

MILLIMETER ARRAY/ALMA-US DESIGN AND DEVELOPMENT

MONTHLY REPORT MONTH END APRIL 2001

1 Executive Summary

The ALMA Coordinating Committee met in Tokyo, Japan on April 5-6. A major outcome of this meeting was a resolution signed by Dr. Cesarsky, Chair of the ACC, Dr. Eisenstein, Vice Chair of the ACC and Dr. Kaifu, Director-General of NAO-J, concerning the Partnership for planning the Atacama Large Millimeter Array (ALMA). One aspect of this resolution is that a Japanese Delegation will, with immediate effect, participate in the work of the ACC through an expanded ALMA Coordinating Committee (EACC). An Expanded ALMA Executive Committee (EAEC) was similarly created to construct detailed plans for a Tripartite ALMA within the guidelines and principals outlined at the meeting.

The newly formed EAEC met immediately after the EACC meeting to identify a process leading to a scope and division of effort for a Tripartite ALMA. A meeting was planned for May in Paris, France of all of the Division Heads and Team Leaders of the three partners. The meeting is intended as both a method of identifying and resolving organizational issues and to extend the teaming relationships that already exist between the US and European members to our Japanese colleagues.

1.1 Financial Statement

[Not Included.]

1.2 Personnel

The ALMA Project staffing is reported by WBS Level-1 category based on the joint project WBS. The total number of full-time equivalent employees was 63.3.

1.3 Progress Against Project Milestones

Attached to this report is the Project Gantt chart displaying the summary-level tasks of the Phase 1 Project WBS. For each of these summary tasks the progress against the baseline is reported as a percent complete. The same information is shown graphically; progress is reported as horizontal bars colored green; work still pending is shown in black or solid blue. Milestones are indicated by triangles, colored green for completed milestones and colored red for pending milestones. The baseline ALMA Project is the North American-European Project, Japan is not a participant in the baseline.

In April, there were no major milestones scheduled for completion. The meeting of the ACC was a major event that occurred this month. Significant work in progress was achieved as described in the reports below.

2 Meetings And Memos

2.1 Meetings Held During April 2001

ACC/EACC Meeting - April 5/6 - Tokyo, Japan
 EAEC Meeting – April 7 – Tokyo Japan
 JRDG Teleconference - April 26
 ASAC Teleconference – April 12
 ALMA US DH Teleconference - April 9, April 16, April 23
 ALMA Joint DH/TL Teleconference - April 30

2.2 Planned Meetings in May 2001

Progress on Photonic Systems for ALMA - May 17 - Bonn, Germany
 Joint Tri-Project Meeting - May 10 - 12 - Paris, France
 ALMA US DH Meeting - May 14, 21
 ALMA Joint DH Meeting - May 29
 ALMA US ASAC Teleconference - May 30
 ASAC Teleconference - May 31
 EAEC Weekly Teleconferences
 ALMA Systems Group Weekly Teleconferences

2.3 ALMA Technical Memos Distributed in April 2001

360	Design of Sideband Separation SIS Mixer for 3 mm Band	Vessen Vassilev and Victor Belitsky
361	Phase Cross-Correction of a 11.2 GHz Interferometer and 183 GHz Water Line Radiometers at Chajnantor	Guillermo Delgado
362	ALMA Receiver Optics Design	J.W. Lamb, et al.
363	Velocity of the Effective Turbulence Layer at Chajnantor Estimated From 183 GHz Measurements	Guillermo Delgado and Lars-Ake Nyman
364	An Antenna Location Mask for Configuration Designs for ALMA	Bryan J. Butler
366	A Telescope Pointing Algorithm for ALMA	J. G. Mangum

The full catalog of the ALMA Memo Series can be found at the ALMA web site at <http://www.alma.nrao.edu/memos/>.

3 Technical Progress Reports

3.1 Antennas

A plan for the layout of thermistors for the Vertex prototype antennas has been developed. This thermistor system will be used to characterize the thermal behavior of the Vertex antenna. The plan draws heavily upon the very successful design implemented on the 30m telescope by Albert Greve (IRAM), Juan Penalver (IRAM), and Michael Bremer (IRAM). The EIE antenna will have a similar system.

The final versions of the Vertex foundation bid drawings are complete and were sent out for bid. A prebid meeting was held on 19 April. Representatives from four contractors attended.

