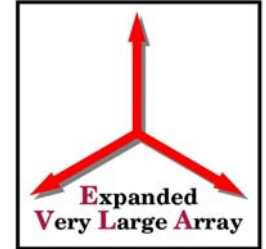


EVLA Front-End CDR

EVLA Front-End Schedule



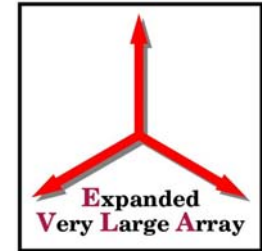
Overview



- Receiver Schedule
 - Core L, C, Transition-X, K, Ka, Q-Band Receivers
 - Future S, Ku, X-Band Receivers
 - Schedule by Band
 - Receiver Rate
- LNA Schedule
 - Antenna Schedule affect on K & Q-Band
- Tracking Receiver Construction Status
- Meeting the construction schedule

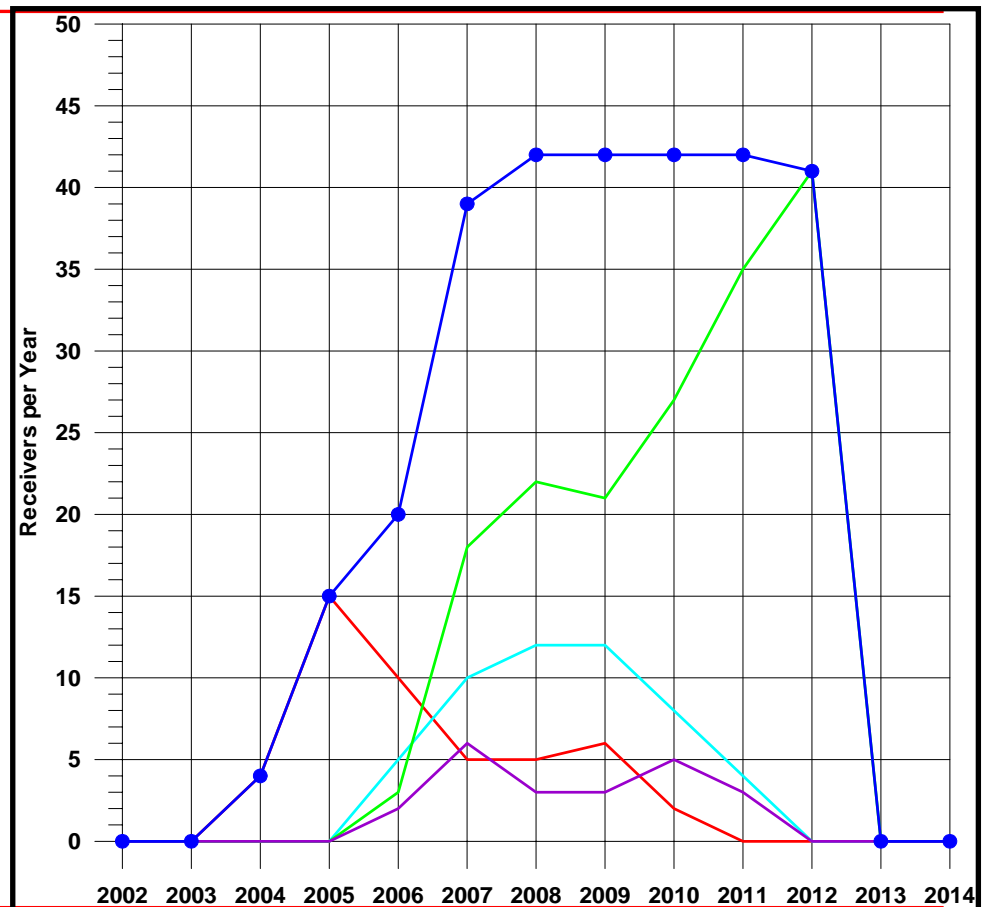


EVLA Receiver Annual Production Rate



