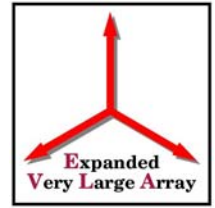


EVLA `Descoping' Options

Rick Perley



Origin of the Problem



- Clear from the beginning that considerable operational personnel would be needed for the EVLA project.
- Problem was: How to estimate, and budget this, in the proposal.
- Solution: Define a new term: ‘Contributed Effort’, and insert a reasonable estimate of what this would be.
- Value inserted: \$12M in 2001 dollars.
- Current situation: The required ‘contributed effort’ is now estimated to be \$17M (2005 dollars).



The Current Problem



- We thus need \$4M more to meet the requirements of the original Phase I proposal.
- The problem is exacerbated by:
 - Anticipated funding shortfalls in operations, so Ops can't simply 'suck it up' without significant cutbacks.
 - e2e requires a significant *increase* over the original budget to provide desirable capabilities.
 - Covering the entire \$4M with project contingency will wipe out that contingency.
- So we must consider the consequences of descopes.



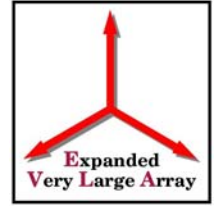
Computing



- Any additional resources (above those currently identified in the budget) directed to computing will worsen the problem.
- M&C is thought to be adequately staffed and funded.
- e2e could use more, but the e2e requirements document is long and deep, and an audit of the requirements and priorities is needed to identify the *essential* needs and required resources.
- Post-processing is in a similar state as e2e.



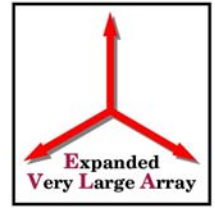
Hardware Descopies



- If project contingency is applied to offset the increase in Contributed Effort, (or to improve computing resources), we must consider descopying the project's 'hardware capabilities'.
- The options (which provide sufficient relief) are limited to:
 - Bandwidth reduction (involves IF and DTS systems)
 - Removal of one or more frequency bands.



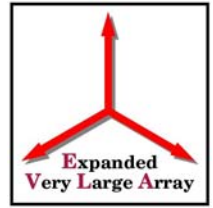
Option A: Halving the Bandwidth



- Savings: Significant -- \$4M.
- Scientific Impact:
 - 40% reduction in continuum sensitivity in K, Ka, Q bands. Small loss in U-band. No effect on others.
 - 50% loss in real-time frequency span.
- This is a complex descope – involves multiple systems and modules.
- Post-construction retrofitting will be difficult and costly. Issues of obsolescence will be important.
- The correlator will be a full-bandwidth system. Having the supplier (LO/IF/DTS) mismatched to the consumer (correlator) is very foolish.
- A decision to do this has to be made now, to accrue savings.
- Funding crisis (if there is one) is 1 – 2 yr. away.



