

SCHEDULE AND TIMELINE

Richard Simon
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Revision History:

11 November 1998: Complete update from baseline WBS plan. Links to internal NRAO web pages with plan details added. This version supersedes all previous versions. R. Simon.

15 November 1998: Typographic corrections, add notice that HTML version does not have all tables.

1999-Feb-12: Complete update of project milestones and schedule, to reflect progress to date and rescheduled tasks. (R. Simon)

1999-Mar-02: Update links (now available to all), editorial changes. (R. Simon)

1999-Apr-21: Update milestones and schedule. (R. Simon)

Introduction

This chapter outlines the schedule and project planning for the Millimeter Array Project. There are two key aspects of planning for the MMA:

- Tasks and milestones which must be accomplished
- Associated target dates.

The logical structure for the project is built around the concept of a "Work Breakdown Structure", or WBS. The WBS is simply an outline plan of all the work to be accomplished, and provides a framework for scheduling, costing, and tracking progress. Once a baseline WBS has been created, the inevitable changes and unexpected developments any real world project experiences may be incorporated into the WBS, and the impact of problems or unexpected difficulties can be allowed for.

There are three principle tables maintained in this chapter, and updated as necessary:

- A summary table of project milestones and target dates.
- The top most level of the WBS Dictionary, which defines the general task areas for the project.
- The Project WBS, expanded to level 2, presented in the form of a Gantt chart.

The overall form of the WBS for the MMA Project has been agreed upon. The tables in this chapter are a snapshot condensed from the detailed project plan. All tasks and milestones are tied to the WBS.

Note: For practical reasons, the HTML version of this chapter does not include detailed tables listed below, other than as links to the relevant PDF files. Readers are *strongly* encouraged to access the [PDF version](#) of this chapter.

Table 1: [MMA Design and Development Phase Milestones](#)

This table lists all scheduled milestones, sorted chronologically within each top level task.

Table 2: [MMA Level 1 Tasks](#)

This table lists all top level tasks from the project WBS, and includes the brief WBS Dictionary entries for each task, where available (some of the Level 1 tasks are described only at level 2 and lower in the WBS).

Table 3: [MMA Task Scheduling](#)

This Table presents a timeline for the project in the form of a Gantt chart, listing all tasks from level 1 or level 2 in the WBS.

Substantially more detailed views of the WBS Gantt Chart and Dictionary are maintained at the following locations in PDF format (the Project Milestones are included for completeness):

- [MMA Project WBS Dictionary](#) (<http://www.cv.nrao.edu/mmaplan/mmadiect.pdf>)
- [MMA Project Gantt Chart](#) (<http://www.cv.nrao.edu/mmaplan/mmagantt.pdf>)
- [MMA Project Milestones](#) (<http://www.cv.nrao.edu/mmaplan/mmamlstn.pdf>)

