



U.S. NAVAL
RESEARCH
LABORATORY



LWA Update & Plans

Greg Taylor (UNM)
On behalf of the LWA Collaboration

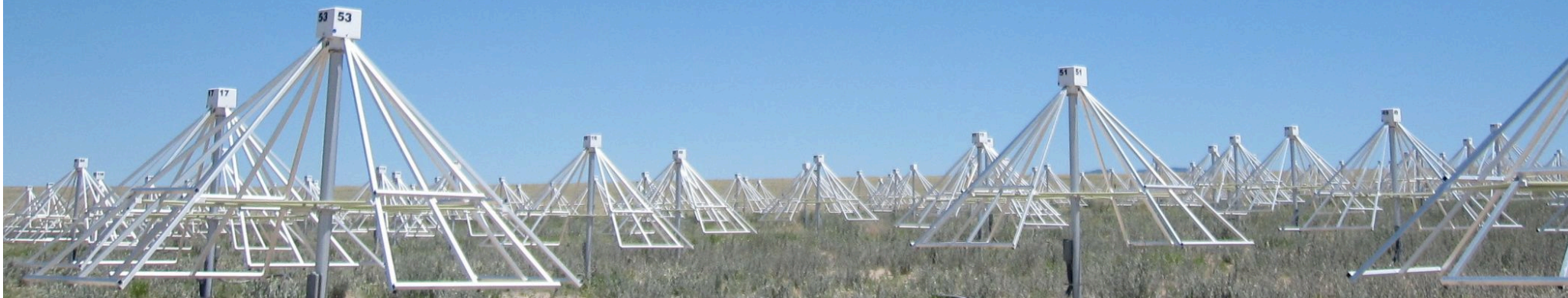
LWA Users Meeting, 8/16/2021



Meeting Logistics

- Safety Protocols: Masks required indoors
- Restrooms down the hall past the LWA-TV display
- Water bottle refill available at water fountain near restrooms
- Dinner at Monroe's on Osuna. Show of hands for attendees?
- LWA-NA site trip on Wednesday, contact me if interested
- The session chair will provide a two-minute warning at T +13 min
- After T+15 min you are into your Q&A time

- Please e-mail me a PDF of your slides following your presentation



LWA Outreach

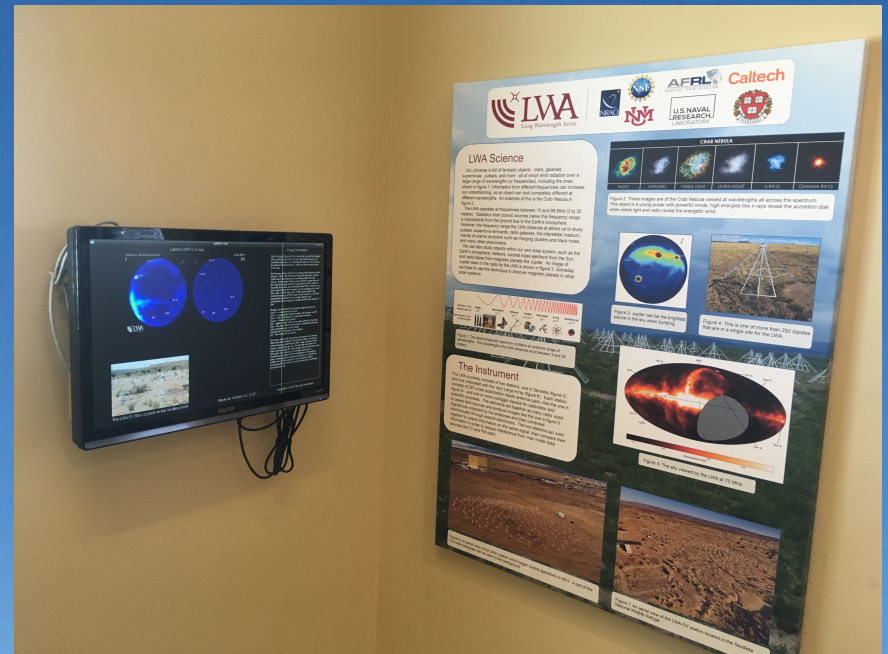
- LWA-TV and LWA-TV channel 2 (GUI available in LSL)
- LWA-TV running at Sevilleta, PAIS, VLA Visitor Center, NRL, ERAU, others?
- LWA demos/tutorials

