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Last changed 2002-May-31

12 SCHEDULE AND BUDGET

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

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 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 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 desi will be frozen and quantity production of the new equipment will begin. The new systems will be installed on antenn at a rate of seven antennas per year beginning in Q2 of 2004, with the last antenna scheduled for retrofit by Q2 of 20 The new receivers will be installed at a slower rate than this, with the last receiver planned for installation in the seco quarter of 2010.

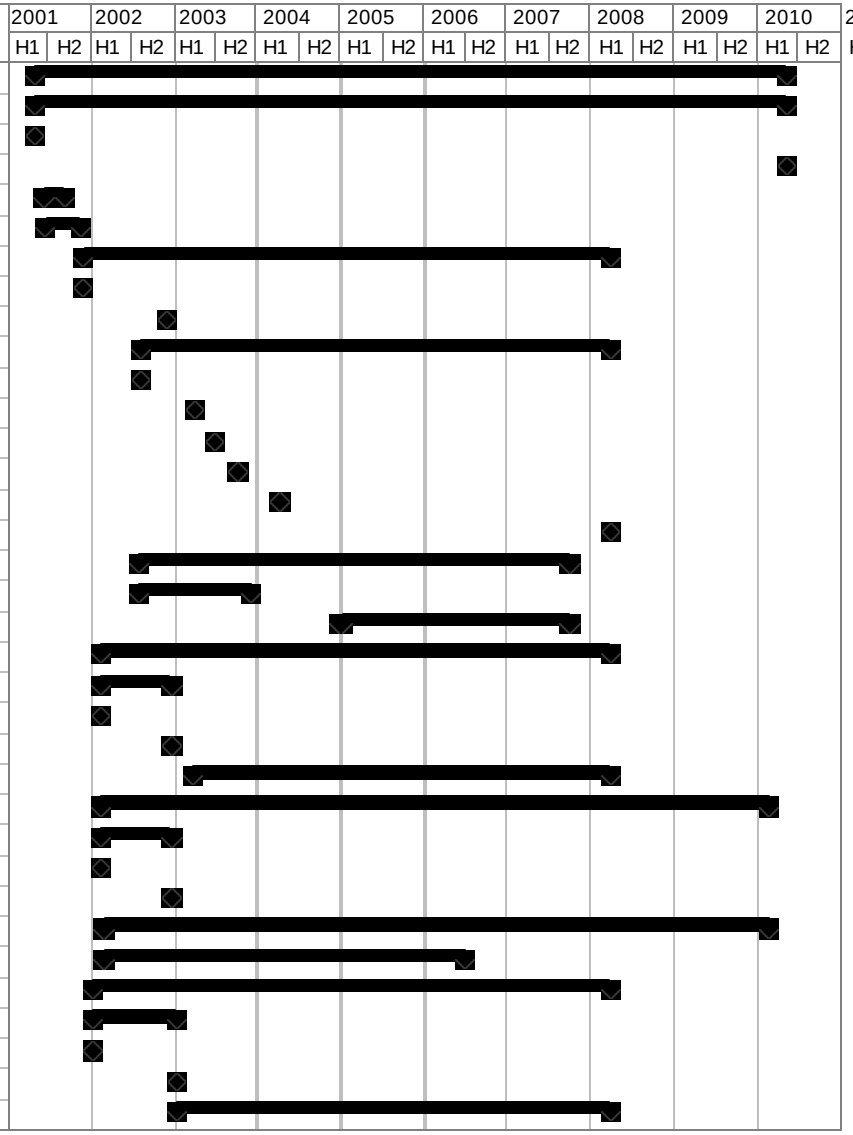
The correlator will be designed and built at the Herzberg Institute of Astrophysics and will be installed in a new correlator room in the VLA control building. A small 3 or 4 antenna prototype of a subset of the correlator will be tested using astronomical observations at the VLA in Q4 of 2005. Equipment 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 c 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 systen 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
6.01	**Project Management**	**Tue 05/01/01**	**Mon 05/10/10**
6.01.05	**Management, Planning**	**Tue 05/01/01**	**Mon 05/10/10**
6.01.05.05	Start Project	Tue 05/01/01	Tue 05/01/01
6.01.05.08	EVLA Operational	Mon 05/10/10	Mon 05/10/10
6.01.05.10	**Detailed Project Mgmt Plan**	**Mon 06/04/01**	**Fri 09/07/01**
6.01.06	**Project Book**	**Mon 06/18/01**	**Thu 11/15/01**
6.02	**System Integration & Testing**	**Tue 12/04/01**	**Mon 03/31/08**
6.02.02	System PDR	Tue 12/04/01	Tue 12/04/01