MMA Design & Development Phase Milestones

WBS Milestone tasks, sorted by WBS and date

WBS (f)	Milestone / Deliverable	Baseline	Current	Actual	Responsible
1	<u>Administration</u>				<u>Brown</u>
1.1.1.10	Project Book: Version 1	1998-07-20	1998-07-20	1998-07-20	Emerson
1.1.4.10	Deliver WBS for D&D phase	1998-09-30	1998-10-16	1998-10-16	Brown
1.1.1.20	Draft Interface Standards	1998-10-30	1998-11-09	1998-11-09	Emerson
1.1.6.10	Deliver Management Plan for D&D	1999-01-29	1998-11-30	1998-11-30	Brown
1.1.3.10	Complete Draft of Business Procedures	1998-10-30	1998-12-04	1998-12-04	Porter
1.1.1.35	Schedule of Reviews	1999-01-29	1999-02-09	1999-02-09	Brown
1.1.2.15	Schedule of Meetings	1999-01-29	1999-02-09	1999-02-09	Wootten
1.1.5.10	Deliver Personnel, Safety & Health Procedures	1999-01-29	1999-03-01	1999-03-01	Brown
1.1.4.15	Deliver preliminary WBS Entire Project	1999-01-29	1999-03-26	1999-03-26	Brown
1.1.4.35	Complete prelim cost estimate	1998-12-31	1999-04-30	NA	Brown
1.1.4.40	Deliver Prelim Cost Estimate	1999-04-30	1999-04-30	NA	Brown
1.1.3.15	Deliver Business Procedures for D&D	1999-04-30	1999-06-01	NA	Porter
1.4.4	Partnership Recommendations to NSF	1999-06-30	1999-06-30	NA	Brown
1.3.2	CONICYT Use Permissions	1999-09-30	1999-09-30	NA	Hardy
1.3.3.15	Access to OSF Land	1999-06-30	1999-12-27	NA	Hardy
1.1.6.15	Deliver Management Plan for Construction	1999-09-30	2000-01-02	NA	Brown
1.1.1.25	Interface Standards	2000-01-31	2000-01-31	NA	Emerson
1.1.4.20	Deliver final WBS entire project	2000-01-31	2000-01-31	NA	Brown
2	<u>Site Development</u>				<u>Gordon</u>
2.1.4	Deliver Development Plan, v. 1	1998-12-15	1999-01-15	1999-01-15	Gordon
2.2.4	Deliver revised development Plan	2000-06-30	2000-06-30	NA	Gordon
2.5	Start Facilities Construction in Chile	2001-01-01	2001-01-01	NA	Gordon
2.15.2	Hire Construction Manager for Chile	2001-03-01	2001-03-01	NA	Gordon
2.20.5.3	Bid Civil Works Construction	2001-12-03	2001-12-03	NA	Gordon
2.25.5.3	Bid Civil Works Construction	2001-12-03	2001-12-03	NA	Gordon
2.30.5.3	Bid OSF/Array Link Construction	2001-12-03	2001-12-03	NA	Gordon
2.20.10.3	Award Array Site Contracts	2002-03-01	2002-03-01	NA	Gordon
2.25.10.3	Award Contracts	2002-03-01	2002-03-01	NA	Gordon
2.30.10.3	Award Contracts	2002-03-01	2002-03-01	NA	Gordon
2.30.15.3	Accept OSF/Array Link	2002-12-13	2002-12-13	NA	Gordon
2.20.15.3	Accept Site Facility	2004-03-15	2004-03-15	NA	Gordon
2.25.15.3	Accept OSF Facility	2004-03-15	2004-03-15	NA	Gordon
	<u>Antenna</u>				<u>Napier</u>
3.2.2	PDR: Antenna	1998-07-28	1998-07-28	1998-07-28	Napier
3.3.5	Vendor Information Meeting	1998-09-23	1998-09-23	1998-09-23	Napier
3.2.4	CDR: Antenna RFP	1998-11-30	1999-03-05	1999-03-05	Napier
3.3.15	Issue Prototype Antenna RFP	1999-01-29	1999-04-06	1999-04-06	Napier
3.3.17	Antenna Bidders Meeting	1999-03-05	1999-05-18	NA	Napier
3.3.20	Receive Prototype Antenna Bid Response	1999-04-30	1999-06-30	NA	Napier
3.3.30	Sign Contract (#1+Option #2)	1999-06-30	1999-10-01	NA	Napier
3.3.35.05	Prototype Antenna PDR	2000-02-15	2000-02-15	NA	Napier
3.6.2	PDR: Antenna Metrology	2000-05-24	2000-03-01	NA	Napier

