

12 SCHEDULE AND BUDGET

Revision History

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

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 6th 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. Modifications to the cryogenics systems on the antennas for compatibility with the new receivers.
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.
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 narrow band digitizers. Provision of switching equipment required to

EVLA Project Book Chapter 12: Schedule and Budget

		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 will be designed and prototyped during 2002 and early 2003. In the second quarter (Q2) of 2003 a prototype system will be installed on at least one antenna (the EVLA Test Antenna). 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 Q4 of 2003, 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 seven antennas per year beginning in Q2 of 2004, with the last antenna scheduled for retrofit by Q2 of 2008. The new receivers will be installed at a slower rate than this, with the last receiver planned for installation in the second quarter of 2010.

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 Q2 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 Book Chapter 12: Schedule and Budget

WBS	Task Name	Start	Finish	2001		2002		2003		2004		2005		2006		2007		2008		2009		2010		2011	
				H1	H2	H1	H2	H1	H2	H1	H2	H1	H2	H1	H2	H1	H2	H1	H2	H1	H2	H1	H2		
6.01	Project Management	Tue 05/01/01	Mon 05/10/10	[Gantt bar]																					
6.01.05	Management, Planning	Tue 05/01/01	Mon 05/10/10	[Gantt bar]																					
6.01.05.05	Start Project	Tue 05/01/01	Tue 05/01/01	[Gantt bar]																					
6.01.05.08	EVLA Operational	Mon 05/10/10	Mon 05/10/10	[Gantt bar]																					
6.01.05.10	Detailed Project Mgmt Plan	Mon 06/04/01	Fri 09/07/01	[Gantt bar]																					
6.01.06	Project Book	Mon 06/18/01	Thu 11/15/01	[Gantt bar]																					
6.02	System Integration & Testing	Tue 12/04/01	Mon 03/31/08	[Gantt bar]																					
6.02.02	System PDR	Tue 12/04/01	Tue 12/04/01	[Gantt bar]																					
6.02.03	System CDR	Mon 12/02/02	Mon 12/02/02	[Gantt bar]																					
6.02.04	Transition Plan	Mon 08/05/02	Mon 03/31/08	[Gantt bar]																					
6.02.04.05	Start fiber cabling on Array	Mon 08/05/02	Mon 08/05/02	[Gantt bar]																					
6.02.04.10	Choose EVLA test antenna	Tue 04/01/03	Tue 04/01/03	[Gantt bar]																					
6.02.04.15	Start Interferometry Tests - EVLA & VLA	Tue 07/01/03	Tue 07/01/03	[Gantt bar]																					
6.02.04.20	Freeze Electronics Design/Start Production	Mon 10/06/03	Mon 10/06/03	[Gantt bar]																					
6.02.04.25	Start antenna outfitting	Mon 04/05/04	Mon 04/05/04	[Gantt bar]																					
6.02.04.50	Last antenna converted to EVLA design	Mon 03/31/08	Mon 03/31/08	[Gantt bar]																					
6.03	Civil Construction	Thu 08/01/02	Mon 10/01/07	[Gantt bar]																					
6.03.05	Fiber Optic Cable	Thu 08/01/02	Tue 12/02/03	[Gantt bar]																					
6.03.10	New Correlator Room	Mon 01/03/05	Mon 10/01/07	[Gantt bar]																					
6.04	Antennas	Wed 02/13/02	Mon 03/31/08	[Gantt bar]																					
6.04.01	Management/Subsystem Engineering	Wed 02/13/02	Wed 12/18/02	[Gantt bar]																					
6.04.01.05	Feed Cone PDR	Wed 02/13/02	Wed 02/13/02	[Gantt bar]																					
6.04.01.10	Feed Cone CDR	Wed 12/18/02	Wed 12/18/02	[Gantt bar]																					
6.04.05	Feed Cone Production	Mon 03/17/03	Mon 03/31/08	[Gantt bar]																					
6.05	Front End Systems	Tue 02/12/02	Fri 02/26/10	[Gantt bar]																					
6.05.01	Management/Subsystem Engineering	Tue 02/12/02	Tue 12/17/02	[Gantt bar]																					
6.05.01.05	Receiver/Feed PDR	Tue 02/12/02	Tue 02/12/02	[Gantt bar]																					
6.05.01.10	Receiver/Feed CDR	Tue 12/17/02	Tue 12/17/02	[Gantt bar]																					
6.05.05	Receiver Build & Installation	Mon 03/04/02	Fri 02/26/10	[Gantt bar]																					
6.05.10	Feeds	Mon 03/04/02	Fri 06/23/06	[Gantt bar]																					
6.06	Local Oscillator System	Mon 01/14/02	Mon 03/31/08	[Gantt bar]																					
6.05.01	Management/Subsystem Engineering	Mon 01/14/02	Mon 01/13/03	[Gantt bar]																					
6.06.01.05	LO/IF PDR	Mon 01/14/02	Mon 01/14/02	[Gantt bar]																					
6.06.01.10	LO/IF CDR	Mon 01/13/03	Mon 01/13/03	[Gantt bar]																					
6.06.05	LO production	Mon 01/13/03	Mon 03/31/08	[Gantt bar]																					