Vertex has completed a revised finite element model for evaluation. This model consists of 35073 elements. In the model, Vertex provides CFRP plate data for analysis. NRAO is evaluating the model in parallel and will examine the results for consistency.

An assessment of options for the production antenna procurement plan is underway. Management has asked that three models be analyzed for ways in which the three partners produce antennas:

- Model 0 - Two or three independent contracts for antennas meeting the same specifications

- Model 1 - common antenna design with 2 or 3 contracts for a fraction of the antennas built to the common design
- Model 2 - common antenna design with one system integrator (could be a contractor or could be the project) who integrates subassemblies produced by 3 subcontractors (one of the subcontractors could also be the system integrator).

These will be discussed in detail at the Paris meeting of the Tripartite Division Heads and Team Leaders.

3.2 Frontend

The Joint Receiver Design Group met by teleconference 23 April. One of the issues discussed was the frontend specification for Total Power Stability proposed by the ASAC of 10^{-4} in one second. In view of the fact that this specification is likely to affect both the difficulty and expense of producing the front ends for ALMA, the JRDG decided to request additional details from the ASAC. This includes a more precise definition of what is required. It would be desirable to have the astronomy requirements stated more clearly and from these and estimates of atmospheric contributions, derive with the power spectrum of the total power fluctuations.

A review of the costing model for frontend production was held in Charlottesville this month. The purpose of the meeting was to update the year old cost estimates to reflect the maturing design following completion of the Frontend PDR in February. A number of areas were identified that require new estimates to complete the revised cost model. These estimates will be completed next month.

3.3 Local Oscillator System

We received good news from our collaborators at Rutherford Appleton Lab. Their first test integrating the u2t photomixer in a W-band waveguide was successful, with 25 microwatts of RF power measured at 100 GHz; and the device not fully driven. Power was flat from 77 to 103 GHz. The next iteration will use a different waveguide probe that will eliminate the need for a tuner.

3.4 Backend Subsystem

A review was held for the fiber optic work plan with our collaborators at Jodrell Bank. The antenna cable wrap drawing was sent to Jodrell so they could study effect of bends on the fiber optic cable.

The schematic for the total power detector/amplifier/lowpassfilter board is complete. A layout for the board is underway.

3.5 Correlator

A report on the testing of the prototype station card is available on the ALMA correlator web page at

http://www.alma.nrao.edu/development/correlator/Alma_Correlator_Station_Card_Test_Report.pdf

Innotech, the custom correlator chip contractor, has completed the top level chip design but still needs a few days for simulation analysis before the design is ready to proceed to mask layout. Recent price quotes from the silicon foundry are unchanged from their original quote.

Both filter card inputs and outputs have now been tested error free at a card clock rate of 125 MHz. The filter card input signals work error free over about a 180 degree variation in card clock phase. The filter card outputs, however, only work over about 70 degrees of phase variation.

For the Long Term Accumulator, write and read operations between the C167 processor and all 8 banks of SDRAM have been accomplished. In the process, two un-soldered FPGA pins were found. These are the only assembly problems found to date, and something like 75% of all data paths have now been exercised.

The Long Term Accumulator card (LTA) has been demonstrated to meet its specifications. This involves reading the LTA SDRAM, adding in new "integrations" and storing results back in the RAM. The SDRAM on the LTA is so large that it would take many hours to completely test the entire card using only the microprocessor port to the memory. To solve this problem a FPGA hardware support is being designed to aid microprocessor testing of the card.

3.6 Computing

The definition of the test interferometer data format has been completed. The document has been distributed for comment.

Considerable progress on the CAN simulator has been made. This will allow us to simulate CAN nodes via simple scripting on PC's. A binding to the Python scripting language will be required.

Development is continuing for the Time Service software, specifically the Duration and Epoch classes. These classes are now working and a test routine has been written for them. Code to allow a CORBA client to properly create and destroy these server objects now exists.

New LCUClock and Clock interfaces based on the CORBA Time Service and ACE were developed, and distributed for comment.

Updated versions of the TICS design documents "Time Distribution" and "Time System and Representation" were submitted. Several other ACS design documents were delivered from our European colleagues.

3.7 Systems Engineering

Planning for the Test Interferometer continues to mature. Issues receiving attention this month include, office accommodations for TI personnel, TI computer network details, weather tower sitting, webcam installation, lightning protection, fibre optic cable testing, VLA warehouse accessibility to TI and the overall TI cabling plan.