MMA Design & Development Phase Milestones

WBS Milestone tasks, sorted by WBS and date

WBS (f)	Milestone / Deliverable	Baseline	Current	Actual	Responsible
3.5.30	CDR: Antenna Apex	1999-10-29	2000-03-14	NA	Napier
3.8.2	Deliver Transporter Requirements	2000-03-31	2000-03-16	NA	Napier
3.8.4	Issue Transporter RFP	2000-06-30	2000-06-04	NA	Napier
3.3.35.10	Prototype Antenna CDR	2000-07-03	2000-07-03	NA	Napier
3.3.35.15	Prot Antenna Complete Design Doc	2000-10-02	2000-10-02	NA	Napier
3.3.35.20	Prot Antenna Final Design Approval	2000-11-01	2000-11-01	NA	Napier
3.8.10	Sign Transporter Contract	2001-01-26	2000-12-24	NA	Napier
3.6.40	CDR: Antenna Metrology	2001-02-14	2001-01-28	NA	Napier
3.5.40	Deliver Prototype Antenna Apex	2001-01-31	2001-01-31	NA	Napier
3.3.35.25	Prot Antenna Fabrication Complete	2001-04-02	2001-04-02	NA	Napier
3.3.35.30	Prot Antenna Assembly Complete	2001-04-30	2001-04-30	NA	Napier
3.6.12	Deliver Prototype Antenna Metrology	2001-05-17	2001-05-17	NA	Napier
3.3.45	Delivery of Antenna #1	2001-06-01	2001-06-01	NA	Napier
3.8.20	Deliver/Accept Transporter #1	2001-06-01	2001-06-01	NA	Napier
4	Receivers				Emerson
4.1.12.7	Complete 86 GHz vacuum window prototype	1998-11-20	1998-11-20	1998-11-20	Webber
4.1.6.10	Complete 230 LO Plate, sideband source plates	1999-02-19	1998-12-01	1998-12-01	Webber
4.1.8.1.10	Comp. Eval. 200-300 GHz bal & sb-sep prototypes	1999-01-22	1999-03-08	1999-03-08	Webber
4.2.7	Deliver Test Ant Amplifier: 30 GHz Band	1999-06-29	1999-06-29	NA	Webber
4.1.18.5	Deliver Test Ant mixer: 86 GHz band	1999-06-30	1999-06-30	NA	Webber
4.1.1.2	PDR: SIS Mixer	1999-01-29	1999-09-15	NA	Webber
4.1.12.10	Complete 86 GHz Vac. Window Development	1999-04-23	1999-09-20	NA	Webber
4.1.18.3	Deliver Test Ant mixer: 230 GHz band	1999-06-30	1999-09-30	NA	Webber
4.2.9	Deliver Test Ant Amplifier: 90 GHz Band	1999-09-30	1999-09-30	NA	Webber
4.3.5	Complete Eval. Rcvr. Interface agreements	1999-05-31	1999-10-01	NA	Emerson
4.3.10	CDR: Evaluation Receiver	1999-11-29	1999-11-29	NA	Emerson
4.1.4.7	Complete Cryogenic IF plates for mixer testing	1999-06-01	1999-11-29	NA	Webber
4.1.11.2.10	First MMIC IF Amplifier Tests	1999-04-09	1999-11-30	NA	Webber
4.1.10.10	Complete Wafer Evaluation circuits	1999-08-13	1999-12-01	NA	Webber
4.1.9.10	Complete automated mixer testing	1999-12-03	1999-12-03	NA	Webber
4.1.6.11	Complete 650 LO plate	1999-10-22	1999-12-12	NA	Webber
4.1.8.3.1.9	Start 650 building block mixer tests	1999-10-22	1999-12-20	NA	Webber
4.2.8	Deliver Prototype Amplifier: 30 GHz Band	2000-01-31	2000-01-31	NA	Webber
4.1.11.2.14	Complete integrated MMIC IF development	1999-10-01	2000-02-28	NA	Webber
4.4.4	PDR: MMA Receiver	1999-09-24	2000-03-31	NA	Emerson
4.1.11.4.4	Complete IF development	2000-03-01	2000-04-17	NA	Webber
4.1.8.2.3.9	230 balanced mixer tests	1999-11-08	2000-05-02	NA	Webber
4.1.13.15	Complete Fourier Transform Spectrometer	2000-03-03	2000-05-03	NA	Webber
4.1.1.5	CDR: SIS Mixer	1999-09-30	2000-07-07	NA	Webber
4.1.8.3.2.9	Start 650 SSB Mixer tests	2000-04-21	2000-09-25	NA	Webber
4.1.8.3.3.9	Start 650 balanced mixer tests	2000-04-21	2000-09-25	NA	Webber
4.1.8.2.4.9	230 bal., sideband-sep. mixer tests	2000-05-08	2000-12-05	NA	Webber
4.4.35	CDR: MMA Receiver System	2000-07-05	2000-12-29	NA	Emerson

