

MILLIMETER ARRAY/ALMA-US DESIGN AND DEVELOPMENT

MONTHLY REPORT MONTH END MARCH 2001

1 Executive Summary

The report of the February meeting of the Millimeter Array Oversight Committee (MMAOC) was distributed this period. In the introduction to the report, the committee noted the following:

The ALMA project is ready to start construction and we recommend that the NSF approve ALMA to move to Phase II. The ALMA team is more than ready for ALMA construction.

The project has made impressive technical progress and is meeting the goals for Phase I.

The NRAO is to be commended for remarkable technical and managerial progress. They have initiated implementation of all of the recommendations we requested at our last meeting, and moved the project from a scientific dream to a realistic plan for an observatory.

NRAO has made rapid progress in all areas, including technical tasks, project management, and also international coordination, and is poised to enter the construction phase of the project. NRAO has shown that they have succeeded admirably in the Design and Development Phase (Phase I).

The MMAOC report can be found at <http://www.alma.nrao.edu/docs/mmaoc2001.pdf>.

Significant activities this month centered on preparation for the ALMA Coordination Committee meeting to be held early in April in Tokyo. This ACC meeting is expected to be a major step toward a Tripartite ALAM that includes the Japanese. A significant open question is how antennas would be procured among the three partners. To begin exploring this and other similar issues, a series of meetings were held this month between the Japanese Antenna and Systems engineers and the US and European Division Heads and Team Leaders. These were very productive meetings that identified a number of specific issues that will have to be resolved in the coming months.

Progress continues on the US prototype antenna. Vertex is transitioning from design to fabrication. All critical parts are now on order. The design of the CFRP backup structure is nearing completion. Vertex continues to explore options for accelerating the fabrication process to recover the additional time spent on the design phase.

2 Programmatics

2.1 Financial Statement

The month-end financial statement organized by WBS Level-1 category is attached. The expenditure is in keeping with our current spending plan. The Project total expended and committed at the end of March was \$26.73M, an amount that is 83.5% of the total \$32M received for the design and development phase of the project and available for expenditure. Continuous detailed review of spending for the remainder of the year will be carried out to assure that the budget is not exceeded.

Planned spending for a fourth year of design and development shows that the allocated \$6M will carry the project to the assumed availability of construction funds in October 2001. The desire to minimize the potential schedule impact of this funding shortfall requires that all available budget contingency be applied to funding tasks critical to the test interferometer. The test interferometer is the primary critical path item. The lack of any budget contingency for 2001 translates to an extremely high budget risk through the end of the design and development phase. This will become especially critical should construction funds not be available in October 2001.

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 62.3.

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 March, two major milestones were scheduled for completion. These were *Deliver Revised Operations Plan* (WBS 2.07.15) and *Deliver Test Correlator* (WBS 7.10.30).

A draft operations plan was completed in March. This draft will be used to initiate discussions over the next several months on final plans for operations.

The Test Correlator was shipped from Charlottesville to Socorro at the end of February where it will be integrated with modules for the Test Interferometer.

3 Meetings And Memos

3.1 Meetings Held During March 2001

ALMA SSR Meeting - March 1-2

JRDG Teleconference - March 1, March 9, March 19, March 29

4.3 Local Oscillator System

Updated central rack layout for TI photonic reference and DC power requirements for this rack. Ordered two slave lasers for TI laser synthesizers.

Ordered two commercial photomixers for 75-120 GHz bands that will allow us to do test and development until photomixers from RAL are available.

Began detailed design of the holography transmitter and reference feed horns.

Phase locked the Test Interferometer W-band Gunn oscillator to the photonic reference at 83 GHz.

Successfully tested a new laser phase lock technique, using an optical Bragg cell rather than the laser itself to correct the frequency/phase errors in the loop. The phase noise was an improvement over anything we have done previously.

Conducted bench tests on the effect of fiber polarization drift on the level of the photonic reference signal. Using an inexpensive polarization controller we demonstrated that this level could be adjusted and maximized.