6.02.03	System CDR	Mon 12/02/02	Mon 12/02/02
6.02.04	**Transition Plan**	**Mon 08/05/02**	**Mon 03/31/08**
6.02.04.05	Start fiber cabling on Array	Mon 08/05/02	Mon 08/05/02
6.02.04.10	Choose EVLA test antenna	Tue 04/01/03	Tue 04/01/03
6.02.04.15	Start Interferometry Tests - EVLA & VLA	Tue 07/01/03	Tue 07/01/03
6.02.04.20	Freeze Electronics Design/Start Production	Mon 10/06/03	Mon 10/06/03
6.02.04.25	Start antenna outfitting	Mon 04/05/04	Mon 04/05/04
6.02.04.50	Last antenna converted to EVLA design	Mon 03/31/08	Mon 03/31/08
6.03	**Civil Construction**	**Thu 08/01/02**	**Mon 10/01/07**
6.03.05	**Fiber Optic Cable**	**Thu 08/01/02**	**Tue 12/02/03**
6.03.10	**New Correlator Room**	**Mon 01/03/05**	**Mon 10/01/07**
6.04	**Antennas**	**Wed 02/13/02**	**Mon 03/31/08**
6.04.01	**Management/Subsystem Engineering**	**Wed 02/13/02**	**Wed 12/18/02**
6.04.01.05	Feed Cone PDR	Wed 02/13/02	Wed 02/13/02
6.04.01.10	Feed Cone CDR	Wed 12/18/02	Wed 12/18/02
6.04.05	**Feed Cone Production**	**Mon 03/17/03**	**Mon 03/31/08**
6.05	**Front End Systems**	**Tue 02/12/02**	**Fri 02/26/10**
6.05.01	**Management/Subsystem Engineering**	**Tue 02/12/02**	**Tue 12/17/02**
6.05.01.05	Receiver/Feed PDR	Tue 02/12/02	Tue 02/12/02
6.05.01.10	Receiver/Feed CDR	Tue 12/17/02	Tue 12/17/02
6.05.05	**Receiver Build & Installation**	**Mon 03/04/02**	**Fri 02/26/10**
6.05.10	**Feeds**	**Mon 03/04/02**	**Fri 06/23/06**
6.06	**Local Oscillator System**	**Mon 01/14/02**	**Mon 03/31/08**
6.05.01	**Management/Subsystem Engineering**	**Mon 01/14/02**	**Mon 01/13/03**
6.06.01.05	LO/IF PDR	Mon 01/14/02	Mon 01/14/02
6.06.01.10	LO/IF CDR	Mon 01/13/03	Mon 01/13/03
6.06.05	**LO production**	**Mon 01/13/03**	**Mon 03/31/08**



