Antenna Electrical Infrastructure

Selection of OMT Design for the EVLA X-band Receiver

Bob Broilo

Electrical Engineer

Atacama Large Millimeter/submillimeter Array
Expanded Very Large Array
Robert C. Byrd Green Bank Telescope
Very Long Baseline Array

NRAO

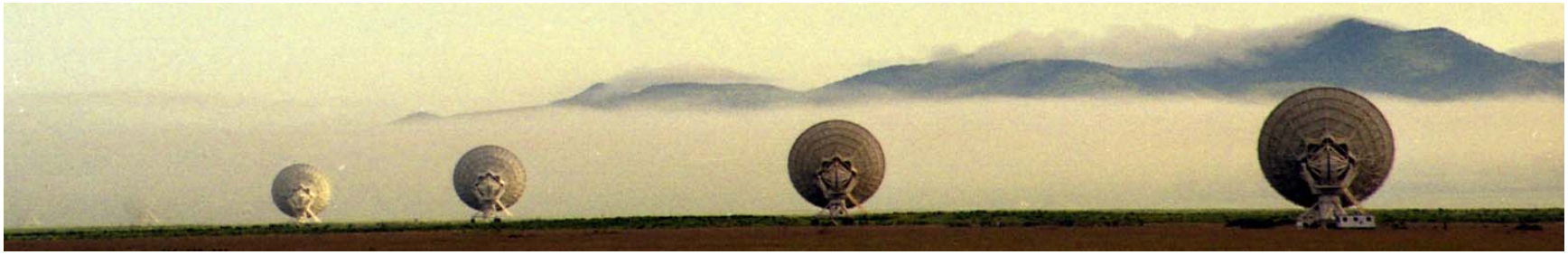
Compressor Load

- Three compressors
- Average 16.7A each phase
- 208V 3-phase, 88% PF
- 6.4kVA or 5.6kW each
- 16.8kW per antenna
- 62% of total antenna load

Antenna Power Feed

- Cryos are fed from 208V, 90A, 12-space, 3-phase sub-panel
- All breaker spaces taken
- Panel loaded to 60A
- Allowed 72A Max constant load (80% rule)
- Sub-panel fed from 150A contactor in ped room power panel

Antenna Power Feed (cont'd)

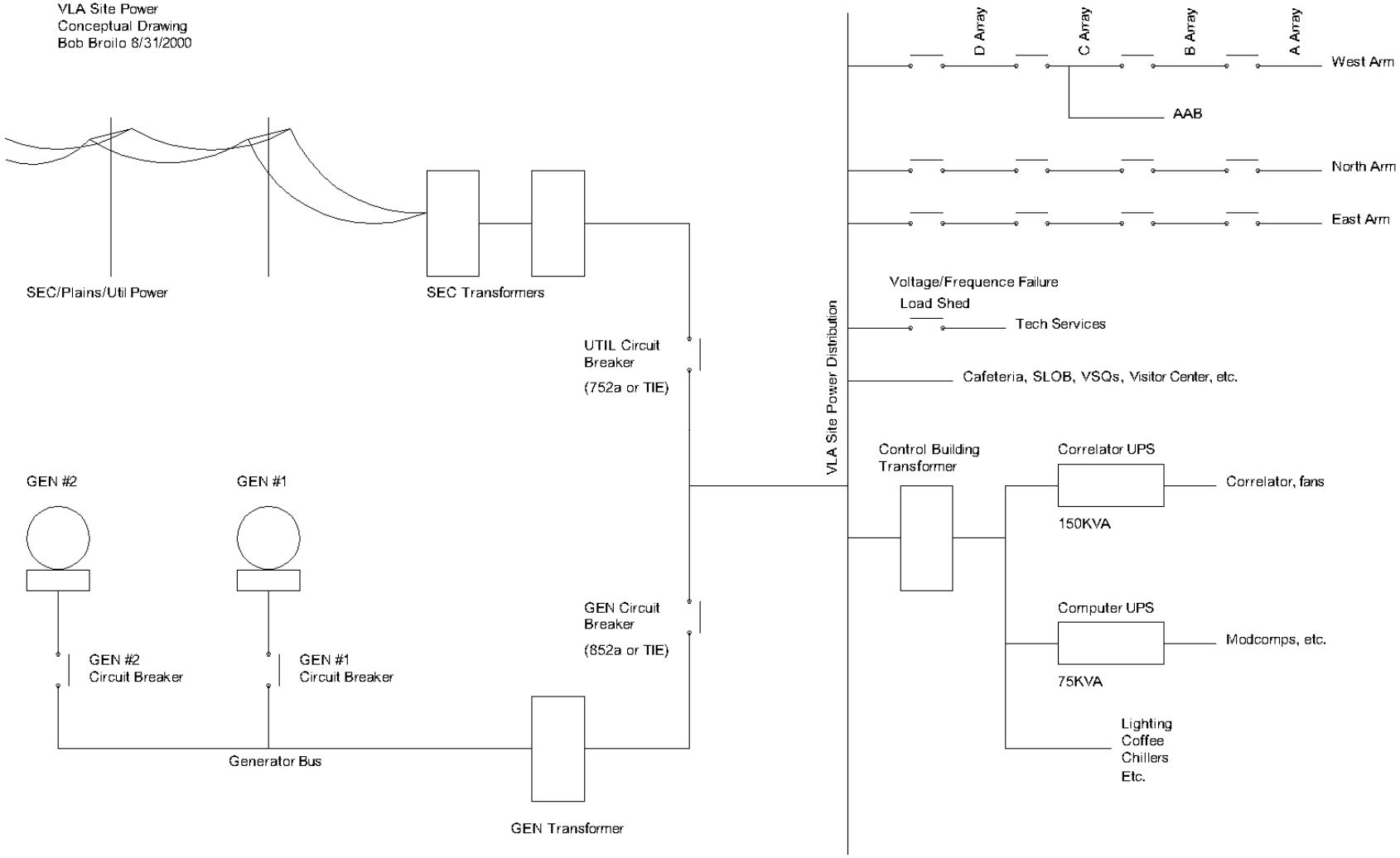


- Antennas are fed through 208V umbilical cord from array transformers, 12,470V from underground cable
- Underground primary conductors are #2 Al: good to 2.9MVA
- Most have individual 75kVA transformers
- 12 D-array pads share 6 112.5kVA transformers in pairs
- Transporters have 70kVA generators