4.4 Backend Subsystem

Finished testing five available mixers and started optimize/debug process for testing mixer conversion loss.

Researched data on lowpass filter ICs for the total power detectors.

Wrote specs and RFQ packages for test interferometer digital attenuators 4-12 GHz and for integrated 2x2 matrix switches 4-12 GHz.

4.5 Correlator

Innotech reports that simulation of the custom correlator chip is proceeding well and we will have adequate speed margin for the 125 MHz chip clock rate. They have completed a successful simulation of the core logic. The next step is the final top level simulation. They expect to submit the chip design for layout in early to mid April.

A design review of the correlator card was held and the design should be ready to submit the card to layout shortly. The main concern with this card is the difficult PCB layout (over 5700 nets and 77 large 240-pin quad flat packs).

The re-layout of the test fixture motherboard was completed and is ready for quotes for board fabrication.

Checkout of the Long Term Accumulator/Correlator Control Card (LTACCC) is proceeding smoothly. Work so far has concentrated on control software running in the embedded Infineon C167 processor and on a host PC that will be used by all control cards in the correlator.

Basic operation of individual FPGA devices at 125 MHz, transfer of data between the C167 processor and FPGA chips, and operation of data transfers over the card CAN bus have been verified.

The next stage of work will concentrate on the actual Long Term Accumulation functions required on the card, where the next significant step will be to accomplish write/read control, at 125 MHz, over the large SDRAM data banks that provide the storage for accumulation results.

4.6 Computing

A simple ACS client/server program is now working. Several problems with the ACS installation were identified and corrected. Began implementation of ConvertTime class that will be an ACS server.

Prepared documentation for review of AMBSI designs and revised schematics choosing new static RAMs and fixed some prior errors.

Checked several new code modules into the ESO-NRAO common code repository. These modules connect ACS properties with the AMB CAN bus.

Revised the status of M&C ICDs and sent the list around to Div Heads.

Designed more detail on startup of Test Interferometer system control exec software.

Received complimentary copy of IBM DB2 relational database management system [as educational/ research organization]. Installed DB2 on windows and conducted transaction rate test for NT environment. Even this worst case looks useful. Proceeding to install on linux for a more optimized and tuned configuration. Constructing and testing equipment monitor point data collection and archiving.

4.7 Systems Engineering

Reviewed the current planning for the implementation and operation of the TI and made some modifications to the tasking in this plan. Visited the VLA site to review the current state of the TI site preparation. Discussed safety issues and facilities for the TI with Gene Cole and Guy Stanzio at the VLA site.

Completed detailed specification and vendor for the TI weather instrumentation.

Investigated how TI safety plan should best be organized. Reviewed VLA safety procedures and SOW ALMA System Safety Program proposal commissioned by ESO in this regard.

Tested closed loop software servo control for the nutator . Held progress review and demonstration capabilities for ESO. Studied illumination of nutator housing by receiver feeds.

Received second (cooled) CCD camera. Will begin software integration, testing and mount fabrication ASAP.

The ALMA Documentation Specialist position has been filled. Stacy Oliver has accepted this position and will start in Tucson on April 9th.

Met with Japanese antenna and systems engineers for four days and discussed a wide-range of ALMA issues. Most of our discussions were related to a possible Japanese involvement in the Test Interferometer.

4.8 Imaging and Calibration

Extending the analysis of wind data at the Chajnantor site. Specifically, we have LOTS of data on surface winds, from seven different weather stations in the area, plus radiosonde data, plus estimates of the winds aloft from the interferometer data. Rather than doing a bulk statistical analysis, as was done in ALMA Memo 322 (which is quite valid in its approach for a general comparison of Chajnantor and Pampa la Bola), this analysis is a correlational analysis that will assist in identifying changes within the site.

Restarted submm tipper in lab. Deployment to Chajnantor expected in late April. Planned site campaign for late April.

