Budget, Schedule, Contingency

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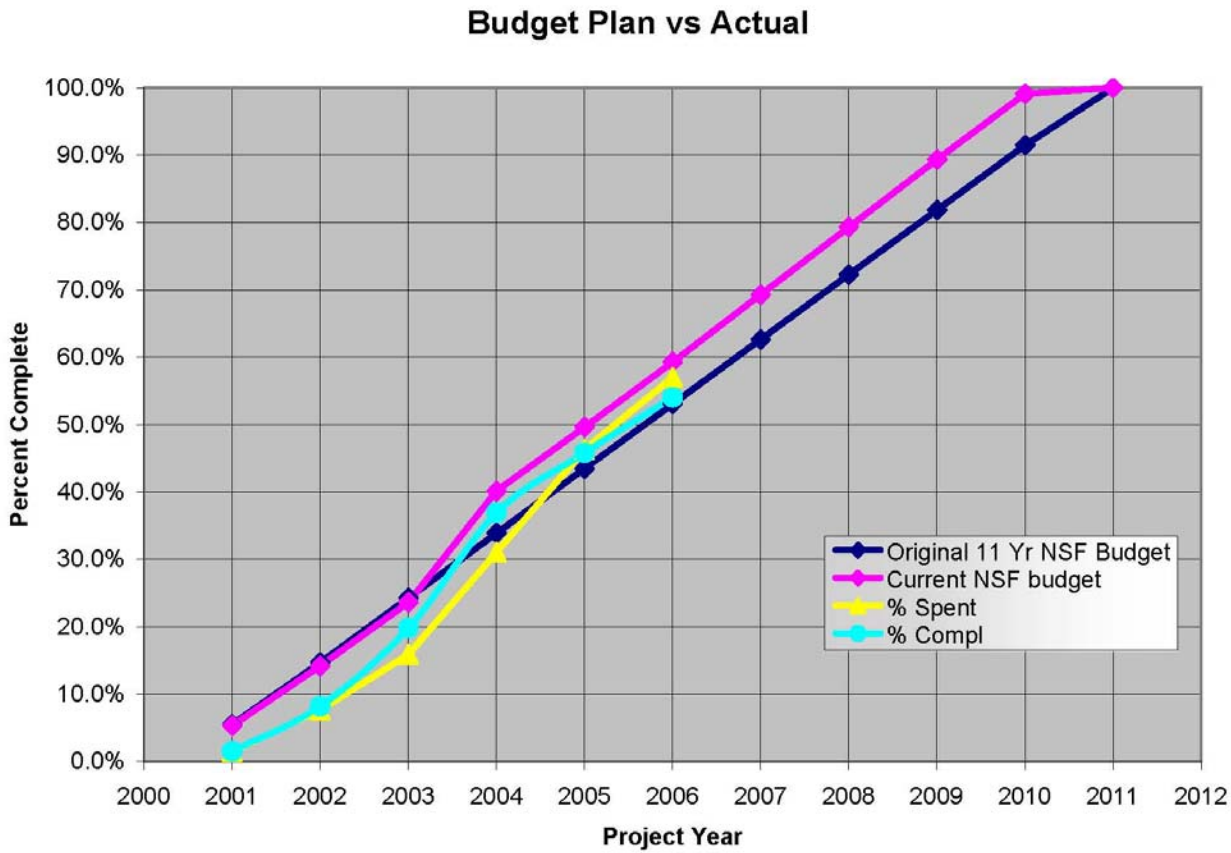
Outline

- Schedule
- Milestones
- Budget
- Contingency
- Project Risks
- Risk Analysis
- Descope Options