MMA Design & Development Phase Milestones

WBS Milestone tasks, sorted by WBS and date

WBS (f)	Milestone / Deliverable	Baseline	Current	Actual	Responsible
4.10.10	PDR: Cryogenics Development	2000-07-05	2000-12-29	NA	Emerson
4.1.8.2.10	Deliver prototype 230 GHz	2000-07-03	2001-02-06	NA	Webber
4.10.15	CDR: Cryogenics Development	2001-03-30	2001-03-30	NA	Emerson
4.3.20	Deliver Antenna Test Eval Receiver	2001-05-01	2001-05-01	NA	Emerson
4.4.30.4	Deliver Prototype Dewar	2001-01-31	2001-07-27	NA	Emerson
4.1.8.3.4.9	Start 650 Bal. sb. sep. mixer tests	2001-04-20	2001-09-24	NA	Webber
4.10.20	Deliver Prototype Cryogenics System	2001-11-30	2001-11-30	NA	Emerson
4.1.8.3.5	Deliver prototype 650 GHz	2001-11-02	2002-04-08	NA	Webber
4.4.50	Complete Prototype MMA Receiver	2002-03-29	2002-05-24	NA	Emerson
4.4.65	Release MMA Receiver for manufacture	2002-10-25	2002-12-20	NA	Emerson
5	<u>LO System</u>				<u>Emerson</u>
5.3.4	PDR: Multiplier Chain LO	1998-11-16	1999-02-19	1999-02-19	Webber
5.4.2.2	Optical R/T Phase Lab Demo	1999-02-26	1999-03-29	1999-03-29	Emerson
5.4.1.3	Photonic Phase Cal Feasibility Demo	1998-12-31	1999-04-15	1999-04-15	Emerson
5.4.2.4	PDR: Optical R/T phase meas.	1999-04-30	1999-06-30	NA	Emerson
5.2.3	PDR: LO Reference	1999-06-30	1999-06-30	NA	Sramek
5.4.1.5	PDR: Photonic Phase Cal System	1999-05-31	1999-06-30	NA	Emerson
5.4.5	PDR: Photonic LO	1999-06-30	1999-06-30	NA	Emerson
5.3.3.3.9	Deliver 230 GHz Doubler Power Demo	1998-12-31	1999-07-01	NA	Webber
5.4.6.6	Deliver 100 GHz Velocity Matched photomixer	1999-10-29	1999-10-29	NA	Emerson
5.3.6.4	Deliver Prototype 230 GHz LO for Prot. Rcvr.	1999-12-27	1999-12-27	NA	Webber
5.4.1.7	CDR: Photonic Phase Cal System	1999-12-31	1999-12-31	NA	Emerson
5.4.2.8	CDR: Optical R/T Phase Measurement	1999-12-31	1999-12-31	NA	Emerson
5.4.2.9	Decision: Opt or Microwave R/T Phase Meas for MMA	2000-01-30	2000-01-30	NA	Sramek
5.3.5.10	Deliver 230 GHz MC LO for Eval Rcvr	2000-03-01	2000-03-01	NA	Webber
5.4.10	CDR: Photonic LO	2000-03-31	2000-03-31	NA	Emerson
5.5	CDR: LO System	2000-06-30	2000-06-30	NA	Emerson
5.6	Decision: Multiplier Chain or Photonic LO	2000-06-30	2000-06-30	NA	Emerson
5.3.3.8	CDR: Multiplier Chain LO	2000-03-31	2000-12-01	NA	Webber
5.4.1.9	Deliver Photonic Phase Cal prototypes	2000-12-31	2000-12-31	NA	Emerson
5.2.35	Deliver LO Reference bench prototype	2001-01-31	2001-01-31	NA	Sramek
5.2.40	Deliver LO Ref Field Prototypes	2002-03-01	2002-03-01	NA	Sramek
5.4.13	Deliver Prototype Photonic LO	2002-08-23	2002-08-23	NA	Emerson
5.8	Production Review: LO	2003-02-28	2003-02-28	NA	Emerson
5.4.1.11	Production Review: Photonic Phase Cal	2003-05-05	2003-03-03	NA	Emerson
6	<u>IF System</u>				<u>Sramek</u>
6.3	PDR: IF System	1999-04-30	1999-05-17	NA	Sramek
6.10	CDR: IF System	2000-03-31	2000-03-31	NA	Sramek
6.15	Deliver (Bench) Prototype IF System	2001-01-31	2001-01-31	NA	Sramek
6.20	Deliver IF Field Prototypes to Test Interfeometer	2002-03-01	2002-03-01	NA	Sramek
7	<u>FO System</u>				<u>Sramek</u>
7.3	PDR: FO System (IF Transmission)	1999-05-14	1999-05-17	NA	Sramek
7.6.6	PDR: FO System (LO Transmission)	1999-06-30	1999-06-30	NA	Sramek

