

## **12 SCHEDULE AND BUDGET**

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### Revision History

2001-Nov-08: Initial release, Budget and Schedule from EVLA Management Plan, September 2001

2002-May-31: Updated budget section to be current as of Q2 2002

2003-Aug-16: Updated budget and schedule to be current as of Q3 2003

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### **12.1 Introduction**

In this chapter a brief summary of the schedule and budget information for the project is provided. This information will change as the project progresses, so readers should understand that the information provided is current as of the date identified in the Revision History above. If required, a more up-to-date or more detailed version of this information can be requested from EVLA Project Management.

### **12.2 Project Work Breakdown Structure (WBS)**

The EVLA Project is the 6<sup>th</sup> activity within NRAO's overall WBS. The work of the EVLA is subdivided into the 12 principal Level 2 tasks shown in Table 12.1.

**Table 12.1 EVLA Project WBS Level 2 tasks**

WBS No.	Task Name	Task Description
6.01	Project Management	Project management including work definition, budget and schedule control. Advisory committee, design review and oversight activities.
6.02	System Integration and Testing	All system engineering activities during the design, integration, installation and test phases of the project. Management of the technical aspects of both the hardware and software systems. Provision of shared systems such as modules, racks and power supplies.
6.03	Civil Construction	Burial of the long-distance fiber optics cables along the arms of the array. Construction of a new shielded room to house the new EVLA correlator.
6.04	Antennas	Structural modifications to the VLA feed support structure on the antennas to allow installation of the new feed and receiver systems. Modifications to the vertex rooms on the antennas to allow installation of the new electronic systems.
6.05	Front End Systems	Design, construction and installation of all feeds and receivers for the eight EVLA receiver bands. Includes conversion to first IF at 8-12 GHz. Modifications to the cryogenics systems on the antennas for compatibility with the new receivers.
6.06	Local Oscillator System	Provision of a central reference oscillator system and an antenna remote local oscillator (LO) system. Provision of a "round-trip-phase" monitoring system to measure the phase of the LO at each antenna.
6.07	Fiber Optic System	Provision of all fiber optics systems including the fiber, the optical transmitters and the optical receivers for LO distribution, IF transmission and M/C.
6.08	Intermediate Frequency System	Provision of all frequency converters required to convert the signal from the 8-12 GHz band at the output of each receiver to the 2-4 GHz baseband input to the digitizers. Provision of the wide band and

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		narrow band digitizers. Provision of switching equipment required to direct the desired IF into each of the digitizers.
6.09	Correlator	Construction and installation of the EVLA correlator, supplied by Canada, and NRAO interfaces.
6.10	Monitor and Control System	Provision of hardware and software for array monitor and control. Includes both the central computer system and the electronics system located in each module for interface to the M/C system.
6.11	Data Management and Computing	Provision of software and hardware for observation preparation and scheduling and for post-correlation data processing. Includes a pipeline system for rapid image formation.
6.12	Education and Public Outreach	EVLA contribution to NRAO's EPO program.

A listing of the detailed Level 3 and Level 4 tasks in the WBS is available at

<http://www.nrao.edu/evla/admin/budget/wbssumm.pdf>

### **12.3 Project Schedule**

The overall plan for the EVLA project is as follows.

The new EVLA equipment required for the antennas was designed and prototyped during 2002 and early 2003. In the third quarter (Q3) of 2003 a prototype system is being installed on a VLA antenna (the EVLA Test Antenna – VLA Ant 13). This initial prototype system will consist of the new LO, IF and fiber optics systems, the new feed cone and some of the new feed/receiver designs. Old feeds and receivers will continue to be used where necessary to provide frequency coverage. Also included will be the hardware for the new M/C system and enough of the new M/C software to allow the EVLA Test Antenna to be operated. The prototype system will be tested until Q1 of 2004, at which time the design will be frozen and quantity production of the new equipment will begin. The new systems will be installed on antennas at a rate of four antennas per year beginning in Q3 of 2004, with the last antenna scheduled for retrofit by Q3 of 2010. The new receivers will be installed at a slower rate than this, with the last receiver planned for installation in the second quarter of 2012.