The Holography transmitter and reference feed and lens drawings are complete.

The new ALMA Documentation Specialist started work this month. She is currently investigating some of the software package options and outlining the various program features for maintaining an electronics document archive.

3.8 Imaging and Calibration

The ASAC met by teleconference 12 April. The minutes can be found at

<http://www.alma.nrao.edu/committees/ASAC/asacminutes-01apr.html>

A major issue discussed at the this teleconference was that of post processing of ALMA data. ALMA has not funded an ALMA-specific post processing package, beyond those, which retrieve raw data into a usable format and apply first calibrations. The output will be in a package-neutral FITS format. The Science and Software Requirements group is preparing a list of requirements for this system. A European proposal for an AIPS++ demonstration project at IRAM has been well-received at NRAO. The committee was assured that NRAO is committed to ensuring that AIPS++ can handle ALMA data.

Preparations are underway for an ALMA Calibration Meeting on 21-22 June in Cambridge, England.

A site campaign has been planned and organized for the end of the month. Tests were completed of networking with the Inmarsat ISDN phone. The sub-mm tipper passed its final tests prior to deployment at the site.

A memo by Sakamoto on lightning was revised. The digital elevation models were released and maps were prepared. These can be found at:

<http://www.tuc.nrao.edu/alma/site/Chajnantor/maps/>

ALMA Memo 366 on "A Telescope Pointing Algorithm for ALMA" was submitted.

**MILLIMETER ARRAY/ALMA-US
PROJECT STAFFING**

MONTH END APRIL 2001

WBS Task Name	Number Of Persons Participating in Activity*	Full-time Equivalent Employees
Administration	11	6.4
Site Development	1	0.0
Antennas	4	2.5
Front-End	23	19.3
Local Oscillator	11	8.8
IF and Fiber Optics	6	6.0
Correlator	5	4.0
Computing	9	8.5
System Integration	5	4.8
Calibration	3	3.0
TOTAL:	78.0	63.3

* Several persons in this column are counted two or more times. These particular individuals are involved part-time in more than one activity.


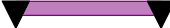

ALMA Milestone Progress


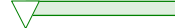

Phase 1 Major Milestones and Tasks selected

Line	WBS (f)	Task	Start	Finish	%done	1999	2000	2001	2002
1	<u>1</u>	Management/Administration	1998-06-01	2010-12-31	45%				
2	1.05	Phase 1 Management	1998-06-01	2001-12-31	75%				
4	1.05.10	Deliver WBS for ALMA D&D phase	1999-10-28	1999-10-28	100%	▲			
6	1.05.20	Deliver final WBS for ALMA project	2000-03-31	2000-03-31	100%		▲		
7	1.05.22	Review: ALMA Management Advisory Committee	2001-06-08	2001-06-08	0%			▲	
8	1.05.25	Project Book	1998-06-01	2001-12-28	74%				
10	1.05.25.10	MMA Project Book: Version 1	1998-07-20	1998-07-20	100%				
11	1.05.25.15	ALMA Project Book: Joint Version	2000-12-08	2000-12-08	100%			▲	
12	1.05.30	Phase 1 Joint Management Plan	1999-11-01	2001-09-21	65%	▽			
14	1.05.30.10	Deliver Phase 1 Joint Management Plan	2000-03-31	2000-03-31	100%		▲		
54	1.10	Phase 2 Planning	1999-01-01	2001-12-31	66%				
57	1.10.15	Deliver Baseline Scope of Phase 2	2000-03-31	2000-03-31	100%		▲		
59	1.10.25	Deliver Draft Phase 2 Plan	2000-05-15	2000-05-15	100%		▲		
61	1.10.35	Management Planning	1999-01-01	2001-12-31	72%				
62	1.10.35.05	Deliver Management Plan for Construction	2000-10-02	2000-10-02	100%		▲		
77	1.20	Agreements in Chile	1998-06-01	2010-12-31	22%				
79	1.20.10	CONICYT Use Permissions	2001-12-31	2001-12-31	0%				▲
86	1.25	Partnerships and Agreements	1999-01-11	2001-12-31	64%				
88	1.25.10	Partnership Recommendations to NSF	1999-03-30	1999-03-30	100%	▲			
91	1.25.25	Final ALMA Partnership Agreements	2001-12-31	2001-12-31	0%				▲
96	<u>2</u>	Site Development	1998-06-01	2010-12-31	24%				
97	2.05	Site Development Management	1998-06-01	2006-01-19	31%				
98	2.05.03	Site Development Management Phase 1	1998-06-01	2001-12-28	75%				
102	2.07	Site Development Requirements	1998-06-01	2001-03-16	96%				
104	2.07.10	Deliver Initial Operations Plan	2000-05-01	2000-05-01	100%		▲		
105	2.07.15	Deliver Revised Operations Plan	2001-03-01	2001-03-01	0%			▲	
106	2.10	Development Plans	1998-06-01	2001-12-10	88%				
107	2.10.05	Prepare Preliminary Development Plan	1998-06-01	1999-10-15	100%	▽			
116	2.10.10	Estimate Development Costs	1999-11-01	2001-12-10	67%	▽			
117	2.10.10.05	Prepare Initial Plan	1999-11-01	2001-05-31	82%	▽			
125	2.10.10.05.38	Deliver Initial Site Development Plan	2000-06-05	2000-06-05	100%		▲		
135	2.10.10.15	PDR: Site Development Plan	2001-10-01	2001-10-01	0%			▲	
137	2.10.10.25	Deliver revised development Plan	2001-12-10	2001-12-10	0%			▲	
138	2.15	Site Legal Issues	2000-08-21	2010-12-31	2%				
139	2.15.05	(CONICYT Use Permissions Delivered from WBS 1)	2001-12-31	2001-12-31	0%				▲

