

MILLIMETER ARRAY/ALMA-US DESIGN AND DEVELOPMENT

MONTHLY REPORT MONTH END FEBRUARY 2001

1 Executive Summary

The Millimeter Array Management Oversight Committee (MMAOC) met in Washington, DC during February. They received two days of in-depth briefings by US project management and division heads on Phase One progress and Phase Two planning. While a written report will not be available until March, it was clear from the exit interview that the committee was pleased with the progress and continues to endorse our plans for construction.

Two other major meetings were held in February. The Frontend Preliminary Design Review (PDR) was held in Tucson, Arizona and the ALMA Science Advisory Committee (ASAC) meet in Florence, Italy. The Frontend PDR, a major project milestone, reviewed the design concepts for the frontend system, cryogenics and optics. The ASAC meeting was focused on prioritizing the potential enhancements that might be possible with the additional resources made available by Japan joining the project.

Another key milestone for the project was the delivery to Socorro of the Test Correlator. The Test Correlator, built at the CDL, will become part of the Test Interferometer used to evaluate the two prototype antennas. It will initially be integrated with the Zero Baseline Interferometer, which also includes the evaluation receivers, LO, backend and monitor and control system assembled in the lab for testing prior to arrival of the antennas.

2 Programmatics

2.1 Financial Statement

[Not Included.]

2.2 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 62.

2.3 Progress Against Project Milestones

Attached to this report is the Project Gantt chart displaying the summary-level tasks of the Phase 1 Project WBS. The tasks in this view of the project are selected from the complete WBS.

In February, two major milestones were scheduled for completion. These were the Frontend PDR (WBS 4.25.05), which was conducted on 19 February 2001, and delivery of the Test Correlator (WBS 7.10.30), which was shipped at the end of February.

3 Meetings And Memos

3.1 Meetings Held During February 2001

- Future Correlator Meeting - February 6-7
- ALMA DH Meeting (teleconference) - February 5, 12
- ALMA DH Face-to-Face Meeting - February 14 (Washington, DC)
- MMAOC Meeting - February 15-16 (Washington, DC)
- ALMA Front End PDR - February 19-20 (Tucson, AZ)
- ASAC Face-to-Face Meeting - February 23-24 (Florence, Italy)
- ACC Teleconference - February 22
- ALMA Configuration PDR - February 26-27 (Grenoble)
- ALMA/NSF Meeting - weekly teleconferences
- ALMA Lo/Rx Meeting - weekly teleconferences
- ALMA Imaging and Calibration Meeting - weekly teleconferences
- ALMA Executive Committee Meeting - weekly teleconferences
- ALMA Control Software - weekly teleconferences
- ALMA Joint Software Management - weekly teleconferences
- ALMA Joint Software Workers - monthly teleconferences
- ALMA SSR - monthly teleconferences

3.2 Planned Meetings in March 2001

ALMA SSR Meeting - March 1-2
 ACC Meeting - March 5, 6 - Tokyo, Japan
 JRDG Teleconference - March 1, March 9, March 19, March 29)
 ASAC Teleconference - March 14
 ALMA US DH Teleconference - March 12, March 19
 ALMA Joint DH/TL Teleconference - March 5

3.3 ALMA Technical Memos Distributed in February 2000

347	60 to 450 GHz Transmission and Reflection Measurements of Grooved and Un-grooved HDPE Plates	G.A. Ediss and T. Globus
348	A Preliminary ALMA Zoom Array Design for the Chanjnantor Site	John Conway
349	Fibre-Optic Link Design of the Atacama IF Data Transfer System	Roshene McCool
350	Feasibility Study of the Enhanced Correlator for 3-Way ALMA I	Sachiko Okumura, et al.
351	275-370 GHz DSB and SSB Waveguide Mixers Employing a Tuned Nb/Al-AIOx/Nb SIS Tunnel Junction	A. Navarrini and B. Lazareff

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

4 Technical Progress Reports

4.1 Antennas

Vertex continues to review their production schedule with the goal to find ways of reducing the fabrication time to recover the additional time spent on the development phase.

The European and US antenna groups met in Sweden to refine the detailed planning for Test Interferometer testing. The result of this meeting was a document summarizing the plan and recommendations.

The baseline conceptual subreflector design for the Nutator was completed.

4.2 Front End

A major milestone for the frontend task, the front end PDR, was achieved during this period. The review was held in Tucson February 19-20. The review was well attended with representatives from the US, Europe and Japan. The panel identified some areas where additional consultation with ASAC will be required to properly translate science goals to realizable engineering specifications.

A technical paper on the results of the single-ended mixer and preamplifier integration was written for presentation at the IEEE International Microwave Symposium. ALMA Memo #347 on the properties of vacuum window candidate geometries using HDPE was written. Several staff prepared for and attended the Space Terahertz symposium and the ALMA Front End PDR.

Design work was nearly completed on the configuration of an interface between a balanced Band 6 SIS mixer (for which we already have working MMIC chips) and an IF preamplifier. Calculations show that good performance can be expected. Drawings for the balanced mixer suitable for integration with a preamplifier were submitted to the shop for fabrication.

Work is continuing on improved optics for the test system, including matching layers for windows, lenses, and IR filters. Further experiments in machining the plastic materials are in progress in the shop, and some materials have been characterized. Using a new computer with a 1 GHz processor and 1 Gbyte of memory running Quickwave, analysis was performed on the characteristics of over-moded waveguide bends, which will probably be, required for LO injection in the ALMA front ends.

A new noise-measuring system using an Agilent E4418B power meter was completed; this will enable SIS mixer testing to proceed faster than with the old HP436 power meter.

