



Production & Maintenance



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May 2006



Electronics Division Manufacturing Goals



- **Out-source board assemblies**
- **Build modules in-house as needed**
- **Ready the facility for manufacturing**
- **ESD protected facility**
- **Production success stories**



Outsource Circuit Cards - Board Vendor Provides:



- **Fully assembled boards/cables**
- **Some assemblies tested**
 - Flying probe tests
 - NRAO test fixtures
- **ESD packaged and labeled**
- **Scheduled deliveries**
- **Hazardous chemical handling**



In-house Module Assembly Preparation



- **Trained staff**
- **Same team that built the prototypes**
- **Complete assembly drawings**
- **New soldering stations**
- **Test equipment & computers in place**



Planning for Small Production Runs



- **Goal is to produce 28 identical antennas**
- **Small quantity builds, 5-10 at a time**
- **In-house module assembly and test**
- **VLBA cable and small parts assembly**



Inventory Control



- **New and old warehouse managed by Skip Lagoyda, Business Manager**
- **Control of high dollar items**
- **PeopleSoft software re-order mechanisms**





CDL / EVLA Coordination



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	14	2004
Antenna 16 (Az Bearing)	Feb 27, 2005	Apr 28, 2005	2	2	-	2	-	-	2	-	-	-	0		
Antenna 13 (retrofit)	May 22, 2005	Jul 21, 2005	-	-	-	2	-	-	-	0	2	2	-	16	2005
Antenna 18 (Az Bearing)	Jul 1, 2005	Aug 30, 2005	2	2	-	2	-	-	-	2	-	-	2		
Antenna 24	Jan 28, 2006	Mar 29, 2006	2	2	-	2	-	-	-	2	-	2	-	32	2006
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	-		
Antenna 17	Dec 3, 2006	Feb 1, 2007	2	2	-	2	-	-	-	2	2	2	-	72	2007
Antenna 1	Feb 3, 2007	Apr 4, 2007	2	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	-		
Antenna 11	Oct 21, 2008	Dec 20, 2008	2	2	2	2	-	-	2	-	4	-	2	82	2008
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		
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	-	80	2009
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		
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	-		



Attributes of In-house Module Assembly



- Minimize module storage problems
- Tight engineering control
- Improve the design
- Fast turn-around time
- Distributed parts inventory





ESD Preparation



- 12 ESD stations including floor mats
- ESD totes and parts bins
- ESD shoes and wrist straps
- Humidity controlled facility

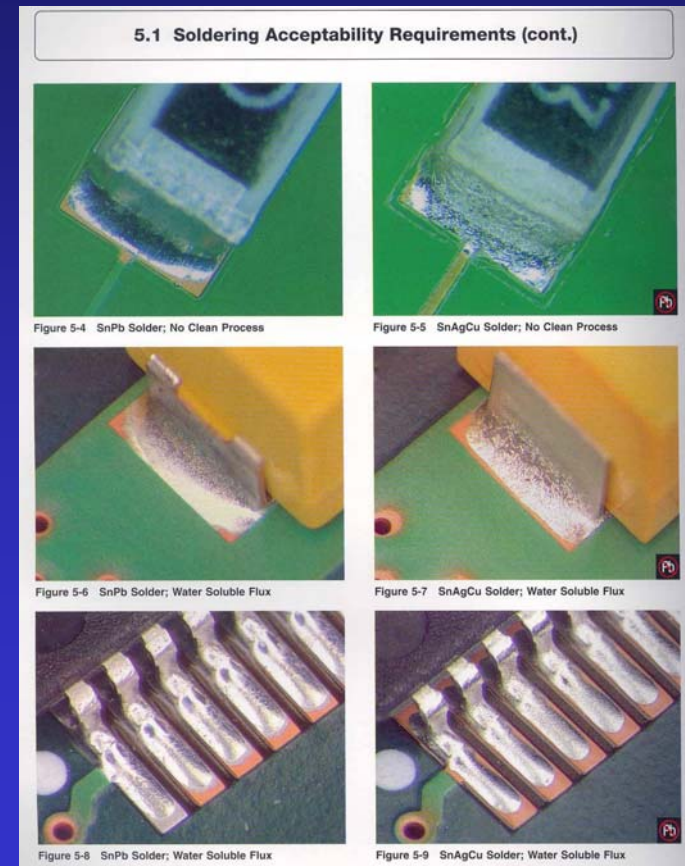




Solder & Flux Compatibility, and Quality Issues



- **Trained staff**
- **Some components only available in lead-free.**
- **Can be used with ‘leaded’ solder.**
- **May require higher soldering temperatures, 20 to 30 degrees higher (Fahrenheit).**