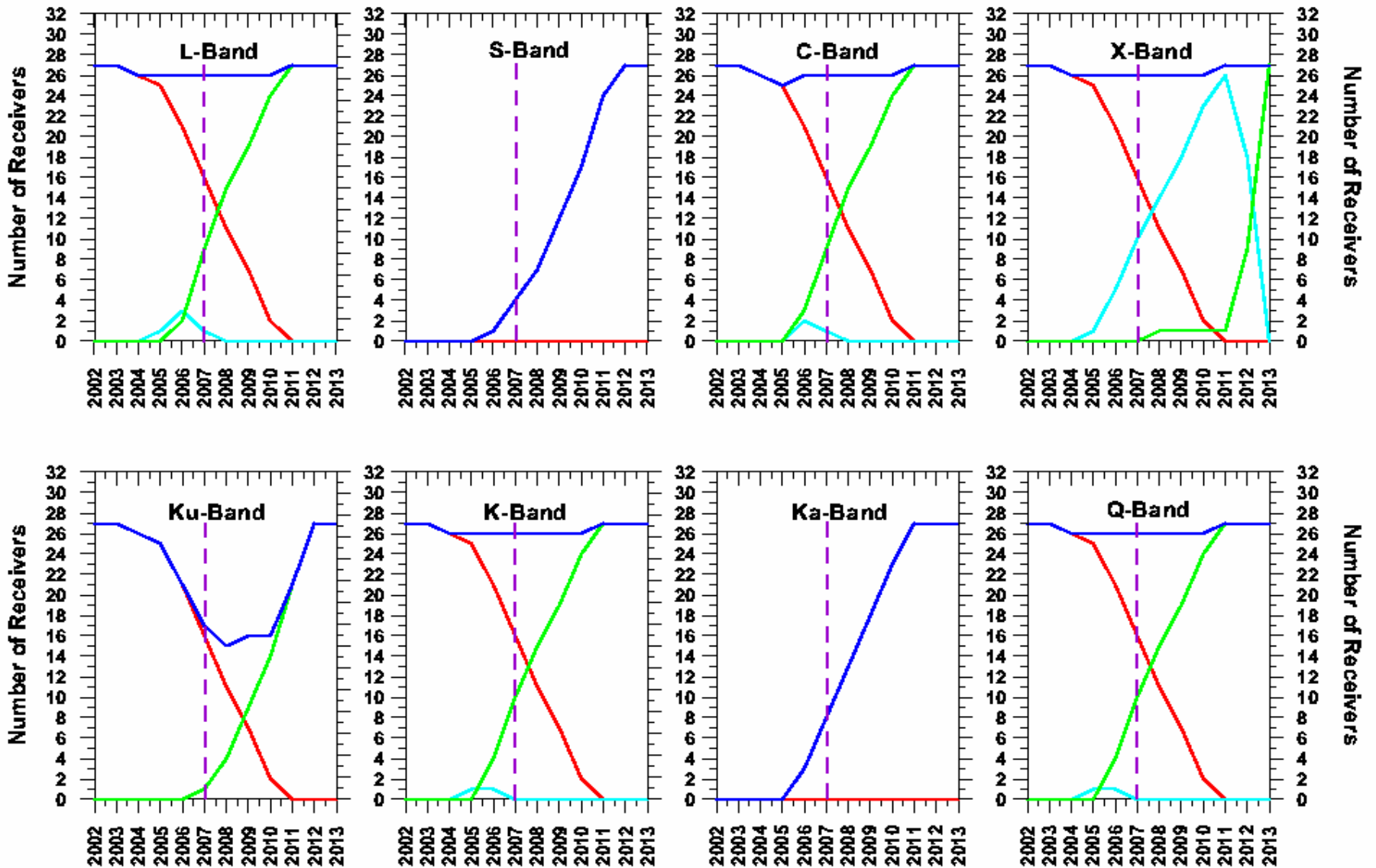
Option B: Removing Frequency Bands



- Three bands are on the block:
 - S-Band (\$1.3M)
 - X-Band (\$1.3M)
 - U-Band (\$1.7M)
- We have already decided that Ka-band (28 – 40 GHz) is the highest priority new band, and will not be considered for removal.
 - This decision can be reconsidered in an emergency situation.
- The following slide shows the current receiver outfitting plan.

EVLA Receiver Schedule - Baseline Plan (~4 Antennas/Year)

Receivers Available at the Beginning of each Calendar Year (based on Antenna Outfitting Plan - 4 Nov 2004)



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

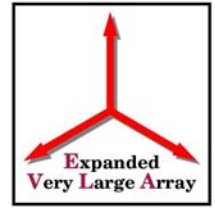
Prototype WIDAR Available for Early Science

(RHH : 8 Nov 2004)



Band Descopes

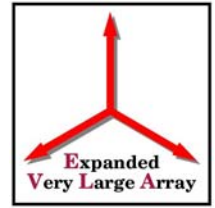
X-Band (8 – 12 GHz)



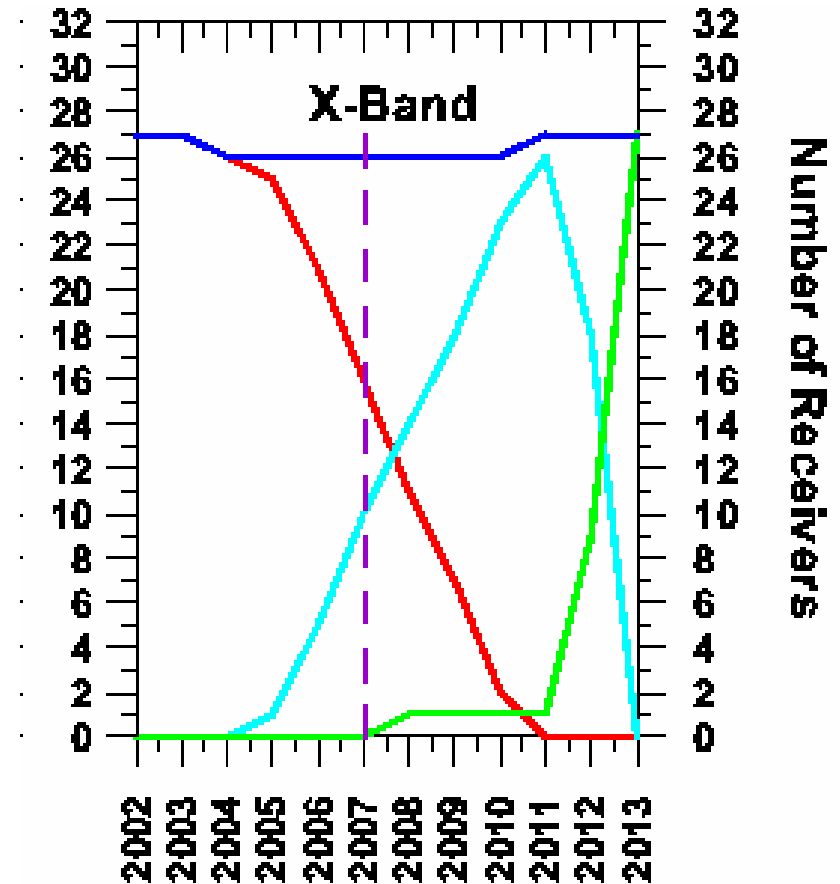
- We have already a good X-band system in place ($T_{\text{sys}} \sim 35\text{K}$, 7.8 – 8.8 GHz).
- Not 'upgrading' this band would leave a ~ 3 GHz 'hole' (9 – 12 GHz) in the continuous frequency coverage.
- Scientific impact:
 - Both continuum (sensitivity reduced by 50%) and line (span reduced by 70%).
 - Thermal and non-thermal science equally affected.
- Note: This band already slated to be the last one upgraded.