**EVLA Receiver Schedule
Number Per Year**
Assumes adequate effort thru end 2012
Outfitting Plan as of 16 March 2006

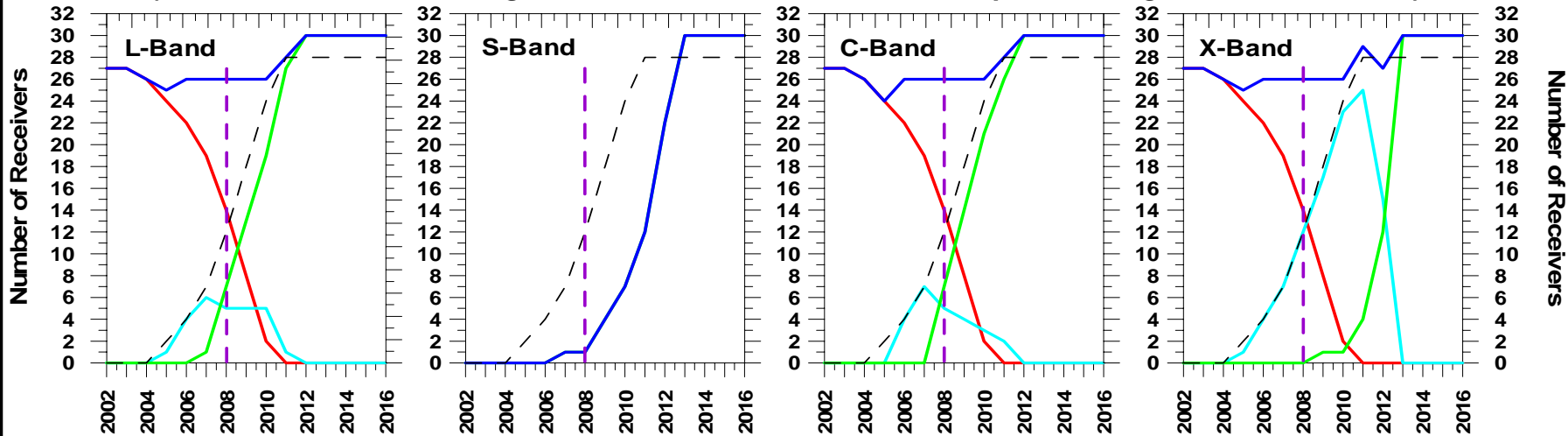
- Transition & Interim Rx's
- Upgraded Rx's
- New Rx's
- Retrofitted Rx's
- Total Rx's



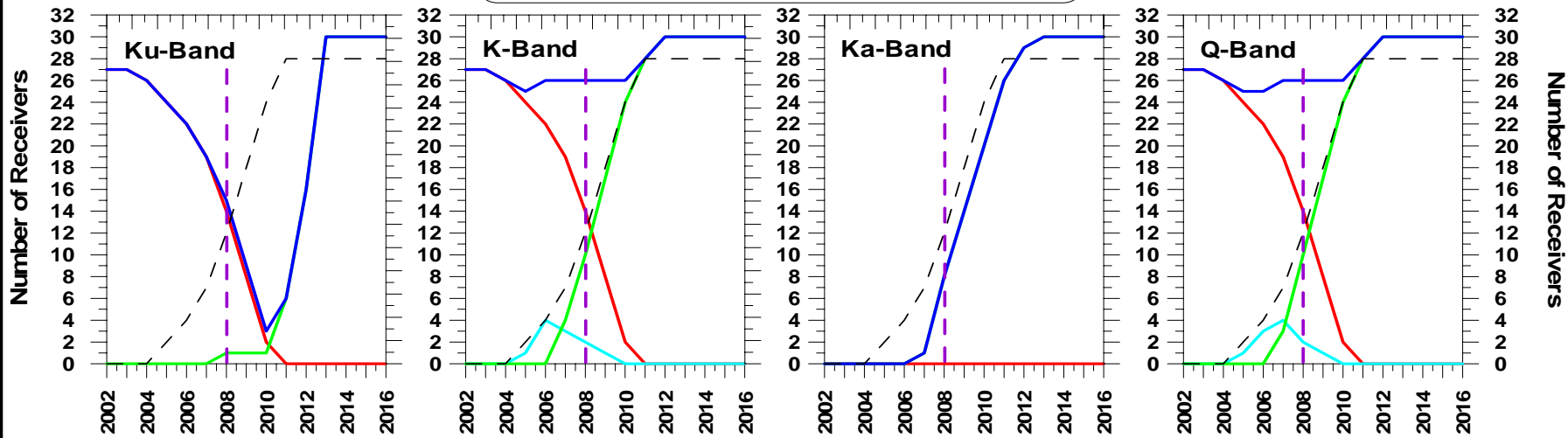
EVLA Receiver Schedule By Band

EVLA Receiver Schedule - Number Available at Beginning of each Calendar Year

(Based on Antenna Outfitting Plan - 16 March 2006 ; Assumes adequate staffing effort thru end 2012)



