2023 LWA Technical Update

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LWA Users Meeting
June 2, 2023

STATION STATUS

LWA-NA

- Still under construction but getting closer
  - Shelter installed with internet access
  - Trenching completed
  - Installing cables now, soon building antennas
- Major work on the digital procesor

LWA-SV

- Running with a PFB on the F-engine, PFB pseudo-inverter on the beamformer output
- Turned on F-engine equalizer coefficients to try to get more out of the 4+4-bit complex data
- Some issues with sensitivity as we worked on enabling these new features, local RFI

LWA1

- DP still hanging on
  - Removed doors on rack to improve cooling
  - Problems developing with beam 3?
- ~90% of dipoles are working
  - 10% ☞ Bad cables? Bad ARX/digitizer channels?

USER COMPUTING

Users Computing Facility

- Three dual socket nodes
  - 190 or 380 GB of memory
  - 20 TB of storage
  - Dual A4500 GPUs
- Storage server

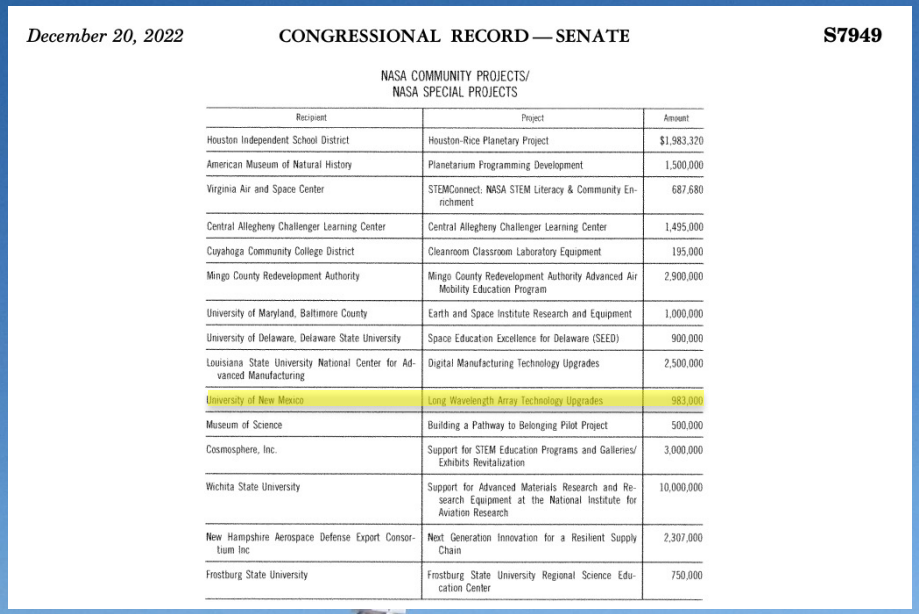
- Changes:
  - New quota info. on login
  - /data/network failure earlier this year

Data Archive

- Server + JBOD chassis
  - ~500 TB of storage on ZFS
  - Expansion capacity to ~800 TB
- Changes:
  - There is now a backup – sync'd daily

STATION REFRESH

Concept to Funding



December 20, 2022 CONGRESSIONAL RECORD — SENATE S7949

NASA COMMUNITY PROJECTS/
NASA SPECIAL PROJECTS

Recipient	Project	Amount
Houston Independent School District	Houston-Rice Planetary Project	$1,983,320
American Museum of Natural History	Planetarium Programming Development	1,500,000
Virginia Air and Space Center	STEMConnect: NASA STEM Literacy & Community Enrichment	687,680
Central Allegheny Challenger Learning Center	Central Allegheny Challenger Learning Center	1,495,000
Cuyahoga Community College District	Cleanroom Classroom Laboratory Equipment	195,000
Mingo County Redevelopment Authority	Mingo County Redevelopment Authority Advanced Air Mobility Education Program	2,900,000
University of Maryland, Baltimore County	Earth and Space Institute Research and Equipment	1,000,000
University of Delaware, Delaware State University	Space Education Excellence for Delaware (SEED)	900,000
Louisiana State University National Center for Advanced Manufacturing	Digital Manufacturing Technology Upgrades	2,500,000
University of New Mexico	Long Wavelength Array Technology Upgrades	983,000
Museum of Science	Building a Pathway to Belonging Pilot Project	500,000
Cosmosphere, Inc.	Support for STEM Education Programs and Galleries/ Exhibits Revitalization	3,000,000
Wichita State University	Support for Advanced Materials Research and Research Equipment at the National Institute for Aviation Research	10,000,000
New Hampshire Aerospace Defense Export Consortium Inc	Next Generation Innovation for a Resilient Supply Chain	2,307,000
Frostburg State University	Frostburg State University Regional Science Education Center	750,000