MMA Design & Development Phase Milestones

WBS Milestone tasks, sorted by WBS and date

WBS (f)	Milestone / Deliverable	Baseline	Current	Actual	Responsible
7.13	Decision: Analog/Digital Transmission	1999-07-30	1999-10-29	NA	Sramek
7.10	CDR: FO System	2000-03-31	2000-03-31	NA	Sramek
7.12	Deliver Bench Prototype FO System	2001-01-31	2001-01-31	NA	Sramek
7.20	Deliver FO Field Prototypes to Test Interferometer	2002-03-01	2002-03-01	NA	Sramek
8	<u>Correlator</u>				<u>Webber</u>
8.5.3.3	Decision: FIR Filter or Analog BBC	1998-12-31	1999-02-18	1999-02-18	Webber
8.3.5	PDR: Correlator	1999-08-02	1999-08-02	NA	Webber
8.5.8	CDR: Finite Impulse Response Filter	1999-07-01	2000-02-28	NA	Webber
8.2.6	Deliver Test Correlator to VLA site	2000-03-31	2000-03-31	NA	Webber
8.10	CDR: Prototype Correlator	2000-07-31	2000-07-31	NA	Webber
8.5.16	Deliver FIR Filter for Test Interferometer	2000-12-01	2000-12-01	NA	Webber
8.12.5	Deliver Prototype Correlator to VLA site	2003-05-30	2003-05-30	NA	Webber
8.13.1.5	Deliver 1/4 Correlator to MMA site	2004-06-18	2004-06-18	NA	Webber
8.13.2.4	Deliver 1/4 Correlator to MMA site	2005-03-25	2005-03-25	NA	Webber
8.13.3.4	Deliver 1/4 Correlator to MMA site	2005-12-30	2005-12-30	NA	Webber
8.13.4.4	Deliver 1/4 Correlator to MMA site	2006-10-06	2006-10-06	NA	Webber
9	<u>Computing</u>				<u>Glendenning</u>
9.4.4	Deliver: M&C Draft Interface specifications	1999-06-01	1999-06-01	NA	Glendenning
9.2	PDR: Comp. Requirements & Control Software	1999-06-30	1999-06-30	NA	Glendenning
9.7.4	CDR: Test Correlator Software	1999-09-01	1999-10-31	NA	Glendenning
9.4.8	CDR: Monitor & Control System	2000-03-31	2000-01-30	NA	Glendenning
9.5.7	CDR: Single Dish Antenna Test System	2000-03-01	2000-03-01	NA	Glendenning
9.4.10	M&C Board available	2000-03-31	2000-03-31	NA	Emerson
9.7.7	Deliver Test Correlator Software	2000-03-01	2000-05-28	NA	Glendenning
9.13.3	CDR: Archiving	2000-05-29	2000-05-29	NA	Glendenning
9.5.11	Deliver Single Dish Antenna Test System	2001-03-01	2001-03-01	NA	Glendenning
9.4.13	Deliver: M&C System	2001-03-30	2001-03-30	NA	Glendenning
9.6.1.4	Deliver Holography System Software	2001-03-30	2001-03-30	NA	Emerson
9.14.3	CDR: Real-time Imaging	2001-07-24	2001-07-24	NA	Glendenning
9.15.3	CDR: Scheduling	2000-12-28	2003-12-01	NA	Glendenning
10	<u>System Integration</u>				<u>Emerson</u>
10.7.3	Design Review: Holography System	1999-03-29	1999-04-19	1999-04-19	Emerson
10.2.3	Deliver MMA Interfaces and Standards Document	1999-04-30	1999-06-30	NA	Emerson
10.10.2	Deliver Prot. Ant. Testing Plan	1999-07-02	1999-07-02	NA	Emerson
10.4.2	Design Review: Test Int. Site Preparation	2000-04-03	2000-04-03	NA	Sramek
10.7.6	Deliver Holography System	2000-06-30	2001-03-30	NA	Emerson
10.4.7	Test Interferometer Site Complete	2001-04-30	2001-04-30	NA	Sramek
10.10.4.4	Antenna #1 Outfitting Complete	2001-11-02	2001-09-03	NA	Emerson
10.10.9.4	Antenna #2 Outfitting Complete	2002-05-31	2002-04-01	NA	Emerson
11	<u>Calibration & Imaging</u>				<u>Wootten</u>
11.1.6.1	Site Char. & Monitoring Review (URSI meeting)	1999-01-11	1999-01-11	1999-01-11	Radford
11.3.3.4	Initial Amplitude Cal Review	1999-05-31	1999-05-31	NA	Wootten
11.3.2.1	Initial Radiometric Phase Cal Review	1999-05-31	1999-06-09	NA	Wootten

