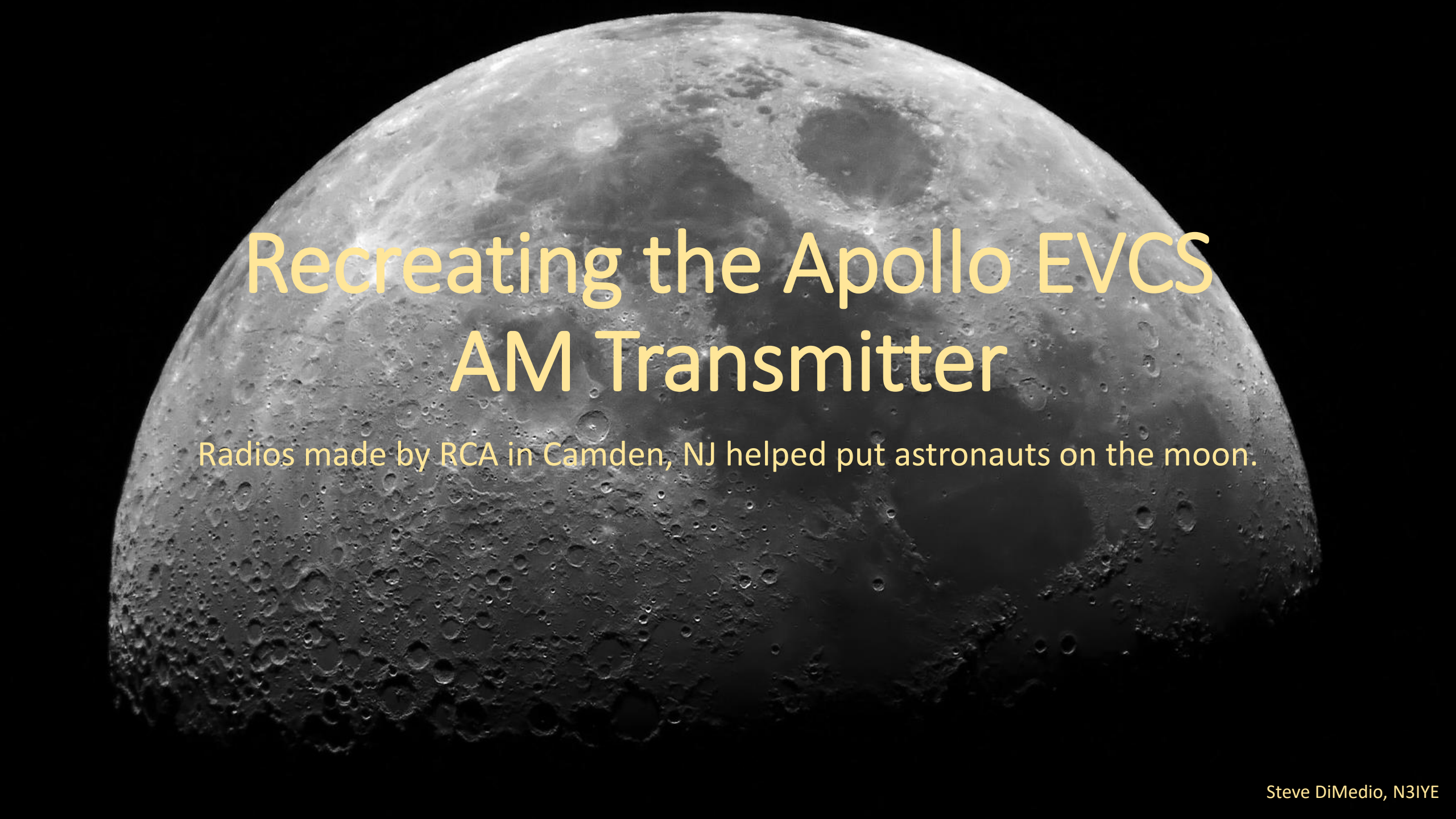
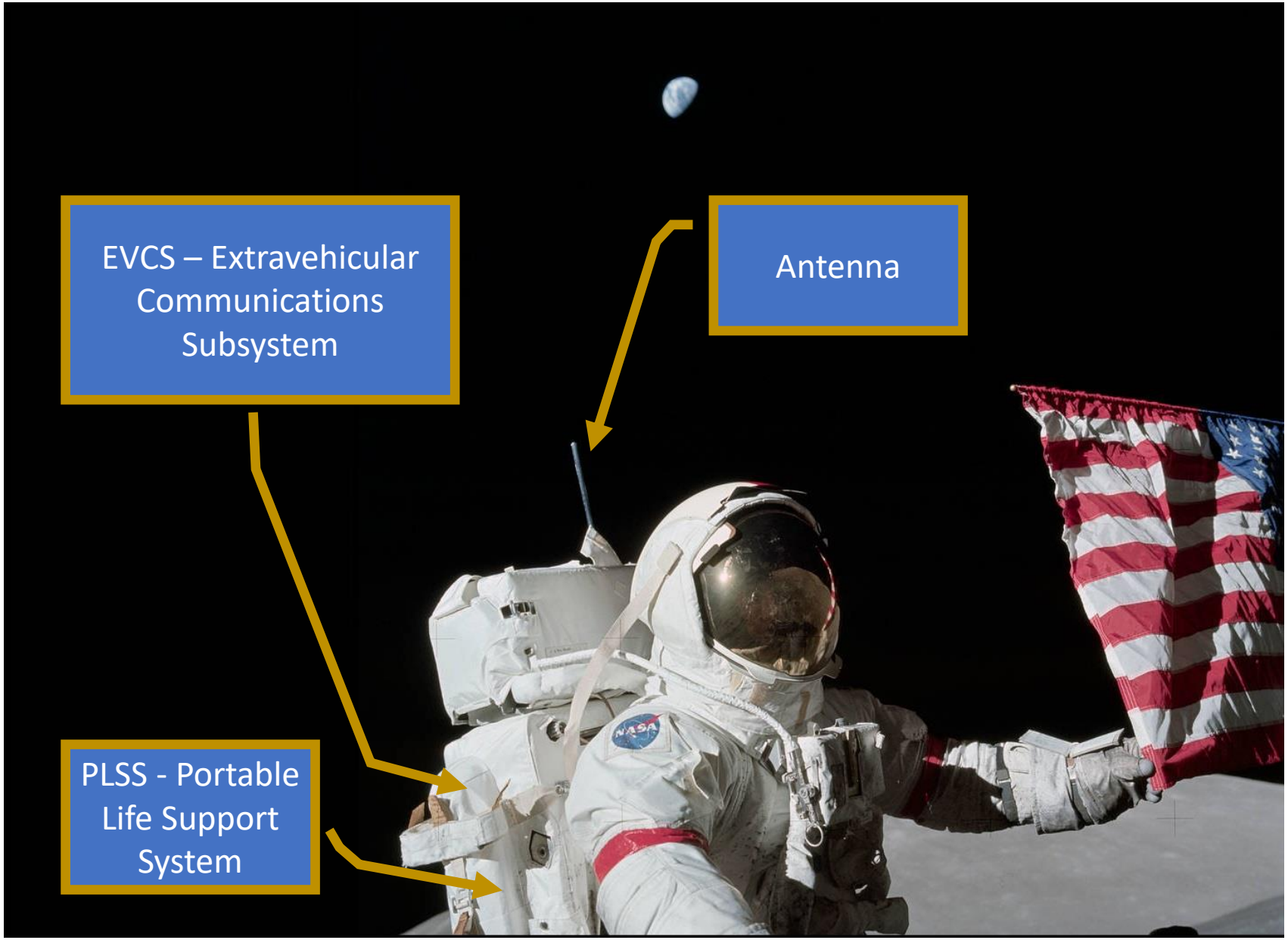


Recreating the Apollo EVCS AM Transmitter

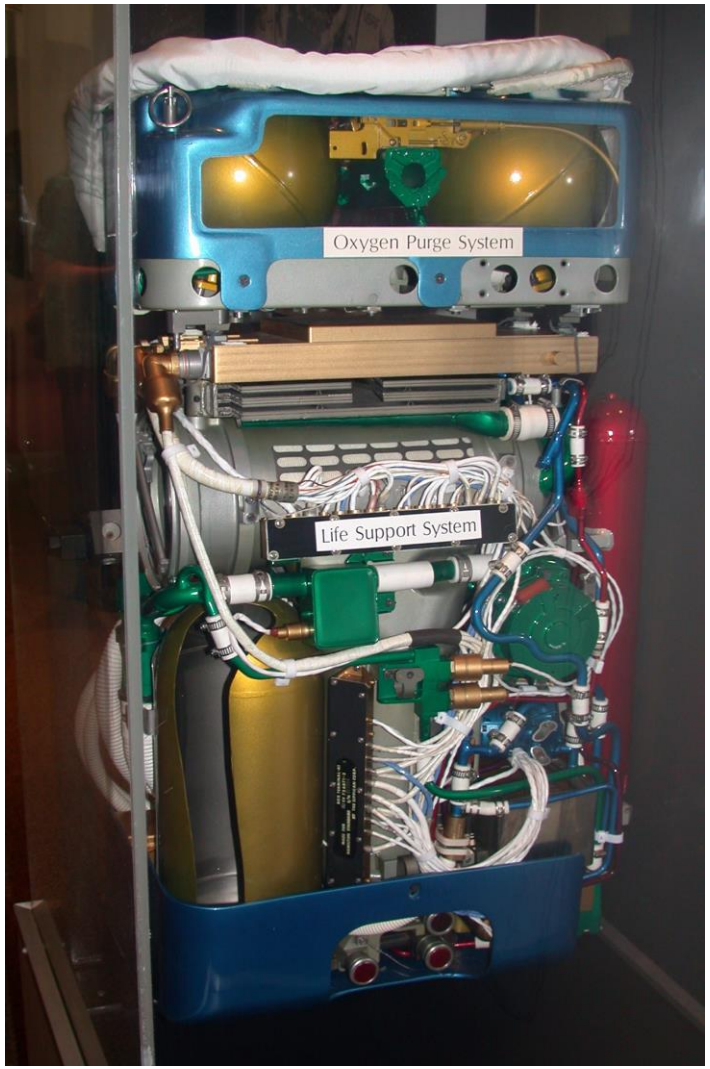
Radios made by RCA in Camden, NJ helped put astronauts on the moon.