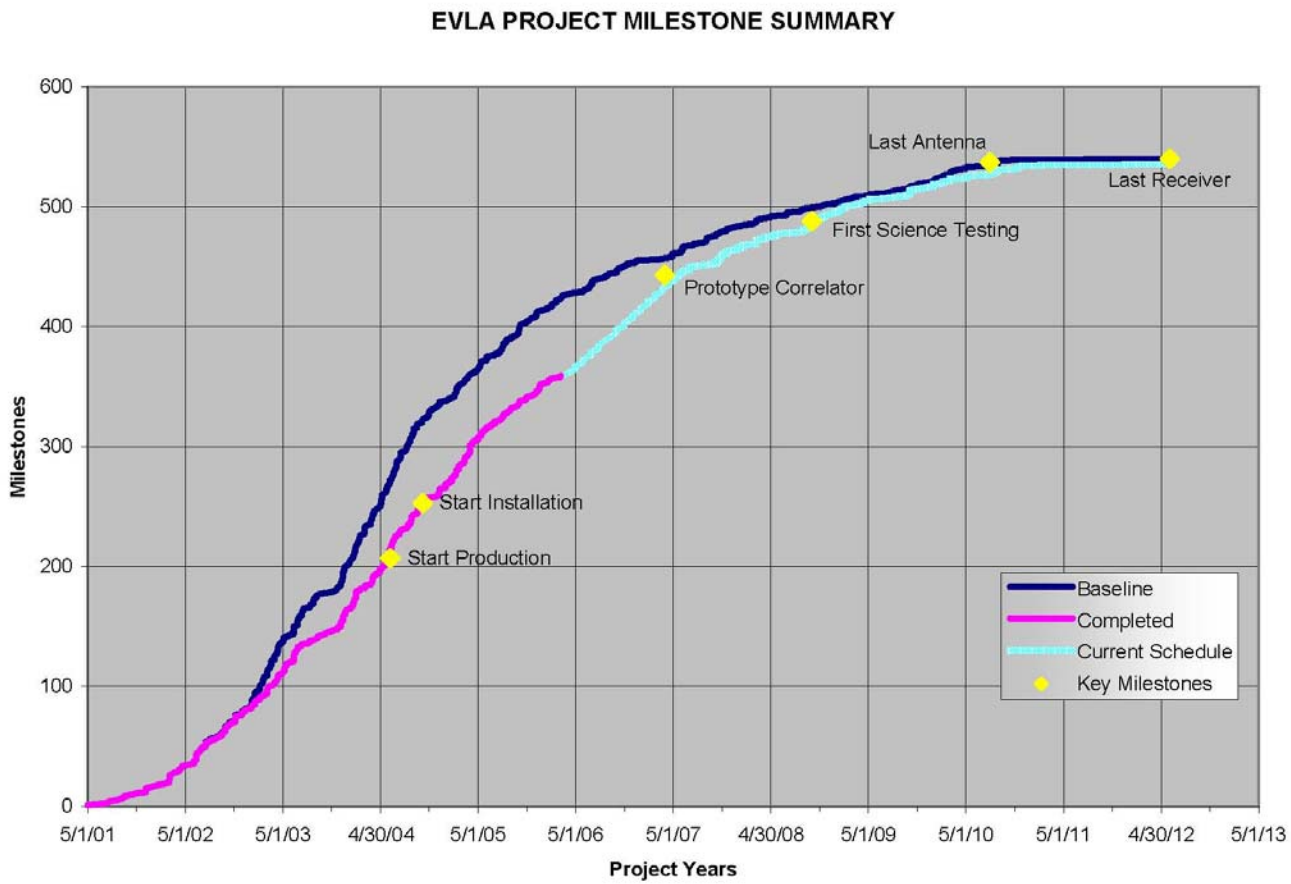
Completion Status of Budget and Schedule - 1

- Definitions of terms used in plots and tables
  - Percent Spent: comparison between the money actually spent on a task and the value assigned to it in the original project plan
  - Percent Complete: comparison between the value of the work completed on a task to its total value in the original project plan

Completion Status of Budget and Schedule - 2



Milestone Completion



WBS Level 2 Completion Status - 1

- Project Management: 52.1% spent, 45.8% complete
- Systems Integration: 76.1% spent, 70.1% complete
  - Overspent in parts for bins and modules
- Civil Construction: 87.8% spent, 80.5% complete
  - Advance purchase of materials
- Antennas: 69.1% spent, 59.2% complete
  - Advance purchase of materials
- Front End Systems: 55.1% spent, 43.4% complete
  - Delay in receiver production

