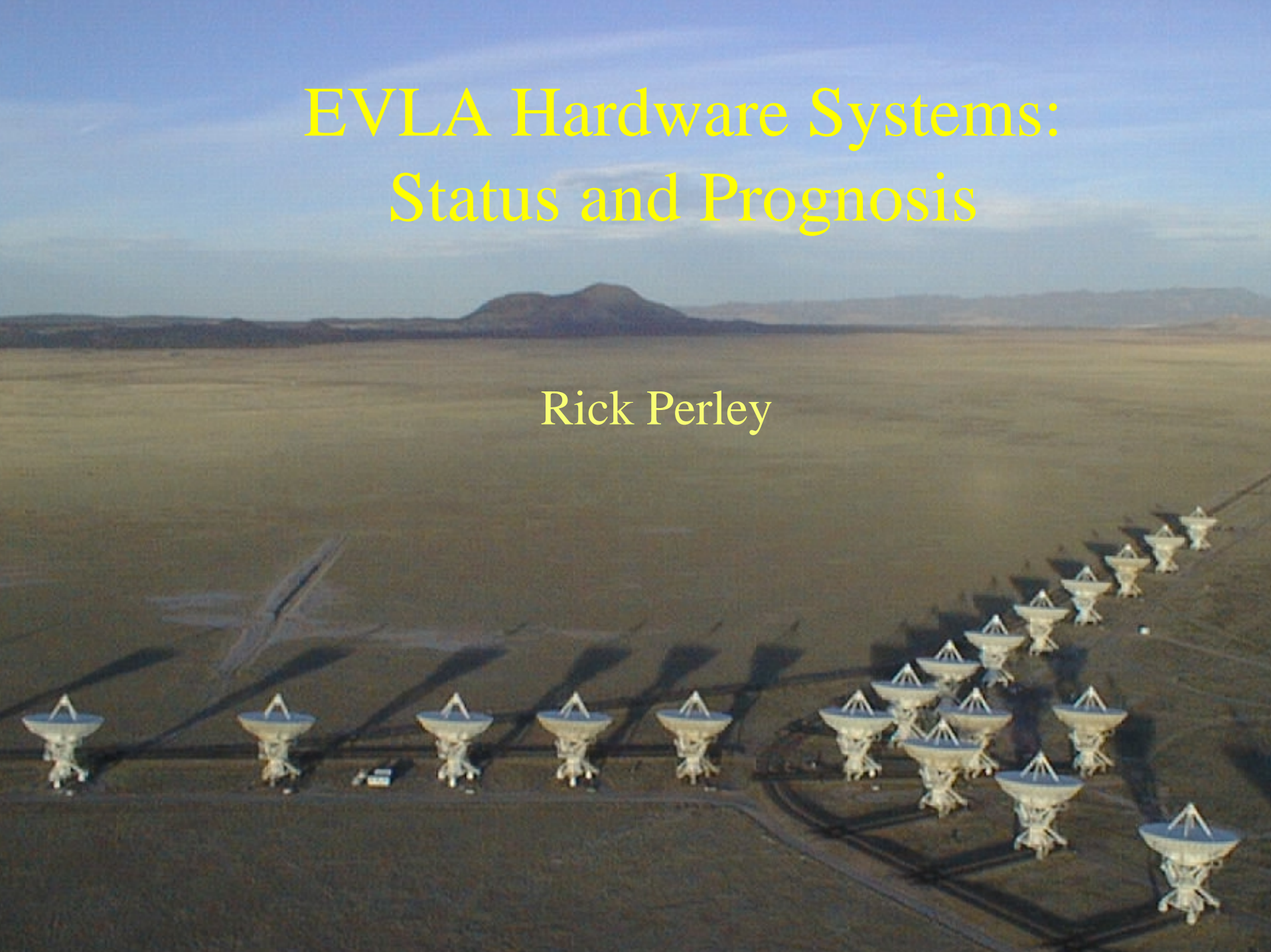


EVLA Hardware Systems: Status and Prognosis

Rick Perley





Key EVLA Project Goals



- Fundamental Goal: By building on the existing infrastructure, multiply ten-fold the VLA's observational capabilities.
- Full frequency coverage from 1 to 50 GHz.
 - 8 frequency bands with cryogenic receivers.
 - Two separately-tunable polarization pairs – with no restrictions on their tuning (unlike current VLA).
- 1 μ Jy point-source continuum sensitivity (most bands)
- New correlator with 8 GHz/polarization capability
 - 16384 minimum channels/baseline with full polarization
 - Full recirculation capability for increased flexibility
 - 128 independently tunable frequency slots.
- Noise-limited full-beam imaging in all Stokes parameters
- Completion by 2012.