Held MMA ImCal and ASAC teleconferences; minutes of the ASAC meeting are at <http://www.cv.nrao.edu/~awootten/mmaimcal/asac/asacmar01minutes.html>

and those for February are at:

<http://www.cv.nrao.edu/~awootten/mmaimcal/asac/asacfeb01minutes.htm>)

The Configuration PDR report is now complete. It can be found at:

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

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

MONTH END MARCH 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	4.8
Calibration	3	3.0
TOTAL:	77.0	62.3

* 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)






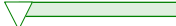


Milestone

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%				
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: <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






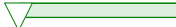



Line	WBS (f)	Task	Start	Finish	%done	1999	2000	2001	2002
386	3.10.27.15	Deliver Prototype EIE Nutator	2002-01-02	2002-01-02	0%				
422	4	Front End Subsystem	1998-06-01	2010-12-31	24%				
423	4.05	Front End Management/Subsystem Engineering	1998-06-01	2010-12-31	28%				
428	4.05.10	Front End Subsystem 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






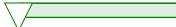



Line	WBS (f)	Task	Start	Finish	%done	1999	2000	2001	2002
1393	6.10.45.35	Test Bench qualification tests	2001-07-03	2001-09-03	0%				
1411	<u>7</u>	Correlator							
1419	<u>7.10</u>	Test Correlator	1998-06-01	2010-12-31	22%				
1419	<u>7.10</u>	Test Correlator	1998-07-20	2001-03-01	99%				
1425	7.10.30	Deliver Test Correlator to Alma Test site	2001-03-01	2001-03-01	0%				
1426	<u>7.15</u>	Baseline Correlator	1998-07-03	2008-04-23	40%				
1427	<u>7.15.05</u>	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	<u>7.15.10</u>	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	<u>7.15.15</u>	Custom Board Development	1999-06-23	2002-05-06	44%				
1453	<u>7.15.15.05</u>	Station Card	1999-06-23	2002-03-08	30%				
1466	<u>7.15.15.10</u>	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	<u>7.15.15.15</u>	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	<u>7.15.15.20</u>	System Control Card	1999-09-02	2002-05-06	47%				
1496	<u>7.15.20</u>	Correlator Chip Development	1999-01-04	2001-07-23	82%				
1545	8	Computing Subsystem							
1	<u>8.03</u>	Computing Development (Phase 1)	1998-06-01	2002-04-24	48%				
2	<u>8.03.05</u>	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	<u>8.03.10</u>	Science Software Requirements	2000-07-14	2001-09-01	99%				
17	<u>8.03.15</u>	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	<u>8.03.25</u>	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	<u>8.03.30</u>	Control Software	2000-07-14	2002-04-24	33%				
49	<u>8.03.30.05</u>	Test Interferometer Control Software	2000-07-14	2002-04-24	33%				
204	<u>8.03.30.80</u>	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	<u>8.03.35</u>	Correlator Software	2000-07-14	2002-03-01	43%				
227	<u>8.03.35.05</u>	Test Correlator	2000-07-14	2001-06-20	66%				

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

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ASSOCIATED UNIVERSITIES, INC.
 National Radio Astronomy Observatory
 MMA D&D Report
 For the Three Months Ending March 31, 2001