MMA Design & Development Phase Milestones

WBS Milestone tasks, sorted by WBS and date

WBS (f)	Milestone / Deliverable	Baseline	Current	Actual	Responsible
11.3.2.4	Decision: 183 or 22 GHz Phase monitor	2001-05-31	1999-07-01	NA	Wootten
11.2.3	Design Review: Array Configuration	2000-01-31	2000-01-31	NA	Wootten
11.1.6.2	Mid-term Site Char. & Monitoring Review	2000-03-31	2000-03-31	NA	Radford
11.3.2.2	Mid-term Radiometric Phase Cal Review	2000-05-31	2000-05-31	NA	Wootten
11.3.3.5	Mid-term Amplitude Cal Review	2000-05-31	2000-05-31	NA	Wootten
11.1.6.3	Final Site Char. & Monitoring Review	2001-03-30	2001-03-30	NA	Radford
11.3.2.3	Final Radiometric Phase Cal Review	2001-05-31	2001-05-31	NA	Wootten
11.3.3.6	Final Amplitude Cal Review	2001-05-31	2001-05-31	NA	Wootten

Report name:

MMA Level 1 Tasks

WBS (f)	Task	Start	Finish	Duration	Work
<u>1</u>	<u>Administration</u>	<u>1998-06-01</u>	<u>2001-01-01</u>	<u>135.2w</u>	<u>603.01w</u>
	Element Scope: This task includes all the responsibilities for management of the MMA project. Management of the project engineering, business and contracting affairs, personnel, budget and schedule, the WBS, documentation, standards, reporting and archive are all included within this task. In addition it is the responsibility of this task to assure that the MMA project meets its scientific goals.				
<u>2</u>	<u>Site Development</u>	<u>1998-06-01</u>	<u>2007-12-28</u>	<u>500w</u>	<u>137.8w</u>
	Element Scope: In the initial D&D phase it is the responsibility of the Division Head for Site Development to draft an operating plan for the MMA in Chile. He will do this by establishing the operational requirements and then creating an operational model that meets those requirements. The plan will be developed in consultation with the universities and observatories presently operating facilities in Chile. The plan will be costed. In the construction phase of the project the Division Head will be responsible for construction of the civil works.				
<u>3</u>	<u>Antenna</u>	<u>1998-06-01</u>	<u>2002-12-30</u>	<u>239.2w</u>	<u>712.46w</u>
	Element Scope: This element includes all steps required for producing all antennas delivered to site on foundation provided. Setting surface to require accuracy. Making certain all antennas meet design specification. Producing antenna transporters. Will provide mechanical support for interfaces to antenna.				
<u>4</u>	<u>Receivers</u>	<u>1998-06-01</u>	<u>2007-04-27</u>	<u>465w</u>	<u>2,421.29w</u>
<u>5</u>	<u>LO System</u>	<u>1998-06-01</u>	<u>2007-03-09</u>	<u>458w</u>	<u>1,099.44w</u>
<u>6</u>	<u>IF System</u>	<u>1998-11-02</u>	<u>2002-03-01</u>	<u>173.8w</u>	<u>335w</u>
	The IF system includes 1) at the antenna, the broadband 4 - 12 GHz signal path between the receiver and the fiber optic transmitter and 2) in the Central Electronics Building (CEB), the broadband signal path between the fiber optic receiver and the digital sampler. The interface to the receivers is after the band selection switch and final room temperature amplifiers in the receiver package.				
	During the D&D phase, a complete IF system design will be done and select modules and sub-modules will be prototyped. The module interfaces and Monitor/Control interfaces will be developed and tested. The goal is to prototype enough of the system so that construction of the test interferometer system can proceed rapidly when the construction phase begins, and deliver a bench prototype system before 12/00.				
<u>7</u>	<u>FO System</u>	<u>1999-01-25</u>	<u>2002-03-01</u>	<u>161.8w</u>	<u>407w</u>
	Fiber Optic System - This element includes the fiber optic transmitter / receiver pairs and all associated M/C and interconnecting FO cabling for relaying the signals of four subsystems: 1) the broadband IF, 2) the LO reference distribution, 3) the round trip phase correction, and 4) the M/C system.				
	During the D&D phase, the complete fiber optic system design will be done and prototype transmitter/ receiver pairs for each of the four sub-systems (IF, LO ref, round-trip phase, and M/C) will be demonstrated. The module interfaces and Monitor/Control interfaces will be developed and tested. The goal is to prototype enough of the system so that construction of the test interferometer system can proceed rapidly when the construction phase begins. The prototype system will be delivered by 12/00.				
<u>8</u>	<u>Correlator</u>	<u>1998-06-01</u>	<u>2007-03-30</u>	<u>461w</u>	<u>484w</u>
	The MMA correlator will accept multiple baseband analog signals from the IF system, digitize them, and calculate the cross-correlation functions on a pairwise basis.				
<u>9</u>	<u>Computing</u>	<u>1998-10-01</u>	<u>2006-07-18</u>	<u>406.8w</u>	<u>296.5w</u>
	These activities implement all MMA system software. This includes real-time and near-real-time software to monitor and control hardware devices, software to schedule the array, software to format the data suitably for post-processing, software to archive and restore the data, software to perform fundamental calibrations (e.g. pointing) required to operate the array, commissioning software (e.g. holography), and software to implement a near-real-time image pipeline.				
	It does not generally include post-processing software, firmware which is "inside" the device (possibly excepting the correlator), or engineering test software which is not needed during operations (i.e., operators would not run it).				
<u>10</u>	<u>System Integration</u>	<u>1998-06-01</u>	<u>2003-03-28</u>	<u>252w</u>	<u>621.9w</u>
<u>11</u>	<u>Calibration & Imaging</u>	<u>1998-06-01</u>	<u>2001-06-01</u>	<u>157w</u>	<u>565w</u>
	This covers aspects of characterizing the MMA site at Chajnantor, of designing and optimizing the array configurations, of correcting astronomical observations for atmospheric and instrumental effects, and of understanding the characteristics and quality of the images the MMA will produce.				