Milestones: **bold type**
Summary Tasks: underline

Joint Task 
Eur Task 
US Task 

Summary (Joint) 
Summary (Eur) 
Summary (US) 




Milestone 
Progress 
Completed Mlstrn 




Phase 1 Major Milestones and Tasks selected

Line	WBS (f)	Task	Start	Finish	%done	1999	2000	2001	2002
140	2.15.10	(Access to OSF Land Delivered from WBS 1)	2001-12-31	2001-12-31	0%				
141	<u>2.15.15</u>	<u>Process Environmental Documents (EIA)</u>	2000-08-21	2002-01-31	22%				
143	2.15.15.07	EIA Started	2000-10-02	2000-10-02	100%				
144	2.15.15.10	Deliver Initial EIA	2000-12-09	2000-12-09	100%				
146	2.15.15.20	Submit EIA Documents	2001-04-02	2001-04-02	0%				
252	3	Antenna Subsystem	1998-06-01	2010-12-31	20%				
253	<u>3.05</u>	<u>Antenna Management/Subsystem Engineering</u>	1998-06-01	2010-12-31	19%				
256	<u>3.05.10</u>	<u>Antenna Subsystem Engineering</u>	1998-06-01	2010-07-01	16%				
257	<u>3.05.10.05</u>	<u>Antenna Subsystem Design & Specification</u>	1998-06-01	1999-03-05	100%				
263	3.05.10.05.30	Antenna PDR	1998-07-28	1998-07-28	100%				
265	3.05.10.05.40	CDR: Antenna RFP/CfT	1999-03-05	1999-03-05	100%				
267	<u>3.10</u>	<u>Prototype Antennas</u>	1998-09-22	2003-04-11	41%				
268	<u>3.10.05</u>	<u>U.S. Prototype Antenna</u>	1998-09-22	2002-12-19	41%				
271	3.10.05.15	Issue Prototype Antenna RFP	1999-03-30	1999-03-30	100%				
275	3.10.05.35	Sign Contract (Prototype Antenna #1)	2000-02-22	2000-02-22	100%				
276	<u>3.10.05.40</u>	<u>US Prototype antenna contract supervision</u>	2000-03-02	2001-11-22	54%				
278	3.10.05.40.10	Vertex Prototype antenna PDR	2000-06-20	2000-06-20	100%				
279	3.10.05.40.15	Vertex Prototype antenna CDR	2000-11-15	2000-11-15	100%				
285	3.10.05.40.22	Vertex Prototype Site Assembly Start	2001-08-10	2001-08-10	0%				
289	3.10.05.40.45	Deliver Vertex Prototype Antenna	2001-10-20	2001-10-20	0%				Under Review
296	<u>3.10.10</u>	<u>European Antenna Prototype Procurement</u>	1999-03-31	2003-04-11	26%				
298	3.10.10.10	Issue prototype antenna CfT	1999-04-30	1999-04-30	100%				
302	3.10.10.30	Sign prototype antenna #2 contract	2000-02-21	2000-02-21	100%				
303	<u>3.10.10.35</u>	<u>Prototype antenna contract supervision</u>	2000-02-21	2002-04-12	22%				
305	3.10.10.35.10	EIE Prototype antenna PDR	2000-06-22	2000-06-22	100%				
306	3.10.10.35.15	EIE Prototype antenna CDR	2000-11-09	2000-11-09	100%				
310	3.10.10.35.28	EIE Starts Installation on Site	2001-10-11	2001-10-11	0%				
316	3.10.10.35.45	Deliver EIE Prototype Antenna	2002-03-08	2002-03-08	0%				Under Review
322	<u>3.10.20</u>	<u>Vertex Metrology/Test Equipment</u>	2000-04-01	2001-11-28	61%				
348	3.10.20.40	Deliver Vertex Antenna Metrology System	2001-11-28	2001-11-28	0%				
350	<u>3.10.22</u>	<u>EIE Metrology/Test Equipment</u>	2000-04-01	2001-11-28	34%				
376	3.10.22.40	Deliver EIE Antenna Metrology System	2001-11-28	2001-11-28	0%				
378	<u>3.10.25</u>	<u>Prototype Vertex Nutator</u>	2000-04-03	2001-09-28	63%				
382	3.10.25.15	Deliver Prototype Vertex Nutator	2001-09-28	2001-09-28	0%				
384	<u>3.10.27</u>	<u>Prototype EIE Nutator</u>	2001-02-16	2002-01-02	0%				