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Division	Project to Date Allocation	March Expended	Project to Date Expended	Balance Work in Process	Transfer to Fixed Assets	Commitment	Total Expended and Committed	Uncommitted Balance
808 MMA Design & Development 120								
12001 ALMA Administration								
2030 Fixed Assets								
00 Fixed Assets	14,944	0	14,944	0	14,944	0	14,944	0
3010 Personnel Compensation								
Personnel Compensation	1,082,918	47,026	1,225,946	1,225,946	0	0	1,225,946	143,028-
3020 Benefits								
Benefits	324,875	15,467	362,564	362,564	0	0	362,564	37,689-
3030 Materials & Services								
00 General M&S	235,056	29,596	289,071	289,071	0	0	289,071	54,015-
010325 Shipping and Freight	30,000	3,305	31,633	31,633	0	0	31,633	1,633-
0201 Additions to Tucson Lab	249,000	2,710	373,428	373,428	0	710	374,138	125,138-
0202 Modifications to AOC Space	197,853	0	197,854	197,854	0	0	197,854	1-
0203 CDL Rental Space and Remod	71,662	2,019	78,595	78,595	0	0	78,595	6,933-
0205 Chilean Facilities	181,000	0	164,685	164,685	0	0	164,685	16,315
101 ALMA Phase 1 EPO	0	0	12,787	12,787	0	0	12,787	12,787-
3040 AUI Management Fee								
AUI Management Fee	340,000	0	340,000	340,000	0	0	340,000	0
3050 Communications & Utilities								
Communications & Utilities	26,000	3,069	39,505	39,505	0	0	39,505	13,505-
3060 Travel								
Travel	261,000	0	0	0	0	0	0	261,000
3061 Travel - Domestic								
Travel - Domestic	0	2,659	119,735	119,735	0	0	119,735	119,735-
3062 Travel - Foreign								
Travel - Foreign	0	2,320	90,615	90,615	0	0	90,615	90,615-
3063 Travel - Relocation								
Travel - Relocation	0	0	18,227	18,227	0	0	18,227	18,227-
3064 Travel - Non-Employee								
Travel - Non-Employee	0	14,946	59,181	59,181	0	0	59,181	59,181-
12001 ALMA Administration	3,014,308	123,117	3,418,770	3,403,826	14,944	710	3,419,480	405,172-
12002 ALMA Site Development								
3010 Personnel Compensation								
Personnel Compensation	93,864	0	95,474	95,474	0	0	95,474	1,610-
3020 Benefits								
Benefits	28,159	0	19,210	19,210	0	0	19,210	8,949

3030	Materials & Services								
	Materials & Services	0	0	1,686	1,686	0	0	1,686	1,686-
00	General M&S	40,000	0	29,078	29,078	0	0	29,078	10,922
3060	Travel								
	Travel	31,857	0	0	0	0	0	0	31,857
3061	Travel - Domestic								
	Travel - Domestic	0	0	7,207	7,207	0	0	7,207	7,207-
3062	Travel - Foreign								
	Travel - Foreign	0	0	14,671	14,671	0	0	14,671	14,671-
	12002 ALMA Site Development	193,880	0	167,326	167,326	0	0	167,326	26,554
	12003 ALMA Antenna								
2030	Fixed Assets								
00	General M&S	5,008	0	5,008	0	5,008	0	5,008	0
3010	Personnel Compensation								
	Personnel Compensation	669,341	14,171	725,467	725,467	0	0	725,467	56,126-
3020	Benefits								
	Benefits	200,802	4,676	211,335	211,335	0	0	211,335	10,533-
3030	Materials & Services								
00	General M&S	59,992	3,089	38,281	38,281	0	3,100	41,381	18,611
0101	Design Concept 1	100,000	0	116,365	116,365	0	0	116,365	16,365-
0102	Design Concept 2	248,000	0	147,799	147,799	0	100,200	247,999	1
03	Procure Prototype Antenna	6,203,700	121,756	1,013,202	1,013,202	0	5,311,438	6,324,640	120,940-
033501	Ant.Contract Supervision&C	75,000	0	14,870	14,870	0	13,000	27,870	47,130
0520	Nutator Device	65,000	747	15,934	15,934	0	0	15,934	49,066
06	Metrology	27,641	310	4,988	4,988	0	0	4,988	22,653
3060	Travel								
	Travel	165,829	0	0	0	0	0	0	165,829
3061	Travel - Domestic								
	Travel - Domestic	0	0	54,549	54,549	0	0	54,549	54,549-
3062	Travel - Foreign								
	Travel - Foreign	0	1,832	79,833	79,833	0	0	79,833	79,833-
3064	Travel - Non-Employee								
	Travel - Non-Employee	0	0	25,697	25,697	0	0	25,697	25,697-
	12003 ALMA Antenna	7,820,313	146,581	2,453,328	2,448,320	5,008	5,427,738	7,881,066	60,753-
	12004 ALMA Receiver Systems								
203T	Fixed Asset - Transfer								
	Fixed Asset - Transfer	0	0	10,915	0	10,915	0	10,915	10,915-
0107	FA - Equipment Rack	0	0	45,536	0	45,536	0	45,536	45,536-
2030	Fixed Assets								
0107	FA - Equipment Rack	45,536	0	28,095	0	28,095	0	28,095	17,441
0115	FA - Lab Equipment	56,972	0	56,972	0	56,972	0	56,972	0
05	FA - Lab/Test Equipment	10,915	0	152,936	0	152,936	0	152,936	142,021-
10	FA - Cryogenics	21,346	0	21,346	0	21,346	0	21,346	0
3010	Personnel Compensation								
00	Personnel Compensation	804,585	52,114	836,083	836,083	0	0	836,083	31,498-