WBS Level 2 Completion Status - 2

- LO Systems: 75.5% spent, 75.1% complete
- Fiber Optics Systems: 64.4% spent, 58.8% complete
- IF Systems: 61.5% spent, 52.7% complete
- M&C System: 57.6% spent, 51.1% complete
  - Contingency applied to address overrun in contributed effort
- Data Management & Computing: 51.2% spent, 40.0% complete
  - Contingency applied to address overrun in contributed effort and to provide additional e2e staff
  - Staff needed to make progress

Completed Milestones

Examples (see list in information packet):	Date
– Install prototype system on test antenna	Q2 2003
– Start production assembly of antenna fiber	Q2 2004
– Start production of LO/IF outfitting	Q2 2004
– Start production of module interface board (MIB)	Q3 2004
– Start production of L-band feed horns	Q4 2004
– Routine test observing software available	Q1 2005
– Install 4P converter (T301) in test antenna	Q3 2005
– Start production of K-band receiver upgrade	Q3 2005
– Deliver EVLA antenna 14 to operations	Q4 2005
– Start installation of shielded room	Q4 2005

Remaining Milestones

• Examples:	Date
– DCAF software ready for testing	Q2 2006
– Test prototype of S-band feed horn	Q3 2006
– Deliver 7 antennas to operations	Q4 2006
– Complete installation of shielded room	Q4 2006
– Start production of L-band receiver	Q4 2006
– Complete delivery of UX converters (T303)	Q4 2006
– Start production of 3-bit, 4Gsps digitizer	Q2 2007
– Test prototype correlator on 4 EVLA antennas	Q3 2007
– Complete round trip phase module (L352)	Q4 2007
– M&C system ready for archive	Q2 2009

Critical Path Tasks

- Examples:

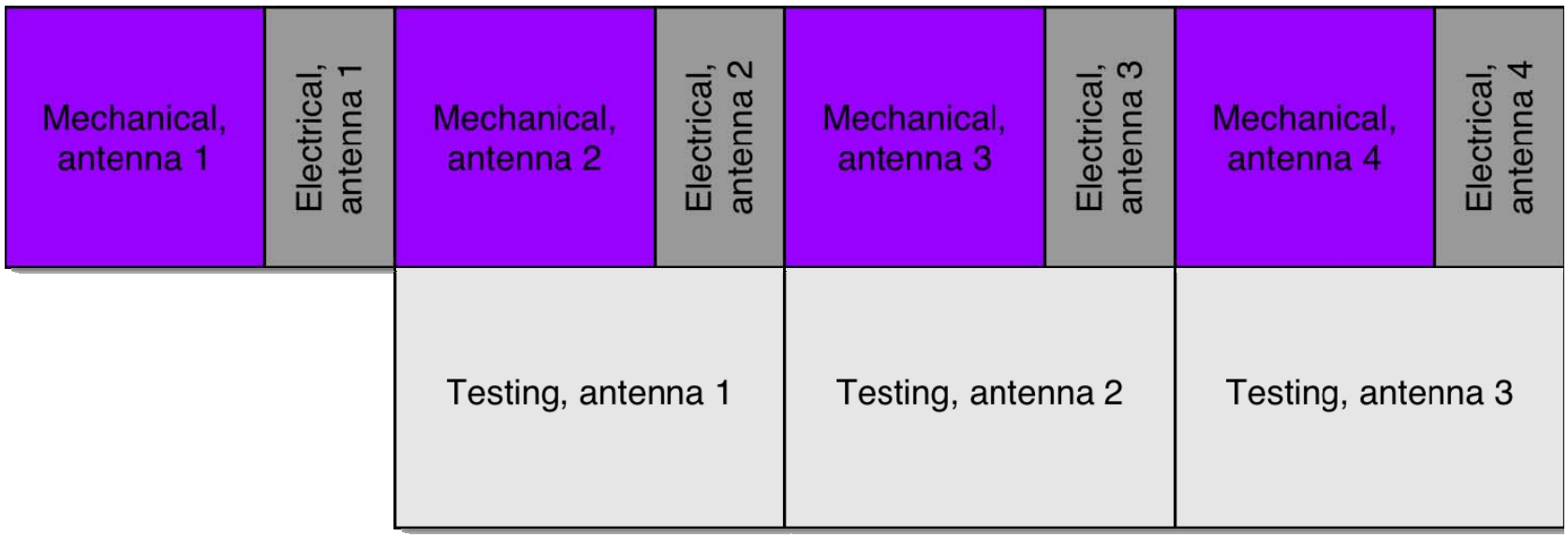
	Date
– TelCal software ready for testing	Q2 2006
– Complete prototype of L-band receiver	Q3 2006
– Conduct critical design review of M&C system	Q4 2006