Milestones: **bold type**
Summary Tasks: underline

Joint Task 
Eur Task 
US Task 

Summary (Joint) 
Summary (Eur) 
Summary (US) 

Milestone 
Progress 
Completed Mlstr 

ALMA Milestone Progress

Phase 1 Major Milestones and Tasks selected










Line	WBS (f)	Task	Start	Finish	%done	1999	2000	2001	2002
386	3.10.27.15	Deliver Prototype EIE Nutator	2002-01-02	2002-01-02	0%				
422	4	Front End Subsystem	1998-06-01	2010-12-31	24%				
423	4.05	Front End Management/Subsystem Engineering	1998-06-01	2010-12-31	28%				
428	4.05.10	Front End Subsystem Design & Specification	1999-09-01	2000-09-08	100%				
432	4.05.10.20	Final Front End Specifications	2000-09-08	2000-09-08	100%				
436	4.10	SIS Mixer Development	1998-06-01	2003-12-17	73%				
442	4.10.10	Balanced, sideband separating SIS mixers	1998-06-01	2003-12-17	74%				
443	4.10.10.05	Specifications	1998-06-01	2000-03-20	100%				
445	4.10.10.05.10	Review: SIS Mixer	2000-03-20	2000-03-20	100%				
505	4.10.10.40	Mixers	1998-06-01	2003-12-17	61%				
510	4.10.10.40.10	230 GHz	1999-01-11	2002-05-02	67%				
558	4.10.10.40.10.25	Deliver prototype 230 GHz Mixer	2001-12-31	2001-12-31	0%				
580	4.10.10.45	Automated Mixer Testing	1998-06-01	2001-08-31	82%				
585	4.10.10.45.25	Complete automated mixer characterization	2000-08-01	2000-08-01	100%				
601	4.10.10.53	Integrated IF	2000-03-01	2001-12-31	29%				
607	4.10.10.55	Vacuum Windows	1998-06-01	2000-02-11	100%				
617	4.10.10.55.50	Complete 86 GHz Vac. Window Development	2000-02-11	2000-02-11	100%				
666	4.20	Antenna Evaluation Front Ends	1998-10-27	2002-04-11	74%				
674	4.20.40	Review: Evaluation Front End	2000-02-29	2000-02-29	100%				
680	4.20.70	Deliver Antenna Test Eval Front End #1	2001-10-12	2001-10-12	0%				
682	4.20.80	Deliver Antenna Test Eval Front End #2	2001-11-15	2001-11-15	0%				
683	4.25	Prototype Front Ends	2001-02-19	2004-03-04	0%				
684	4.25.05	PDR: Front End Subsystem	2001-02-19	2001-02-19	0%				
685	4.25.10	Front End Engineering Model	2001-02-20	2002-04-12	0%				
698	4.25.10.20	Front End Eng. Model Progress Review 2	2001-08-20	2001-08-20	0%				
699	4.25.10.25	Deliver Front End Eng. Model Components	2001-12-21	2001-12-21	0%				
764	5	Local Oscillator Subsystem	1998-06-01	2010-12-31	18%				
765	5.05	LO Management/Subsystem Engineering	1998-06-01	2010-12-31	20%				
769	5.05.15	LO Ref system definition	1999-10-01	2000-02-29	100%				
773	5.05.15.20	PDR: LO Reference	2000-02-29	2000-02-29	100%				
774	5.05.17	PDR: LO Subsystem	2001-06-15	2001-06-15	0%				
779	5.10	Prototype LO	1998-06-01	2009-12-24	49%				
780	5.10.03	LO Reference US Phase 1	1998-06-01	2002-03-29	58%				
784	5.10.05.10	LO Reference Test Int Prototype Modules	2000-08-23	2002-01-29	34%				
785	5.10.05.10.10	FO Receiver, LO Reference	2000-12-01	2002-01-29	17%				