--- EVLA Antenna Outfitting Schedule



Key = Old , Transition/Interim , New , Total Receivers

Prototype WIDAR Available for Early Science in 2007 Q3

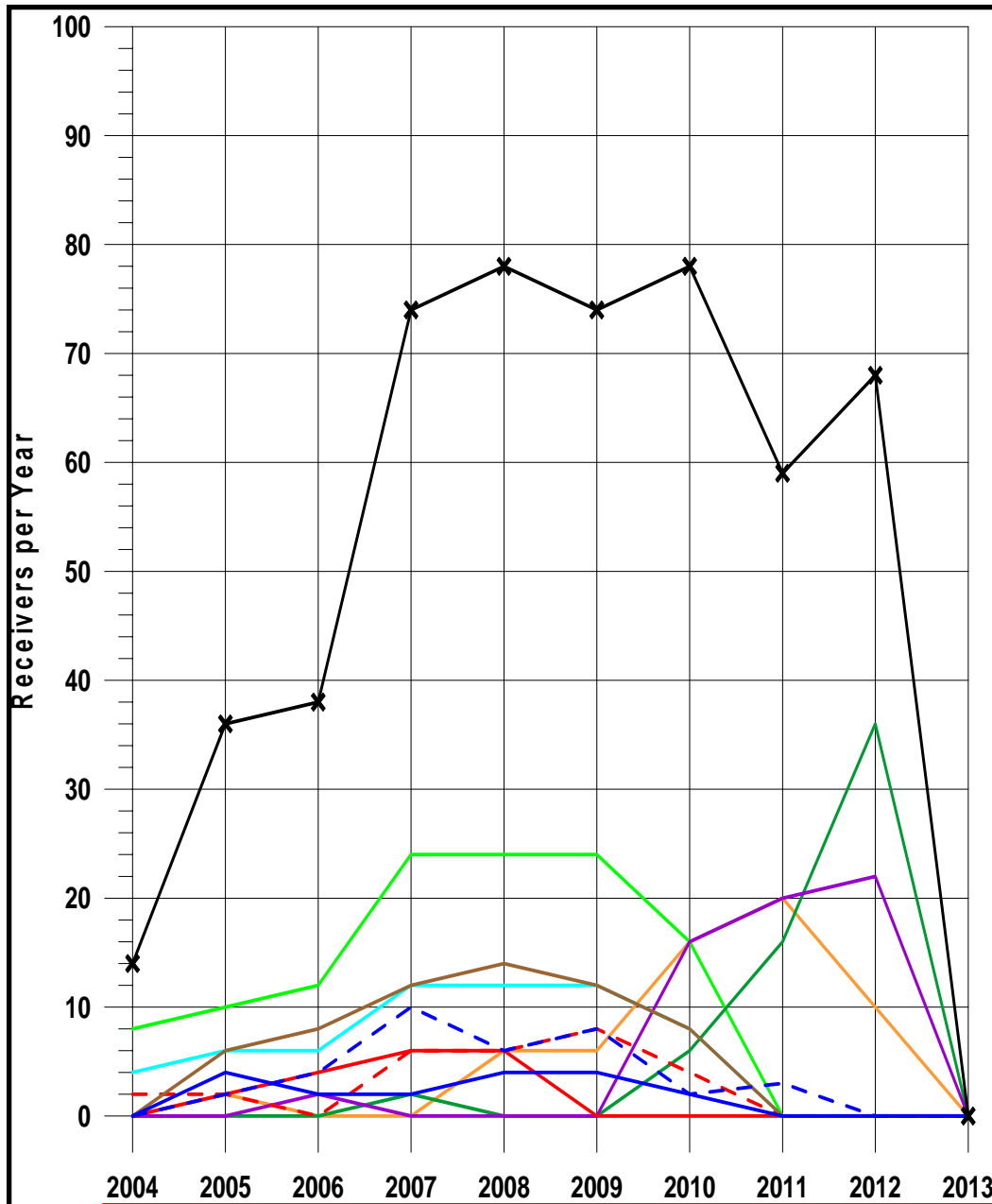
(RHH : 16 March 2006)