- **Pulsar B0329+54**
- **Unknown Pulsar**
- **Pulsar Rotation Measure**
- **Jovian Burst**
- **Solar Burst**
- **Crab Pulsar Giant Pulses**
- **All-Sky Meteor Echoes**
- **Single Baseline Interferometer**

- Docker containers now available
- LWA interactive sky maps:

<http://fornax.phys.unm.edu/low-frequency-sky/index.html>

<https://fornax.phys.unm.edu/multi-wavelength-sky/index.html>



LWA Store

- Vehicle for providing equipment or services
- Still working on software licensing and pricing
- Possible items:
 - DLITE station (4 antennas, radios, cabling, etc.)
 - Swarm station (64 antennas, ARX, ADP, etc.)



Current Support

- Meteor Trail Radio Emission (NSF) – ends 8/31/2021
- Spectrum Innovation Initiative: Spectrum-Agile Cognitive Communications for Terrestrial and Space Applications (NSF) – ends 9/1/2021
- Mid-Scale Innovations Program (NSF) – ends 9/30/2022
- Ionosphere and Transients (NRL) - ends 7/31/2024
- Ionospheric Research (AFRL) – ends 7/31/2025
- Bifrost Cyberinfrastructure (NSF) – ends 6/30/2024
- LWA Center at UNM (unrestricted)
- LWA Store



Projects

~60 observing projects ongoing

Cumulative: 100+ users from 40 institutions and 4 countries

CFP10 deadline late October 2021

CFP10 observing begins January 1, 2022



CFP9

CFP: 9

Code	Allocated	Observed	Percent Completed
LD016	400.000	177.128	44.28
LF004	180.000	0.000	0.00
LK010	160.000	7.000	4.38
LD017	192.000	7.233	3.77
LK011	3000.000	1976.000	65.87
L0005	900.000	0.000	0.00
LM006	20.000	0.000	0.00
LS019	120.000	0.000	0.00
LS020	1248.000	29.250	2.34
LW011	240.000	169.922	70.80
LZ001	1000.000	0.000	0.00
DA003	40.000	30.000	75.00
DK005	100.000	0.667	0.67
DI001	40.000	0.000	0.00
Summary:	7640.000	2397.201	31.38



LWA Publications

77. DiLullo, C., Taylor, G.B., & Dowell, J.
2021, JAI, submitted
[Improvements to the Search for Cosmic Dawn Using the Long Wavelength Array](#)
76. Varghese, S.S., Dowell, J., Obenberger, K.S., Taylor, G.B., & Malins, J.
2021, JGR Space Physics, submitted
[Broadband Imaging of Meteor Radio Afterglows](#)
75. Obenberger, K.S., Dowell, J., Fallen, C.T., Holmes, J.M., Taylor, & G.B., Varghese, S.S.
2020, Radio Science, 56, 7169
[Using Broadband Radio Noise from Power-Lines to Map and Track Dense Es Structures](#)
74. Dike, V., Taylor, G.B., Dowell, J., & Stovall, K.
2020, MNRAS, in press
[Detecting Pulsar Polarization below 100 MHz with the Long Wavelength Array](#)
73. Gerekos, C., Bruzzone, L., & Imai, M.
2020, IEEE Trans. Geosci. Remote Sens, vol 58, No. 4, p. 2250
[A Coherent Method for Simulating Active and Passive Radar Sounding of the Jovian Icy Moons](#)
72. Obenberger, K.S., Holmes, J.M., Ard, S.G., Dowell, J., Shuman, N.S., Taylor, G.B., Varghese, S.S., & Viggiano, A.A.
2020, JGR, 125, 9
[Association between Meteor Radio Afterglows and Optical Persistent Trains](#)
71. DiLullo, C., Taylor, G.B., & Dowell, J.
2020, JAI, 9, 2050008-3
[Using the Long Wavelength Array to Search for Cosmic Dawn](#)
70. Davis, I., Taylor, G.B., & Dowell, J.
2020, MNRAS, 494, 4848
[Observing Flare Stars Below 100 MHz with the LWA](#)
69. Ruan, D., Taylor, G.B., Dowell, J., Stovall, K., Schinzel, F.K., & Demorest, P.B.
2020, MNRAS, 495, 2125
[Discovery of a Pulsar Wind Nebula around B0950+08 with the ELWA](#)