MMA Task Scheduling

Filter for MMA Tasks (Level 1 and 2) selected

WBS (f)	Task	Start	Finish	Duration	Work	1998												1999												2000												2001												2002											
						M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D				
1	Administration	1998-06-01	2001-01-01	135.2w	603.01w	[Summary bar with green progress]																																																											
1.1	<u>Management</u>	1998-06-01	2000-12-29	135w	448.75w	[Summary bar with green progress]																																																											
1.2	<u>Facilities</u>	1998-06-01	2000-12-29	135w	26.13w	[Summary bar with green progress]																																																											
1.3	<u>Agreements in Chile</u>	1998-06-01	2000-12-29	135w	59.33w	[Summary bar with green progress]																																																											
1.4	<u>Partnerships</u>	1998-06-01	2001-01-01	135.2w	68.8w	[Summary bar with green progress]																																																											
2	Site Development	1998-06-01	2007-12-28	500w	137.8w	[Summary bar with green progress]																																																											
2.1	<u>Initial Development Planning</u>	1998-06-01	1999-01-15	33w	39.8w	[Summary bar with green progress]																																																											
2.2	<u>Revise Development Plan</u>	1999-01-18	2000-06-30	76w	98w	[Summary bar with green progress]																																																											
2.5	Start Facilities Construction in Chile	2001-01-01	2001-01-01	0w	0w	[Milestone triangle at 2001-01-01]																																																											
2.10	<u>Site Access</u>	2000-07-03	2007-12-28	391w	0w	[Summary bar with green progress]																																																											
2.15	<u>Preliminary Development</u>	2001-01-01	2001-10-31	43.6w	0w	[Summary bar with green progress]																																																											
2.20	<u>Array Site</u>	2001-06-01	2004-03-15	145.4w	0w	[Summary bar with green progress]																																																											
2.25	<u>Operations Support Facility</u>	2001-06-01	2004-03-15	145.4w	0w	[Summary bar with green progress]																																																											
2.30	<u>OSF/Array Link</u>	2001-06-01	2002-12-13	80.2w	0w	[Summary bar with green progress]																																																											
2.40	<u>Prepare for Instrument Assembly</u>	2003-09-01	2004-08-31	52.4w	0w	[Summary bar with green progress]																																																											
3	Antenna	1998-06-01	2002-12-30	239.2w	712.46w	[Summary bar with green progress]																																																											
3.1	<u>In-house designs</u>	1998-06-01	1999-01-29	35w	140w	[Summary bar with green progress]																																																											
3.2	<u>Specifications</u>	1998-06-01	1999-03-05	40w	29w	[Summary bar with green progress]																																																											
3.3	<u>Procurement of Prototype Antenna</u>	1998-09-22	2001-06-01	140.8w	290.61w	[Summary bar with green progress]																																																											
3.4	Foundation	2000-07-04	2000-10-23	80d	4w	[Task bar]																																																											
3.5	<u>Apex</u>	1999-08-30	2001-01-31	74.6w	58w	[Task bar]																																																											
3.6	<u>Metrology</u>	1999-10-04	2001-05-17	84.6w	113w	[Task bar]																																																											
3.7	Antenna Evaluation and Enhancement	2001-06-04	2001-08-10	50d	15w	[Task bar]																																																											
3.8	<u>Transporter</u>	1999-10-01	2001-06-01	87.2w	17w	[Task bar]																																																											
3.9	Internal Antenna Interface Support	1998-06-01	2001-06-01	157w	7.85w	[Task bar]																																																											
3.15	<u>Procurement of Antenna #2</u>	2001-01-01	2001-12-28	52w	38w	[Task bar]																																																											
3.20	<u>Production Antennas</u>	2002-12-30	2002-12-30	0.2w	0w	[Task bar]																																																											
4	Receivers	1998-06-01	2007-04-27	465w	2,421.29w	[Summary bar with green progress]																																																											
4.1	<u>SIS Mixers</u>	1998-06-01	2003-12-31	291.6w	1,416.62w	[Summary bar with green progress]																																																											
4.2	<u>HFET Amplifiers</u>	1999-01-01	2000-01-31	56.4w	6w	[Summary bar with green progress]																																																											