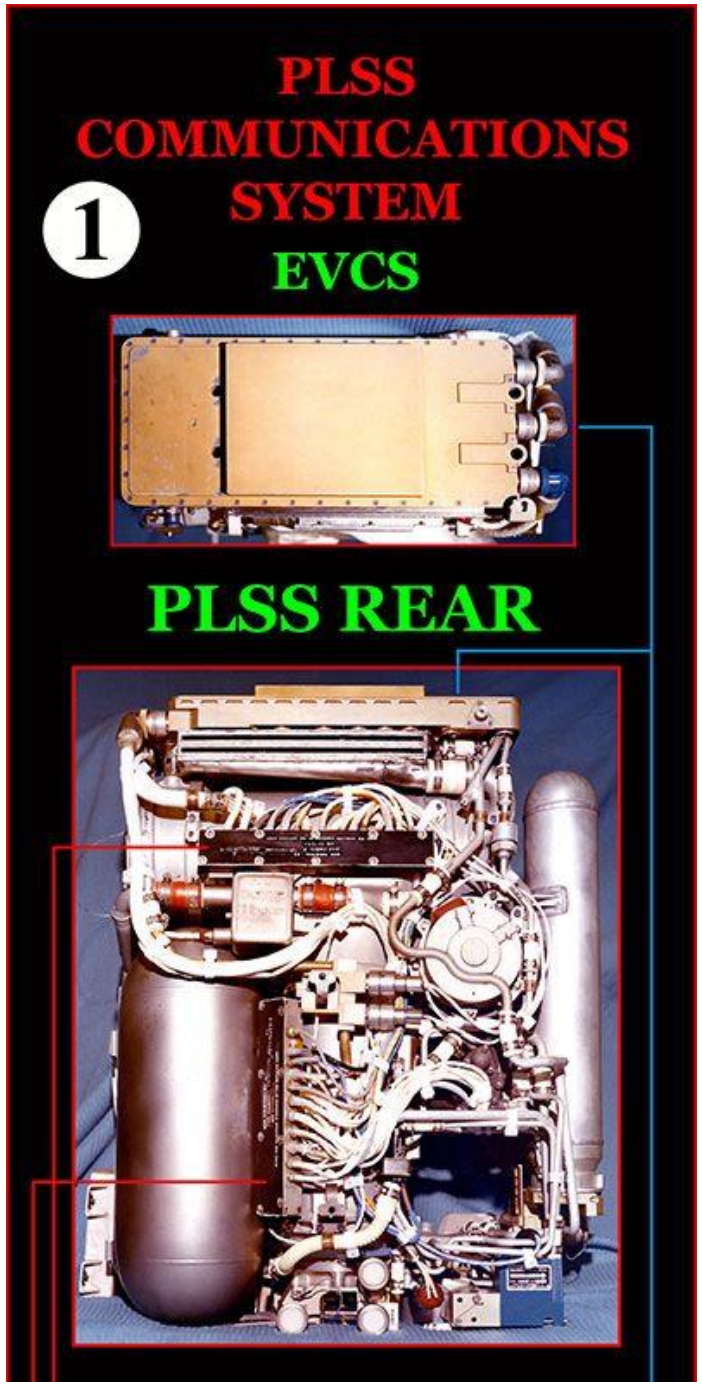
Steve DiMedio, N3IYE

Terms

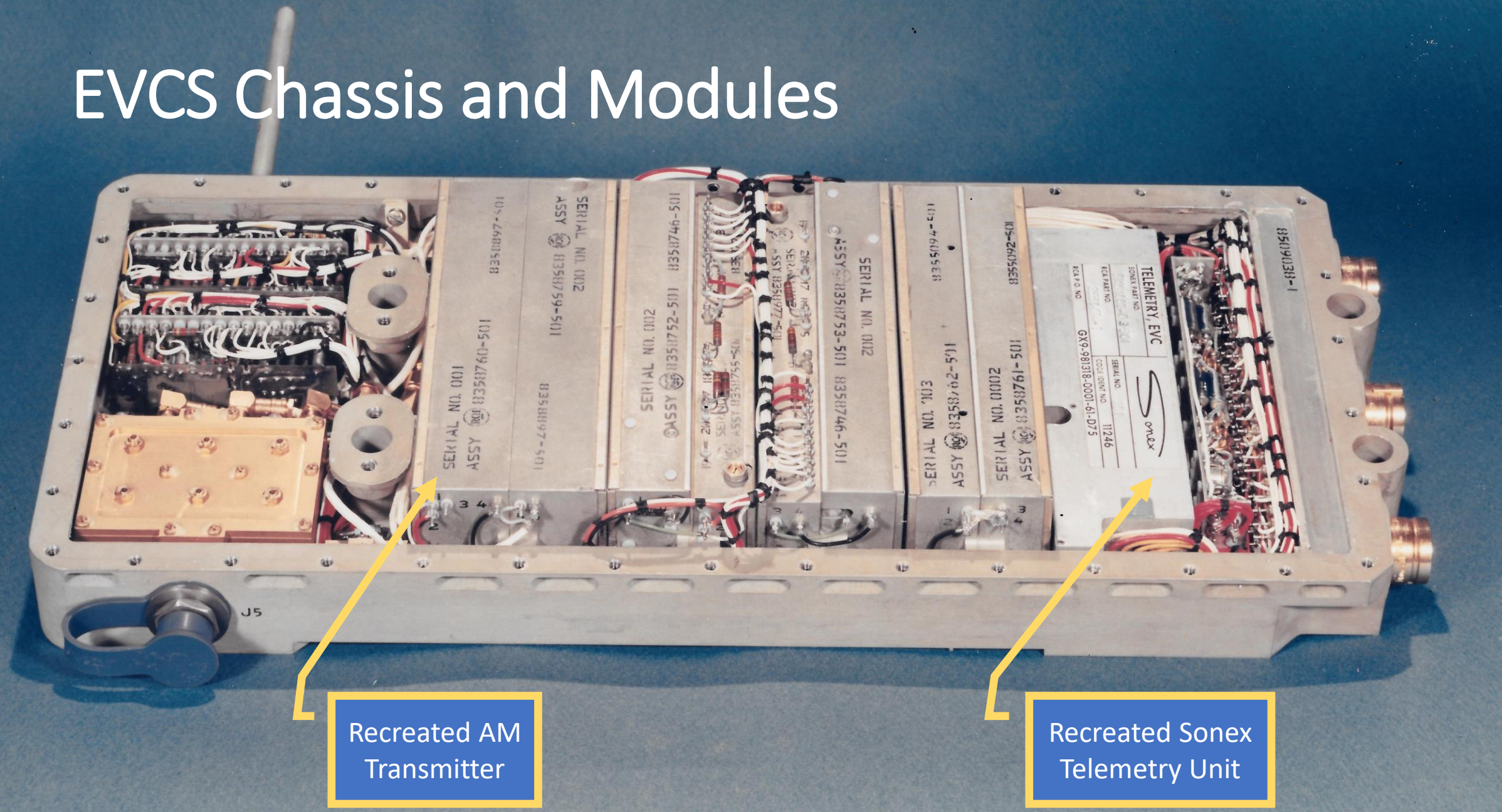

EVCS – Extravehicular Communications Subsystem
Antenna
PLSS - Portable Life Support System

EVCS in the PLSS





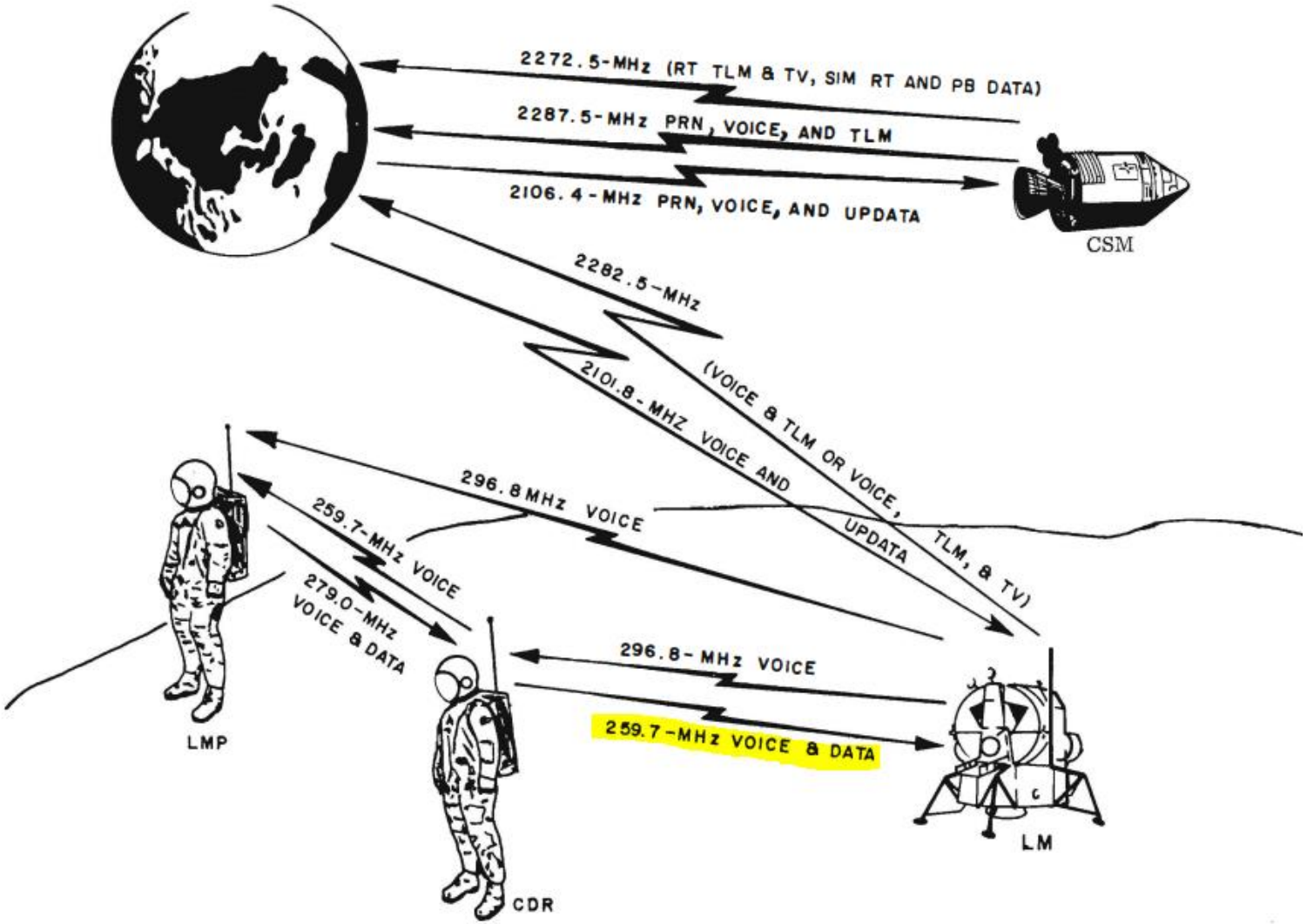
EVCS Chassis and Modules



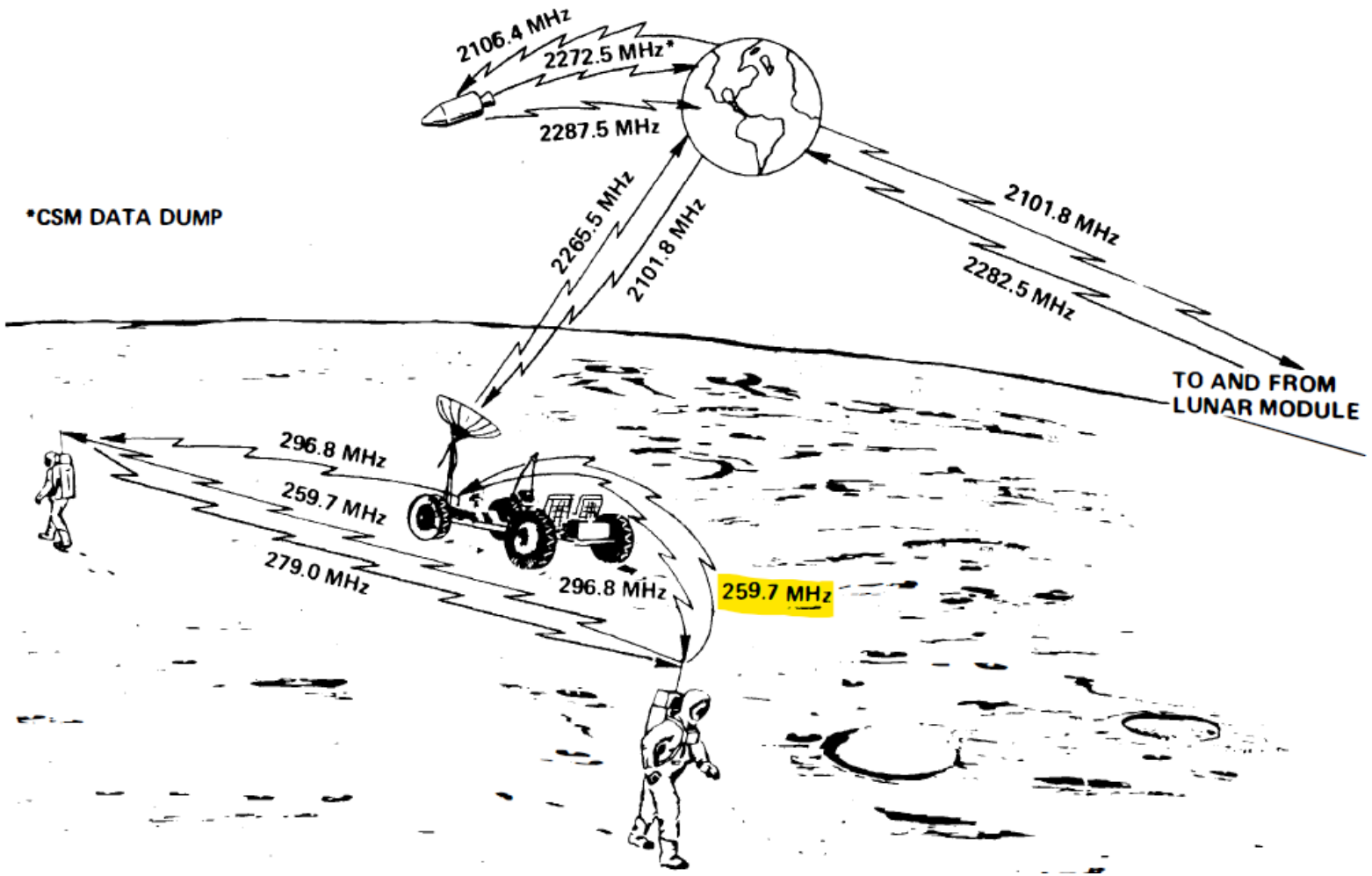
Meeting Jack Yanosov

- Tom Anastasia, Fred Barnum, and I met Jack Yanosov in 2019:

Apollo EVA Communications

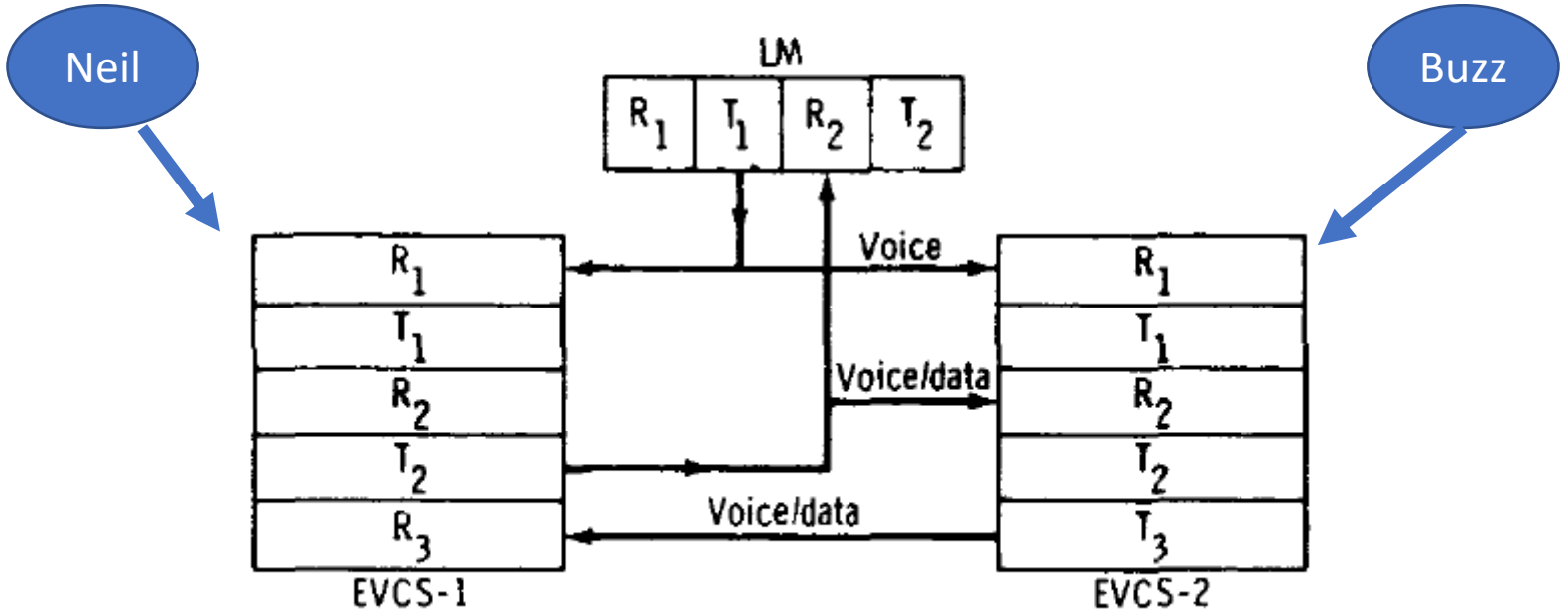


Apollo EVA Communications

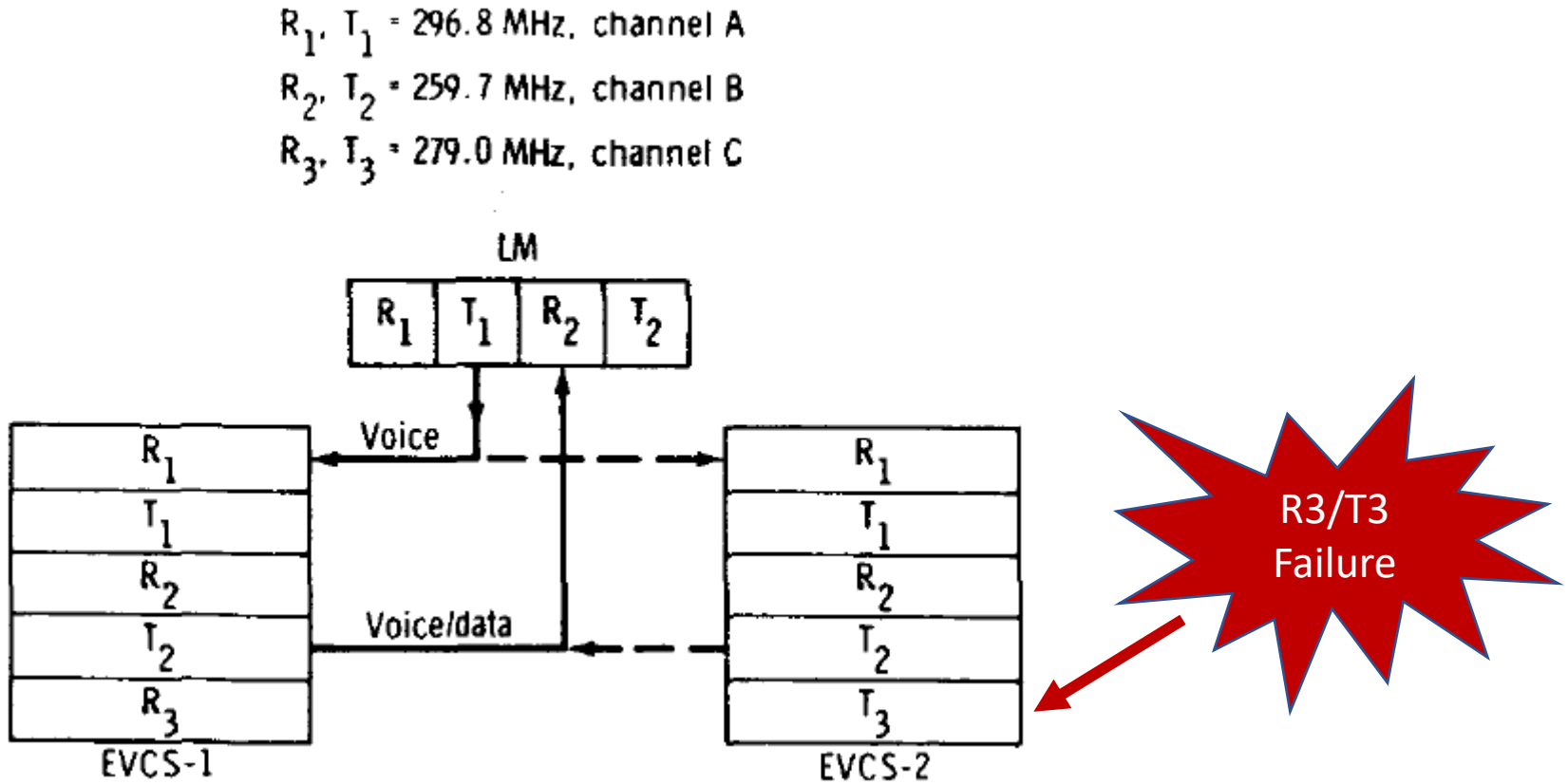


Dual Mode (Full Conference)

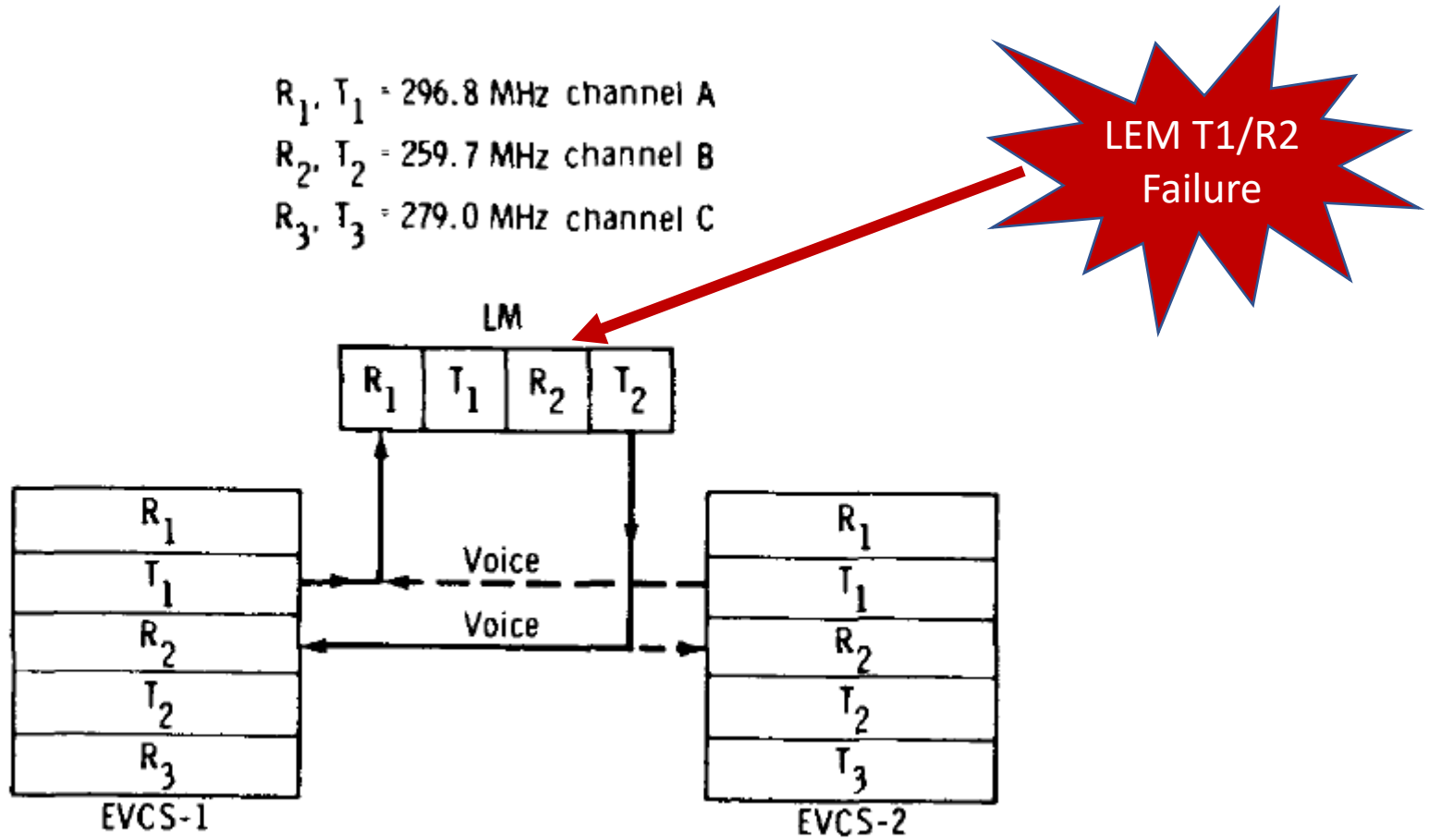
R_1, T_1 = 296.8 MHz, channel A
R_2, T_2 = 259.7 MHz, channel B
R_3, T_3 = 279.0 MHz, channel C