VLA 50-86 MHz

New 4 band feeds (MJP)
4 meter band: 50-86 MHz
All 28 installed

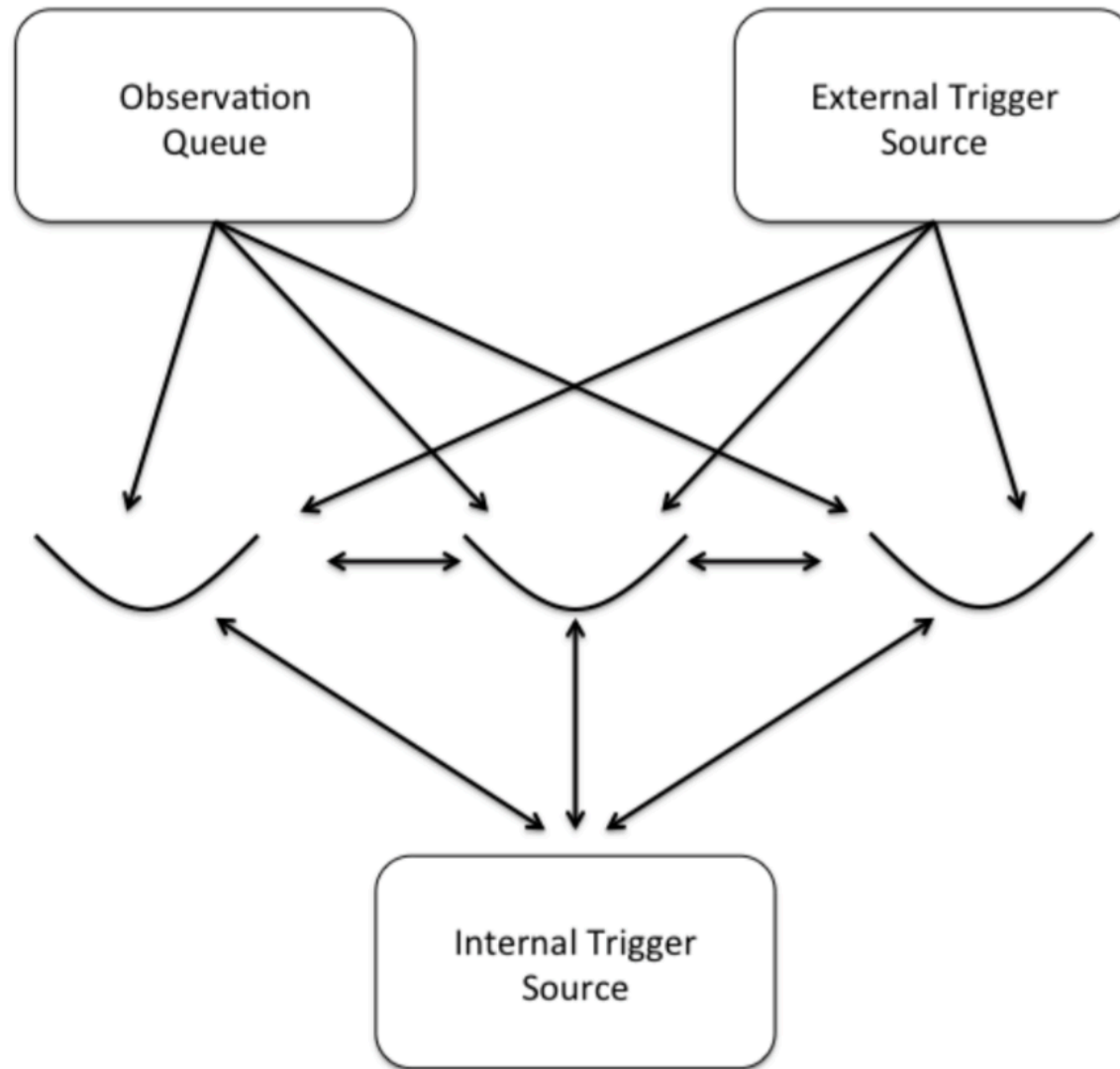
NRAO announced Shared
Risk Observing starting
for August 2, 2021 proposal
deadline