4.3 Local Oscillator System

Fabrication was begun of the prototype 80-240 GHz frequency tripler. The tripler blocks began construction in the shop. The mask sets were ordered and received. A test run of the mask sets using scrap epitaxial material was begun in order to get a head start on the foundry process.

Highly successful end-to-end tests of a bench model ALMA LO system were conducted in Tucson, using the LO driver and phase noise test equipment from Charlottesville, the photonic locked laser reference system from Tucson, and the Central Reference Generator from Socorro. This is the first time all these elements have been joined to make a complete system. A phase-locked signal at 80 GHz was generated, which is suitable for frequency tripling to generate the final LO signal. Phase noise characteristics of various parts of the system and of the integrated whole were conducted, and an ALMA memo on the results was begun.

4.4 Backend Subsystem

Detailed design and prototyping continues on the backend modules for bench integration. Received the Test Correlator in Socorro where it will be integrated with the backend system for the Test Interferometer.

Completed Vector Network Analyzer (VNA) tests of isolators and filters for the downconverter. Started to setup the VNA to test the 4-12 GHz evaluation amplifiers for S parameters and for gain compression.

4.5 Correlator

Final work on the software and hardware of the test correlator was completed, and it was shipped to Socorro.

Testing began on the Long Term Accumulator card. Success was achieved in communicating with the on-board microprocessor and downloading personalities into the FPGA chips.

Testing began on the Station Card. Communications with the microprocessor-interface CPLD chip were established, and personalities were downloaded into the FPGA chips. The chip-to-chip high-speed data interfaces were verified. The internal RAMs in the FPGA chips were verified.

The construction of the test fixture for the Station Card and FIR Filter Card encountered a problem when it was detected that the layout of the board was incorrect (the connectors were wired backwards). A corrected layout was generated and sent off for fabrication.

The design of a test fixture for testing correlator chips was completed.

The initial draft design of the Correlator Card was completed and a review was held. Following comments during the review, the design was completed and preparations were begun for layout.

4.6 Computing

A meeting was held to review AMBSI requirements. The meeting report and final document has been issued. Work towards a CAN device simulator has begun.

A joint memo has been drafted, in cooperation with the NRAO Computing Division, proposing a software division with Europe.

Revision 3 of the “ALMA C++ Coding Standards” and Revision 4 of “The ALMA Software Documentation Standard” were issued. These documents can be found at:

<http://www.alma.nrao.edu/development/computing/docs/memos/index.html>

4.7 Systems Engineering

The ALMA Construction Project Book has now become Version 4.00, and is under Configuration Control. It is now available at:

<http://www.alma.nrao.edu/projectbk/construction/>. The main ALMA web page now links to this address.

This Project Book is now the official technical definition of the ALMA project, and as such is under Configuration Control. Instructions for how to submit changes in future for consideration by the Configuration Control Board (CCB) are available at: <http://www.alma.nrao.edu/projectbk/construction/CCRinstr.html>

All Optical Pointing Telescope components are now on-hand and are ready for powder coating. The mounting details of the controller and optical fiber transmitter in the camera package have now been worked out.

Nutator drawings and a rendering of the design are complete. Initial assembly of laboratory demonstrator is complete and dynamic testing has started. The first open loop test demonstrated 1.5 degree peak-to-peak mirror nutation (the equivalent of 9.7 arcmin on the sky) with a 5 Hz sine wave. Rudimentary closed loop tests with software PID controller have started.

A meeting was held at Lund to discuss Test Interferometer planning with European test group. This was a very productive meeting, where we further refined the TI plan tasks and details regarding how they will be accomplished.

4.8 Imaging and Calibration

The ASAC held a face to face meeting in Florence Italy. A major topic of discussion was the priorities to assign to potential enhancements to the baseline project that might be possible in a three way project with Japan. The complete minutes of the meeting can be found at:

<http://www.alma.nrao.edu/committees/ASAC/asacreport-01-feb.pdf>

A teleconference of the configuration working group was held that resulted in agreement on metrics to be presented to the PDR (though not agreement among callers on which was best!). The strawman agenda for the PDR is at:

<http://www.cv.nrao.edu/~awootten/mmaimcal/almaconfigpdragenda.html>

A search engine was added to the Imaging and Calibration WWW pages to guide the innocent through the over 350 pages of information there.

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

MONTH END FEBRUARY 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	21	17.3
Local Oscillator	11	8.8
IF and Fiber Optics	7	7.0
Correlator	5	4.0
Computing	9	8.5
System Integration	5	4.5
Calibration	3	3.0
TOTAL:	77.0	62.0

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


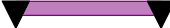

ALMA Milestone Progress


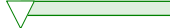

Phase 1 Major Milestones and Tasks selected

Line	WBS (f)	Task	Start	Finish	%done	1999	2000	2001	2002
1	<u>1</u>	<u>Management/Administration</u>	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>	<u>Site Development</u>	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%				
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%				
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		Summary (Joint)	
Eur Task		Summary (Eur)	
US Task		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 Mlstn

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 Mlstrn 

ALMA Milestone Progress

Phase 1 Major Milestones and Tasks selected






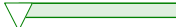


Line	WBS (f)	Task	Start	Finish	%done	1999	2000	2001	2002
1393	6.10.45.35	Test Bench qualification tests	2001-07-03	2001-09-03	0%				
1411	<u>7</u>	Correlator	1998-06-01	2010-12-31	22%				
1419	7.10	Test Correlator	1998-07-20	2001-03-01	99%				
1425	7.10.30	Deliver Test Correlator to Alma Test site	2001-03-01	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	<u>8</u>	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

ALMA Milestone Progress

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	