Primary Backup Mode

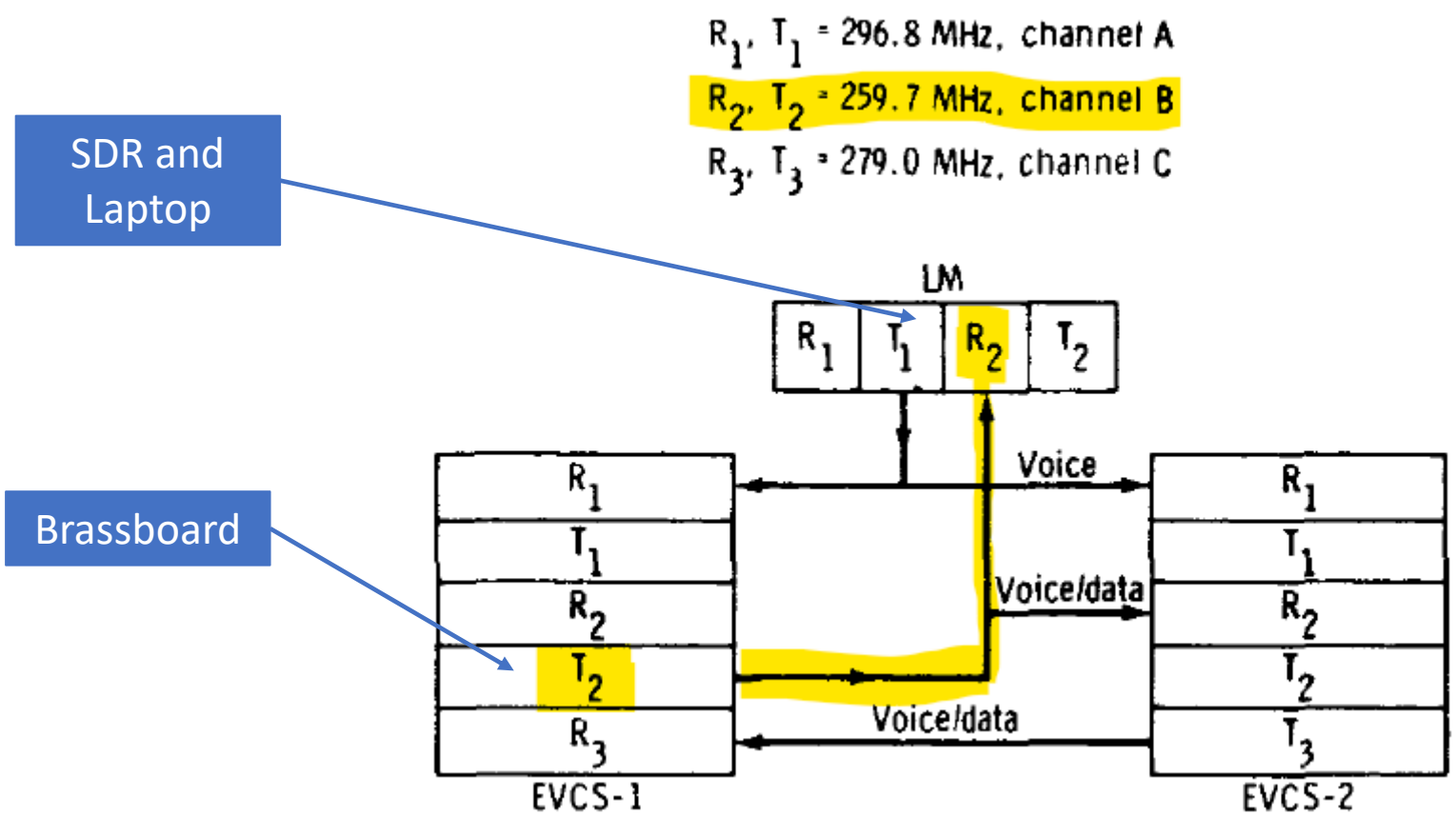


Secondary Backup Mode

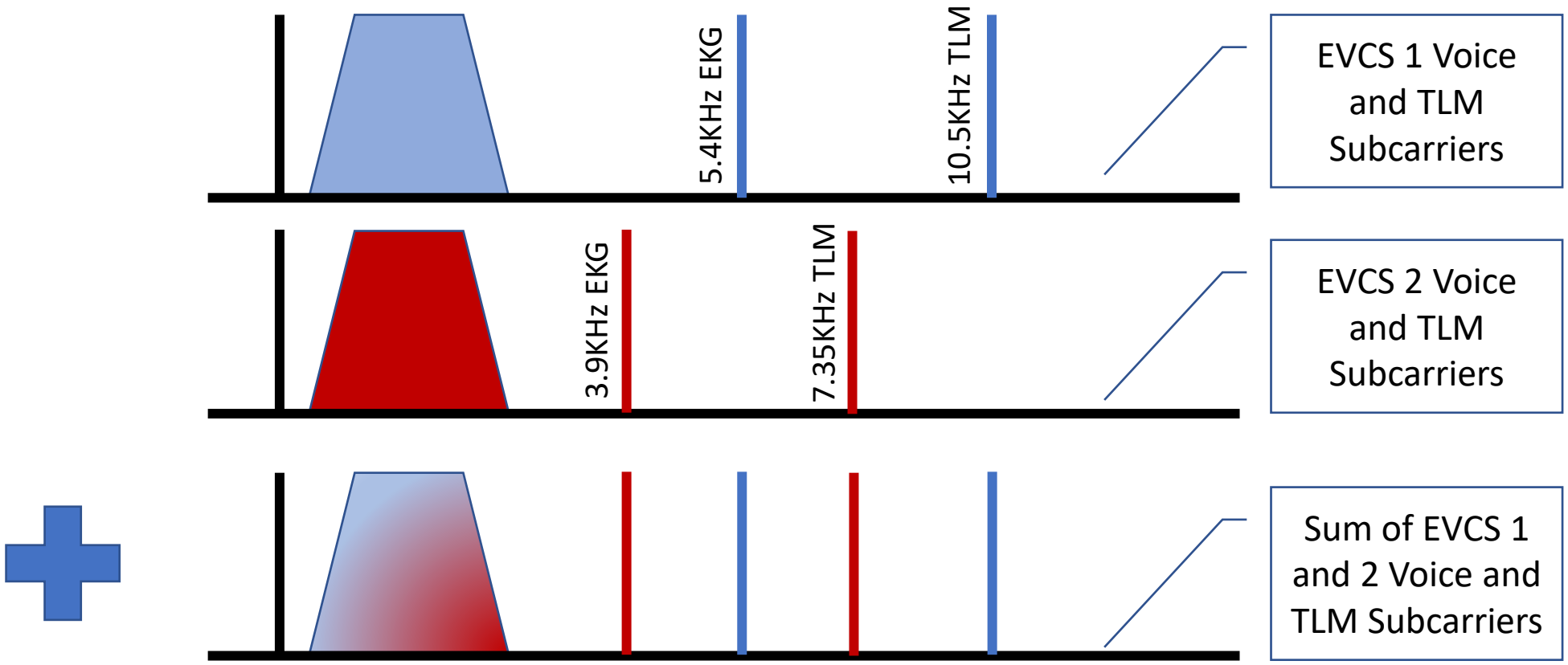


Recreated Path

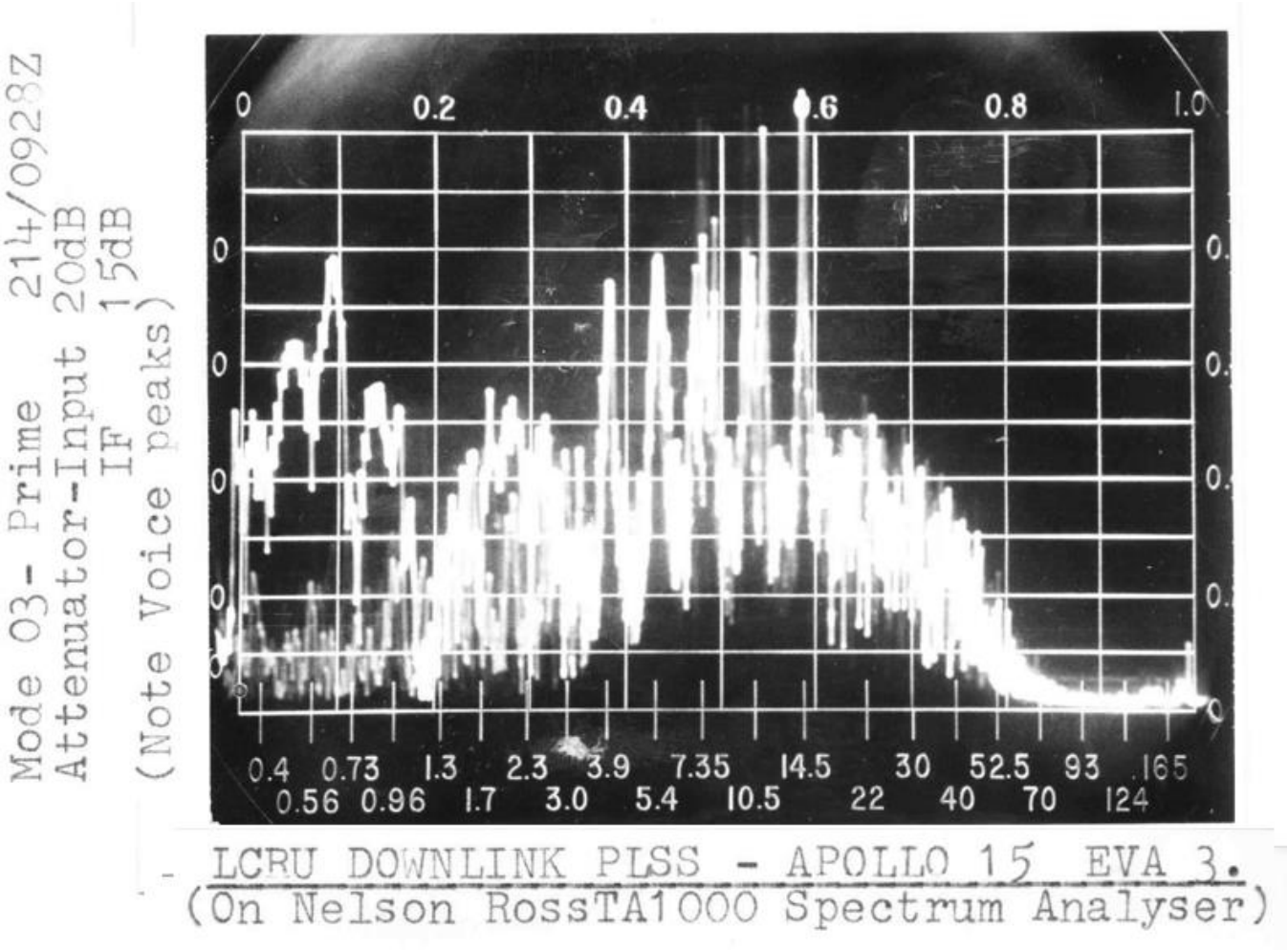
Path recreated



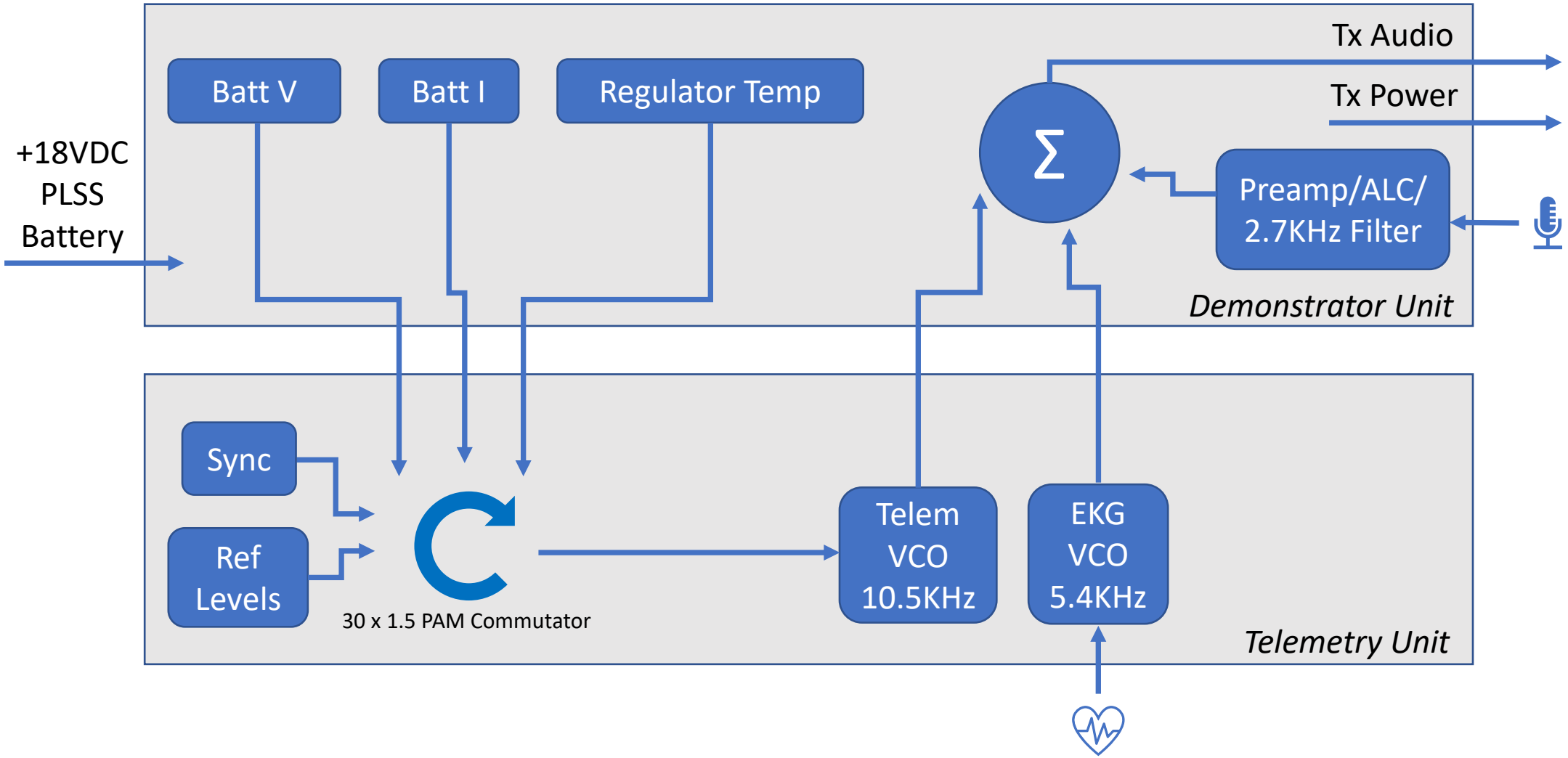
Audio Spectrum - FDM



Audio Spectrum (Parkes and Honeysuckle Creek, AU)



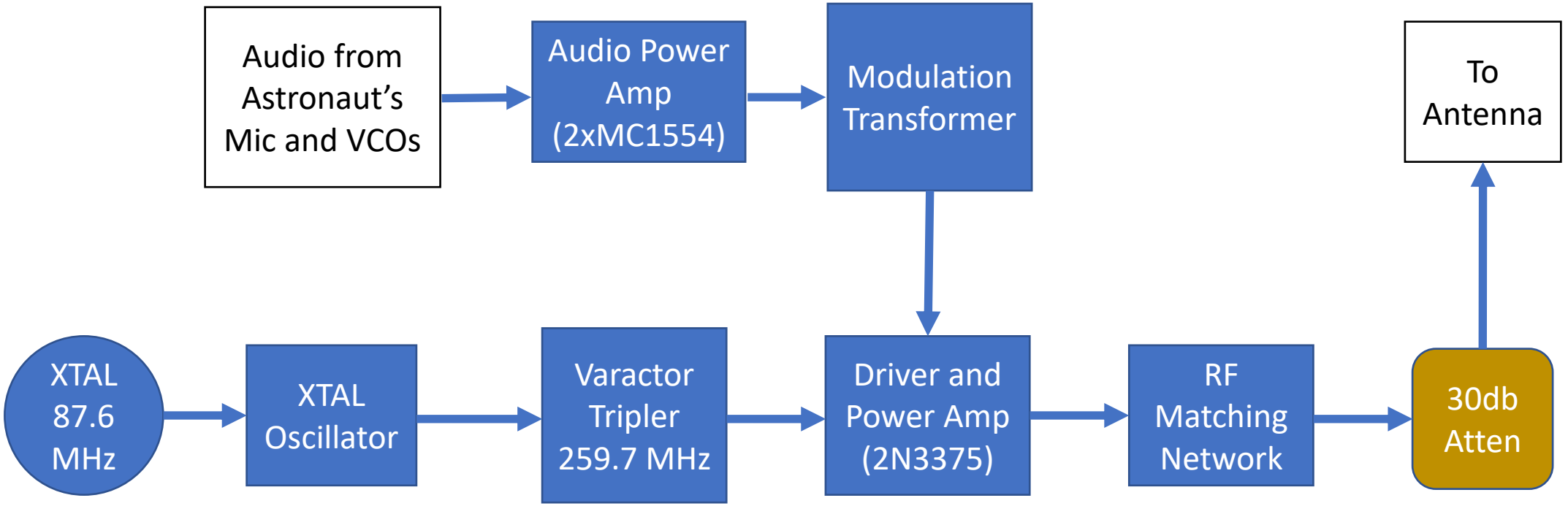
Telemetry - TDM



Telemetry Channels

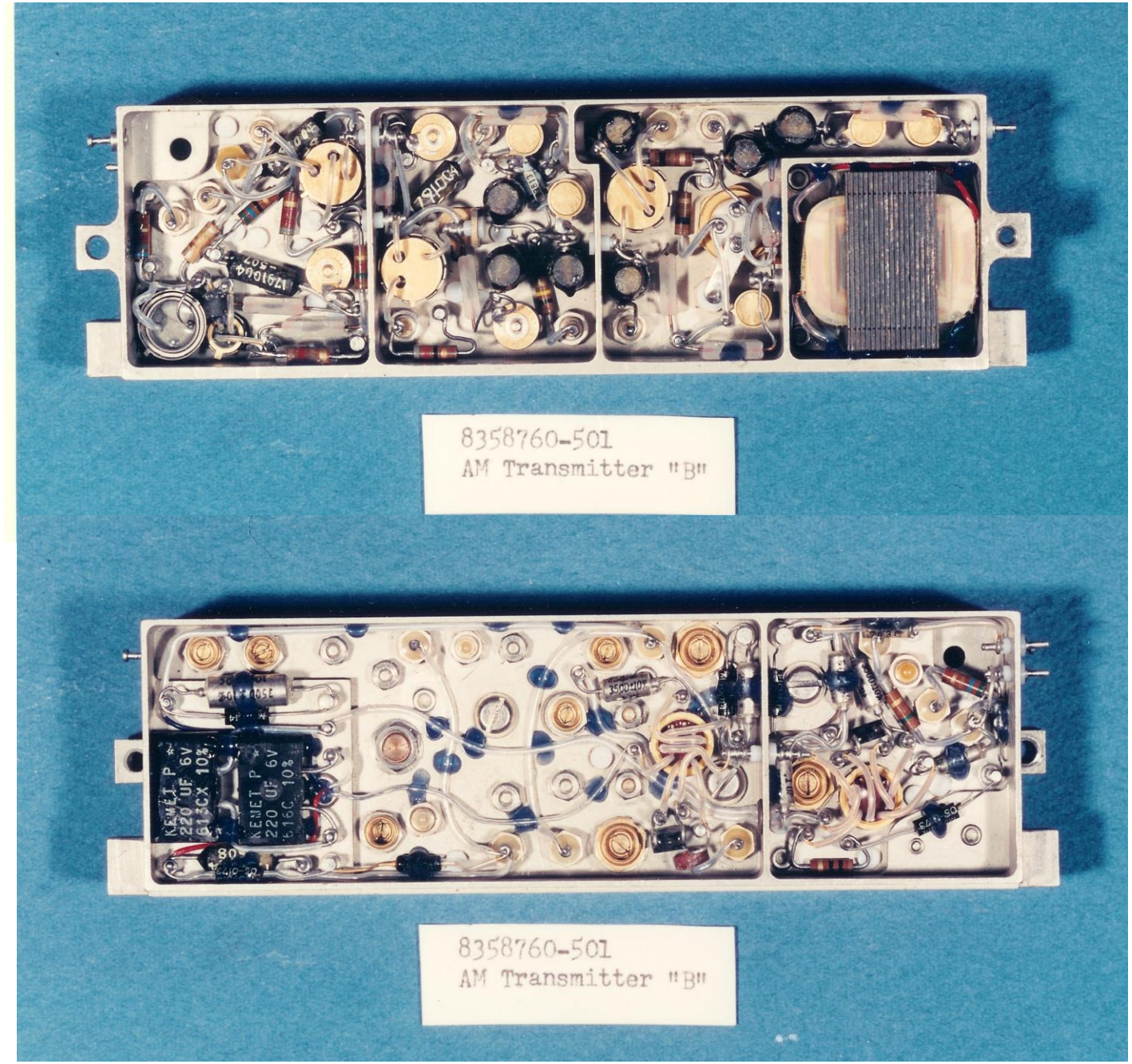
Measurement title	Instrumentation range	Discriminator output range, V dc	Commutator channels
Zero calibration	0 V dc	0	1
Full-scale calibration	5 V dc	5	2
PGA pressure	2.5 to 5.0 psid	0 to 5	3, 21, 24, 27
Feedwater pressure	0 to 5.0 psia	0 to 5	4, 15, 22, 26
Battery current	0 to 10 amps	0 to 5	5, 11
Battery voltage	15.5 to 20.5 V dc	0 to 5	6, 20
Water difference temperature	0° to 15° F	0 to 5	8, 19
LCG inlet temperature	40° to 90° F	3.13 to 1.86	9, 17
Sublimator gas outlet temperature	40° to 90° F	3.13 to 1.86	10, 16
Primary oxygen pressure	0 to 1110 psia	0 to 5	12, 13, 23, 28
Carbon dioxide partial pressure	0.1 to 30 mm Hg	0 to 5	7, 14, 18, 25
Synchronization	- -	(Double width pulse)	29, 30