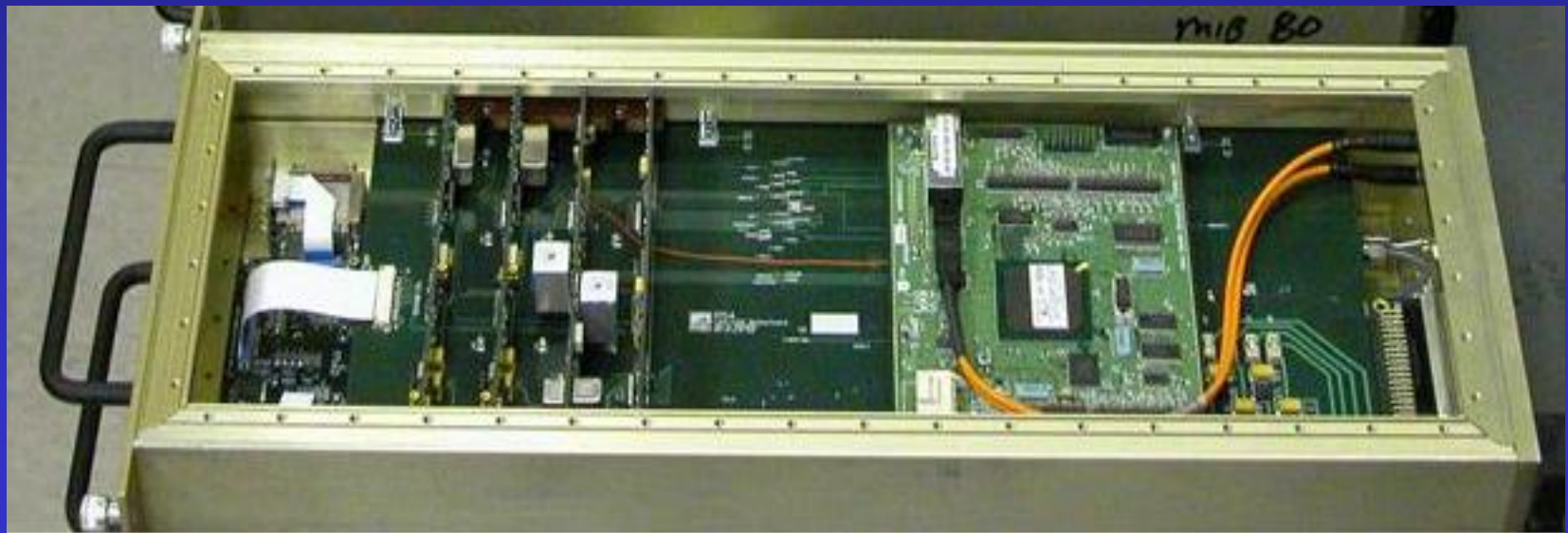




Mother Board Approach

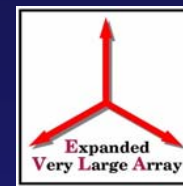


- More robust design
- Easy to assemble





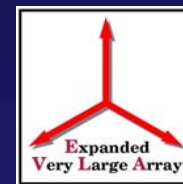
MIB Quality



- **1400 MIBs required for the project**
- **34 in each antenna - in every type of module**
- **Turn-key solution**
 - Large quantity buys lowered price per board
 - 100% flying probe – 100% electrical test
 - 99% yield (last run of 100 boards)



Design for Manufacturability



- 300 pin transponder
- Easy assembly
- 10GHz circuits



**Changed vendor to
save \$400K without
a design change**



Conclusion



- **Ready to maintain production schedule**
- **Looking for cost savings**
- **Utilized every NRAO asset**
- **Manufactured for a 20 year life**