See Frank's talk

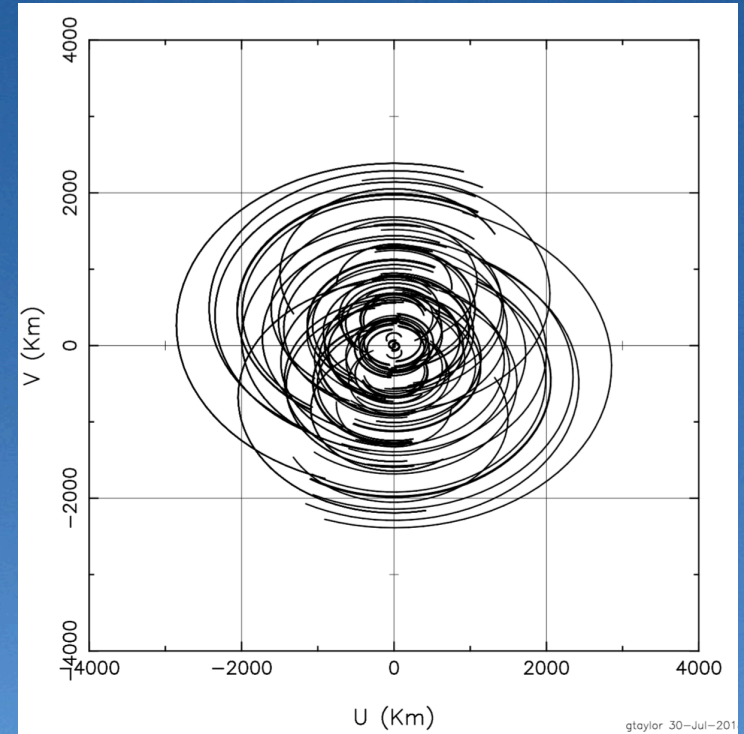


LWA Swarm Concept

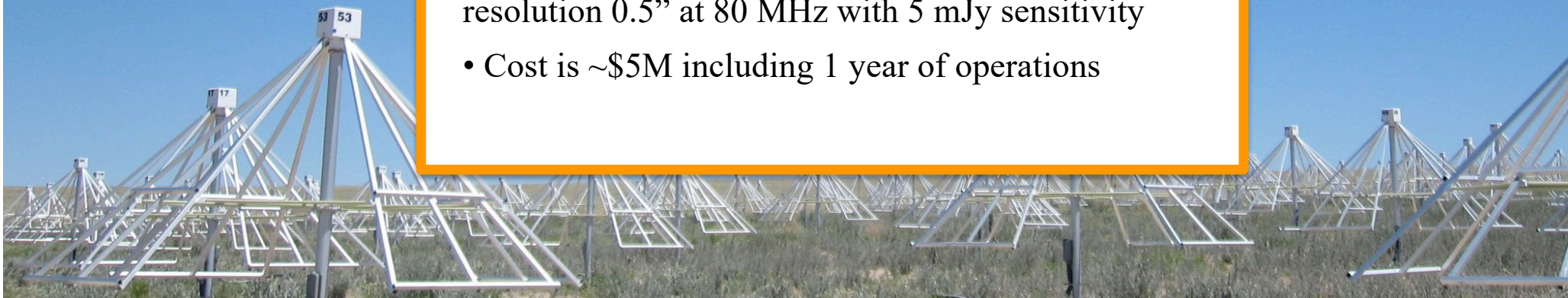
Dowell
& Taylor
2018
JAI



LWA Swarm Concept



- Goal of 3 existing full stations (●) plus ~10 LWA mini stations (●), baselines up to 2500 km for resolution 0.5'' at 80 MHz with 5 mJy sensitivity
- Cost is ~\$5M including 1 year of operations

