceed 0.9 (TBC). Inrush currents will be less than 120% (TBC) of the steady state currents. Although no circuit may be overloaded, there are no restrictions on how the equipment loads are distributed among circuits nor on the phases of the different circuits. It shall be a Site IPT responsibility to provide a suitable electrical power feeder to the lighting panel in the shelter and to power disconnects and circuit breakers in the electrical boxes at the base of the meteorological-only masts. Distribution of power on the load side of the lighting panel and circuit breakers shall be the responsibility of the Science IPT. The Science IPT shall provide the lighting panel for the shelter. Electrical connection shall be done in accordance with ALMA Safety Office requirements. [AD 01, AD 04]

### 3.4 Software/Control Function Interface


An alarm panel will provide over temperature, power out, and fire indications via the Internet connection. The alarms are to be included in the alarm display provided to the Array Operators and emergency response personnel. Neither the panel, the alarm displays, nor the alarm software are a Site IPT responsibility

## 4 Meteorological towers (other than tower at Central Station)

### 4.1 Locations

At least eight towers for nine sets of meteorological equipment (one set will be a spare) are required, one near the center of the array and others each near the end of each arm of the extended configuration. We recommend a total of at least eight towers, including the central tower, for optimum coverage. The Site shall provide all the towers and their installation. Towers shall meet the following requirements:

Locations on ALMA construction grid (at least six of these locations to be chosen; one will be near the central building)	1: 7453657.0 N 620125.0 E (m) (W1)
	2: 7455040.0 N 623451.0 E (m) (W5)
	3: 7457210.2 N 625901.9 E (m) (W8)
	4: 7452986.0 N 626124.0 E (m) (A130)
	5: 7447310.0 N 634062.0 E (m) (S9)
	6: 7451111.2 N 632668.2 E (m) (S7)

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7: 7450388.2 N 629490.2 E (m) (S1)  
 8: 7462869.2 N 633309.9 E (m) (P13)  
 9: 7458399.5 N 631556.8 E (m) (P10)  
 10: 7454297.0 N 628978.0 E (m) (A129)

Maximum equipment mounting height 15 m  
 Capacity at maximum height 20 kg

## 4.2 Electrical

It shall be a Site IPT responsibility to provide a suitable electrical power feeder, 230 VAC, 50 Hz, single phase, 10A, to the lighting panel in the electrical boxes at the base of the meteorological-only masts.

The Site IPT shall provide the weather-proof electrical boxes for the meteorological-only masts, and the disconnect/circuit breakers for the weather-proof boxes, to include installation. Distribution of power on the load side of the lighting panel and circuit breakers shall be the responsibility of the Science IPT.

Electrical connection shall be done in accordance with ALMA Safety Office requirements. [AD 01, AD 04]

## 5 Common Requirements and Responsibilities for Central Station and meteorological towers

### 5.1 Towers

The towers will *not* be suitable to support personnel. Equipment installation or maintenance shall be done with a man lift in cooperation with ALMA Safety Procedures.


### 5.2 Electrical

#### 5.1.1 Electrical Connectors

All plugs and outlets shall conform to *Standard for Plugs, Socket-outlets, and Couplers*, [AD 03]. In the case of the electrical power, the feeder will be hardwired into a lighting panel so that no connector is required. All other connectors, such as Fiber optic, signal, and Internet, are the responsibility of the Science IPT, not Site.

#### 5.1.2 UPS

No uninterruptible power supply (UPS) shall be provided by the Site IPT; a UPS will be included with instruments delivered by the Science IPT to the Central Station Shelter.

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### 5.1.3 Grounding and Lightning Protection

It shall be a Site IPT responsibility to provide a lightning aerial on the weather mast, a down conductor connected to the aerial and leading to ground, a suitable ground, and connection of the down conductor to the ground. The Site IPT shall provide a grounding ring for the tower and both pads, and bonding of the rings to the mast ground and other grounds in the immediate area. It shall be the responsibility of the Science IPT to connect the lighting panel ground to the ground provided by Site, to provide surge suppression as required for AC power and signal lines, and to connect the surge suppressors to the ground provided by Site. [AD 04] and [RD 05 Appendix B]

### 5.1.4 Testing

Site IPT shall “Meggar” and otherwise test the electrical feeders for correct performance.

## 5.2 Communications

The meteorological towers and the Central Station shall be connected to the AOS communications network by a fiber optic Ethernet link. This link shall have the same characteristics as the links between the AOS technical building and the antenna stations. The Site IPT shall provide the fiber optic cable (at least 4 fibers, single mode) and its interment. The Science IPT shall be responsible for the cable termination, routing of the fiber cable in the AOS TB, and routing inside the shelter and mast boxes. The Site IPT shall provide a 3 m service loop at the shelter and the electrical boxes on the meteorological towers and a 10 m service loop at the TB. The Site IPT shall check attenuation levels for the fibers to check that they are within acceptable bounds. The fiber optic communication equipment is not a Site responsibility.


### 5.2.1 Telephones

Voice over IP (VoIP) telephones, if provided, are not a Site IPT deliverable. Connection of telephones and all other communication equipment to the fiber is a Science IPT responsibility.

## 5.3 Electronic Interface

Any required RFI shielding of any and all instruments shall be the responsibility of the Science IPT, not the Site IPT.

## 6 Safety Interface

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## 6.1 Earthquake protection

It shall be a Site IPT responsibility for the meteorological towers to be anchored sufficiently to withstand seismic accelerations. [AD 02]

## 6.2 Fire protection

A CO<sub>2</sub> fire extinguisher will be included inside the Central Station Shelter. Neither the fire extinguisher nor its mounting is a Site IPT responsibility.