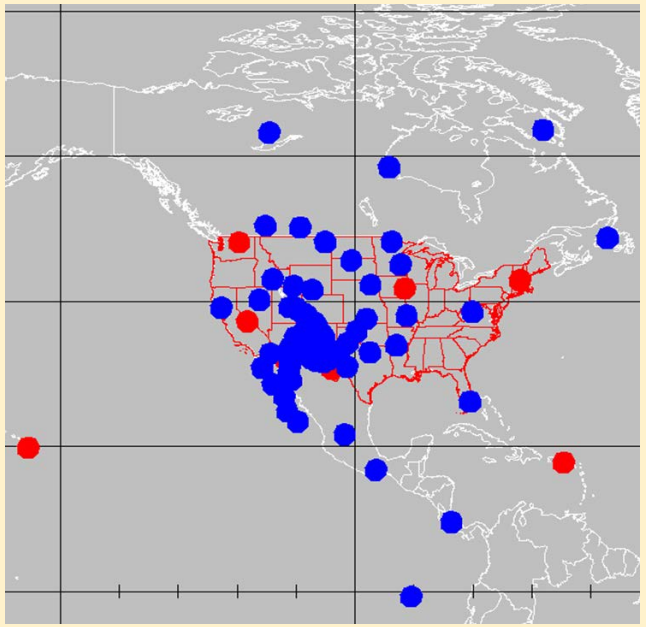
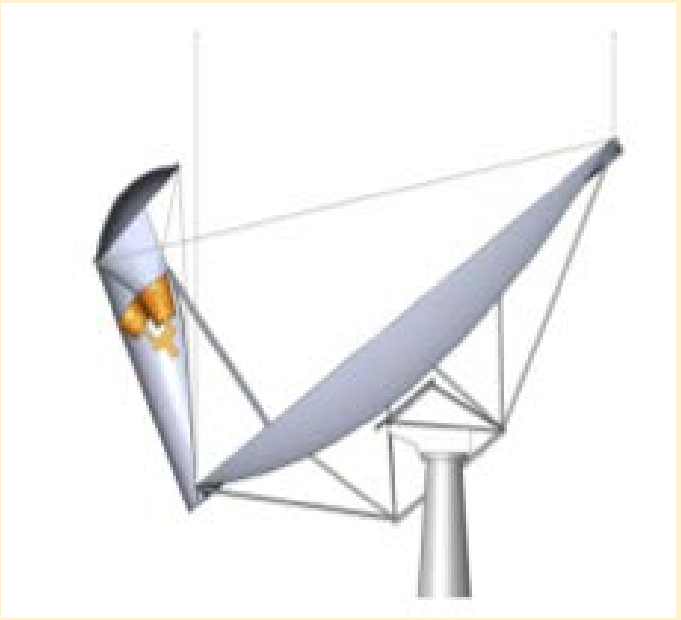
SKA Ideas, Motivation and Funding in the United States



Ken Kellermann
NRAO



SKA History
Manchester, April 3-6,2019

US SKA Meetings/Committies

- 1998 First US SKA Meeting in Green Bank; 9/10 October
  - 63 participants (10 international)
  - Russia (3), Canada (2), Australia (2), UK, Germany, NL
- USSKA Consortium formed (1999) (2 meetings per year)
  - Sent representatives to ISSC/SSEC meetings
- NRAO SKA Project Office
- Chicago Meetings (2005-Chicago, 2006-Tucson, 2007-Washington)
- 2006 NSF Senior Review – Endorsed US involvement (University led)
- 2008 IFAG Washington
- 2008 AUI Future Prospects for US RMS Astronomy

Motivation

- Science
  - EoR - Low Frequencies
  - RG/Quasars – Sensitivity, Resolution, mid frequencies
  - Pulsars - Low Frequencies, Wide FoV
  - Molecular Spectroscopy- High Frequencies
  - New Discoveries
- Opportunity for Funding
- Exert Leadership – NRAO/AUI EoI to Host SPDO (2006)
- Join the Crowd
- ~~Philosophical – "Born Global~~"
- ~~Economic/Industrial Support~~
- ~~Sociological/Educational Impact – e.g, faster smartphones~~

US Precursors, Pathfinders, Prototypes, & Demonstrators

- ATA (Berkeley, SETI Institute)
- LOFAR/LWA/MWA (NRL, MIT/Haystack/UNM
- EVLA/JVLA (NRAO)
- PAPER/HERA (Berkley, NRAO)
- NAA (NRAO/USSKAC)
- MOU with MeerKat –Operations/software (NRAO)
- ngVLA (NRAO)
- DSA/DSA 2000 (Caltech)

US SKA Potential Funding/Support

- NSF
  - MREFC (competing with LSST/ELTs)
  - TDP
  - ATI
- NRAO
- NASA
  - DSN Array (Weinreb) – 400 x 12 m x 3
  - White Paper
- State Department
- DoE/DoD

US SKA Technology Development Program

Managed by Cornell with US SKA Consortium oversight

$1.5M + 4x3M/yr = 13.5M (2000 – 2011)

Supported USSKAC meetings/participation in ISSC/SSEC

Direct TDP Funding:

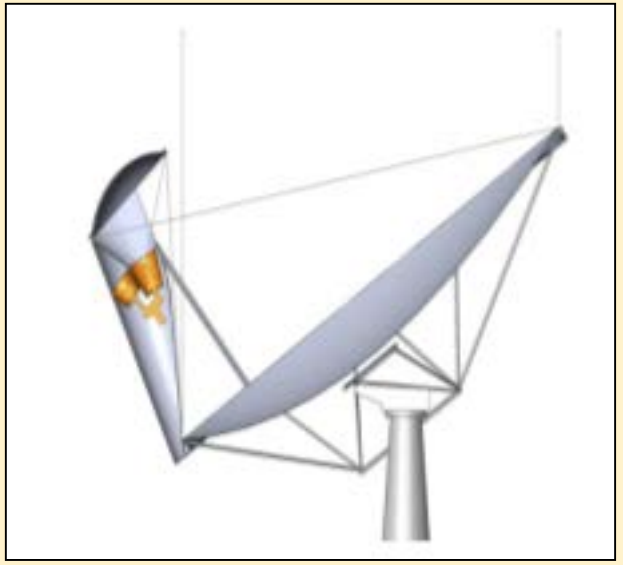
- Caltech (feeds & receivers)
- **Cornell/NAIC** (feeds & receivers, RFI)
- MIT/Haystack Configuration, correlator, RFI
- SETI Institute (feeds, antennas)
- U.C. Berkeley (antennas, feeds)
- Univ. Illinois (calibration)

In-Kind participation:

- JPL
- NRL
- NRAO
- Univ. New Mexico

TDP Prototype Antenna

- Detailed analysis of hydroformed antenna:
- Industrial study of antenna fabrication: Patriot Antennas
  - cost reduction through mass production methods,
  - hydroforming technology
  - cost trade-off, size, frequency range, optics.
- Collaboration with DRAO on composite antennas
- Offset, Gregorian optics
  - Multiple narrow band feeds or fewer broadband feeds
  - Sited at the EVLA
  - Allows testing with an established array
- Prototype 12 m dish to be tested at VLA

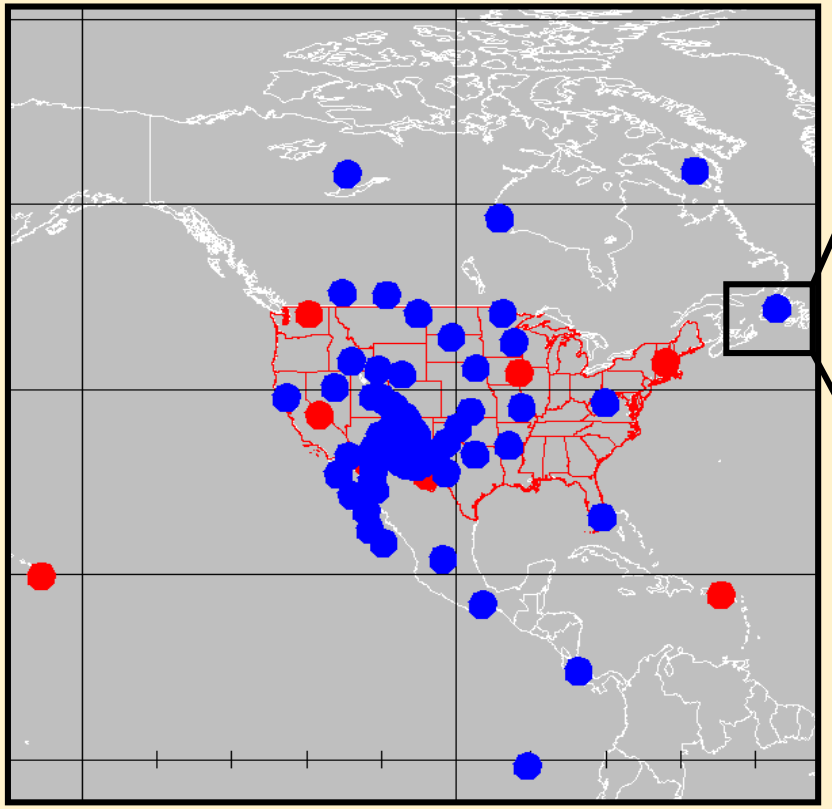


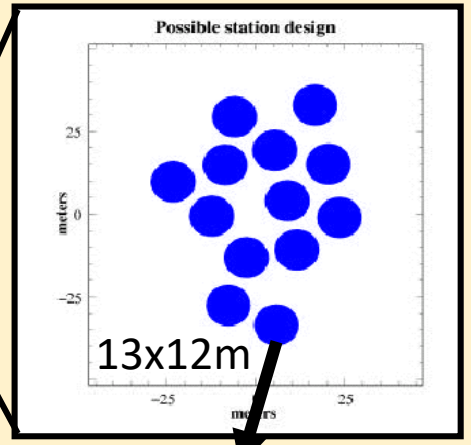
Large N – Small D Strawman Design

US SKA
4400 x 12 m dishes

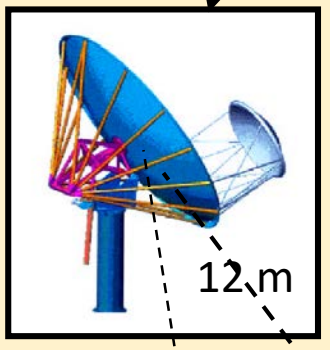
Resolution 0.01 arcsec
@ 21 cm
Sensitivity
25 nJy rms in 1 hr

Centrally condensed
Scale free array
2320 ant inside 35 km
84 stations: 35 to 350 km
76 stations: 350 to 3500 km





84 m



- Infrastructure
  - Roads,
  - power
  - Fiber
  - Buildings
- Experienced staff

A = 500,000 m^2
A_{eff}/T= 20,000 m^2/K

Cost = $1.41 billion