Block Diagram of AM Transmitter

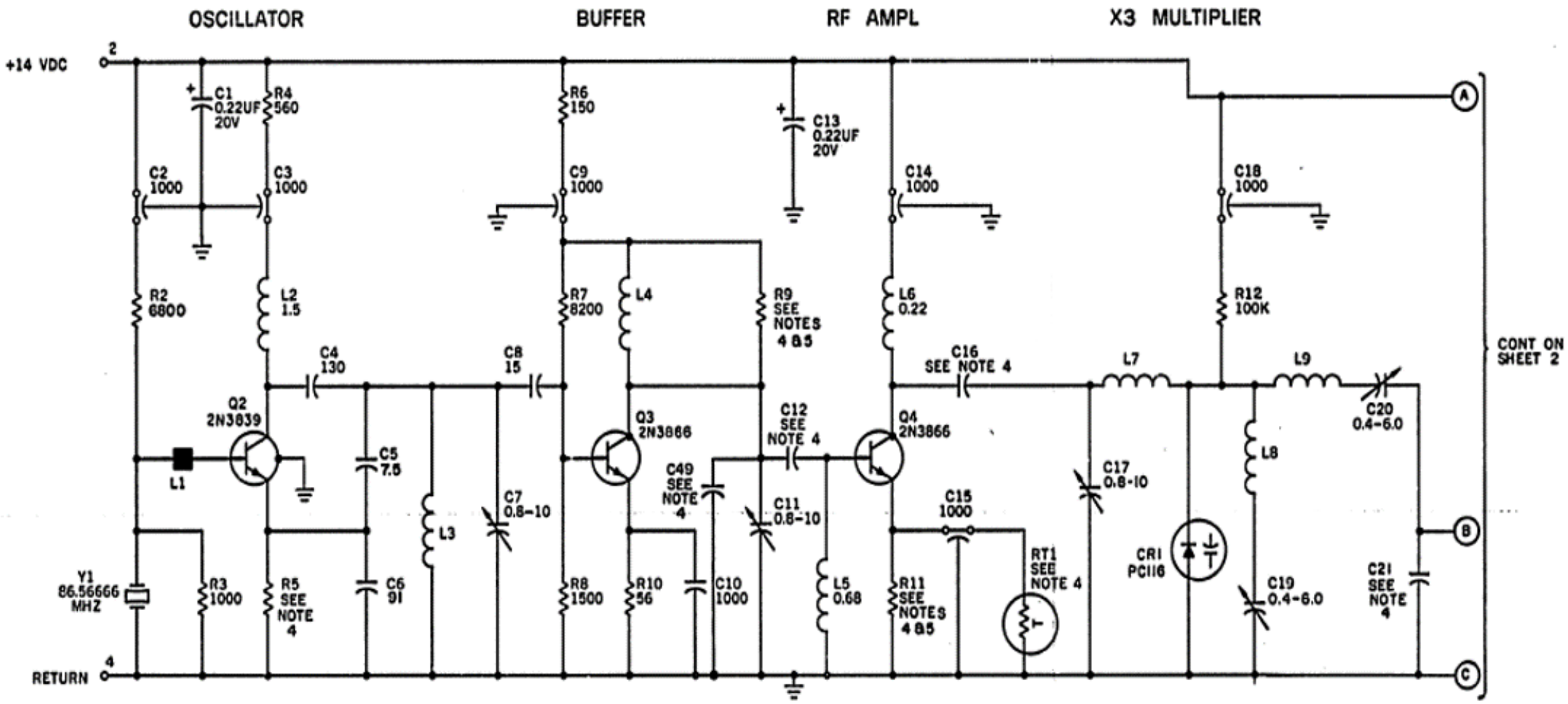


The Radio

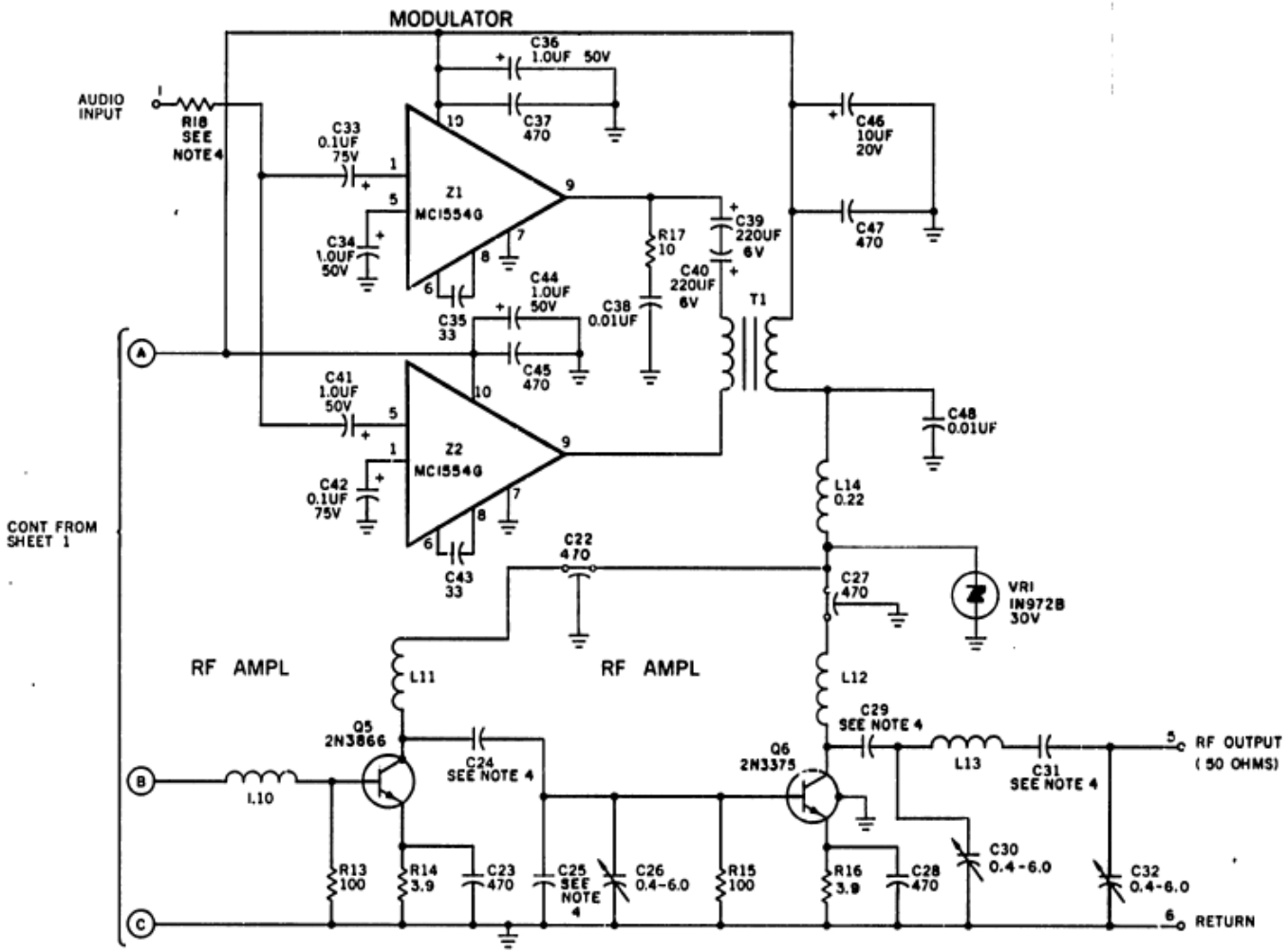
259.7 MHz AM transmitter



AM Transmitter Schematic



AM Transmitter Schematic (cont'd)



AM Transmitter Schematic (cont'd)