LNA Forecast for EVLA Rx's

2	- Qty Required (Light Blue or Yellow)
2	- Full Qty Delivered
2	- Partial Qty Delivered
2	- Awaiting Cryo Upgrade

Antenna Serial Number	Date LNA's Required	Date of Ant Commission	L-Band		S-Band Bal Amp	C-Band	X-Band	Ku-Band	K- Band		Ka-Band	Q- Band		Amps per Year	Year
			LN Bal	HP Bal					Upgrade	New		Upgrade	New		
Antenna 14 (Az Bearing)	All In-House	Jan 31, 2005	2	2	-	2	-	-	0	-	-	-	0		
Antenna 16 (Az Bearing)	Feb 27, 2005	Apr 28, 2005	2	2	-	2	-	-	2	-	-	-	0	14	2004
Antenna 13 (retrofit)	May 22, 2005	Jul 21, 2005	-	-	-	2	-	-	0	2	2	-	-		
Antenna 18 (Az Bearing)	Jul 1, 2005	Aug 30, 2005	2	2	-	2	-	-	2	-	-	-	2	16	2005
Antenna 24	Jan 28, 2006	Mar 29, 2006	2	2	-	2	-	-	2	-	2	-	-		
Antenna 26 (Az Bearing)	Aug 19, 2006	Jun 23, 2006	2	2	2	2	-	-	0	-	-	-	2		
Antenna 23	Apr 24, 2006	Oct 18, 2006	2	2	-	2	-	-	2	2	2	-	-	32	2006
Antenna 17	Dec 3, 2006	Feb 1, 2007	2	2	-	2	-	-	2	2	2	-	-		
Antenna 1	Feb 3, 2007	Apr 4, 2007	2	2	2	2	-	2	-	4	2	-	-		
Antenna 19	Apr 1, 2007	May 31, 2007	2	2	-	2	2	-	2	2	2	-	-		
Antenna 21	May 28, 2007	Jul 27, 2007	2	2	2	2	-	-	2	-	4	2	-		
Antenna 10 (Az Bearing)	Aug 24, 2007	Oct 23, 2007	2	2	-	2	-	-	2	2	2	-	-	72	2007
Antenna 11	Oct 21, 2008	Dec 20, 2008	2	2	2	2	-	-	2	-	4	-	2		
Antenna 25	Jan 6, 2008	Mar 6, 2008	2	2	-	2	-	-	2	-	2	-	2		
Antenna 2	Mar 3, 2008	May 2, 2008	2	2	2	2	-	-	2	-	4	2	-		
Antenna 5	May 1, 2008	Jun 30, 2008	2	2	-	2	-	-	2	2	2	-	-		
Antenna 9	Jun 27, 2008	Aug 26, 2008	2	2	2	2	-	-	2	4	-	0	-		
Antenna 20 (Az Bearing)	Sep 21, 2008	Nov 20, 2008	2	2	-	2	-	-	2	-	2	-	2	82	2008
Antenna 3	Dec 8, 2008	Feb 6, 2009	2	2	2	2	-	-	2	-	2	-	2		
Antenna 7	Feb 6, 2009	Apr 7, 2009	2	2	-	2	-	2	-	2	2	2	-		
Antenna 15	Apr 4, 2009	Jun 3, 2009	2	2	2	2	-	-	2	-	2	2	-		
Antenna 4	May 31, 2009	Jul 30, 2009	2	2	-	2	-	2	2	-	2	-	2		
Antenna 8	Jul 27, 2009	Sep 25, 2009	2	2	2	2	-	-	2	-	2	-	2		
Antenna 27	Sep 24, 2009	Nov 23, 2009	2	2	-	2	-	-	0	2	-	-	2	80	2009
Antenna 28	Dec 7, 2009	Feb 5, 2010	2	2	2	2	-	2	2	-	2	2	-		
Antenna 6	Feb 8, 2010	Apr 9, 2010	2	2	-	2	-	-	2	-	2	-	0		
Antenna 22	Apr 5, 2010	Jun 4, 2010	2	2	2	2	-	2	-	0	2	2	-		
Antenna 12	Jul 24, 2010	Sep 22, 2010	2	2	-	2	-	-	0	2	2	-	-		
Retrofit Earlier Antennas	Aug 1, 2010	-	6	6	4	4	-	2	2	-	4	-	2	80	2010
Retrofit Earlier Antennas	Jan 1, 2011	-	-	-	6	-	6	6	-	-	-	2	-		
Retrofit Earlier Antennas	Aug 1, 2011	-	-	-	6	-	6	6	-	-	-	1	-	39	2011
Retrofit Earlier Antennas	Jan 1, 2012	-	-	-	6	-	6	6	-	-	-	-	-		
Retrofit Earlier Antennas	Aug 1, 2012	-	-	-	6	-	6	6	-	-	-	-	-	36	2012
Retrofit Earlier Antennas					5		6	6							
Retrofit Earlier Antennas					5		6	6						34	2013
Retrofit Earlier Antennas							11	6							
Retrofit Earlier Antennas							11	6						34	2014
Retrofit Earlier Antennas															
Retrofit Earlier Antennas														0	2015
Spare LNA's	Anytime	-	6	6	6	6	6	6	-	6	6	-	6	54	
Sub-Totals			66	66	66	66	66	66	28	24	66	35	24	573	
			132						52			59			