Maintaining Schedule -1

- To maintain project schedule, we need to accelerate retrofits from the planned rate of 5 antennas per year to 5.5
- Can we accelerate the antenna retrofit rate?
  - Retrofits are becoming an assembly line
    - Major components stockpiled (e.g. cryo compressors, HVAC units, L-band feed horns, antenna platforms)
    - Most electronics designs are mature
  - Staff continues to become more efficient in antenna retrofits
  - VLA antennas have been adequately maintained. Their reliability is excellent.

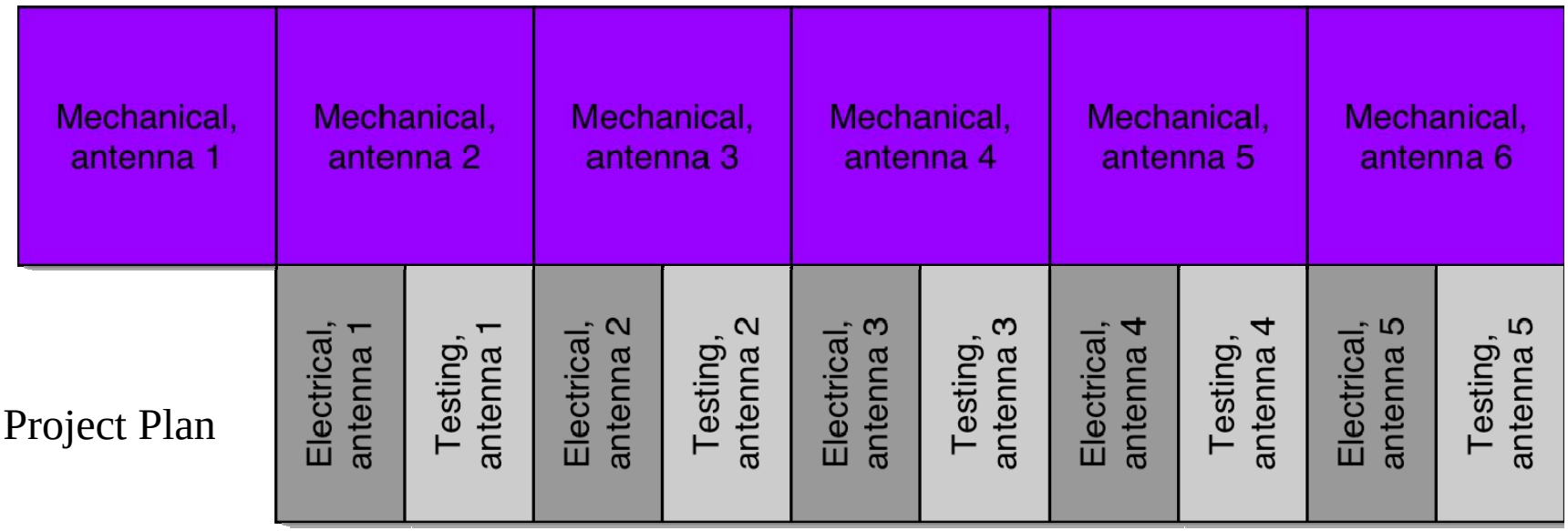
Antenna Retrofit Sequence: Current

Up until now, we have been pursuing the mechanical and electrical outfitting of EVLA antennas serially, with testing proceeding in parallel.