01	Personnel Compensation-SIS	1,241,255	42,617	1,331,724	1,331,724	0	0	1,331,724	90,469-
3020	Benefits								
00	Benefits	241,375	16,903	248,135	248,135	0	0	248,135	6,760-
01	Benefits-SIS Mixers	372,376	14,064	391,429	391,429	0	0	391,429	19,053-
3030	Materials & Services								
00	General M&S	0	0	8,369	8,369	0	0	8,369	8,369-
0102	Sideband Source Plates	26,296	0	6,253	6,253	0	0	6,253	20,043
0103	Room Temperature IF Plates	13,422	0	8,322	8,322	0	0	8,322	5,100
0104	Cryogenic IF Plates	5,321	33	3,053	3,053	0	0	3,053	2,268
0105	Dewar Instrumentation	69,261	3,248	29,412	29,412	0	0	29,412	39,849
0106	LO Plates	102,966	0	103,191	103,191	0	0	103,191	225-
0107	Equipment Rack	74,930	0	48,434	48,434	0	0	48,434	26,496
0108	Mixers	1,102,240	30,315	1,166,572	1,166,572	0	367,188	1,533,760	431,520-
0110	Wafer Evaluation	19,317	0	19,317	19,317	0	0	19,317	0
0111	Integrated IF	27,998	310	30,244	30,244	0	1,048	31,292	3,294-
0112	Vacuum Windows	9,113	0	9,113	9,113	0	0	9,113	0
0115	Lab Equipment	24,483	0	24,669	24,669	0	0	24,669	186-
0116	Lab Supplies	100,453	871	75,237	75,237	0	2,052	77,289	23,164
0117	Lab Software	90,280	0	64,085	64,085	0	0	64,085	26,195
02	HFET	0	0	220	220	0	0	220	220-
03	Antenna Evaluation	376,960	38,532	470,321	470,321	0	37,083	507,404	130,444-
05	Lab/Test Equipment	391,585	4,235	240,588	240,588	0	2,749	243,337	148,248
10	Cryogenics	148,790	0	134,186	134,186	0	14,300	148,486	304
3060	Travel								
00	Travel-Budget	112,716	0	0	0	0	0	0	112,716
01	Travel-Budget SIS Mixer	68,227	0	0	0	0	0	0	68,227
3061	Travel - Domestic								
00	Travel - Domestic	0	2,476	50,031	50,031	0	0	50,031	50,031-
01	Travel - Domestic SIS Mixe	0	5,844	34,057	34,057	0	0	34,057	34,057-
3062	Travel - Foreign								
00	Travel - Foreign	0	0	16,267	16,267	0	0	16,267	16,267-
01	Travel - Foreign SIS Mixer	0	0	2,028	2,028	0	0	2,028	2,028-
3063	Travel - Relocation								
00	Travel - Relocation	0	5,624	45,655	45,655	0	3,000	48,655	48,655-
01	Travel - Relocation SIS Mi	0	0	15,209	15,209	0	0	15,209	15,209-
3064	Travel - Non-Employee								
00	Travel - Non-Employee	0	2,266	13,613	13,613	0	0	13,613	13,613-
01	Travel - Non-Employee SIS	0	0	8,238	8,238	0	0	8,238	8,238-
	12004 ALMA Receiver Systems	5,558,718	219,452	5,749,855	5,434,055	315,800	427,420	6,177,275	618,557-
	12005 ALMA LO System								
203T	Fixed Asset - Transfers								
0401	FA-Photonic Phase Cal Syst	0	0	6,150	0	6,150	0	6,150	6,150-
2030	Fixed Assets								
0204	Lab/Test Equipment	95,323	0	101,117	0	101,117	0	101,117	5,794-
03	FA - Multiplier Chain LO	109,038	0	109,038	0	109,038	0	109,038	0
0303	FA - Multiplier R&D	0	24,000	24,000	0	24,000	0	24,000	24,000-
0401	FA-Photonic Phase Cal Syst	6,150	0	77,340	0	77,340	33,460	110,800	104,650-