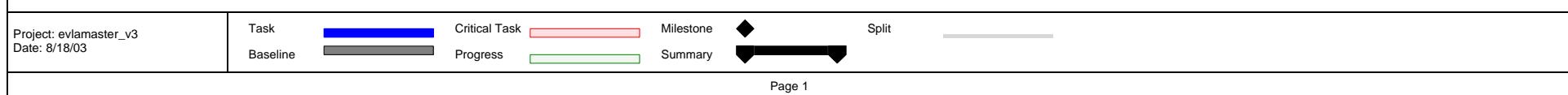
The correlator will be designed and built at the Herzberg Institute of Astrophysics and will be installed in a new correlator room in the VLA control building. A small 3 or 4 antenna prototype of a subset of the correlator will be tested using astronomical observations at the VLA in Q4 of 2005. Equipment will begin to be installed in the new correlator room at the VLA in Q2 of 2006 and first testing of the first subset of the final correlator will begin in Q4 of 2006. First “shared risk” science using a subset of the correlator could begin in Q2 of 2007, with full correlator commissioning planned to be complete by Q1 of 2009.

The software for the new monitor and control system will be scheduled so as to provide the level of support required for the various phases of hardware delivery described above. This will include support for the new electronics system on an antenna in Q3 of 2003, support for VLA observations using transition hardware in Q2 of 2004, tests of the prototype correlator in Q4 of 2005, tests of the final correlator in Q4 of 2006 and early science with a subset of the correlator in Q2 of 2007. Similarly, new data management software will be available as required to handle the data from the new correlator.

The summary project schedule for all parts of the project, required to support the schedule goals listed above, is presented below.