EVLA Amplifier Annual Production Rate



EVLA LNA Schedule - Number Per Year (Excludes Spares)
Outfitting Plan as of 31 March 2006

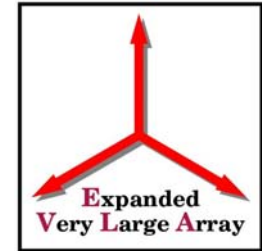
- L-Band
- S-Band
- C-Band
- X-Band
- Ku-Band
- - - K-Band - Upgrade
- K-Band - New
- Ka-Band
- - - Q-Band - Upgrade
- Q-Band - New
- * Total

(RHH : 31 March 2006)



Completed Antennas

Front-End Interim Systems



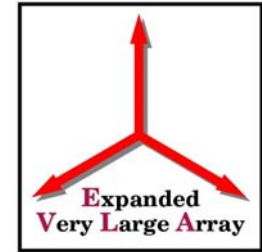
Completed <i>Planned Task</i>	Interim Receiver	Transition Receiver	EVLA Compliant Receiver	Receiver to be added at a Later Date
----------------------------------	------------------	---------------------	-------------------------	--------------------------------------

Antenna S/N	L	S	C	X	Ku	K	Ka	Q
14	L#32(i) 15 Dec 2004 <i>To be replaced by new 1-2 GHz EVLA Rx</i>	-	C#01(i) 27 Jan 2005 <i>To be upgraded with new EVLA Card Cage, AC Box, 4-8 GHz Polarizer & LNA's</i>	X#01(t) 17 Nov 2004	-	K#28(i) 15 Dec 2004 <i>To be upgraded with new EVLA Card Cage</i>	-	Q#30(i) 15 Mar 2005 <i>To be upgraded with new EVLA Card Cage & new LCP LNA</i>
16	L#01(i) 5 May 2005 <i>To be replaced by new 1-2 GHz EVLA Rx</i>	-	C#03(i) 24 Nov 2005 <i>To be upgraded with new 4-8 GHz Polarizer & LNA's Revised AC Box</i>	X#35(t) 5 Mar 2005	-	K#22(i) 5 May 2005 <i>To be upgraded with new EVLA Card Cage</i>	-	Q#31(i) 16 Nov 2005 <i>To be upgraded with new EVLA Card Cage</i>
13	L#02(i) 27 April 2004 <i>To be replaced by new 1-2 GHz EVLA Rx</i>	-	C#02(i) 8 Dec 2005 <i>To be upgraded with new EVLA Card Cage, 4-8 GHz Polarizer & 4-8 GHz LNA's Revised AC Box</i>	X#29(t) 27 Aug 2003	-	K#27(i) 11 Feb 2004 <i>To be upgraded with new EVLA Card Cage</i>	-	Q#17(i) 22 Feb 2006 <i>To be upgraded with new EVLA Card Cage</i>



Antennas Being Outfitted

Front-Ends Underway



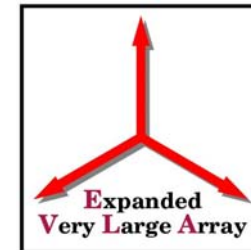
Completed <hr/> <i>Planned Task</i>	Interim Receiver	Transition Receiver	EVLA Compliant Receiver	Receiver to be added at a Later Date
----------------------------------------	------------------	---------------------	-------------------------	--------------------------------------

