Cost Estimate of the Atacama Telescope from Scaling Laws

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1. The recent experience of the ALMA Project in procuring two prototype 12m antennas can be used as the basis for an estimate of the cost of the Atacama telescope.

2. The ALMA technical specifications are not as demanding as those of the Atacama telescope

   - ALMA surface rms accuracy spec is 25 microns with a goal of 20 microns (Vertex Antenna Systems accepted 20 microns as the delivery specification)
   - Antenna diameter is 12m
   - Pointing specification is 0.”6 rms over a 20 minute period (between pointings) in a wind of 9 m/s.
   - ALMA telescope designs are rigid, not homologous, because they are meant to be used for interferometry.

3. Presuming that there is no need for a fundamental change in technology to go from the ALMA specifications to those of the Atacama telescope, we can use the approximate cost of the one-off ALMA prototype antenna (the “baseline”) together with scaling relations to estimate the cost of the Atacama telescope.

Extrapolated Cost of the Atacama Telescope

Cost Category	**Baseline 12m (113 sq m) (dollars in M$)**	Scaling Exponent with Diameter (RLB)	**25 m Antenna (491 sq m) (dollars in M$)**	**30m Antenna (707 sq m) (dollars in M$)**
Management and Engineering				
Engineering Management +QA	1.0	1.0	2.1	2.5
Design	1.3	1.0	2.7	3.3
Technical Test and Demonstration	0.4	1.0	0.8	1.0
Subtotal Engineering	**2.7**		**5.6**	**6.8**
Reflector				
Backup Structure	1.8	2.5	11.3	17.8
Panels	0.2	2.0	0.9	1.3
Panel Adjustors	0.8	2.0	3.5	5.0
Secondary Support	0.1	1.0	0.2	0.3
Misc. (HVAC, Secondary positioning, etc)	0.7	1.0	1.5	1.8
Subtotal Reflector	**3.6**		**17.3**	**26.0**
Mount				
AZ-EL Pedestal (=EL Pedestal+Az ring)	1.0	2.0	4.3	6.3
Foundation	0.2	2.5	1.3	2.0
Subtotal Mount	**1.2**		**5.6**	**8.2**
Tooling, Shipping, Erection	**1.2**	2.0	5.2	7.5
TOTAL: ANTENNA (M$)	**8.7**		**33.7**	**48.5**
Cost per square meter of Collecting Area in k$)	76.99		68.66	68.62

Atacama Telescope Project Cost ($M)

	25 m Antenna (dollars in $M)	30m Antenna (dollars in $M)
Site Development, Road at $100k/km for 10 km	1.0	1
Building (8 people, 300 sq ft per person, 250$/sq ft)	0.6	0.6
Dome (Area=pi*(1.5*telescope radius)2)*$3000/sq m)**	3.3	4.8
Real Time Metrology (Edge Sensors?) at $2000/sq m	1.0	1.4
Instrumentation	7.0	7
Cornell/Caltech Telescope Project (4 FTE for 4 years?)	2.4	2.4
Antenna	33.7	48.5
Total Project Cost	**49.0**	**65.7**

Cost Drivers

Antenna

1. **Pointing Specification** (ALMA 0.”6 over 20 minutes, 2” blind over the sky)

2. **Elevation Limit**

   - **> 90 degrees (i.e. over the top?)**
   - **Lowest elevation for observations (?)**

3. **Wind specification ?**

4. **Multiple foci with a ability to switch between/among ? (what do we do when the weather is not submm quality? How much is this worth?)**

5. **Build a very rigid back structure and a simple metrology system or a low-cost back structure and a very capable metrology system to correct for gravitational deformations? Where is the optimum?**

Project

1. **How much initial emphasis, if any, should be given to equipping the telescope with heterodyne receivers and digitial correlators for high resolution spectroscopy?**