3010	Personnel Compensations								
03	Personnel Compensation-Mul	415,295	24,436	491,237	491,237	0	0	491,237	75,942-
04	Personel Compensation-Phot	413,254	25,140	548,843	548,843	0	0	548,843	135,589-
3020	Benefits								
03	Benefits-Multiplier Chain	124,588	7,997	147,322	147,322	0	0	147,322	22,734-
04	Benefits-Photoic LO	123,976	8,296	162,737	162,737	0	0	162,737	38,761-
3030	Materials & Services								
02	LO Reference	169,411	6,318	104,661	104,661	0	42,671	147,332	22,079
0204	Lab/Test Equipment	12,339	2,459	17,029	17,029	0	0	17,029	4,690-
03	Multiplier Chain LO	68,962	495	71,595	71,595	0	2,598	74,193	5,231-
0302	Tunable phase-lock source	36,000	410	35,339	35,339	0	0	35,339	661
0303	Multiplier R&D	380,000	7,410	82,234	82,234	0	167,400	249,634	130,366
0401	Photonic Phase Cal System	602,550	7,117	262,796	262,796	0	96,335	359,131	243,419
0406	High Speed Photomixer Deve	194,586	0	194,586	194,586	0	0	194,586	0
501	Test Int First LO	0	21,536	36,785	36,785	0	27,830	64,615	64,615-
3060	Travel								
	Travel	58,280	0	0	0	0	0	0	58,280
04	Travel	20,000	0	0	0	0	0	0	20,000
3061	Travel - Domestic								
	Travel - Domestic	0	6,347	44,051	44,051	0	0	44,051	44,051-
04	Travel - Domestic	0	1,015	3,182	3,182	0	0	3,182	3,182-
3062	Travel - Foreign								
	Travel - Foreign	0	0	21,566	21,566	0	0	21,566	21,566-
3063	Travel - Relocation								
	Travel - Relocation	0	0	10,539	10,539	0	0	10,539	10,539-
3064	Travel - Non-Employee								
	Travel - Non-Employee	0	0	4,518	4,518	0	0	4,518	4,518-
	12005 ALMA LO System	2,829,752	142,976	2,556,665	2,239,020	317,645	370,294	2,926,959	97,207-
	12006 ALMA IF System								
2030	Fixed Assets								
04	De-Multiplexer with Matrix	147,580	0	147,580	0	147,580	0	147,580	0
3010	Personnel Compensation								
	Personnel Compensation	557,100	35,031	567,596	567,596	0	0	567,596	10,496-
3020	Benefits								
	Benefits	167,130	11,445	170,192	170,192	0	0	170,192	3,062-
3030	Materials & Services								
00	General M&S	36,686	0	37,365	37,365	0	1,980	39,345	2,659-
04	De-Multiplexer with Matrix	114,158	2,521	32,369	32,369	0	299	32,668	81,490
05	IF Bench Prototype	118,215	3,599	46,896	46,896	0	35,245	82,141	36,074
3060	Travel								
	Travel	43,236	0	0	0	0	0	0	43,236
3061	Travel - Domestic								
	Travel - Domestic	0	413	23,021	23,021	0	0	23,021	23,021-
3062	Travel - Foreign								
	Travel - Foreign	0	0	3,611	3,611	0	0	3,611	3,611-
3063	Travel - Relocation								
	Travel - Relocation	0	0	10,173	10,173	0	0	10,173	10,173-