EVLA PROJECT  
DETAIL SCHEDULE

As of June 30, 2003



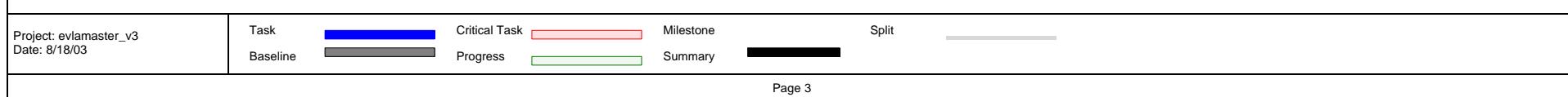
EVLA PROJECT  
DETAIL SCHEDULE

As of June 30, 2003



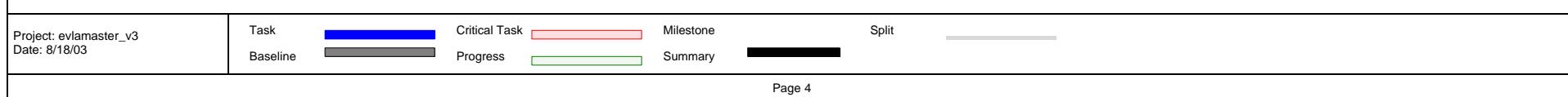
EVLA PROJECT  
DETAIL SCHEDULE

As of June 30, 2003



EVLA PROJECT  
DETAIL SCHEDULE

As of June 30, 2003



EVLA PROJECT  
DETAIL SCHEDULE

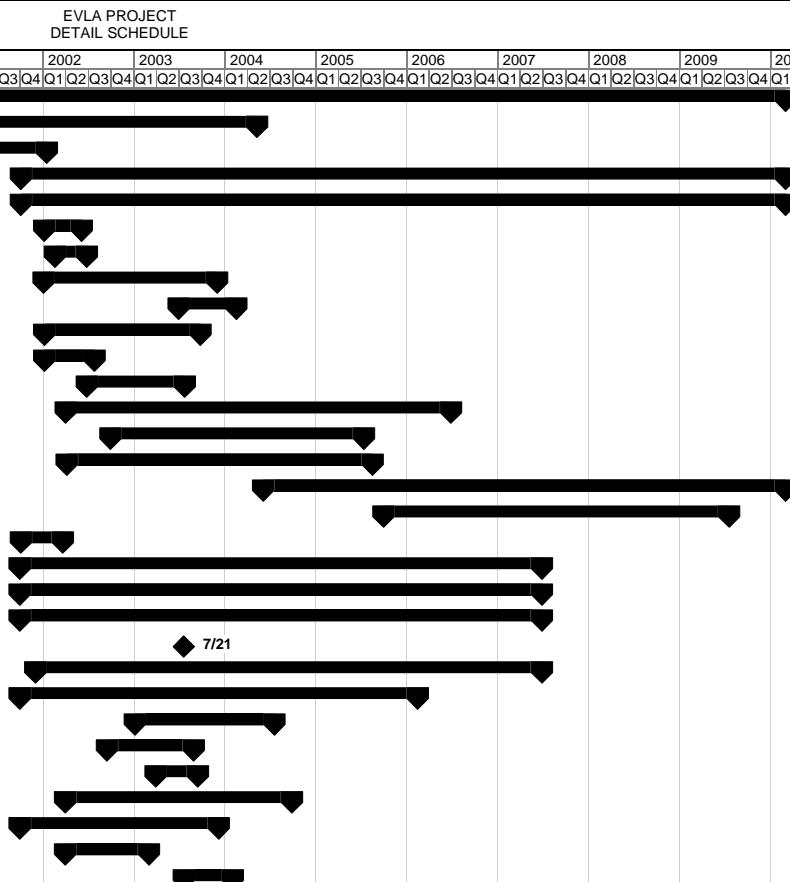
As of June 30, 2003

The Gantt chart illustrates the timeline and dependencies for various projects across different Work Breakdown Structures (WBS) from 2001 to 2012. The chart uses horizontal bars to represent tasks, with arrows indicating dependencies between them. A legend at the bottom right defines the symbols used:

- Task:** Represented by a solid black bar.
- Milestone:** Indicated by a diamond symbol.
- Completed Task:** Indicated by a bar with a diagonal line through it.

Key data points extracted from the chart:

WBS	Task Name	Start Date	Finish Date	% Compl.
10.20	M&C EVLA Software	5/1/01	3/4/10	17%
10.20.5	Stabilization of the VLA	5/1/01	5/10/04	69%
10.20.5.1	Modcomp to Modcomp Replacement	5/1/01	1/16/02	100%
10.20.10	Requirements (High Level, Raw)	10/5/01	3/4/10	13%
10.20.10.5	Engineering	10/5/01	3/4/10	12%
10.20.10.15	Correlator Backend	1/7/02	6/5/02	100%
10.20.10.20	Correlator M & C	2/19/02	6/26/02	100%
10.20.15	High Level Sftware Arch & Design	1/4/02	12/2/03	21%
10.20.20	Test & Dev Support, Enhanced Ant	7/1/03	2/17/04	0%
10.20.25	Mid-Level Analysis & Design	1/8/02	9/25/03	36%
10.20.25.5	Detailed (Well-Formed) Requir	1/8/02	7/26/02	100%
10.20.25.10	e2e IF Specifications	6/27/02	7/24/03	54%
10.20.30	Test & Dev Support, Correlator	4/3/02	6/29/06	12%
10.20.30.5	Correlator Monitor & Control	9/30/02	7/13/05	9%
10.20.30.10	Correl Data Products - FFTs, F	4/8/02	8/18/05	12%
10.20.35	Detailed Design & Coding	6/4/04	3/4/10	0%
10.20.35.35	Correlator, at VLA Site	10/1/05	7/20/09	0%
10.20.10.10	Operations	10/5/01	3/22/02	100%
11	DATA MGMT/E2E	10/1/01	6/30/07	40%
11.1	e2e Project	10/1/01	6/30/07	40%
11.1.1	Management and Project Book	10/1/01	6/30/07	0%
11.1.1.1	Requirements	7/21/03	7/21/03	0%
11.1.1.3	EVLA milestones	12/3/01	6/30/07	0%
11.1.1.5	Phases	10/1/01	2/14/06	0%
11.1.2	Infrastructure	1/6/03	7/19/04	4%
11.1.3	Proposal submission toolkit	9/16/02	8/29/03	84%
11.1.7	Observation scheduling toolkit	3/31/03	9/15/03	20%
11.1.8	Pipeline toolkit	4/1/02	9/27/04	29%
11.1.10	Archive toolkit	10/1/01	12/8/03	80%
11.1.11	Calibration toolkit	4/1/02	3/3/03	100%
11.1.12	Master Address List	7/22/03	2/2/04	0%



Project: evlamaster\_v3  
Date: 8/18/03

A horizontal bar chart illustrating task status across various categories. The categories are represented by colored bars: Task (blue), Critical Task (red), Milestone (grey), Split (light grey), Baseline (black), Progress (green), and Summary (black). The length of each bar corresponds to the status or progress level for that category.