Antenna Power Feed (cont'd)

- Underground 12,470V supply for each arm is switched and fused at "hatch"
- East and North arms are fused at 30A
- West arm is fused at 40A and supplies AAB

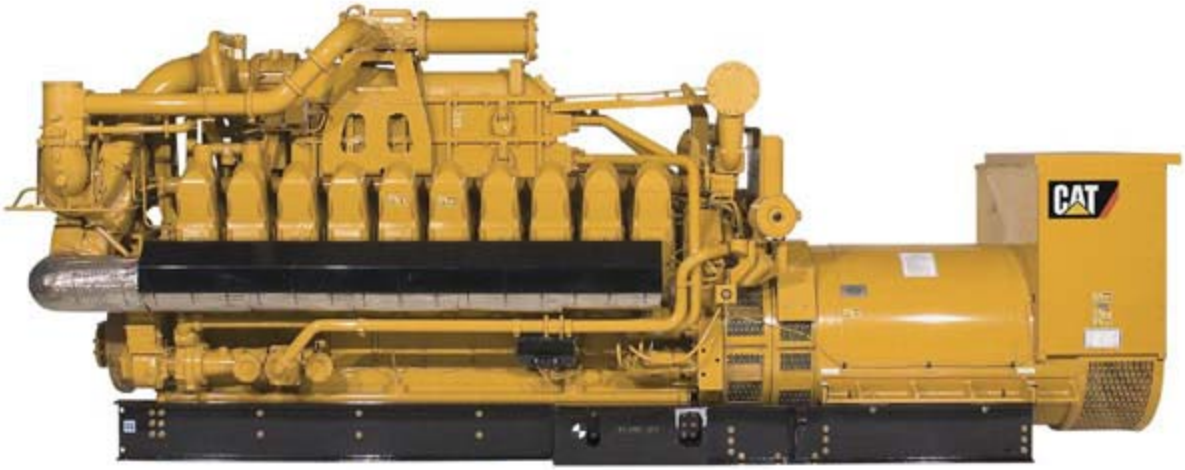
Site Power Feed



Site Power Feed (cont'd)

- 2MVA 24.9kV to 12,470V transformer utility feed
- 2MVA 480V to 12,470V generator transformer
- VLA site load: 1.1MVA base, 1.6MVA occasional in winter
- EVLA predicted to **add 460kVA**
- HVAC and electrical projects have **saved 260kVA**
- Predicted EVLA load: **1.3** base, **1.8MVA** occasional

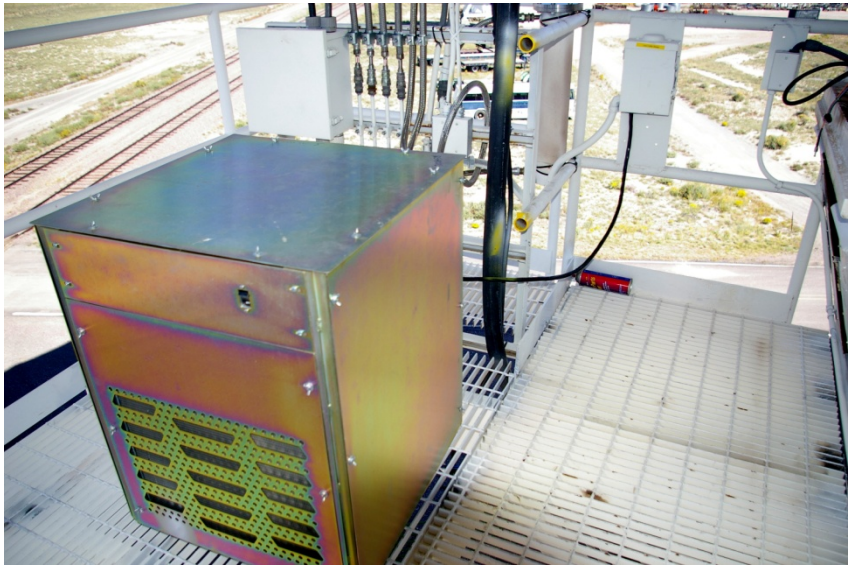
Site Power Feed (cont'd)



- Generators recently overhauled and load tested to 1385kVA each
- One generator can keep all cryos "alive", but only by shutting off WIDAR and building heat

Cryo Compressor Load

- Adding a cryo compressor to the antennas adds 170kVA
- Total site load with 4th compressor: 1.5 to 2.0MVA
- Constant allowed site load with existing transformers: 1.6MVA (80% rule)
  - Need bigger site transformers
- However, fuses, wire, generators, array transformers etc. are sufficient



Electrical Distribution Cost

- Per Antenna
  - 15-space breaker panel
  - 30A breaker
  - wire (#2 and #10)
  - Disconnect
  - Conduit
  - 125A breaker
  - = $800 each
- Transformers
  - 2.5 – 3MVA, $22k each
  - Pads, elbows, wire, etc $7k
- Materials total **~$75k**

Ongoing Power Cost

- At $0.085/kWh (Power price is likely to rise)
  - 49MWh/year
  - $4.2k/antenna/year
  - **$116k/year**