EVLA Project Book Chapter 12: Schedule and Budget

WBS	Task Name	Start	Finish	2001		2002		2003		2004		2005		2006		2007		2008		2009		2010		2011
				H1	H2	H1	H2	H1	H2	H1	H2	H1	H2	H1	H2	H1	H2	H1	H2	H1	H2	H1	H2	H1
6.11	Data Management & Computing	Tue 01/15/02	Tue 05/01/07																					
6.11.01	Management/Subsystem Engineering	Tue 01/15/02	Mon 09/09/02																					
6.11.01.05	Data Processing Architecture PDR	Tue 01/15/02	Tue 01/15/02																					
6.11.01.10	Data Processing Architecture CDR	Mon 09/09/02	Mon 09/09/02																					
6.11.05	Proposal preparation and submission	Tue 09/10/02	Mon 12/01/03																					
6.11.10	Observation Preparation Software	Tue 09/10/02	Wed 10/01/03																					
6.11.15	Observation scheduling	Tue 09/10/02	Thu 04/01/04																					
6.11.20	Image Pipeline	Mon 05/03/04	Wed 11/01/06																					
6.11.25	Data archive	Mon 06/02/03	Mon 05/02/05																					
6.11.30	Data Post Processing	Tue 09/10/02	Tue 05/01/07																					
6.11.35	Networking	Tue 10/01/02	Sat 11/01/03																					
6.11.40	Computing hardware	Tue 09/10/02	Thu 09/12/02																					
6.12	Education & Public Outreach	Mon 07/02/07	Fri 11/28/08																					

12.4 Project Budget

All funds are given in US\$(FY2001). The project funding will come from 4 sources. \$51.5 M from new NSF funds, \$12 M in manpower provided by the NRAO operations budget, approximately \$11 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

VLA EXPANSION PROJECT BUDGET										
Note: All monetary amounts are listed in \$k (FY2001)										
	2001	2002	2003	2004	2005	2006	2007	2008	2009	Sub-total
6.01 Project Management	76.1	119.1	169.1	220.3	177.8	155.6	144.4	99.8	40.8	1203
6.02 System Integration & Testing	268.2	572.2	88.4	52.1	44.1	44.1	42.6	26.6	24.6	1163
6.03 Civil Construction	0.0	770.4	221.0	145.0	445.0	40.0	0.0	0.0	0.0	1621
6.04 Antennas	47.7	222.2	725.6	432.7	242.3	196.3	155.0	149.4	15.2	2186
6.05 Front End Systems	239.4	460.8	1414.6	2602.9	1650.0	683.0	378.7	167.3	0.0	7597
6.06 Local Oscillator System	30.0	132.0	492.5	429.8	403.5	398.5	393.5	393.5	393.5	3067
6.07 Fiber Optic System	10.8	1084.4	1269.6	1044.3	924.3	924.3	824.3	700.0	0.0	6782
6.08 Intermediate Frequency System	20.0	494.0	499.0	586.0	586.0	586.0	586.0	586.0	586.0	4529
6.09 Correlator	149.0	366.3	159.3	622.3	38.3	4276.8	1879.0	45.0	17.0	7553
6.10 Monitor & Control System	19.2	367.9	441.1	406.4	255.0	237.7	204.3	172.1	64.0	2168
6.11 Data Management & Computing	0.0	10.3	114.5	266.5	85.5	33.0	184.0	126.0	526.0	1346
6.12 Education & Public Outreach							250.0	250.0		500
Sub-Total M&S	860	4600	5595	6808	4852	7542	5042	2716	1667	39715
NRAO Wages & Benefits	448	2915	3603	3612	2976	2544	2386	2288	1700	22470
Canadian Labor	54	383	641	490	468	365	624	321	136	3482
Total M&S+W/B	1362	7898	9838	10911	8296	10451	8051	5325	3503	65667
Contingency (15%)	204	1185	1476	1637	1244	1568	1208	799	525	9850
Redirected NRAO Effort	-275	-1585	-2070	-2065	-1523	-1319	-1158	-1165	-857	-12019
Canadian Contribution	-203	-749	-800	-1113	-506	-4642	-2503	-366	-153	-11035
Mexican Contribution			-1000	-1000						-2000
ELVA Project Funds	1088	6748	7443	8370	7511	6057	5598	4592	3019	50464
AUI Fee 2%	22	135	149	167	150	121	112	92	60	1009
NSF Funded	1110	6883	7592	8537	7661	6178	5710	4684	3079	51473
	2001	2002	2003	2004	2005	2006	2007	2008	2009	