X-Band Receiver Rate



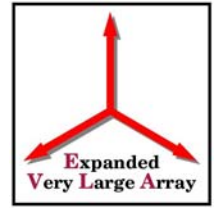
- Current plan keeps number of available receivers near 27 throughout.
- New systems would not go on until 2010.
- Descoping X-band would leave the 27 original (current) systems.





Band Describes

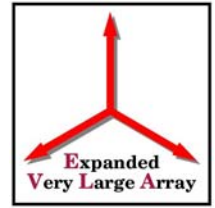
S-Band (2 – 4 GHz)



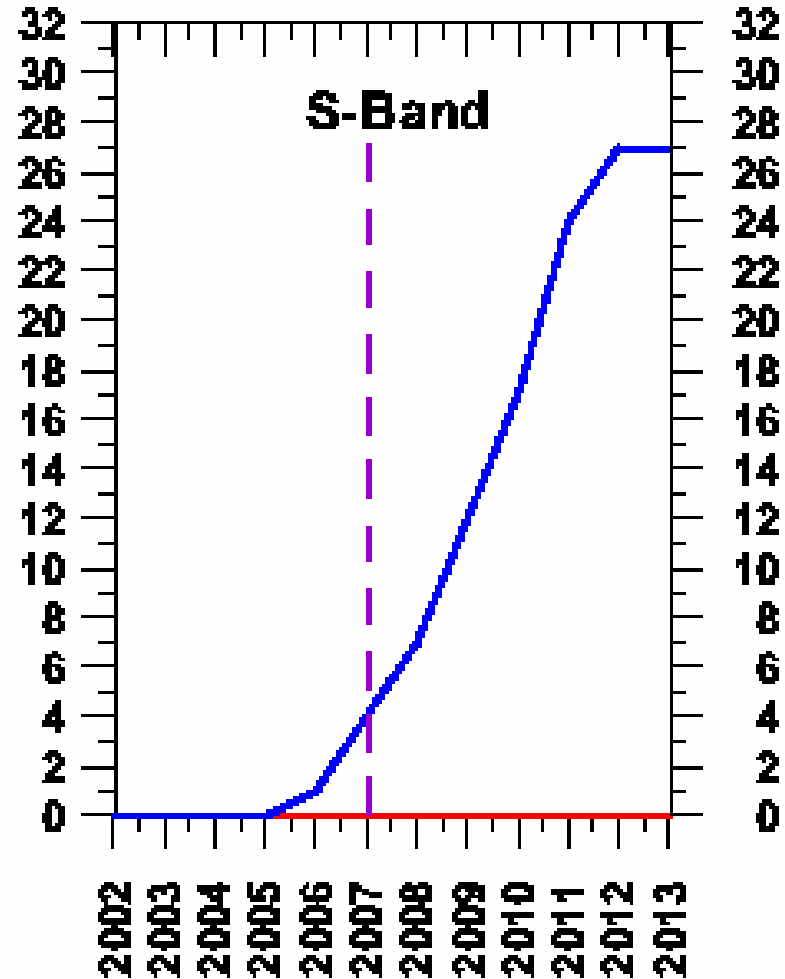
- S-Band expected to provide the most sensitive capability for non-thermal sources:
 - Twice the bandwidth and much higher efficiency than L-band => twice the sensitivity!
 - Much less RFI than L-band (but not negligible).
 - Easily overcomes the spectral slope loss for non-thermal emission.
 - Far better for low-frequency thermal source science.
- Losing this band will have a major negative impact on non-thermal source science.