- Idea – Try to make all our LWA stations the same
- Added to UNM's federal priorities list
- Funded through the 2022 omnibus spending bill

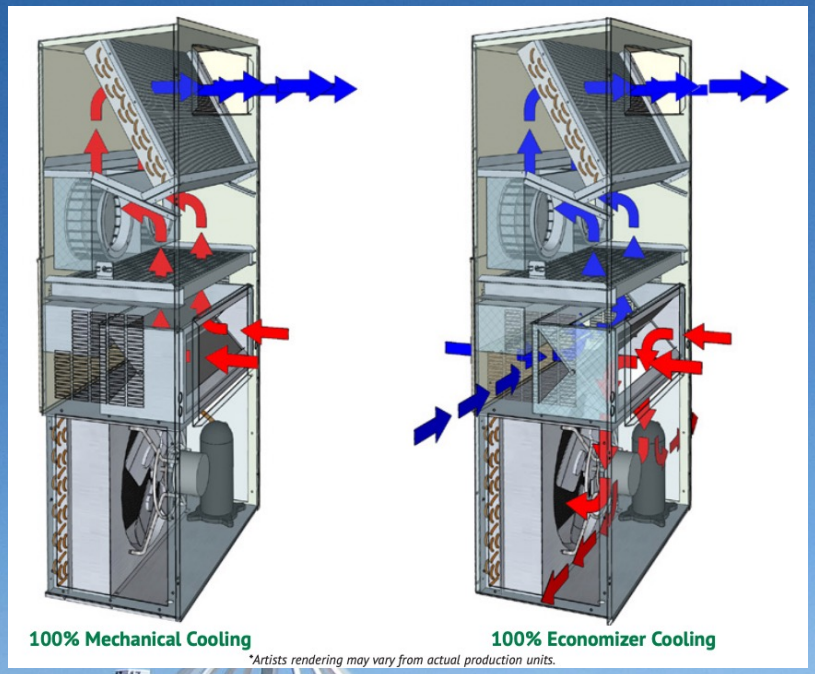
The Vision

- Unify the digital processors
  - FPGA/GPU system with more flexibility
- Address cooling issues
  - New, more efficient HVAC
- Bring <10 MHz observing to LWA1
  - New ARX board design

Digital Processor

- Switch to FPGA/GPU system like at LWA-NA & OVRO-LWA
  - SNAP2 boards with custom digitizers
  - ~70 MHz of bandwidth
  - Fully independent beams
  - Better diagnostics