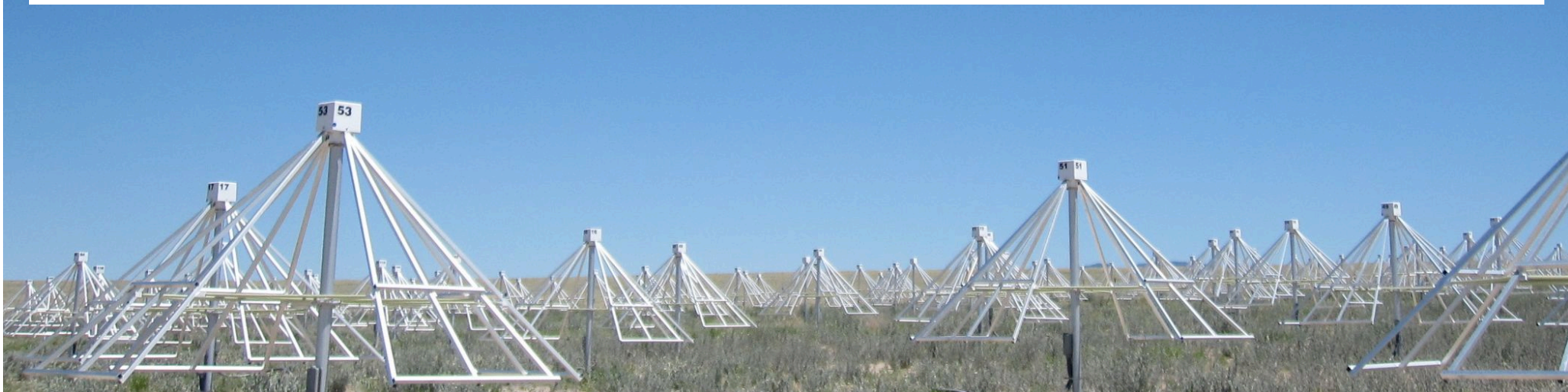


LWA Swarm Concept

- Develop new scientific capability in the US
- Provide educational opportunities in STEM (including 3 MSI Universities)
- Build on success of LWA with low risk investment
- White paper submitted to 2020 Decadal Survey

The Swarm Development Concept for the LWA

GREG B. TAYLOR,¹ JAYCE DOWELL,¹ YLVA PIHLSTRÖM,¹ FRANK SCHINZEL,² NAMIR KASSIM,³ GREGG HALLINAN,⁴
IAN M. HOFFMAN,⁵ DAVE BESSON,⁶ STEVEN PROHIRA,⁶ ANDRI M. GRETARSSON,⁷ RAMON D. FOBES,⁷
THOMAS J. MACCARONE,⁸ TIMOTHY DOLCH,⁹ JUDD D. BOWMAN,¹⁰ DANIEL C. JACOBS,¹⁰ FREDRICK E. JENET,¹¹
STAN KURTZ,¹² AND OTHERS¹³