EVLA-I Performance Goals

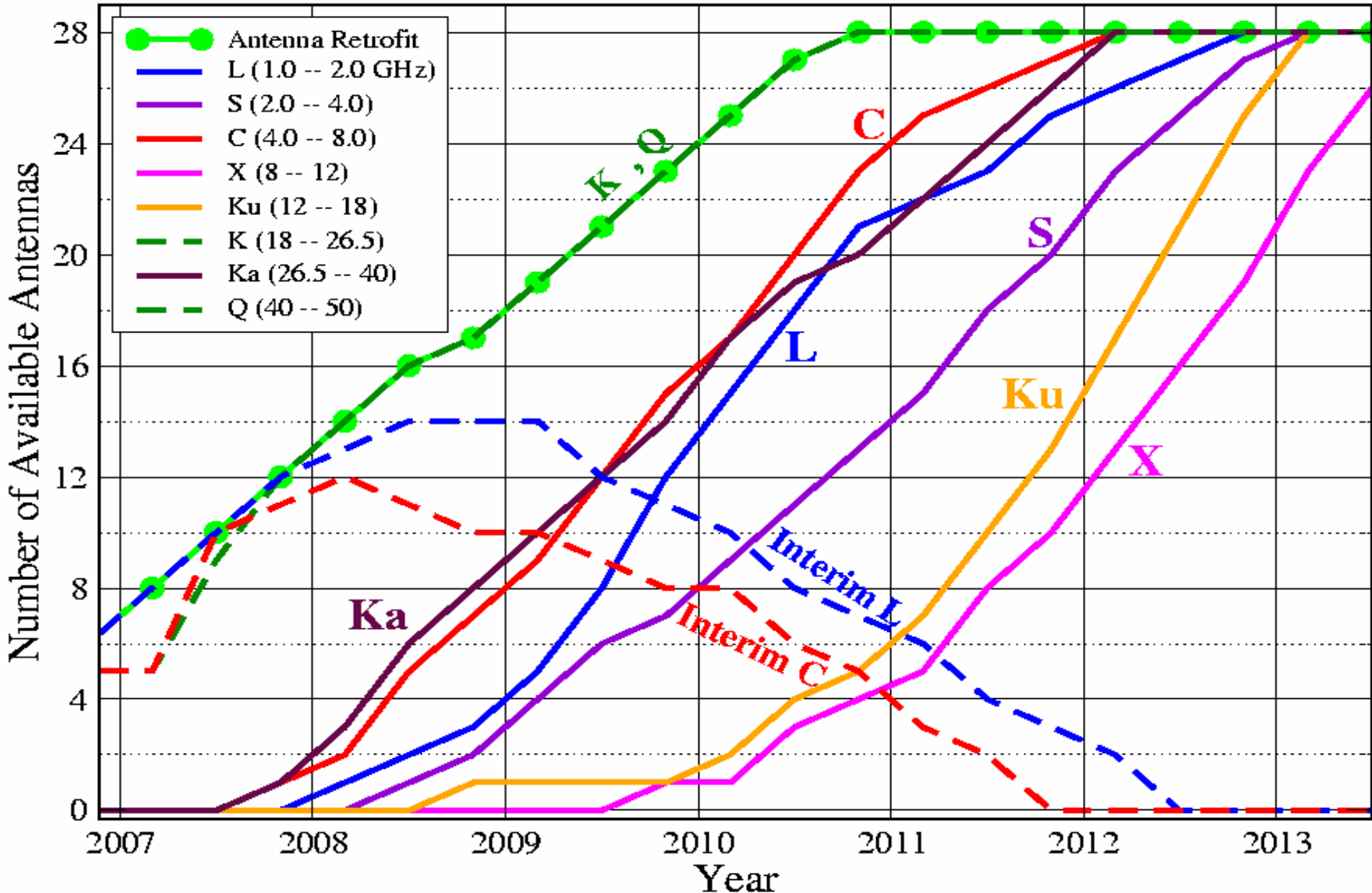


The EVLA's performance is vastly better than the VLA's:

Parameter	VLA	EVLA	Factor
Point Source Sensitivity (1- σ , 12 hours)	10 μ Jy	1 μ Jy	10
Maximum BW in each polarization	0.1 GHz	8 GHz	80
# of frequency channels at max. bandwidth	16	16,384	1024
Maximum number of frequency channels	512	4,194,304	8192
Coarsest frequency resolution	50 MHz	2 MHz	25
Finest frequency resolution	381 Hz	0.12 Hz	3180
(Log) Frequency Coverage (1 – 50 GHz)	22%	100%	5

The cost to the NSF for this >10-fold improvement is \$59M – about 1/3 the cost of the original VLA.

Band Availability Timescale





Scientific Capabilities Growth



- Until the WIDAR correlator is available for scientific use (earliest will be mid 2009), new science capabilities come from new frequency access:
 - **L-Band** (1.2 – 2.0 GHz) – The new space from 1.74 – 2.0 GHz appears free of RFI!
 - **C-Band:** Good sensitivity, but poor polarization outside ‘old’ frequency range. (Will be corrected by new OMTs). With only 10 days’ notice, the special C-band call for proposals returned 19 proposals (9 for D config., 10 for A config.)
 - **K-Band:** Full tuning range of 18 – 26.5 GHz now available.
 - **Ka-Band:** By end of 2008, a sufficient number (~9) of new Ka band (26 – 40 GHz) receivers will be on line for good new science.
 - **Q-Band:** The old tuning separation limitation of 400 MHz between IF pairs is gone.



EVLA Status – End of 2008



- In 18 months (at which point the prototype correlator testing should be completed, and the final system under installation), we expect to have on line:

Definitions:

- **Final:** The system in its final, EVLA State, with full tuning capabilities.
- **Interim:** Modern electronics, but old narrow-band OMT, limiting sensitivity or polarization purity.
- **Old:** The VLA system, either on an unmodified VLA antenna, or transferred to an upgraded EVLA antenna. Limited tuning capabilities.

Band	Final	Interim	Old
4/P	14	0	10
L	4	14	10
S	3	0	0
C	8	10	10
X	0	0	28
Ku	0	0	10
K	18	0	10
Ka	9	0	0
Q	18	0	10



Project Book Requirements



- Chapter 2 of EVLA Project Book contains all the detailed technical performance requirements.
 - Sensitivity, stability, pointing accuracy, polarization purity, bandpass stability, and much more.
- Tests conducted so far indicate we should meet all the requirements.
- Some requirements will need special tests to determine if we meet specs.
- New EVLA post-doc (Brigette Hesman) will take charge of acceptance procedures.



Short-Term Issues of Concern



- Phase and Amplitude Stability
 - We believe all major issues affecting stability are understood.
 - Remaining problems are mainly due to VLA design, and observing methodologies to avoid them are on 'EVLA Returns' web page.
- Cross-Array (VLA x EVLA) Performance Issues
 - Hybrid-array performance not ideal.
 - Some problems will be eliminated upon Modcomp replacement.
 - Others (closure error, loss of sensitivity due to bandpass mismatch, Doppler tracking) will remain until completion of retrofit process.
- Modcomp Replacement
 - Modcomps to be retired June 27.
 - Although some special modes will not be available in July, we are confident all existing capabilities will be restored shortly afterwards.



Longer-Term Issues of Concern



- Optimized High Frequency Performance
 - Fine tuning of optics (primarily via holography) will be needed to improve high frequency performance.
 - This work cannot even begin until late 2007, and is likely to be deferred to late 2008.
- Decommissioning VLA antennas?
 - In Jan 2009, ten VLA antennas left.
 - By Jan 2010, only four VLA antennas left.
 - At some point in 2009 (or 2010?), it will not be worth continuing to operate these.
 - The committee's opinion on when these should be decommissioned will be helpful.