CONTRACT NO. NAS 9-7508 | REL

DRAWN Harry F. Kroh, Jr. 19 Jul 1968 | DATE

CHECKED Harry F. Kroh, Jr. 24 Jul 1968 | DATE

DESIGN ACTIVITY APPD. J. A. Spencer 24 July 1968 | DATE

RADIO CORPORATION OF AMERICA
NEW YORK, N. Y.
CAMDEN PLANT

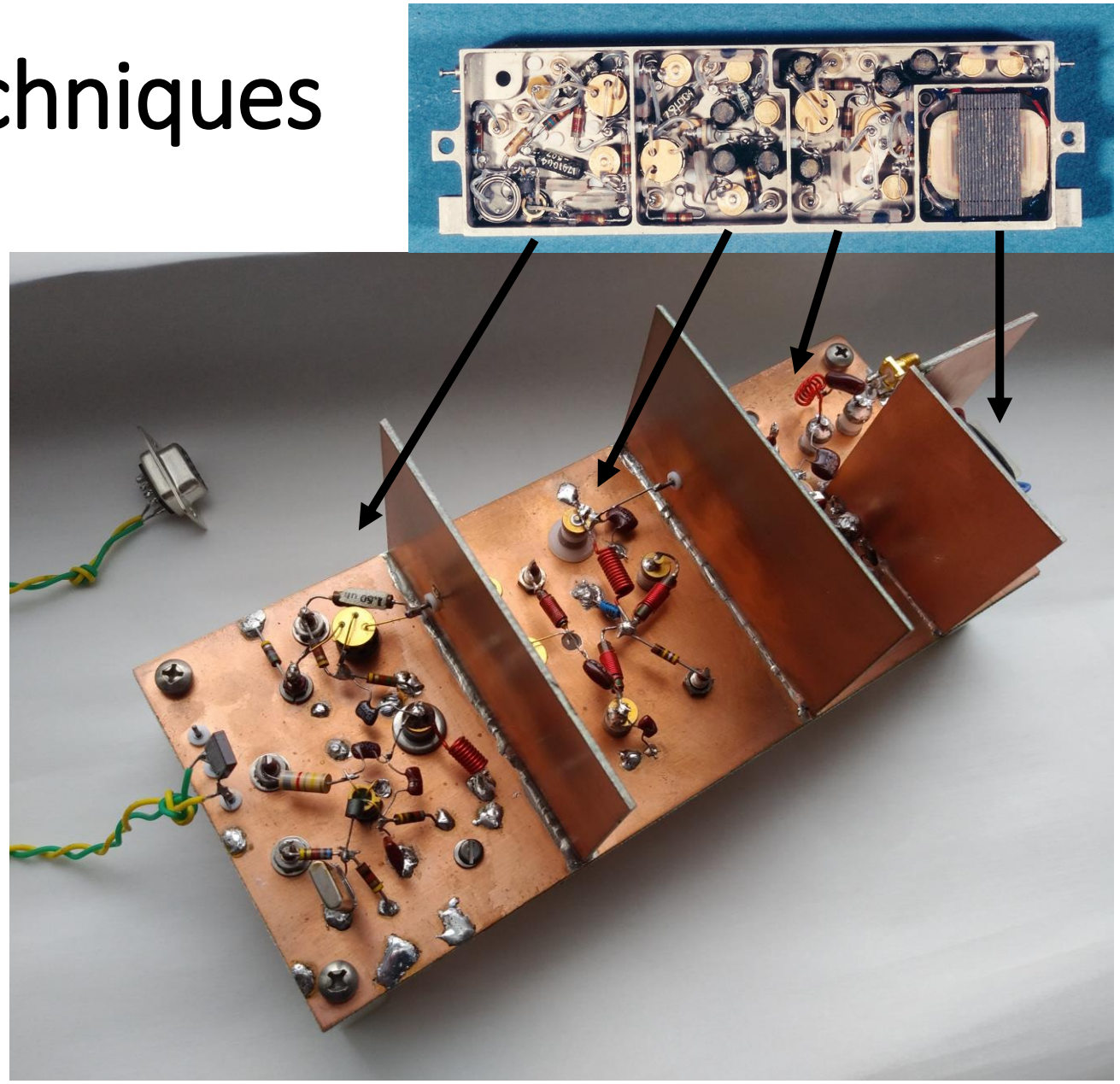
INTERCONNECTION DIAGRAM COMMUNICATOR, EXTRA VEHICULAR NO. I

SIZE D | CODE IDENT NO. 49671 | 8659497

SCALE NONE | WEIGHT —— | SHEET 1 OF 3

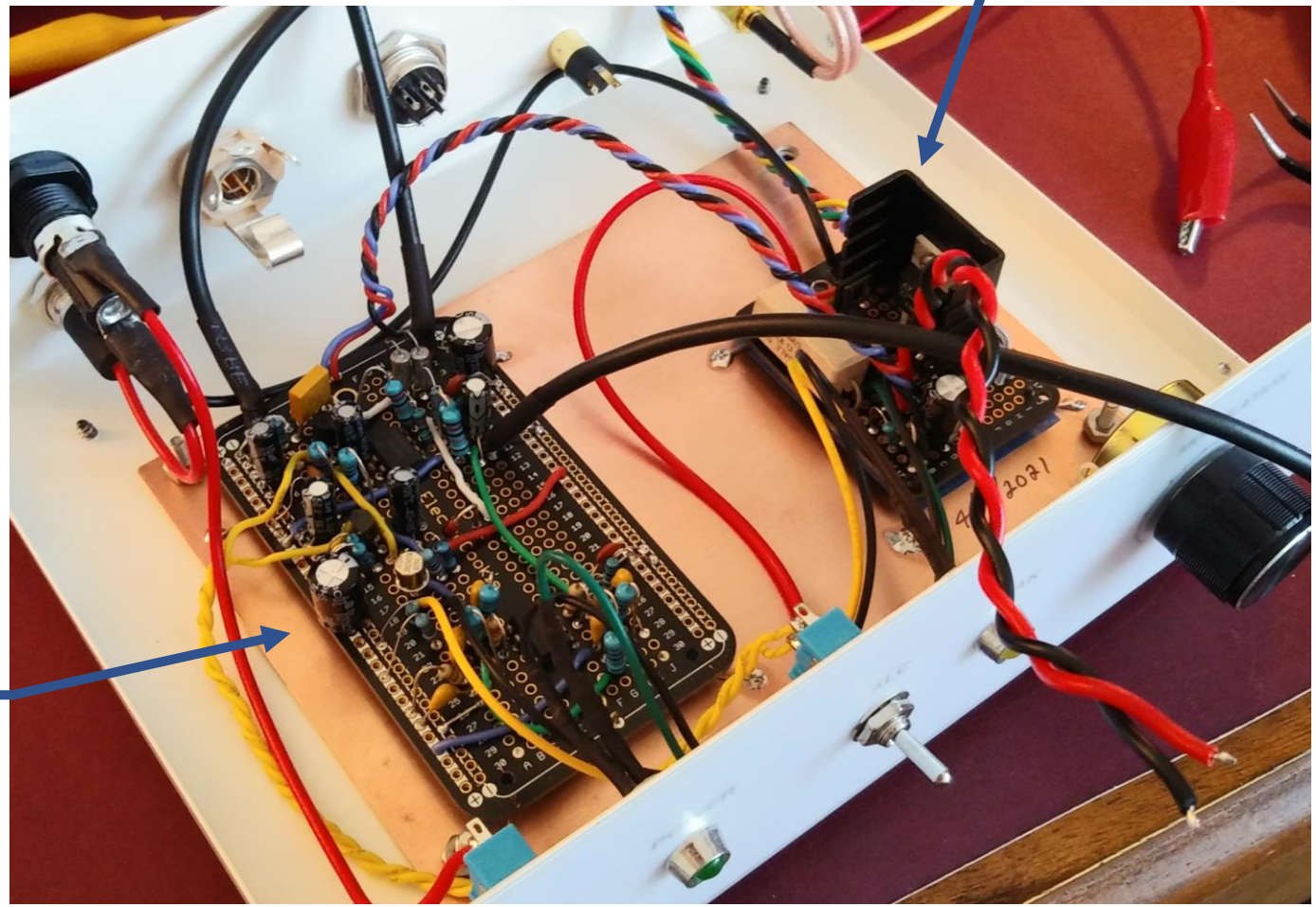
Construction Techniques

- Brassboard
  - For VHF



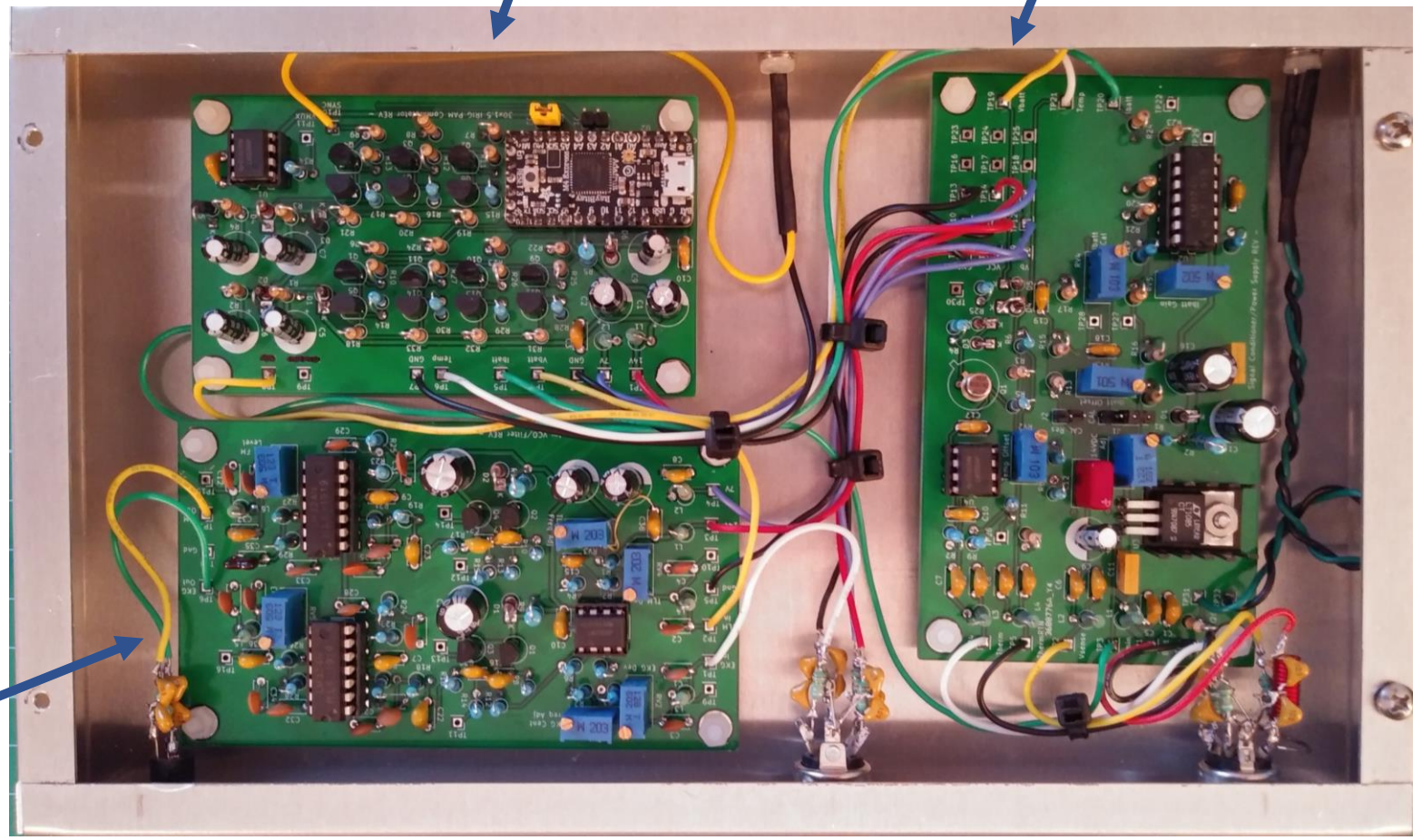
Construction Techniques

- Protoboard
  - For DC, Audio



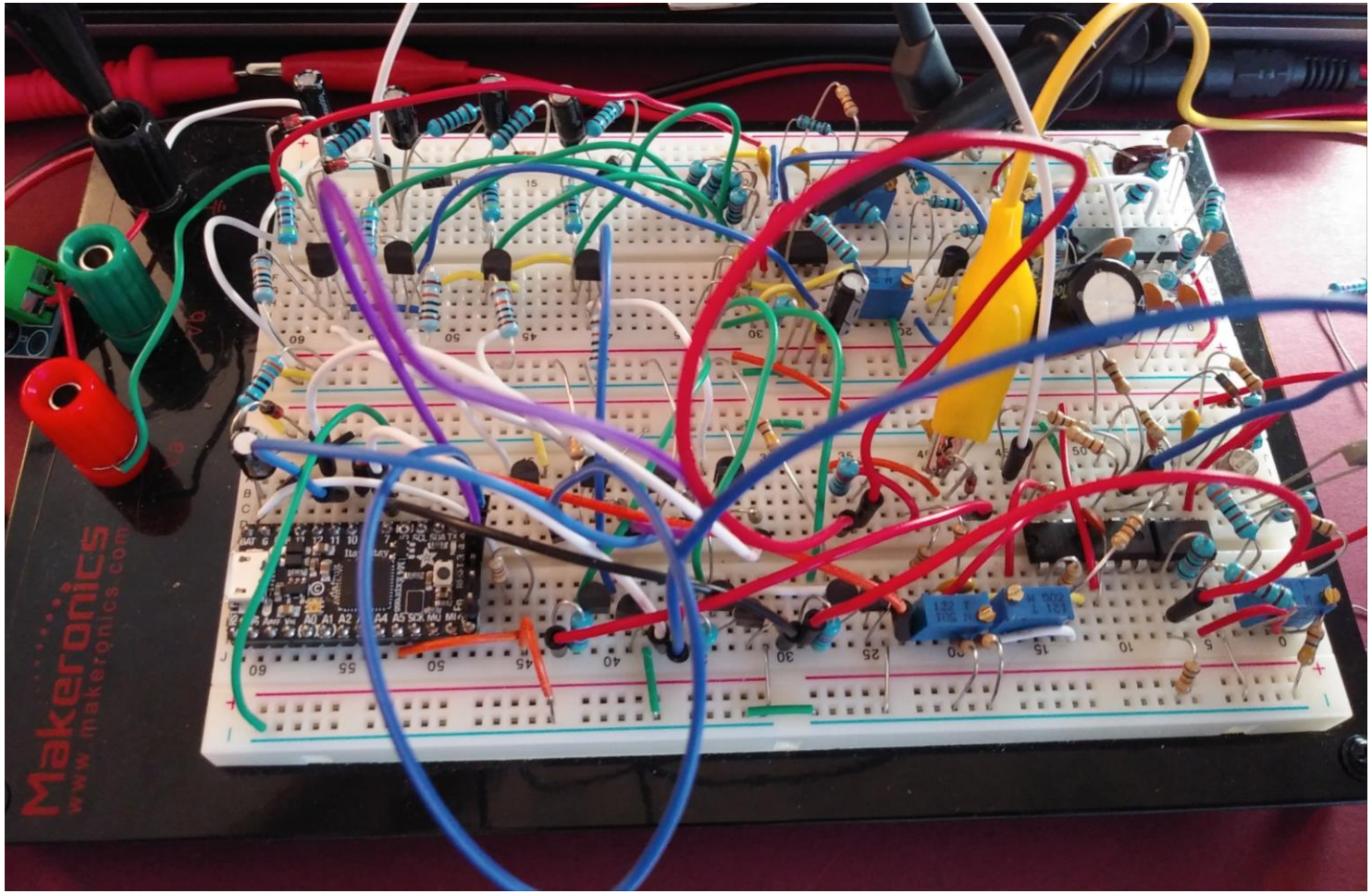
Construction Techniques

- PCB
  - VCOs
  - Commutator
  - Signal Conditioner
  - Power Supply

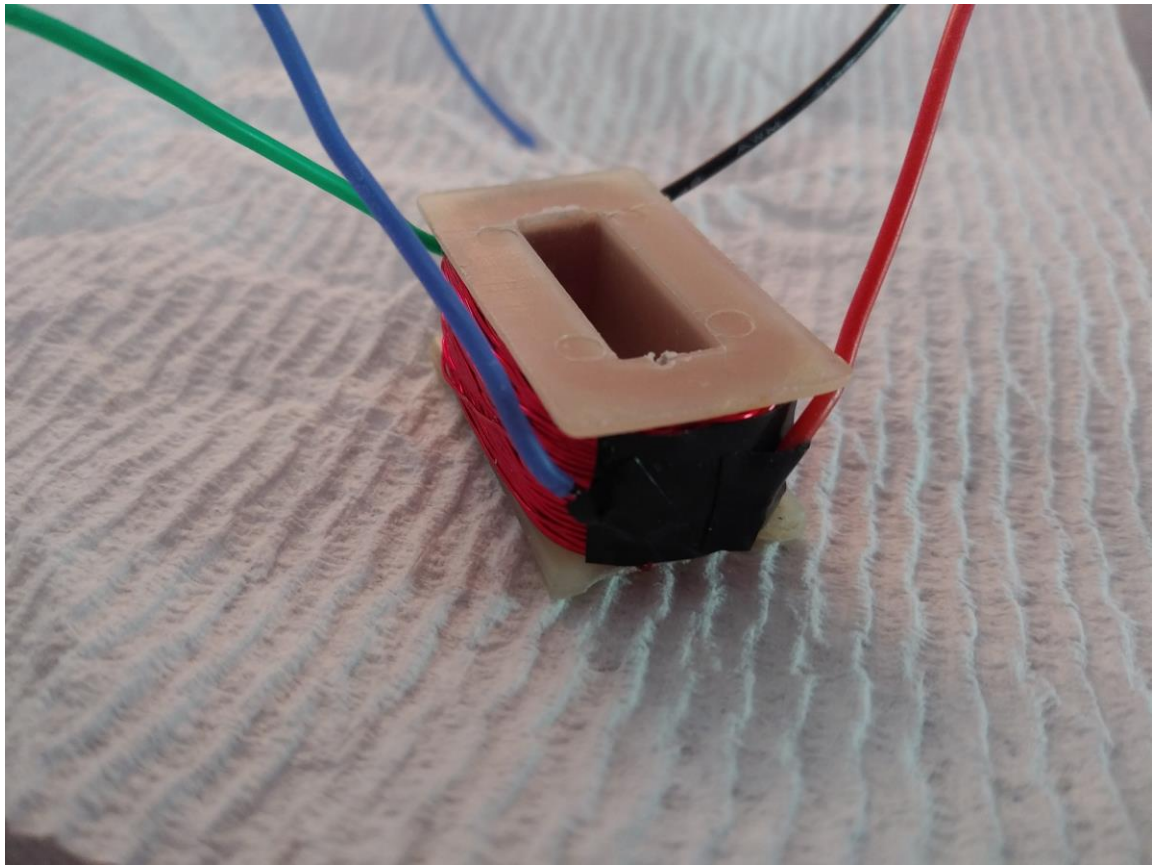


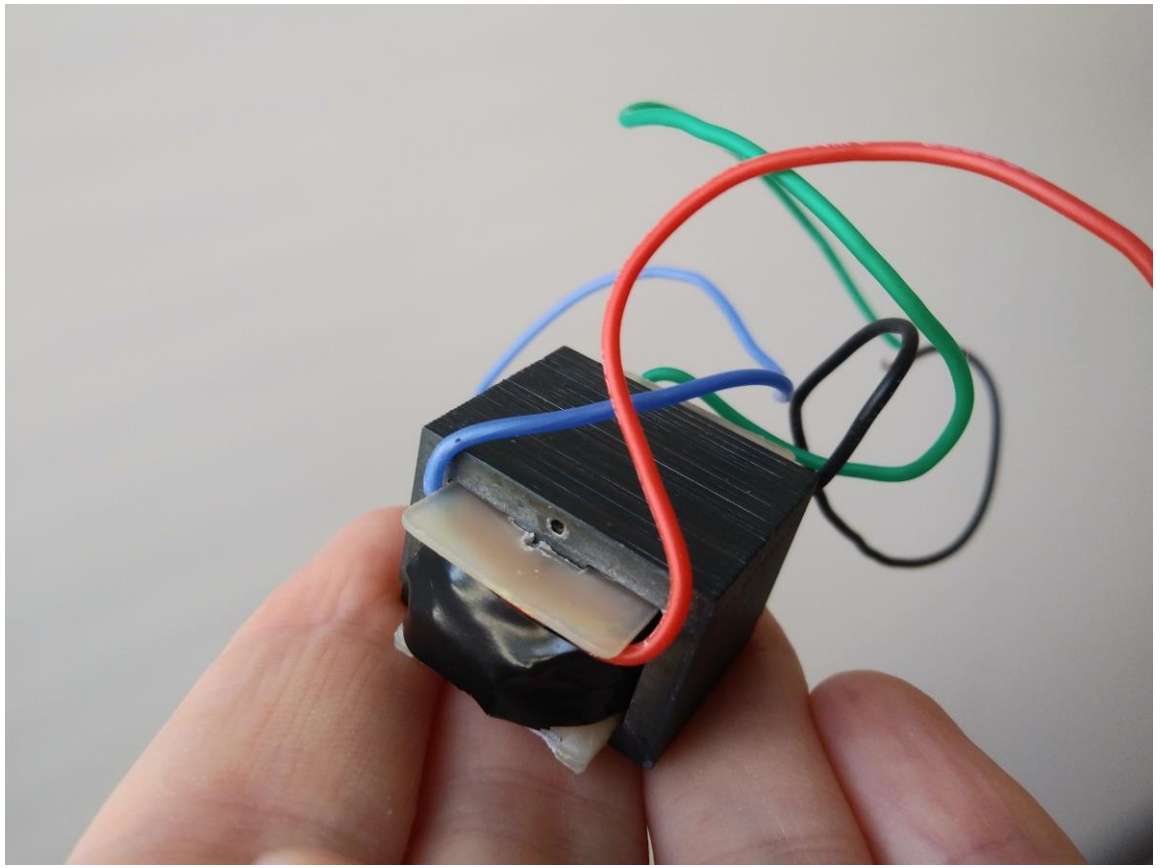
Construction Techniques

- Solderless
  - Experimenting



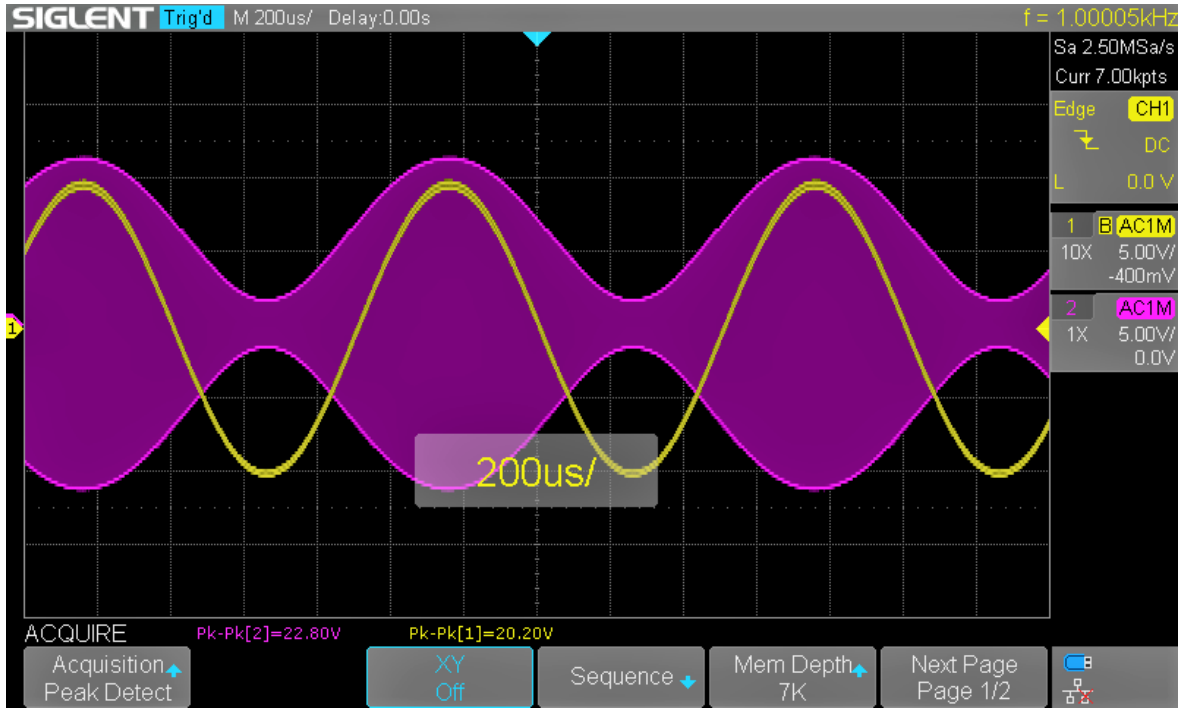
Modulation Transformer



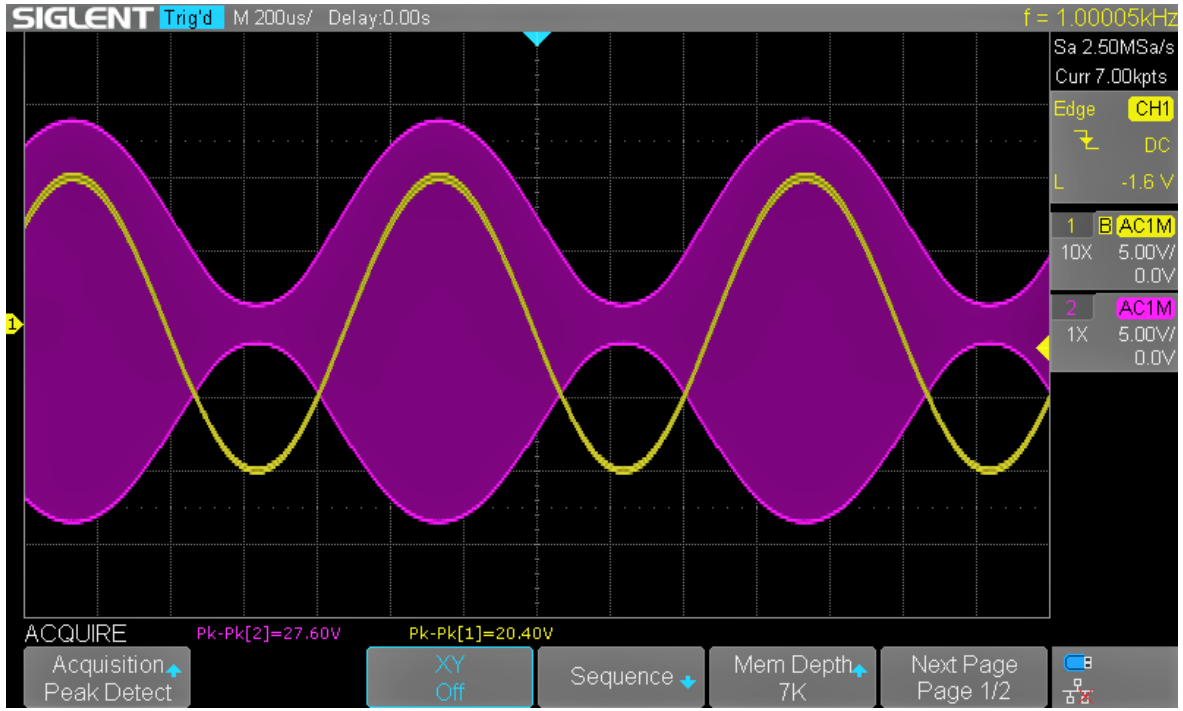


Waveform Photos - Envelope