Cooling

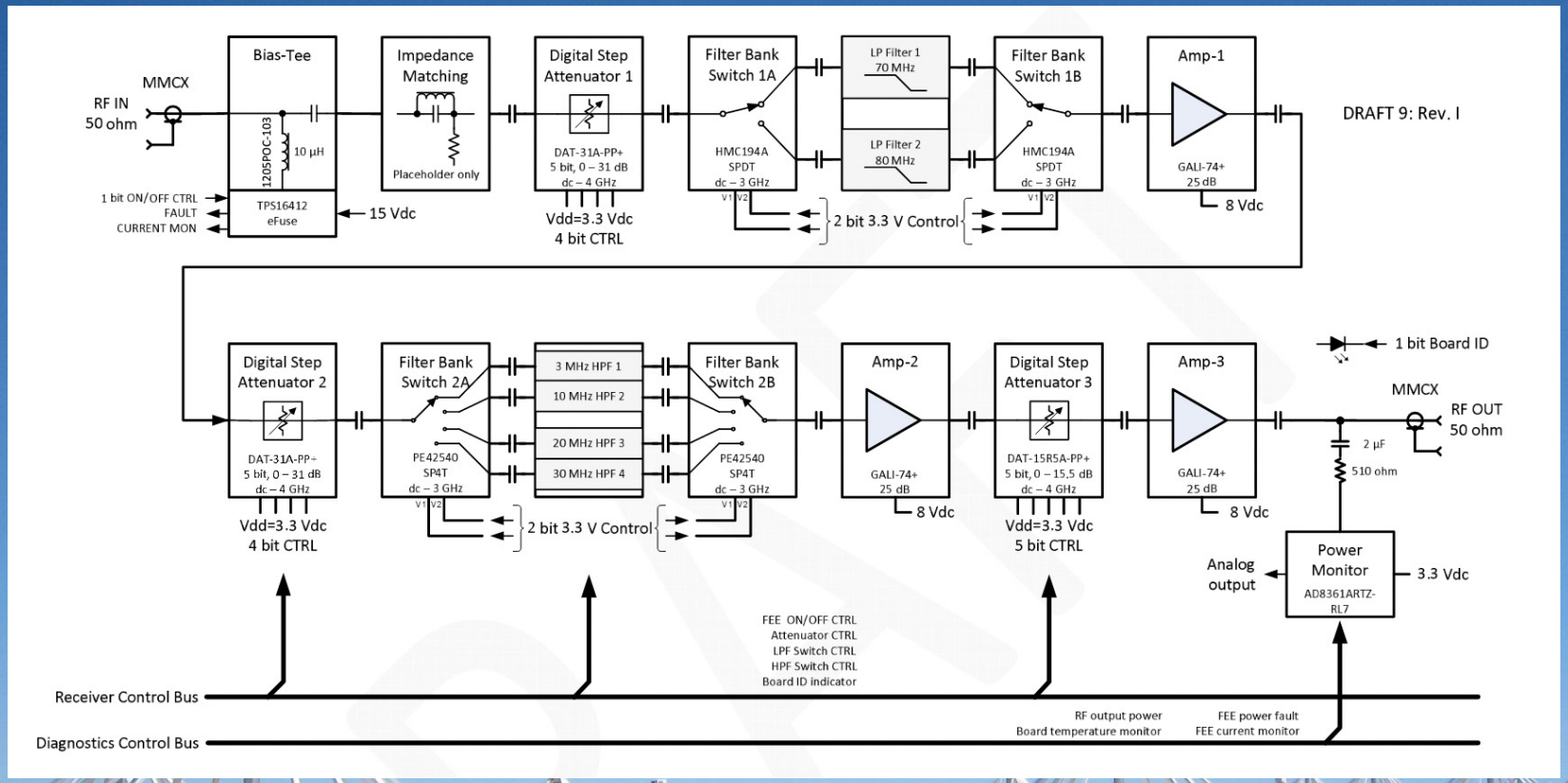


- Switch from two right hand units to a right and a left
- Switch to HVACs with economizers
  - Why run the compressor in the winter?

New ARX Board Design

- Take best of Revs. G and H to create I
  - Rev. G – Gali-74 and SPI control
  - Rev. H – Filter concept and impedance matching
- Goal is to have a design that is robust and with good part availability in the future

ARX Rev. I


MMCX
RF IN
50 ohm
Bias-Tee
1205POC-103
10 µH
1 bit ON/OFF CTRL
FAULT
CURRENT MON
TPS16412
eFuse
15 Vdc
Impedance Matching
Placeholder only
Digital Step Attenuator 1
DAT-31A-PP+
5 bit, 0 – 31 dB
dc – 4 GHz
Vdd=3.3 Vdc
4 bit CTRL
Filter Bank Switch 1A
HMC194A
SPDT
dc – 3 GHz
V1 V2
LP Filter 1
70 MHz
LP Filter 2
80 MHz
2 bit 3.3 V Control
Filter Bank Switch 1B
HMC194A
SPDT
dc – 3 GHz
V1 V2
Amp-1
GALI-74+
25 dB
8 Vdc
DRAFT 9: Rev. I
Digital Step Attenuator 2
DAT-31A-PP+
5 bit, 0 – 31 dB
dc – 4 GHz
Vdd=3.3 Vdc
4 bit CTRL
Filter Bank Switch 2A
PE42540
SP4T
dc – 3 GHz
V1 V2
3 MHz HPF 1
10 MHz HPF 2
20 MHz HPF 3
30 MHz HPF 4
2 bit 3.3 V Control
Filter Bank Switch 2B
PE42540
SP4T
dc – 3 GHz
V1 V2
Amp-2
GALI-74+
25 dB
8 Vdc
Digital Step Attenuator 3
DAT-15R5A-PP+
5 bit, 0 – 15.5 dB
dc – 4 GHz
Vdd=3.3 Vdc
5 bit CTRL
Amp-3
GALI-74+
25 dB
8 Vdc
1 bit Board ID
MMCX
RF OUT
50 ohm
2 µF
510 ohm
Analog output
Power Monitor
AD8361ARTZ-RL7
3.3 Vdc
FEE ON/OFF CTRL
Attenuator CTRL
LPF Switch CTRL
HPF Switch CTRL
Board ID indicator
Receiver Control Bus
Diagnostics Control Bus
RF output power
Board temperature monitor
FEE power fault
FEE current monitor

THE FUTURE

The Digital Frontier

- Future development will focus on the digital side of a station
  - Add new features or reduce cost per input
- What will this look like?
  - FX or DFX?
  - RFSoC? Digitize at the antenna? Something else?

THE END