LWA Swarm Membership

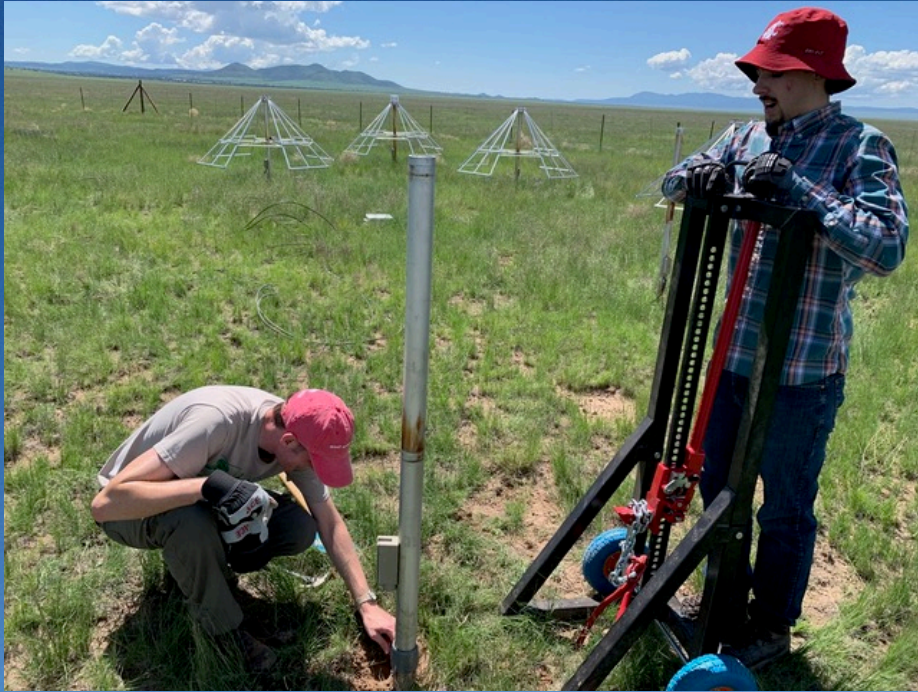
- University of New Mexico – Greg Taylor
 - Texas Tech University – Tom Maccarone
 - Arizona State University – Judd Bowman
 - Embry-Riddle Aeronautical University – Andri Gretarsson
 - University of Victoria – Ian Hoffman → TBD
 - Hillsdale College – Tim Dolch
-

In discussions:

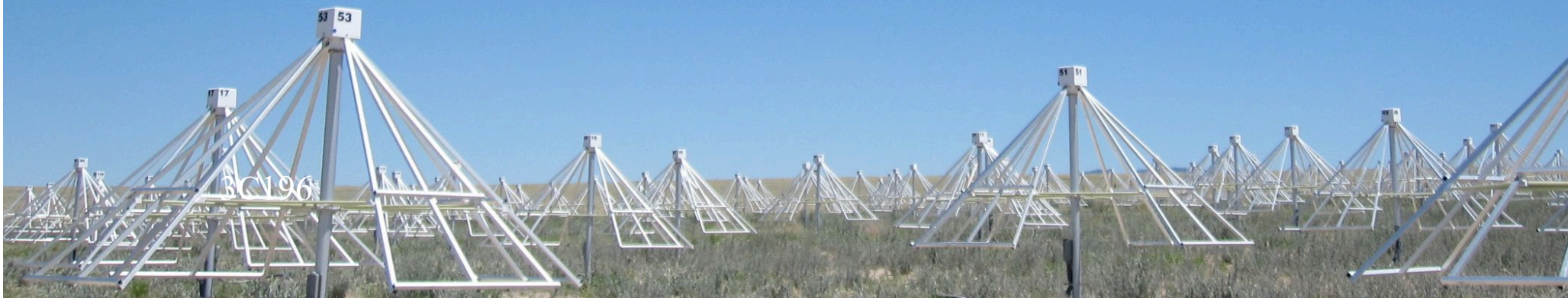
- UTRGV – Teviet Creighton
- Caltech – Gregg Hallinan
- Univ. of Colorado - Various