Milestones: bold type Summary Tasks: <u>underline</u>	Joint Task	Summary (Joint)	Milestone
	Eur Task	Summary (Eur)	Progress
	US Task	Summary (US)	Completed Mlstrn

ALMA Milestone Progress

Phase 1 Major Milestones and Tasks selected

Line	WBS (f)	Task	Start	Finish	%done	1999	2000	2001	2002
820	5.10.05.10.15	Two-Laser generator, RF synthesizer	2000-08-23	2001-07-05	32%				
831	5.10.05.10.20	Second LO synthesizer	2000-11-01	2002-01-08	19%				
866	5.10.05.10.25	Fringe Generator	2000-10-16	2001-11-20	29%				
901	5.10.05.10.30	Central LO Reference Generator / FO Xmtr	2000-08-23	2001-12-18	54%				
936	5.10.05.15	LO Ref Bench system, integrate and test	2001-06-27	2001-08-08	0%				
939	5.10.05.15.15	Deliver LO Ref bench prototype	2001-06-27	2001-06-27	0%				
940	5.10.05.25	Deliver LO Ref field prototype	2002-01-01	2002-01-01	0%				
946	5.10.10	Multiplier Chain LO Prototype	1998-06-01	2003-07-03	58%				
965	5.10.10.15	Multiplier R&D	1998-06-01	2002-04-01	69%				
966	5.10.10.15.05	Prototype multiplier development	1998-06-01	1999-02-19	100%				
969	5.10.10.15.05.15	PDR: Multiplier Chain LO	1999-02-19	1999-02-19	100%				
970	5.10.10.15.10	55->110 GHz Doubler (Band 9)	1998-06-01	1999-02-26	100%				
982	5.10.10.15.15	110->220 GHz Doubler (Band 9)	1998-06-03	2000-01-30	100%				
995	5.10.10.15.20	80->240 GHz Tripler (Band 6)	1998-08-03	2001-05-01	93%				
1001	5.10.10.15.20.30	Deliver Prototype 80-240GHz tripler	2001-05-01	2001-05-01	0%				
1049	5.10.15	Photonic LO Distribution Prototype	1998-06-01	2002-03-08	63%				
1052	5.10.15.48	Photonic Distribution Development	1999-12-01	2001-09-01	61%				
1053	5.10.15.48.05	PDR: Photonic Distribution	2000-02-28	2000-02-28	100%				
1054	5.10.15.48.10	Photomixer Modules	1999-12-01	2001-09-01	79%				
1064	5.10.15.48.15	Laser Synthesizer and Phase Lock	2000-02-22	2001-08-01	58%				
1073	5.10.15.48.20	Correctors for F/O round trip	2000-01-31	2001-06-28	72%				
1084	5.10.15.55	Deliver Photonic LO Dist Prototype	2001-08-08	2001-08-08	0%				
1142	6	<u>Backend Subsystem</u>	1998-06-01	2010-12-31	19%				
1143	6.05	Backend Management/Subsystem Engineering	1998-06-01	2010-12-31	25%				
1146	6.05.10	Backend system definition	1998-11-02	2000-02-29	100%				
1151	6.05.10.25	Decision: Analog/Digital Transmission	1999-05-24	1999-05-24	100%				
1154	6.05.16	Backend Subsystem PDR	2001-06-15	2001-06-15	0%				
1158	6.10	Prototype Backend Subsystem	1999-02-22	2002-12-30	41%				
1160	6.10.10	Test Int IF Down-Converter	2000-02-01	2002-12-30	45%				
1167	6.10.15	Test Int Data Transmission System	2000-02-29	2002-01-24	44%				
1378	6.10.20	Bench system, integrate and test	2001-06-25	2001-08-03	0%				
1381	6.10.20.15	Deliver Backend bench prototype	2001-06-26	2001-06-26	0%				
1383	6.10.24	Deliver Test Int Backend Field Prototype	2002-01-10	2002-01-10	0%				
1386	6.10.45	Prototype Digitizer/Sampler	2000-03-01	2002-12-30	31%				
1388	6.10.45.10	Pre-prototype ASIC design to foundry (CMOS)	2000-07-17	2000-07-17	100%				

