



Production & Maintenance



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December, 2004



Manufacturing Goals



- **Out-source board assemblies**
- **Ready the facility for manufacturing**
- **Build modules in-house as needed**
- **Maintain the Schedule**



Circuit Boards Designs



- **Designed for automated assembly
Pick-and-Place, PROTEL**
- **Designed for easy module assembly**
- **Multi-layer boards (6-22)**
- **BGA, surface mount components**
 - **Components on both sides**
- **Ready for Out-Sourcing**



NRAO will Provide:



- **Basic Ordering Agreement, 1-2 years**
 - **Long term commitment**
- **Software designs and BOMs**
- **Design reviews with vendors**
- **Dedicated test fixtures**



Board Vendor Provides:



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



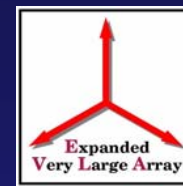
In-house Module Assembly Preparation



- **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 similar antennas**
- **Small quantity builds, 5-10 at a time**
- **In house Module assembly**



Attributes of In-house Module Assembly



- Minimize module storage problems
- Tight engineering control
- Perfect 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





Quality Tools



- **Shaker Table**
- **Environmental Chambers**
- **RFI Shielded Chamber**
- **EVLA Test rack**
- **Producing written QA procedures**





Rework procedures



- **Red/Green Tags**
- **ESD Vacuum Bagger**
- **AOC warehouse for completed modules**
- **AOC Inventory control**





Inventory Control



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





Purchasing Support



- **Competitive bid procedures**
creative selection criteria allows for best vendors – not only lowest price
- **BOA, Blanket Orders, ASAP procedures**
- **Negotiated warranties**
Balanced with in-house testing



Large Procurements



- **Project buys, High dollar items**
- **Qualified Vendors**
- **Best price strategy**
- **Minimize obsolescence costs**
- **Freezes the design**



Appropriate Funding Allocation – DTS Example



- **Formatter board parts cost:**
 - \$9,559.79 (Qty - 10)**
 - Includes \$152.16 cost for assembly & test
 - Includes \$6,600 for 3 transponders
- **Bogue Machine parts \$2,640 (Qty – 4)**
- **RFI Honeycomb filters \$442 per DTS**

Total \$12,641



DTS Example Continued



- **Estimated Costs (excluding samplers)**

Power supply board, VICOR bricks	\$2,700
MIB and digital board	\$1,500
Optical hardware	\$ 600
- **Total ~ \$17,440 ea (\$69,764 per antenna)**

Current WBS estimate	\$72,000
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- **In-House Assembly/Test Labor** **\$4,000**



WBS

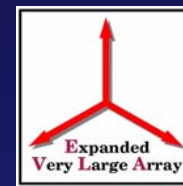


Budget Management Tool

- **Detailed budgets have been developed and are backed by actual cost data**
- **Reviews twice per year**
- **Managed cash flow and work load**
 - **Supports the Schedule**



We are Ready for Production



- **Production Plan & QA**
- **Outsourcing commitment**
- **Cost saving steps in place**
- **COTS parts & equipment**
- **Support the Present Schedule**