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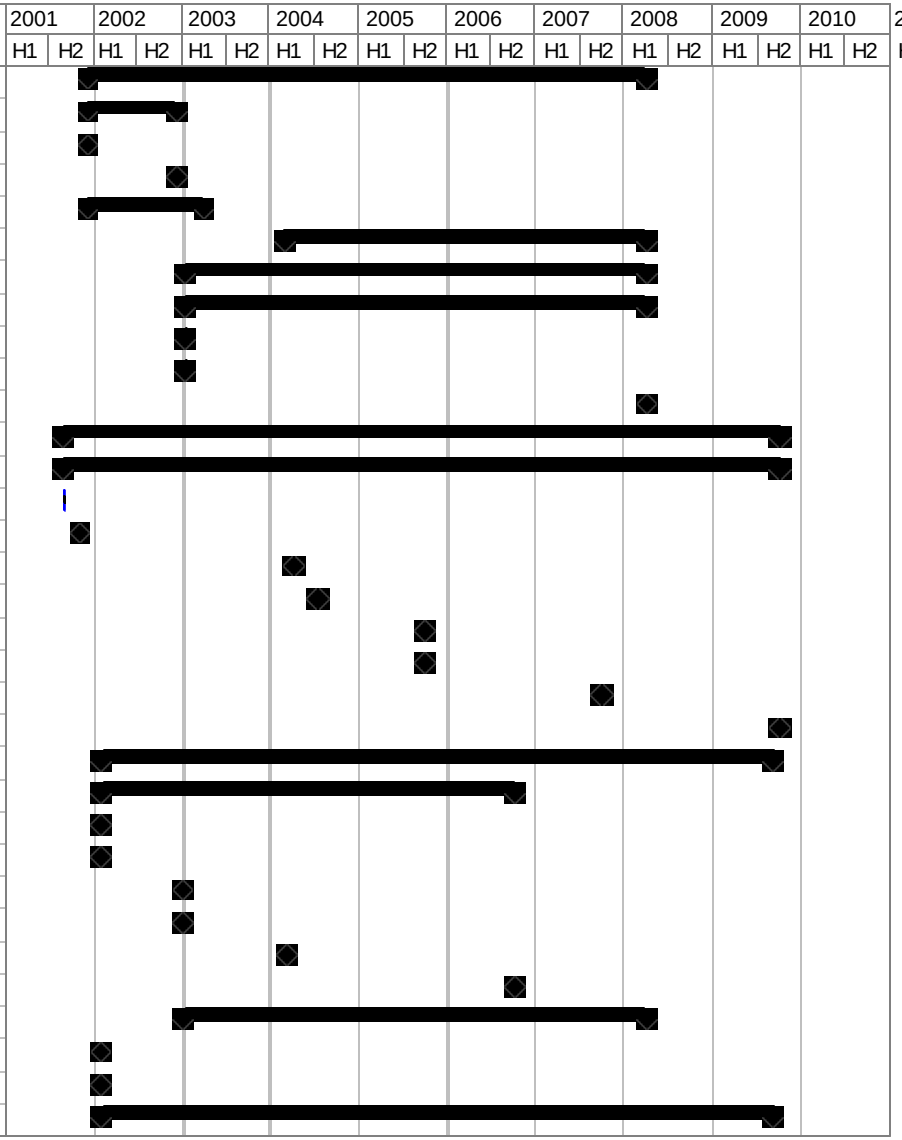
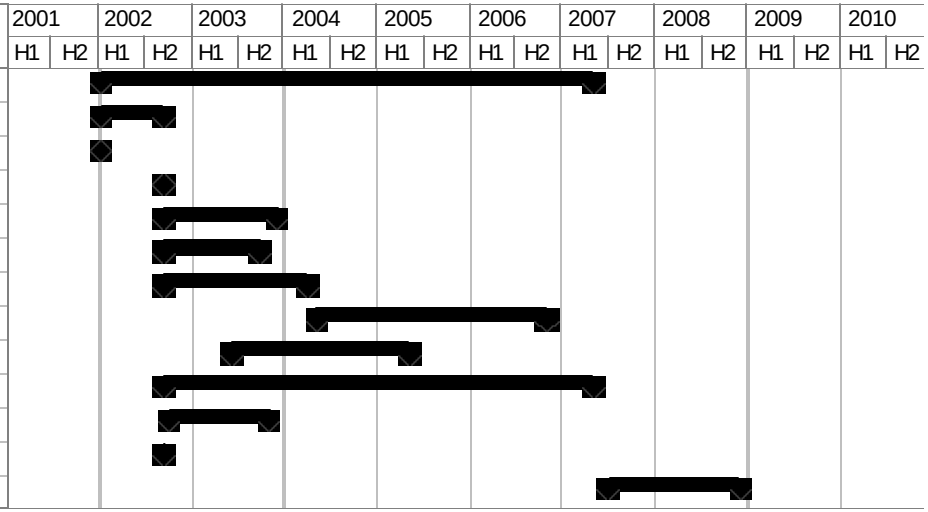
WBS	Task Name	Start	Finish
6.07	**Fiber Optic System**	**Mon 12/10/01**	**Mon 03/31/08**
6.07.01	**Management/Subsystem Engineering**	**Mon 12/10/01**	**Mon 12/09/02**
6.07.01.05	Fiber Optics System PDR	Mon 12/10/01	Mon 12/10/01
6.07.01.10	Fiber Optics Sstem CDR	Mon 12/09/02	Mon 12/09/02
6.07.05	**Fiber Optics System Production**	**Mon 12/10/01**	**Tue 04/01/03**
6.07.10	**Antenna Outfitting**	**Mon 03/01/04**	**Mon 03/31/08**
6.08	**Intermediate Frequency System**	**Mon 01/13/03**	**Mon 03/31/08**
6.08.01	**Management/Subsystem Engineering**	**Mon 01/13/03**	**Mon 03/31/08**
6.08.05	**Band Switches**	**Mon 01/13/03**	**Tue 01/14/03**
6.08.10	**Samplers**	**Mon 01/13/03**	**Tue 01/14/03**
6.08.50	Last antenna convrted to EVLA design	Mon 03/31/08	Mon 03/31/08
6.09	**Correlator**	**Mon 08/27/01**	**Fri 10/02/09**
6.09.01	**Management/Subsystem Engineering**	**Mon 08/27/01**	**Fri 10/02/09**
6.09.01.05	New Correlator planning session	Mon 08/27/01	Tue 08/28/01
6.09.01.10	New Correlator Conceptual Design Review	Fri 11/02/01	Fri 11/02/01
6.09.01.15	User manual available	Mon 04/05/04	Mon 04/05/04