## **12.4 Project Budget**

All funds are given in US\$(FY2003). The project funding will come from 4 sources. \$55.2 M from new NSF funds, \$14.8 M in manpower provided by the NRAO operations budget, approximately \$14 M funded by the Canadian Government for the correlator and \$2M from the Mexican Government. The project budget plan is given in Table 12.2.

**Table 12.2 EVLA Project Budget Plan**

All amounts are in \$k dollars (FY2004)

WBS	Task Name	Actual	Actual	Budgeted											Totals
		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012		
6.01	Project Management	77.0	204.6	272.0	323.5	278.6	271.5	249.3	232.5	177.5	136.5	135.5	0.0	2358	
6.02	System Integration & Testing	212.0	479.5	351.1	530.7	180.4	180.4	184.9	176.9	174.9	76.0	0.0	0.0	2547	
6.03	Civil Construction	0.2	252.1	52.0	242.8	509.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0	1086	
6.04	Antennas	0.0	46.8	268.0	183.0	75.2	45.5	28.0	22.0	8.2	8.0	0.0	0.0	685	
6.05	Font End Systems	385.4	124.1	868.4	2285.1	1113.0	1006.0	1185.7	1046.8	884.1	695.1	285.4	114.4	9993	
6.06	Local Oscillator System	14.1	292.3	560.5	477.0	367.0	367.0	367.0	356.0	353.0	352.5	0.0	0.0	3506	
6.07	Fiber Optic System	4.7	642.8	1125.0	1382.0	933.2	783.2	873.2	743.2	719.2	643.6	478.4	0.0	8328	
6.08	Intermediate Frequency System	0.0	96.0	355.6	575.4	285.0	285.0	285.0	285.0	285.0	283.0	0.0	0.0	2735	
6.09	Correlator	149.0	362.0	155.0	618.0	37.0	4281.5	1879.0	45.0	17.0	0.0	0.0	0.0	7544	
6.10	Monitor & Control System	0.0	216.8	474.9	423.4	280.0	201.3	193.2	193.5	208.9	62.0	54.0	0.0	2308	
6.11	Data Management & Computing	2.8	3.0	208.0	160.0	85.5	26.0	177.0	119.0	519.0	0.0	0.0	0.0	1300	
6.12	Education & Public Outreach	0.0	0.0	0.0	0.0	0.0	0.0	250.0	250.0	0.0	0.0	0.0	0.0	500	
	M&S Total	845	2720	4690	7201	4144	7477	5672	3470	3347	2257	953	114	42891	
	Travel	8	47	89	123	152	167	105	57	48	32	2	4	834	
	NRAO Wages & Benefits	322	2667	4041	4535	4155	3867	3316	3021	2618	554	399	232	29565	
	Canadian Labor	54	414	671	533	468	365	532	321	136	0	0	0	3494	
	Sub Total	1229	5847	9493	12392	8918	11877	9625	6869	6149	2843	1355	350	76785	
	Contingency	0	0	0	0	6	0	0	406	764	2973	1861		6010	
	Redirected NRAO Effort	-195	-1549	-2317	-2186	-1985	-1872	-1703	-1475	-1325	-382	-246	-232	-15195	
	Canadian Contribution	-203	-776	-826	-1151	-505	-4647	-2411	-366	-153	0	0	0	-11038	
	Mexican Contribution				-1000	-1000								-2000	
	EVLA Project Funds	831	3523	6349	8055	5434	5358	5511	5434	5434	5434	2970	119	54562	
	Carryover to next yr	2170	3648	2621			76					119			
	Carryover from prior yr		-2170	-3648	-2621		-6	-76				-119			
	NSF Funded	3001	5000	5322	5434	5434	5428	5435	5434	5434	5434	3089	0	54562	