Milestones: bold type Summary Tasks: <u>underline</u>	Joint Task		Summary (Joint)		Milestone	
	Eur Task		Summary (Eur)		Progress	
	US Task		Summary (US)		Completed Mlstr	

ALMA Milestone Progress


Phase 1 Major Milestones and Tasks selected

Line	WBS (f)	Task	Start	Finish	%done	1999	2000	2001	2002
1393	6.10.45.35	Test Bench qualification tests	2001-07-03	2001-09-03	0%				
1411	<u>7</u>	Correlator	1998-06-01	2010-12-31	22%				
1419	7.10	Test Correlator	1998-07-20	2001-03-01	99%				
1425	7.10.30	Deliver Test Correlator to Alma Test site	2001-03-01	2001-03-01	0%				
1426	7.15	Baseline Correlator	1998-07-03	2008-04-23	40%				
1427	7.15.05	Baseline Correlator Preliminary Design	1998-09-15	2000-01-20	100%				
1432	7.15.05.25	PDR: Correlator	2000-01-20	2000-01-20	100%				
1433	7.15.10	Finite Impulse Response Filter Development	1998-07-03	2001-07-27	86%				
1444	7.15.10.40	PDR: Finite Impulse Response Filter	2000-05-08	2000-05-08	100%				
1451	7.15.10.85	FIR Filter Performance Report	2001-07-27	2001-07-27	0%				
1452	7.15.15	Custom Board Development	1999-06-23	2002-05-06	44%				
1453	7.15.15.05	Station Card	1999-06-23	2002-03-08	30%				
1466	7.15.15.10	Correlator Card	2000-01-03	2001-12-19	52%				
1475	7.15.15.10.55	Deliver Correlator Card	2001-12-19	2001-12-19	0%				
1476	7.15.15.15	Long-Term Accumulator	2000-01-03	2001-12-24	46%				
1485	7.15.15.15.55	Deliver Long Term Accumulator	2001-12-24	2001-12-24	0%				
1486	7.15.15.20	System Control Card	1999-09-02	2002-05-06	47%				
1496	7.15.20	Correlator Chip Development	1999-01-04	2001-07-23	82%				
1545	8	Computing Subsystem	1998-06-01	2010-12-31	4%				
1	8.03	Computing Development (Phase 1)	1998-06-01	2002-04-24	48%				
2	8.03.05	Management	1998-06-01	2002-01-16	72%				
6	8.03.05.20	US/European Joint Software Meeting	2000-11-20	2000-11-21	100%				
8	8.03.05.30	Deliver Phase 2 Computing Plan	2001-06-01	2001-06-01	0%				
10	8.03.10	Science Software Requirements	2000-07-14	2001-09-01	99%				
17	8.03.15	High Level Analysis and Design	2000-07-14	2001-09-02	50%				
18	8.03.15.05	Computer Design Concept	2000-11-15	2000-11-15	100%				
37	8.03.25	ALMA Common Software	2000-07-14	2001-12-02	9%				
43	8.03.25.30	Kitt Peak ACS test	2000-12-01	2000-12-01	100%				
47	8.03.25.50	Release of ACS for Test Interferometer	2001-12-02	2001-12-02	0%				
48	8.03.30	Control Software	2000-07-14	2002-04-24	33%				
49	8.03.30.05	Test Interferometer Control Software	2000-07-14	2002-04-24	33%				
204	8.03.30.80	TICS 1.0: Single Dish/Total Power	2001-11-12	2002-01-08	0%				
211	8.03.30.80.35	TICS Release 1.0	2002-01-08	2002-01-08	0%				
226	8.03.35	Correlator Software	2000-07-14	2002-03-01	43%				
227	8.03.35.05	Test Correlator	2000-07-14	2001-06-20	66%				