LWA-NA Deconstruction - Antennas



29 of 32 antennas removed from site and set aside



LWA-NA Deconstruction – Cable Recovery

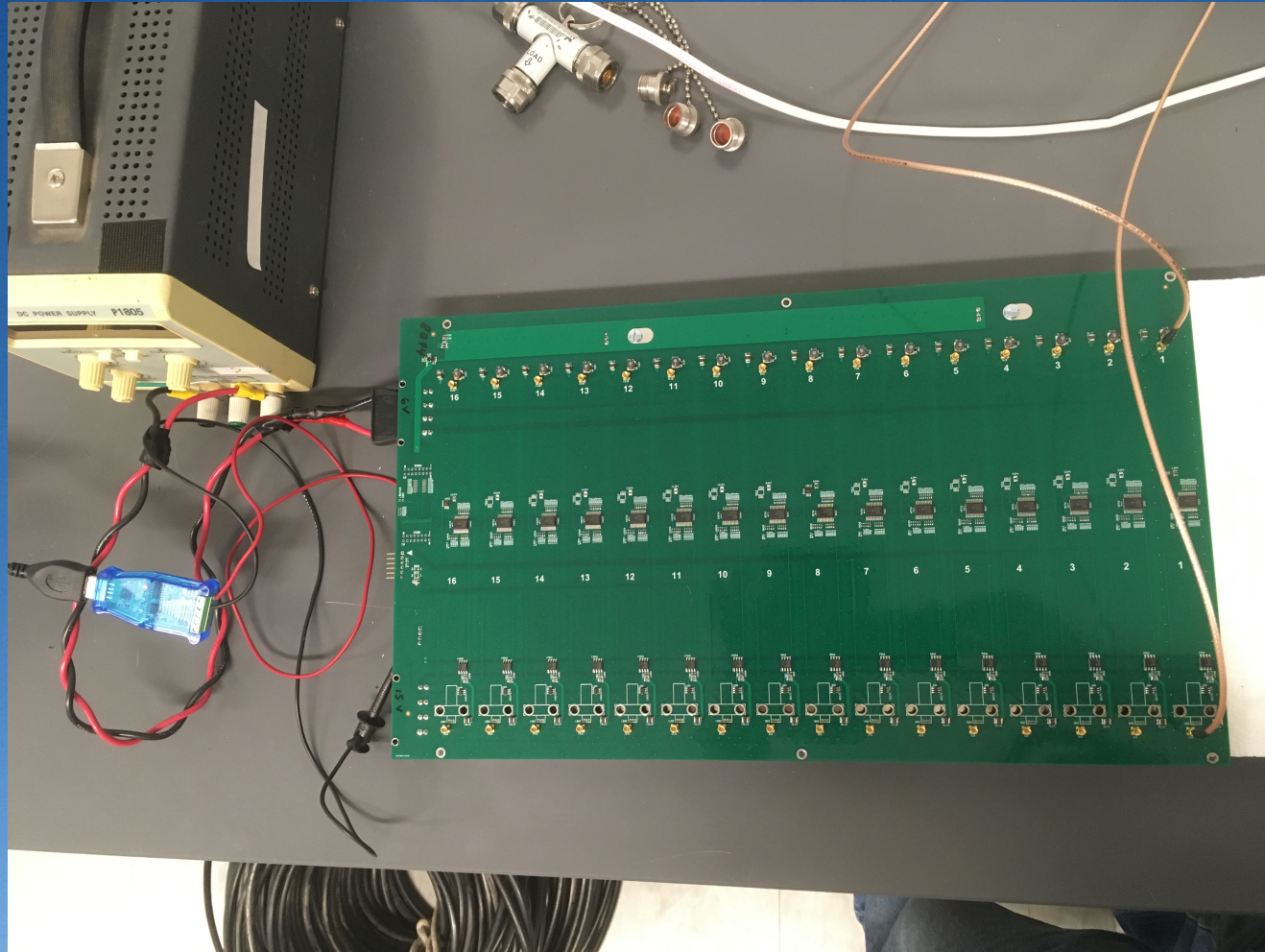


Expect ~40 x 100 m cables at site, also 4 x 100 m LMR400 which could be used for outrigger



LWA-NA Construction

Rev H
ARX
boards
from
OVRO-
LWA
redesign



Summary

- LWA has demonstrated technical feasibility and scientific results (>75 refereed publications to date!)
- Lots of exciting science at low frequencies. Progress requires:
 - High temporal, spectral, and spatial resolution
 - Sensitivity

→ eLWA and **LWA Swarm**
- Current experiments are providing new hardware and software, and a better understanding of the sky at long wavelengths
- LWA capability continues to increase
- NRAO has agreed to shared risk ELWA proposals