3064	Travel - Non-Employee								
	Travel - Non-Employee	0	430	2,253	2,253	0	0	2,253	2,253-
	12006 ALMA IF System	1,184,105	53,439	1,041,056	893,476	147,580	37,524	1,078,580	105,525
	12007 ALMA FO System								
3010	Personnel Compensation								
	Personnel Compensation	53,221	0	54,400	54,400	0	0	54,400	1,179-
3020	Benefits								
	Benefits	15,966	0	16,320	16,320	0	0	16,320	354-
3030	Materials & Services								
00	General M&S	176,352	9,306	172,494	172,494	0	14,205	186,699	10,347-
3060	Travel								
	Travel	15,315	0	0	0	0	0	0	15,315
3061	Travel - Domestic								
	Travel - Domestic	0	0	4,020	4,020	0	0	4,020	4,020-
3063	Travel - Relocation								
	Travel - Relocation	0	0	9,823	9,823	0	0	9,823	9,823-
3064	Travel - Non-Employee								
	Travel - Non-Employee	0	0	2,285	2,285	0	0	2,285	2,285-
	12007 ALMA FO System	260,854	9,306	259,342	259,342	0	14,205	273,547	12,693-
	12008 ALMA Correlator								
2030	Fixed Assets								
03	Preliminary Design	9,476	0	9,476	0	9,476	0	9,476	0
3010	Personnel Compensation								
	Personnel Compensation	629,037	23,661	735,986	735,986	0	0	735,986	106,949-
3020	Benefits								
	Benefits	188,711	7,808	217,296	217,296	0	0	217,296	28,585-
3030	Materials & Services								
02	Test Correlator	35,483	0	35,545	35,545	0	0	35,545	62-
03	Preliminary Design	103,793	4,353	76,916	76,916	0	1,856	78,772	25,021
05	FIR Filter	10,995	0	11,066	11,066	0	0	11,066	71-
07	Correlator Chip	332,300	0	84,161	84,161	0	29,400	113,561	218,739
3060	Travel								
	Travel	73,198	0	0	0	0	0	0	73,198
3061	Travel - Domestic								
	Travel - Domestic	0	647	9,710	9,710	0	0	9,710	9,710-
3062	Travel - Foreign								
	Travel - Foreign	0	0	210	210	0	0	210	210-
3063	Travel - Relocation								
	Travel - Relocation	0	0	61,212	61,212	0	0	61,212	61,212-
	12008 ALMA Correlator	1,382,993	36,469	1,241,578	1,232,102	9,476	31,256	1,272,834	110,159
	12009 ALMA Computing								
2030	Fixed Assets								
00	General M&S	9,476	0	9,476	0	9,476	0	9,476	0