Antenna S/N	L	S	C	X	Ku	K	Ka	Q
18	L#21(i) 29 Mar 2006 <i>To be replaced by new 1-2 GHz EVLA Rx</i>		C#05(i) 28 April 2006 <i>To be upgraded with new 4-8 GHz Polarizer</i>	X#02(t) 10 Nov 2005		K#10(i) 10 Nov 2005 <i>To be upgraded with new EVLA Card Cage</i>		Q#14(i) 28 April 2006 <i>To be upgraded with new EVLA Card Cage</i>
				New Rx <u>Everett & Lisa:</u> - Cold Plate - Thermal Gap - Build Dewar - VLBA Polarizr - Build RF Box - Card Cage - AC Box - Internal Cables <hr/> - SOIDA Test - Leak Test - Install on Ant - Tcals to Ops - Documentation				



Future Antennas

Near-Term Front-Ends



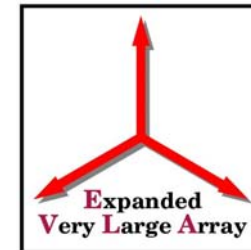
Completed ----- <i>Planned Task</i>	Interim Receiver	Transition Receiver	EVLA Compliant Receiver	Receiver to be added at a Later Date
-------------------------------------------	------------------	---------------------	-------------------------	--------------------------------------

Antenna S/N	L	S	C	X	Ku	K	Ka	Q
24	<p style="text-align: center;">L#11(i) 17 May 2006</p> <p><i>To be replaced by new 1-2 GHz EVLA Rx</i></p>		<p style="text-align: center;">C#04(i) 17 May 2006</p> <p><i>To be upgraded with new 4-8 GHz Polarizer</i></p>	<p style="text-align: center;">X#16(t) 17 May 2006</p>		<p style="text-align: center;">K#29 17 May 2006</p> <p><i>To be upgraded with new EVLA Card Cage</i></p>		<p style="text-align: center;">Q#08(i) 26 May 2006</p> <p><i>To be upgraded with new EVLA Card Cage</i></p>
	<p style="text-align: center;"><u>Dan & Bob:</u></p> <ul style="list-style-type: none"> - <i>New Window ?</i> - <i>Saddlebag fab</i> - <i>Install LNA's</i> - <i>Diode Card</i> - <i>Bias Harness</i> - <i>Phase Balance</i> - <i>Install Hybrid</i> <p>-----</p> <ul style="list-style-type: none"> - <i>SOIDA Test</i> - <i>Leak Test</i> - <i>Install on Ant</i> - <i>Tcals to Ops</i> - <i>Documentation</i> 		<p style="text-align: center;"><u>New Rx</u> <u>Everett & Lisa:</u></p> <ul style="list-style-type: none"> - <i>Cold Plate</i> - <i>Thermal Gap</i> - <i>Build Dewar</i> - <i>VLBA Polarizer</i> - <i>Build RF Box</i> - <i>Card Cage</i> - <i>AC Box</i> - <i>Internal Cables</i> <p>-----</p> <ul style="list-style-type: none"> - <i>SOIDA Test</i> - <i>Leak Test</i> - <i>Install on Ant</i> - <i>Tcals to Ops</i> - <i>Documentation</i> 	<p style="text-align: center;"><u>Rx from Ant 13</u> <u>Dave:</u></p> <ul style="list-style-type: none"> - <i>SOIDA Test</i> <p>-----</p> <ul style="list-style-type: none"> - <i>Leak Test</i> - <i>install on Ant</i> - <i>Tcals to Ops</i> - <i>Documentation</i> 		<p style="text-align: center;"><u>Rx from Ant 23</u> <u>Brent:</u></p> <ul style="list-style-type: none"> - <i>Mod RF/IF Box</i> <p>-----</p> <ul style="list-style-type: none"> - <i>SOIDA Test</i> - <i>Leak Test</i> - <i>Install on Ant</i> - <i>Tcals to Ops</i> - <i>Documentation</i> 		<p style="text-align: center;"><u>Spare Rx</u> <u>Dan & Bob:</u></p> <ul style="list-style-type: none"> - <i>Fab QPAM's</i> - <i>Upgrade LNA's</i> - <i>Bias Harness</i> - <i>Mount QPAM's</i> - <i>New W/G Iso's</i> - <i>New DC Blocks</i> - <i>New Coax Iso's</i> <p>-----</p> <ul style="list-style-type: none"> - <i>SOIDA Test</i> - <i>Leak Test</i> - <i>Install on Ant</i> - <i>Tcals to Ops</i> - <i>Documentation</i>