Apollo

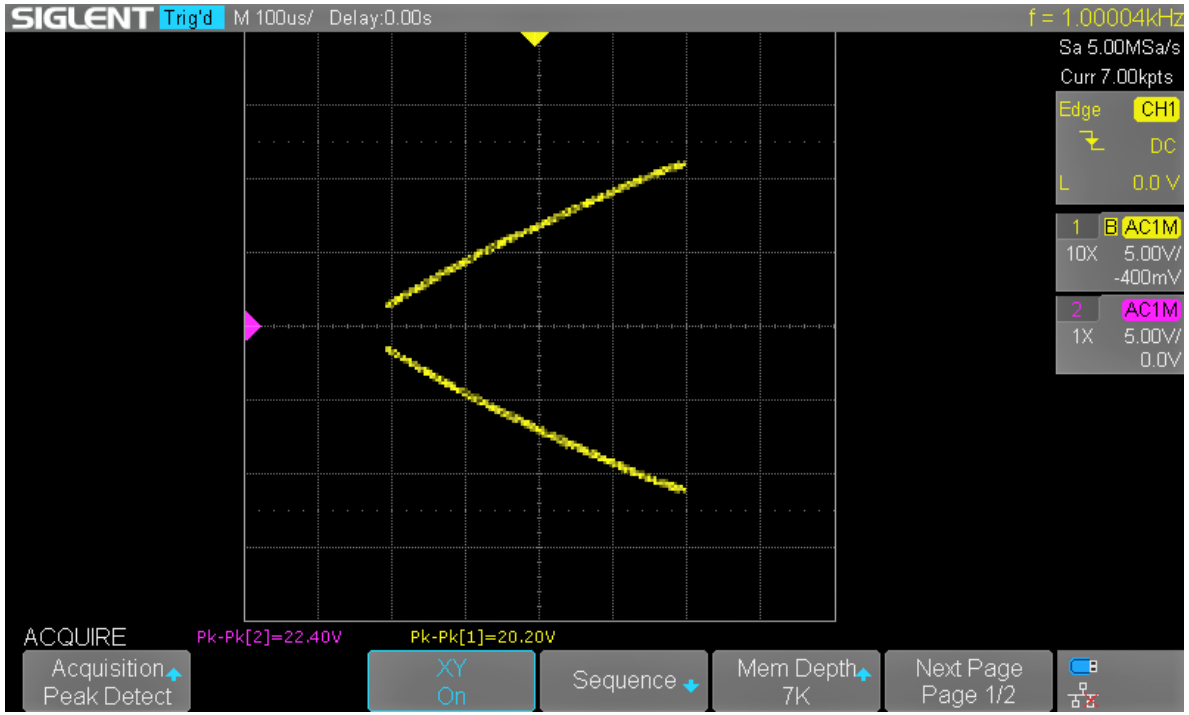


Recreation

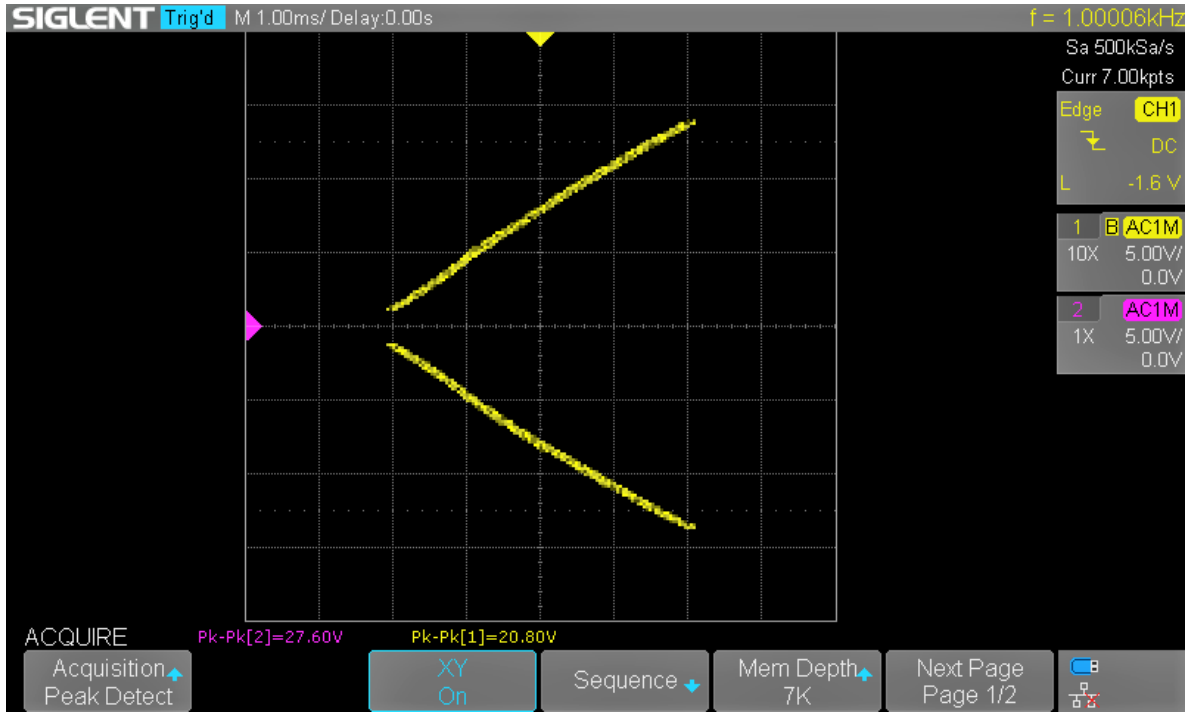


Waveform Photos - Trapezoid

Apollo



Recreation



Learning Opportunities

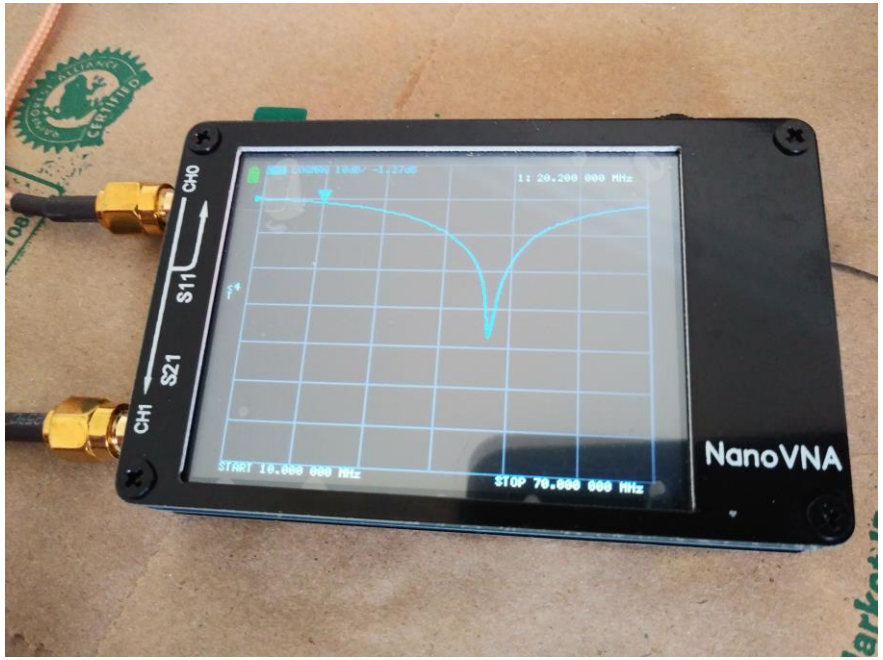
- RF/VHF
  - Smith charts
  - Transformer design
  - Vector Network Analyzer
  - GNU Radio – SDR development platform
    - Custom Python block for Apollo telemetry decoder
- Software Defined Radio (SDR)
- KiCAD schematic capture and PCB routing
- It's a golden age for experimenting/learning
  - Cheap/free software, hardware, tools, test equipment

A Golden Age for Experimenting/Learning

- Inexpensive hardware, tools, test equipment

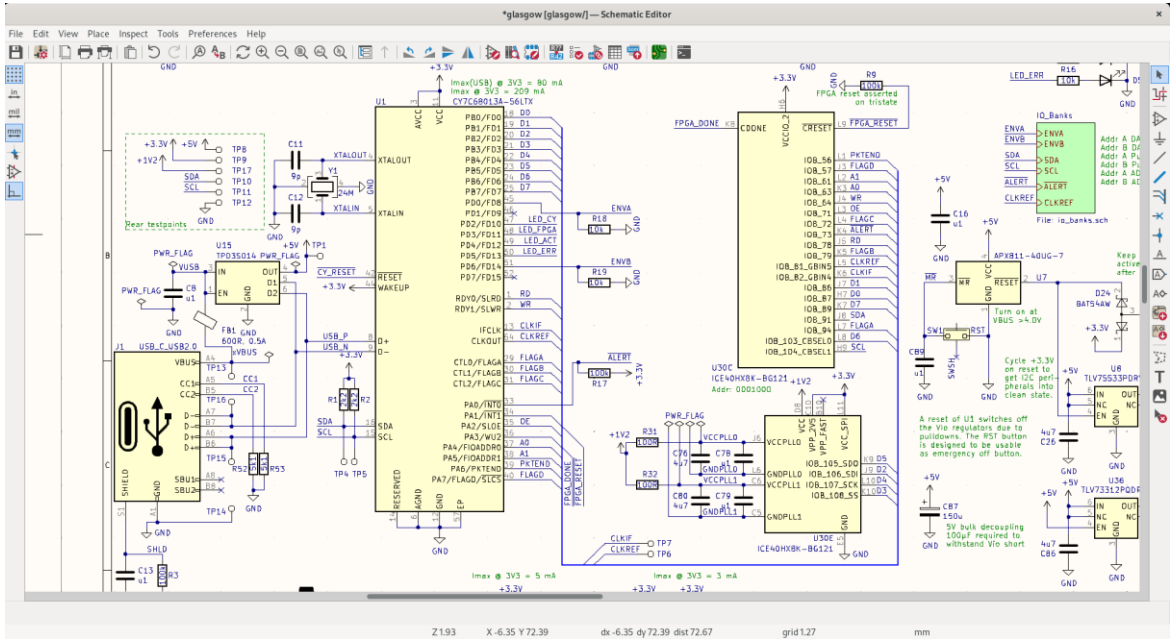
A year's salary in 1983

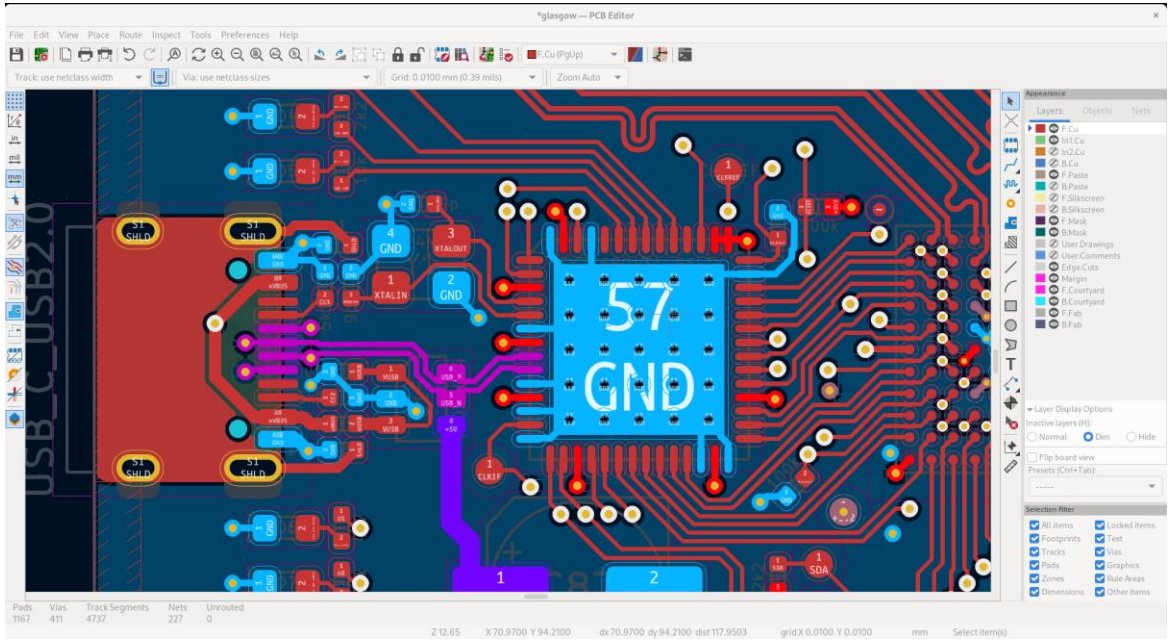
$50 on Amazon



A Golden Age for Experimenting/Learning

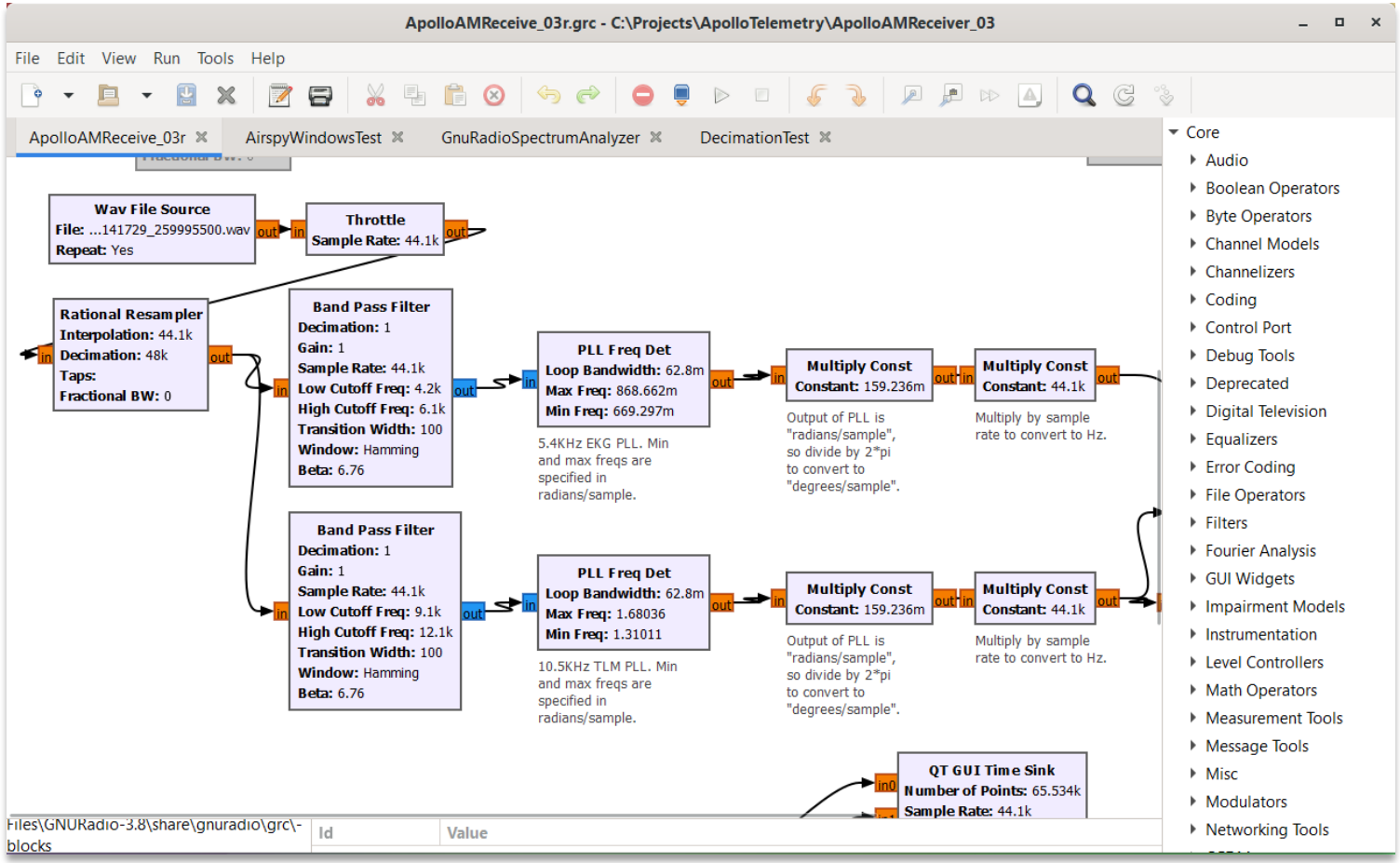
- Low cost/free software
- PCBs inexpensive





A Golden Age for Experimenting/Learning

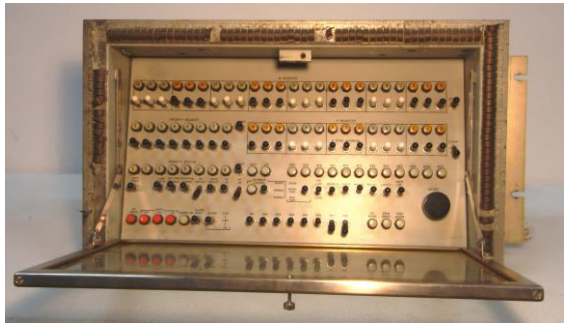
- SDR Dongles
- Graphical Interfaces