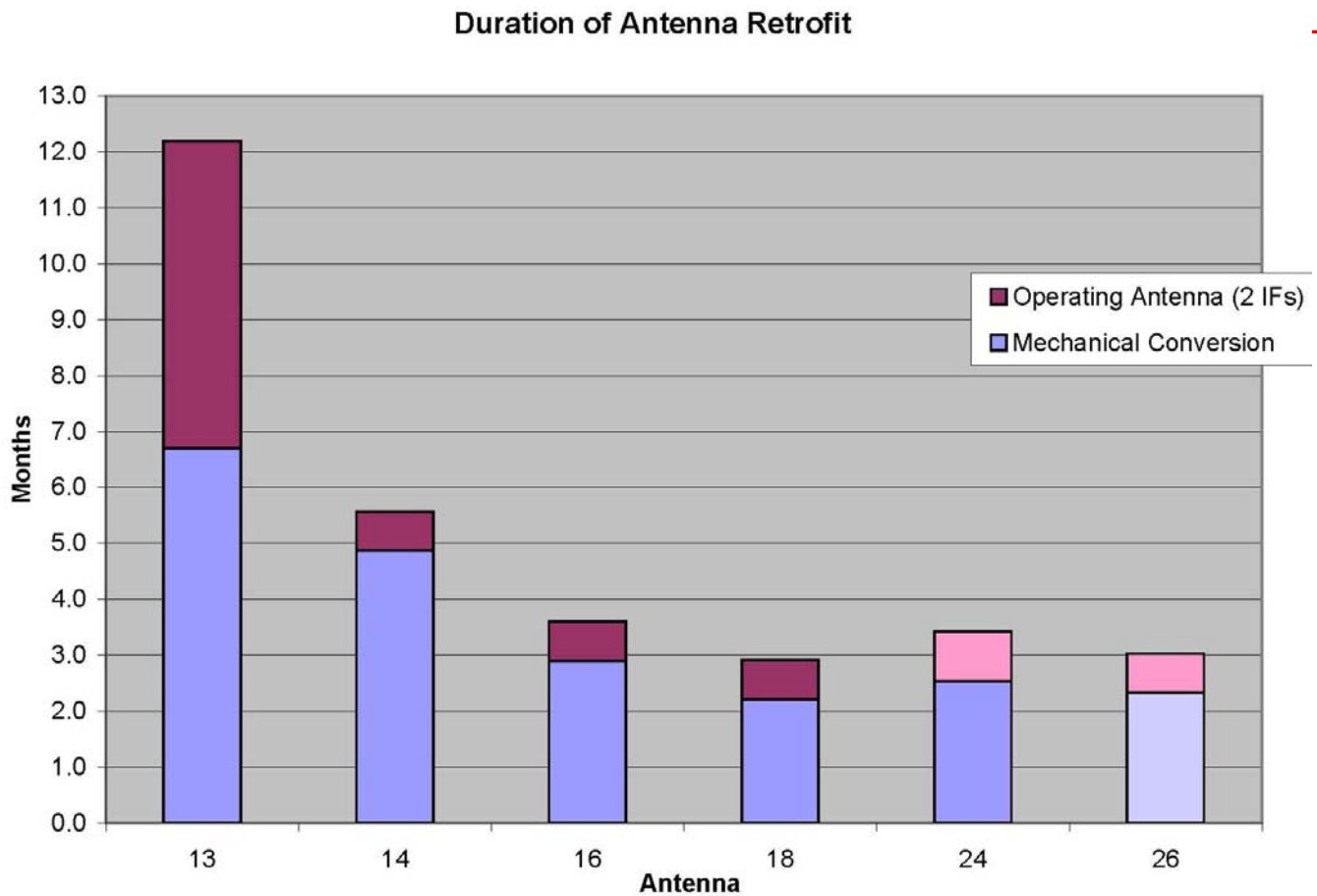


Antenna Retrofit Sequence: Future

In full production, mechanical outfitting of antennas can proceed in parallel with both electrical outfitting and testing.



Retrofit Duration



Maintaining Schedule-2

- Antenna rate of up to 6 per year is possible if :
  - Duration of mechanical overhaul is 2 months.
  - Duration of parallel activities for electrical outfitting and testing is 1 month each.
- … but need to monitor impact on reliability of VLA antennas. Possible issue for VLA users.
- Expect progress in software areas of the project because of additional e2 staffing resources and finalization of M&C design.
- Shift front end production emphasis to Ka-band while solving design issues with wideband OMT.