6.09.01.20	New Correlator PDR	Fri 07/16/04	Fri 07/16/04
6.09.01.25	New Correlator prototype testing w/ 3 baselin	Mon 10/03/05	Mon 10/03/05
6.09.01.30	New Correlator CDR	Mon 10/03/05	Mon 10/03/05
6.09.01.35	Start new Correlator installation	Mon 10/01/07	Mon 10/01/07
6.09.01.40	New Correlator operational	Fri 10/02/09	Fri 10/02/09
6.10	**Monitor & Control System**	**Fri 02/01/02**	**Fri 09/11/09**
6.10.01	**Management/Subsystem Engineering**	**Tue 02/05/02**	**Mon 10/02/06**
6.10.01.05	Monitor&Control Software PDR	Wed 02/06/02	Wed 02/06/02
6.10.01.10	Monitor&Control Hardware PDR	Tue 02/05/02	Tue 02/05/02
6.10.01.15	Monitor&Control Software CDR	Tue 01/07/03	Tue 01/07/03
6.10.01.20	Monitor&Control Hardware CDR	Wed 01/08/03	Wed 01/08/03
6.10.01.25	Full Monitor& Control capabilities available	Mon 03/15/04	Mon 03/15/04
6.10.01.30	Monitor&Control system ready for archive	Mon 10/02/06	Mon 10/02/06
6.10.05	**M&C Electronic Hardware**	**Wed 01/08/03**	**Tue 04/01/08**
6.10.10	Start M&C Network, Hardware & Software	Fri 02/01/02	Fri 02/01/02
6.10.15	Start M&C Computing Systems Hardware & Softw	Fri 02/01/02	Fri 02/01/02
6.10.20	**M&C EVLA Software**	**Fri 02/01/02**	**Fri 09/11/09**