RCA Apollo Hardware

- LM Communications System
- VHF Communications, LM-CSM
- EVCS (backpack radios for lunar exploration)
- Erectable Antenna
- Rendezvous Radar/Transponder
- LM Landing Radar
- LM Descent Engine Control Assembly (DECA)
- LM Attitude Translation Control Assembly (ATCA)
- Saturn Countdown Computers
- Tracking Radar Support
- TV Scan Converters
- Lunar Roving Vehicle VHF Communications
- CSAR (Lunar Sounder)

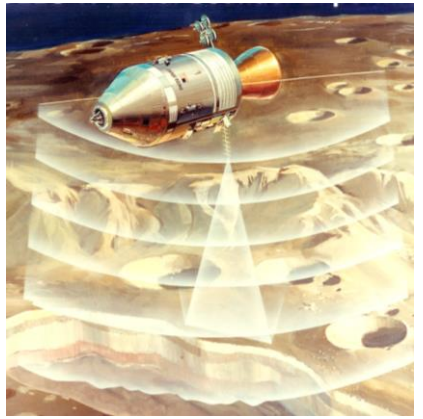
LCRU in lab



Saturn V launch computer

Broadcast TV scan converter

LCRU in use



CSAR/Lunar Sounder

Thanks!

- **Thanks:**
  - Dave Kumpf – RCA microfilm archive
  - Deb Brooks-Manall – RCA microfilm archive
  - Dave O'Rourke – historic Apollo hardware
  - Fred Barnum – RCA photo archive
  - Michelle La Brake – RCA photo archive
- **Honors:**
  - Jack Yanosov – EVCS VHF radios
  - Sam Pietrofitta – Command Module VHF radios
  - Conrad Haber – LCRU radios

References

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Demo Configuration