Budget

- Funding = $93.8M (FY06)
  - NSF project funds $58.7M
  - NRAO contributed effort $16.3M
  - Canadian partner $17.0M (C$20M)
  - Mexican partner $1.8M

Contingency

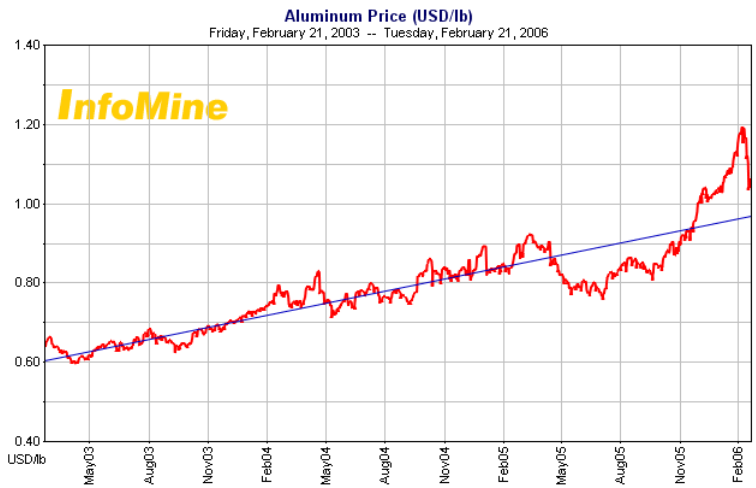
Detailed calculation of percent contingency depends upon whether or not project contingency is used to cover the cost to complete the correlator (corr.).

	Corr. Exclusive	Corr. Inclusive
Contingency, $	$2.8M	$2.8M
Cost to Complete	$32.1M	$44.8M
Contingency, %	8.7%	6.2%

Correlator project carries its own contingency

External Risk Factors

- NRAO operating budget
  - Project dependence upon contributed effort.
  - Ability of operations budget to absorb personnel (e.g. e2e and CASA) moving from project to operations. Ability to support science staff. Plan developed.
- Strength of Canadian dollar
- Correlator funding profile
- Commodity prices
  - Aluminum, steel
  - Gold plating



Retirement of Risk

- Bulk purchase of half transponders
- Bulk purchase of module interface boards
- M&C software support of transition mode observing, including successful implementation of reference pointing
- Eliminated spurious correlation with redesign of digitizer in DTS
- Solved timing problem between EVLA and VLA antennas
- Solved image rejection problem in 4P downconverter (T301) with new filter design
- Solved aliasing problem in baseband downconverter (T304) that limited sensitivity with new filter design
- Selected appropriate fire protection system for new correlator shielded room

Project Risks

• Failure to stay on manpower curve	$1.2M
• Correlator peripherals	$0.8M
• Contribute to EPO program	$0.5M
• Improve RFI protection	$0.3M
• Additional module parts	$0.3M
• Additional feed costs (S, X, Ku)	$0.3M
• Spare correlator boards	$0.2M
• Improve phase stability & RTP	$0.2M
• Improve wideband OMT	$0.2M
• Improve synthesizer (L302)	$0.1M
• Correlator installation manpower	$0.1M
• Redesign 3-bit, 4Gsps samplers	$0.1M
• IF retrofits	$0.1M
• Feed demoisture system	$0.1M

Risk Analysis

- Sum total risk = $4.5M
- Root sum square risk = $1.7M
- Contingency = $2.8M. Comparable to value of a year ago.
- Conclusion:
  - Still possible that project can be completed within budget and nearly on schedule.
  - Contingency coverage of risk is marginal, but no urgency now to implement descope options.
- Goal for FY06 is to refine contingency and risk analysis at finer level of detail (i.e. increase contingency and more accurately assess risk).

Value of Possible Descope Options

- Eliminate receiver bands:
  - X (8-12 GHz) $1.0M 2009 (date to decide on descope)
  - Ku (12-15 GHz) $1.3M 2009
  - S (2-4 GHz) $1.4M 2007
  - Ka (26-40 GHz) $1.2M 2006
- Purchase receiver components, but assemble/install as part of operations. Labor savings to project are:
  - X $0.2M
  - Ku $0.2M
  - S $0.4M
  - Ka $0.2M
- Eliminate solar observing mode $0.2M
- Transfer project-funded e2e effort (6 FTE years) to operations budget $0.7M

Other Possible Descope Options

- Reduce number of antenna retrofits
- Shut down the VLA part of the array for some time period
- Halve the observing bandwidth