S-Band Receiver Plan



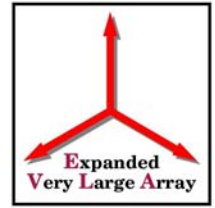
- Current plan begins implementation in 2007, with completion in 2012.
- All would be lost by descoping.





Band Describes

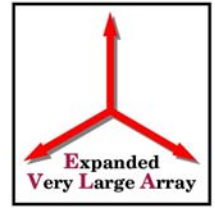
U-Band (12 – 18 GHz)



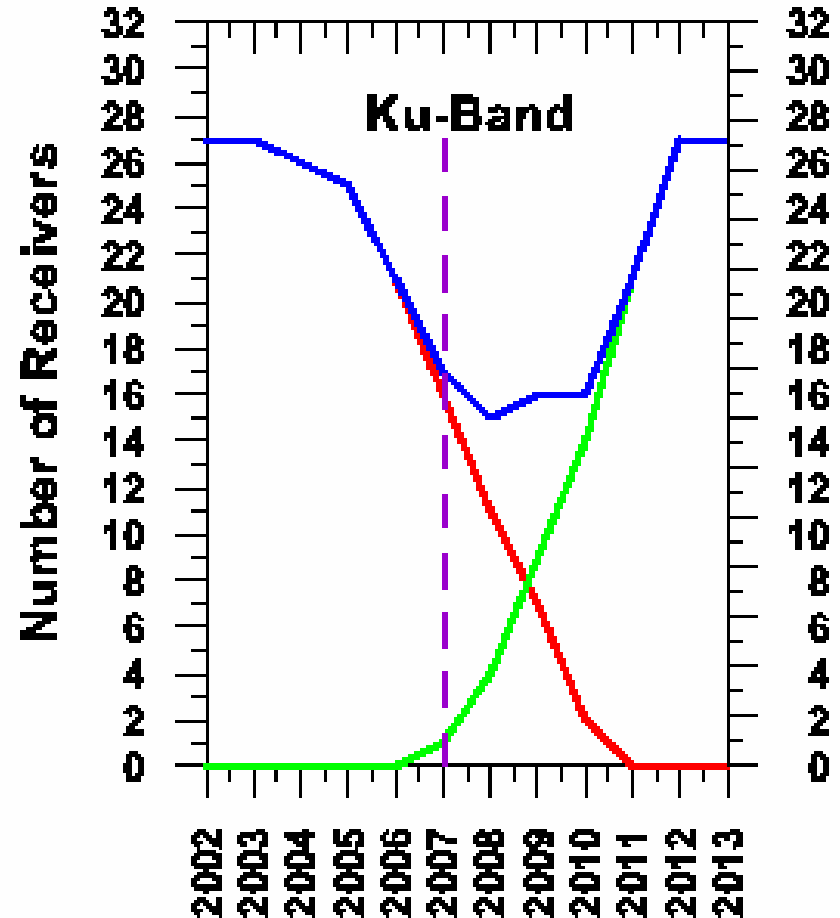
- U-Band is currently the least-utilized band.
 - Likely due more to its relatively poor performance than any lack of science potential!
- Because of this, and for sound programmatic reasons, U-Band is being `sacrificed' as we build up the new receiver capability.
- The plan is to `restore and expand' U-Band capability, starting in 2008?
- Not implementing U-Band at all would leave a 6-GHz-wide gap in the frequency coverage.



Ku-Band Receiver Plan



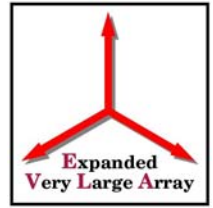
- The number of available Ku-band receivers drops to 15 in 2008, but increases after 2009.
- Descoping this band will have Ku band availability follow the red line to zero in 2011.





Band Descopes

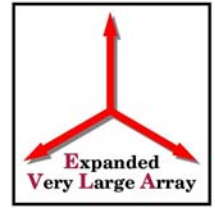
U-Band (12 – 18 GHz)



- Science Impact:
 - U-Band expected to be an important band for thermal science.
 - Very high molecular redshifts (CO 1-0 at $z=6.4$ to 8.3) would be found in this band.
 - Less critical for non-thermal science (and much less so than S-band).
 - Impact exacerbated if X-band AND U-band removed (leaves 9 – 18 GHz gap).



Other Issues and Questions



-
- We might agree that X-band would be the first to go, but which would be next?
 - When would a decision have to be made?
 - Depends on budgets ...
 - Best guess is the crunch comes in 2006.
 - Should development/prototyping these three bands continue anyway?
 - Doing so will significantly eat into funds available.
 - How much should operations be hit, in order to save the hardware capabilities?
 - How much of a `bare bones' software capability can we accept (and for how long), to save the hardware capabilities?