Future Antennas

Longer-Term Front-Ends



Antenna S/N	L	S	C	X	Ku	K	Ka	Q
23	L#??(i) 28 June 2006 To be replaced by new 1-2 GHz EVLA Rx		C#05(i) 28 June 2006 To be upgraded with new 4-8 GHz Polarizer	X#28(t) 28 June 2006		K#11 28 June 2006 EVLA Compliant		Q#?? 28 June 2006 EVLA Compliant
	Rx from Ant ? <u>Dan & Bob:</u> ----- - New Window ? - Install LNA's - Diode Card - Bias Harness - Phase Balance - Install Hybrid - SOIDA Test - Leak Test - Install on Ant - Tcals to Ops - Documentation		New Rx <u>Everett & Lisa:</u> ----- - Cold Plate - Thermal Gap - Build Dewar - VLBA Polarizer - Build RF Box - Card Cage - AC Box - Internal Cables - SOIDA Test - Leak Test - Install on Ant - Tcals to Ops - Documentation	Rx from Ant ? <u>Dave:</u> ----- - SOIDA Test - Leak Test - install on Ant - Tcals to Ops - Documentation		Rx from Ant 24 <u>Brent:</u> ----- - New LNA's? - Bias Harness - Mod RF/IF Box - New Top Plate - New Feed Sect - Eval RF Tree ? - Longer Legs - New Card Cage - AC Box - Internal Cables - Serial EPROM - SOIDA Test - Leak Test - Install on Ant - Tcals to Ops - Documentation		Rx from Ant ? <u>Dan & Bob:</u> ----- - Upgrade LNAs? - Bias Harness ? - Fab QPAM's - Mount QPAM's - New W/G Iso's - New DC Blocks - New Coax Iso's - Longer Legs - New LO Plate - New Card Cage - AC Box - Internal Cables - Mount VR Box - Serial EPROM - SOIDA Test - Leak Test - Install on Ant - Tcals to Ops - Documentation



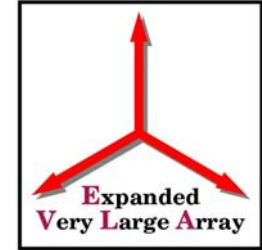
Conclusions - 1



-
- At the peak, we will have to build close to 40 receivers per year.
 - Some receivers are easier than others:
 - **Transition X-Band merely needs SOIDA testing**
 - **Upgraded K & Q-Band are simpler than building a new receiver**
 - Past history – max production:
 - **6 x K-Bands + 6 x Q-Bands + 3 x W-Bands**
 - **For a total of 15 receivers in one year (2000)**
 - **Essentially 3 techs + 1 engineer**
 - For EVLA, we have 8 techs + 3 engineers thru to the end of Project
-



Conclusions - 2



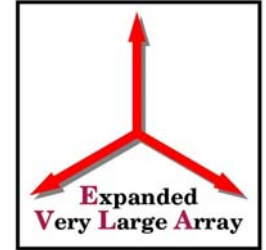
-
- Will also optimize staff effort by:
 - **Designing receiver sub-systems which are compatible with mass production concepts**
 - **Maximizing outsource options**
 - **Ensuring machined parts are available when needed by utilizing external machine shops**
 - **Using production-line techniques for new Rx's (Ka, S, Ku & X-Band)**
 - Also expect less & less maintenance required on old VLA modules as more old VLA A & F-Racks retired
 - **LO modules (F3 & F12) & IF modules (F4, F6 & F9's)**
 - **On EVLA, LO & IF converters are the responsibility of the LO/IF Group**
 - **At some point soon, will have enough spares that old VLA FE modules will never have to be repaired ever again**
 - **This will free up extra manpower (although we'll obviously have more & more receivers that can break and need to be repaired)**
-



Conclusions - 3



-
- Once we get over the initial startup problems, we have a good chance of meeting the production schedule
 - Worst case scenario
 - As long as we have purchased all of the components & hardware up front, the Rx's can be built using Operations staff after the EVLA Project funding ends (beyond 2012)
 - **Ops staff built most of the K & Q-Band receivers on the VLA and all of the W-Band receivers on the VLBA**
 - **But it would certainly take longer than desirable**
 - **Obviously less impact if it is the X-Band build that is deferred (since we already have a scientifically useful narrowband Transition X-Band system)**
-



Questions ?