Milestones: bold type	Task	Progress	Completed Mlstr	Summary Progress
Summary Tasks: <u>underline</u>	Split	Milestone	Summary	



MMA Task Scheduling

Filter for MMA Tasks (Level 1 and 2) selected

WBS (f)	Task	Start	Finish	Duration	Work	1998				1999				2000				2001				2002											
						M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A
9.2	PDR: Comp. Requirements & Control Software	1999-06-30	1999-06-30	0d	0w																												
9.3	Software Practices and Standards	1998-12-01	1999-02-22	12w	9w																												
9.4	<u>Monitor and Control</u>	1998-10-12	2001-03-30	129w	103.5w																												
9.5	<u>Test Antenna Control Software</u>	1998-10-23	2001-03-01	123w	84w																												
9.6	<u>Commissioning Software</u>	2000-06-01	2001-03-30	43.4w	33w																												
9.7	<u>Test Correlator Software</u>	1999-02-15	2000-05-28	67w	40w																												
9.8	Prototype Antenna Software Integration	2001-06-01	2001-11-29	26w	0w																												
9.9	Prototype Antenna Software Support	2001-11-30	2004-11-25	156w	0w																												
9.10	Antenna	1999-02-01	2004-02-27	265w	0w																												
9.11	Correlator	1999-02-01	2004-02-27	265w	0w																												
9.12	Data Production	2001-06-01	2003-05-29	104w	0w																												
9.13	<u>Archiving</u>	1998-12-01	2005-12-26	369w	0w																												
9.14	<u>Near real-time imaging</u>	1999-12-01	2006-07-18	346w	0w																												
9.15	<u>Scheduling</u>	1999-01-01	2005-11-25	360.2w	0w																												
9.16	<u>Off-Line Data Processing</u>	2001-01-01	2001-06-27	25.6w	12w																												
10	System Integration	1998-06-01	2003-03-28	252w	621.9w																												
10.1	Overall Specifications for all systems	1998-06-01	2001-06-01	157w	31.4w																												
10.2	<u>Specification of interfaces and standards</u>	1998-10-01	2001-05-30	139w	30w																												
10.3	Monitor and Control Coordination	1998-10-05	2001-06-01	139w	13.9w																												
10.4	<u>Test Interferometer Site Preparation</u>	2000-02-01	2001-04-30	65w	18w																												
10.7	<u>Holography System</u>	1998-09-01	2001-03-30	134.8w	42w																												
10.10	<u>Prototype Antenna Integration and Testing</u>	1998-06-01	2003-03-28	252w	486.6w																												
11	Calibration & Imaging	1998-06-01	2001-06-01	157w	565w																												
11.1	<u>Site Characterization and Monitoring</u>	1998-06-01	2001-06-01	157w	0w																												
11.2	<u>Configuration Studies</u>	1998-06-01	2001-06-01	157w	0w																												
11.3	<u>Calibration</u>	1998-06-01	2001-06-01	157w	0w																												
11.4	Imaging studies	1998-06-01	2001-06-01	157w	0w																												

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

Task Split

Progress Milestone

Completed Mlstr Summary

Summary Progress