WBS	Task Name	Start	Finish
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$(FY2002). The project funding will come from 4 sources. $52.3 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. It must be noted that the schedule and budget plan presented in this Chapter represent a 9 year plan in which there is a good schedule match between the Canadian supplied correlator and the installation of EVLA electronics systems on the VLA antennas. This is the schedule that the Project desires to follow. The funding profile currently approved by the NSF for the project is an 11 year plan. If a way to accelerate NSF funding cannot be found the rate of retrofitting VLA antennas to the EVLA design will be slowed down from the schedule presented here to match the slower funding rate.

Table 12.2 EVLA Project Budget Plan

VLA EXPANSION PROJECT BUDGET Note: All monetary amounts are listed in $k (FY2002)

		Actual	Budgeted								
		2001	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	Sub-total
6.01	**Project Management**	**80.0**	267.4	269.1	398.3	338.8	285.6	262.4	205.8	117.8	2225
6.02	**System Integration & Testing**	**213.0**	832.8	279.7	145.1	137.1	137.1	138.6	76.6	24.6	1985
6.03	**Civil Construction**	**0.0**	311.0	95.0	160.0	485.0	40.0	0.0	0.0	0.0	1091
6.04	**Antennas**	**46.9**	153.9	516.6	327.7	232.3	196.3	155.0	149.4	15.2	1793
6.05	**Front End Systems**	**338.5**	412.4	1419.6	2602.9	1650.0	683.0	378.7	167.3	0.0	7652
6.06	**Local Oscillator System**	**14.1**	328.0	552.5	489.8	463.5	458.5	453.5	453.5	453.5	3667
6.07	**Fiber Optic System**	**7.8**	854.4	1010.1	1064.3	944.3	924.3	824.3	700.0	0.0	6330
6.08	**Intermediate Frequency System**	**0.0**	202.3	643.5	730.5	730.5	730.5	730.5	730.5	725.0	5223
6.09	**Correlator**	**149.0**	366.3	159.3	622.3	41.3	4285.8	1879.0	45.0	17.0	7565
6.10	**Monitor & Control System**	**0.0**	384.9	441.1	406.4	255.0	237.7	204.3	172.1	64.0	2166
6.11	**Data Management & Computing**	**3.0**	7.3	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	**852**	4121	5501	7214	5363	8012	5460	3076	1943	41542
	NRAO Wages & Benefits	**275**	2690	3611	4009	3398	3197	2792	2543	1963	24479
	Canadian Labor	**54**	383	641	490	468	365	624	321	136	3482
	Total M&S+W/B	**1181**	7194	9753	11713	9229	11574	8876	5940	4042	69504
	Contingency	**0**	0	1322	1234	1036	1230	987	1001	800	7610
	Redirected NRAO Effort	**-148**	-1523	-1818	-1781	-1546	-1534	-1318	-1147	-923	-11737
	Canadian Contribution	**-203**	-749	-800	-1113	-506	-4642	-2503	-366	-153	-11035
	Mexican Contribution			-1000	-1000						-2000
	EVLA Project Funds	**830**	4922	7457	9053	8213	6628	6043	5429	3767	52342
	Carryover to next yr	**2170**	2248								
	Carryover from prior yr		-2170	-2248							
	NSF Funded	**3000**	5000	5209	9053	8213	6628	6043	5429	3767	52342
		2001	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**

EVLA antennas available		1	5	11	17	22	28	Rework & spare components	
Rcvr prototypes	2	4	6	8					
Rcvrs available		4	32	62	102	142	176	206	240