3010	Personnel Compensation								
	Personnel Compensation	801,912	45,172	923,645	923,645	0	0	923,645	121,733-
3020	Benefits								
	Benefits	240,574	14,884	277,471	277,471	0	0	277,471	36,897-
3030	Materials & Services								
00	General M&S	139,913	11,458	136,366	136,366	0	4,189	140,555	642-
14	Near Real-Time Imaging	103,087	0	102,141	102,141	0	4,536	106,677	3,590-
201	ALMA Test Site Building	7,500	0	15,657	15,657	0	0	15,657	8,157-
202	ALMA Test Site Electrical	23,575	578	69,677	69,677	0	1,080	70,757	47,182-
203	ALMA Test Site Civil Works	21,417	675	17,173	17,173	0	2,363	19,536	1,881
3060	Travel								
	Travel	112,180	0	0	0	0	0	0	112,180
3061	Travel - Domestic								
	Travel - Domestic	0	1,000	38,914	38,914	0	0	38,914	38,914-
3062	Travel - Foreign								
	Travel - Foreign	0	8,878	49,892	49,892	0	0	49,892	49,892-
3063	Travel - Relocation								
	Travel - Relocation	0	0	15,802	15,802	0	0	15,802	15,802-
3064	Travel - Non-Employee								
	Travel - Non-Employee	0	0	18,865	18,865	0	0	18,865	18,865-
	12009 ALMA Computing	1,459,634	82,645	1,675,079	1,665,603	9,476	12,168	1,687,247	227,613-
	12010 ALMA System Integration								
2030	Fixed Assets								
00	General M&S	9,750	0	9,750	0	9,750	0	9,750	0
3010	Personnel Compensation								
	Personnel Compensation	319,361	19,008	377,513	377,513	0	0	377,513	58,152-
3020	Benefits								
	Benefits	95,808	6,467	112,849	112,849	0	0	112,849	17,041-
3030	Materials & Services								
00	General M&S	32,107	22,830	34,537	34,537	0	5,820	40,357	8,250-
0403	Test Int.Site Prep	0	0	5,684	5,684	0	0	5,684	5,684-
07	Holography System	76,000	4,003	39,719	39,719	0	1,697	41,416	34,584
3060	Travel								
	Travel	35,798	0	0	0	0	0	0	35,798
3061	Travel - Domestic								
	Travel - Domestic	0	0	33,069	33,069	0	0	33,069	33,069-
3062	Travel - Foreign								
	Travel - Foreign	0	5,280	26,763	26,763	0	0	26,763	26,763-
3064	Travel - Non-Employee								
	Travel - Non-Employee	0	0	1,317	1,317	0	0	1,317	1,317-
	12010 ALMA System Integration	568,824	57,588	641,201	631,451	9,750	7,517	648,718	79,894-
	12011 ALMA Calibration & Imagi								
2030	Fixed Assets								
01	Site Characterization	0	0	10,250	0	10,250	0	10,250	10,250-
3010	Personnel Compensation								

	Personnel Compensation	443,048	12,827	489,229	489,229	0	0	489,229	46,181-
3020	Benefits								
	Benefits	132,914	4,188	142,809	142,809	0	0	142,809	9,895-
3030	Materials & Services								
00	General M&S	0	0	549	549	0	0	549	549-
01	Site Characterization	161,333	39	126,106	126,106	0	3,100	129,206	32,127
030102	BIMA 22 GHz	311,150	0	311,150	311,150	0	0	311,150	0
030103	OVRO 22 GHz	200,950	0	100,000	100,000	0	100,950	200,950	0
030301	Dual Load Calibration Syst	200,000	0	101,150	101,150	0	98,850	200,000	0
3060	Travel								
	Travel	116,083	0	0	0	0	0	0	116,083
3061	Travel - Domestic								
	Travel - Domestic	0	0	52,925	52,925	0	0	52,925	52,925-
3062	Travel - Foreign								
	Travel - Foreign	0	5,440	59,983	59,983	0	0	59,983	59,983-
3064	Travel - Non-Employee								
	Travel - Non-Employee	0	0	176	176	0	0	176	176-
	12011 ALMA Calibration & Imagi	1,565,478	22,494	1,394,327	1,384,077	10,250	202,900	1,597,227	31,749-
	12015 ALMA Seperate Funding								
3025	Antenna evaluat front end #2								
401	Antenna evaluat front end	0	0	399,964-	399,964-	0	0	399,964-	399,964
	12015 ALMA Seperate Funding	0	0	399,964-	399,964-	0	0	399,964-	399,964
	12099 ALMA Business Office								
3030	Materials & Services								
999	Contingency/Carryover	2,129,059	0	0	0	0	0	0	2,129,059
	12099 ALMA Business Office	2,129,059	0	0	0	0	0	0	2,129,059
808	MMA Design & Development 120	27,967,918	894,067	20,198,563	19,358,634	839,929	6,531,732	26,730,295	1,237,623