Milestones: bold type Summary Tasks: <u>underline</u>	Joint Task	Summary (Joint)	Milestone
	Eur Task	Summary (Eur)	Progress
	US Task	Summary (US)	Completed Mlstr

Phase 1 Major Milestones and Tasks selected

Line	WBS (f)	Task	Start	Finish	%done	1999	2000	2001	2002
237	8.03.37	Prototype Correlator	2001-03-12	2002-03-01	0%				
244	8.03.37.35	CDR: Prototype Correlator Software	2002-03-01	2002-03-01	0%				
270	8.03.65	Telescope Calibration	2000-11-19	2001-12-01	0%				
276	8.03.65.30	Release for Test Interferometer	2001-12-01	2001-12-01	0%				
1546	9	System Engineering & Integration	1998-06-01	2010-12-31	14%				
1549	9.10	System Engineering	1998-06-01	2010-12-31	25%				
1551	9.10.10	System Block Diagram for Array	1999-12-31	1999-12-31	100%				
1553	9.10.20	System Design Review	2000-02-28	2000-02-28	100%				
1556	9.12	Test Site Preparation/Outfitting	2000-02-01	2001-06-04	72%				
1558	9.12.10	Design Review: Test Int. Site Preparation	2000-05-15	2000-05-15	100%				
1559	9.12.15	ALMATSF	2000-07-31	2001-06-04	67%				
1	9.12.15.05	PROCURE TEST SITE MATERIALS	2000-07-31	2000-12-04	99%				
25	9.12.15.20	ANTENNA TEST SITE PREPARATION	2000-10-02	2001-02-14	82%				
56	9.12.15.25	ANTENNA SITE FOUNDATIONS	2001-02-08	2001-06-01	0%				
1561	9.12.35	Test Interferometer Site Complete	2001-06-01	2001-06-01	0%				
1594	9.15	ALMA Prototype Interferometer Evaluation	1998-06-01	2003-12-16	8%				
7	9.15.20	Vertex Antenna Integration and Testing	2001-08-10	2002-12-04	0%				
9	9.15.20.10	Vertex Antenna Installation	2001-08-10	2001-11-08	0%				
49	9.15.20.30	Vertex Antenna Systems Installation and Testing	2001-12-17	2002-09-05	0%				
110	9.15.20.40	Millimeter Receiver Installation and Tests (Vertex)	2002-09-06	2002-09-26	0%				
149	9.15.30	EIE Antenna Integration and Testing	2001-10-11	2002-12-12	0%				
151	9.15.30.10	EIE Antenna Installation	2001-10-11	2002-01-09	0%				
191	9.15.30.30	EIE Antenna Systems Installation and Testing	2002-03-11	2002-09-23	0%				
248	9.15.30.35	Millimeter Receiver Installation and Tests (EIE)	2002-09-24	2002-10-04	0%				
285	9.15.40	Interferometer Tests	2002-12-13	2003-03-11	0%				
1595	9.20	Holography System	1998-09-01	2002-02-28	32%				
1600	9.20.25	CDR: Holography System	2000-10-10	2000-10-10	100%				
1611	9.20.30	Deliver Holography System	2002-02-28	2002-02-28	0%				
1621	10	Science	1998-06-01	2009-12-31	54%				
1622	10.05	Scientific Requirements	1998-06-01	2001-12-28	74%				
1623	10.10	Site Monitoring and Characterization	1998-06-01	2001-12-28	74%				
1624	10.15	Array Design and Operation	1998-06-01	2001-12-28	74%				
1625	10.17	PDR: ALMA Array Layout	2001-02-26	2001-02-26	0%				
1626	10.20	Calibration	1998-06-01	2001-12-28	74%				
1627	10.25	Imaging	1998-06-01	2001-12-28	74%				

Milestones: bold type Summary Tasks: <u>underline</u>	Joint Task		Summary (Joint)		Milestone	
	Eur Task		Summary (Eur)		Progress	
	US Task		Summary (US)		Completed Mlstr	