Infrastructure Improvements Update

Calvert RACES

Dec 2024

Project Overview

- May 2017 - Calvert County Emergency Management offered to fund a significant upgrade to the RACES infrastructure within the county.

- Plans include new antennas and feedlines installed on three County towers and two EOC's

- New radio equipment

- **All antennas & radios procured by and owned by the County**

Status as of Dec 2024
-The Chronology-

- May 2017 – Planning starts
  - meeting with County personnel and hired consultant
- June-Aug 2017 – Design effort on system architecture, tower & antenna locations
- Aug 2017 - Bill of Materials (BOM) given to County
  - funds not available
- Fund become available in summer 2020
  - Over $22,000 County funds committed (equipment plus antennas/install)
- June 2020 - BOM updated
- July-Aug 2020 – Antennas & feedlines installed (Motorola)
- Aug 2020 - County releases Request for Quote
- Sep 2020 - Bid won by Holzberg Communications, Inc. in New Jersey
- Oct 2020 – Equipment begins to arrive at County office
- Nov 2020 – Site visits to both EOC's and Barstow shelter for layout
- Nov 2021 – Courthouse EOC and Barstow Sites Operational
- Jun 2024 – Public Safety Bldg EOC Operational

The Team

- N3XMZ – Calvert RACES Officer
- N3AE – Calvert ARES EC
- K3UGA – Indispensable effort reviewing design and preparing Bill of Materials
- N3PPH, KC3RKP, W3PQS and others helping with installation
- Jack Anderson from Altairis Technology Partners
  - Consultant hired by County for their big EMCOMM upgrade
  - Also a licensed amateur radio operator

The <u>Initial</u> Plan

- Requirements as jointly developed with the County
  - Support EOC at Prince Frederick Courthouse and backup EOC at Calvert Public Safety Department (PSD) in Barstow
  - Two RACES operator seats at each EOC
  - One voice radio and one digital mode radio
  - Computer at each seat
    - County-provided and connected to their LAN
    - WebEOC
    - Winlink Express application installed
  - Antennas at each EOC high enough to cover tri-county area

Imposed Constraints

- Cannot install any antennas on the Courthouse that extend more than 5 ft from the roofline at the back of the Courthouse
  - Tests on Courthouse roof show marginal path to 147.105 Davidsonville (Central Regional Net)
    - Could raise 147.105 but well short of full quieting
    - Central Regional Net critical in region-wide call-up
- Need new antennas, feedline and radios at the alternate EOC in Barstow
  - Had no RACES radios or antennas at alternate EOC

38°32.31' N 76°35.03' W, FM18QM

Satellite

Overlays

Red Line is
Direction to ERN

Hallowing Park 🌲

Calvert County
Circuit Court
🏛

166° 24.5 miles

Duke St

Duke St

Altairis Proposed Approach

- Locate EOC antennas on the Barstow tower

- Use RemoteRig's from the EOC's to Barstow
  - RemoteRig connectivity using County's dedicated and redundant LAN from the EOC's to Barstow
  - LAN Independent of the internet
  - LAN interconnects EOC's and all tower sites
  - Microwave backed up by fiber optics
    - "0.99999 reliability"
      - have not seen how this was calculated.

RemoteRig

Calvert LAN

- Installed and supported by Motorola as part of the P25 Phase II county infrastructure update
- Motorola set up three Ethernet Pipes or Epipes for Calvert RACES
- An Epipe is a point-to-point Ethernet bridging service that forwards traffic from one site to another
  - essentially "looks" like a hardwired Ethernet cable between sites
  - isolated from all other LAN traffic
  - can use any IP addressing scheme
  - Ethernet switches at each site used to direct traffic
- Our Epipes
  - between Courthouse EOC and Barstow tower shelter
  - between Alternate EOC and Barstow tower shelter
  - between Mt Hope tower shelter and Lusby Tower shelter
    - For possible future VOIP link between CARA 2M and 70cm repeaters

The Catch 22 Concern

- The new county emergency communications system will be highly capable and robust
- Unlikely to depend on RACES except in the very worse case scenario
- But the worse case scenario may include loss of the LAN, which would mean loss of RACES link from EOC's to Barstow.
  - Calvert RACES EOC ops severely limited by low antenna height restrictions
- Another downside - remotely located RF decks make growth to sound card digital modes like VARA more difficult (but not impossible)

Solution to LAN Loss

- Include a separate radio at Barstow capable of acting as a cross-band repeater to reach Davidsonville and elsewhere
  - Solves voice backup but not packet
  - Select a radio that can change channels by touch tone commands
  - Need to automatically generate touch tones to avoid mistakes
    - Old style auto-dialer or software (no solution yet)

- Install two small dual-band antennas (Diamond X50A's) on the back Courthouse roof and PSD roof to reach the cross-band repeater as well as CARA repeaters & digipeaters

  - Note: Only radio front panels at EOC seats, so RemoteRig used to reach radio RF deck's in the EOC equipment room
    - These RemoteRig connections are made by dedicated CAT6 cable. No LAN.
   - Same configuration at primary and alternate EOC's

Radios

- Need dual band radios capable of working with RemoteRig
- Need a radio capable of operating as a cross-band repeater that can also be remotely controlled (i.e. radio remote control of cross-band enable and disable as well as frequency changes).
- Radios tested:
  - Kenwood TM-V71A
  - Kenwood TM-D710G
- Down-selected to TM-V71A
  - note: Remote control of the TM-V71A unavailable starting with serial number B8610081 (chip obsolescence)
  - RACES has ONE TM-V71A with an earlier S/N to use as the backup crossband repeater

Final System Architecture

- System diagram on the next slide

- Kenwood TM-V71A radios

- For the diagram on the next slide:
  - Physical locations shown left to right
  - Equipment at each location shown top to bottom
  - Legend for diagram on slide after the diagram

- All equipment now operational
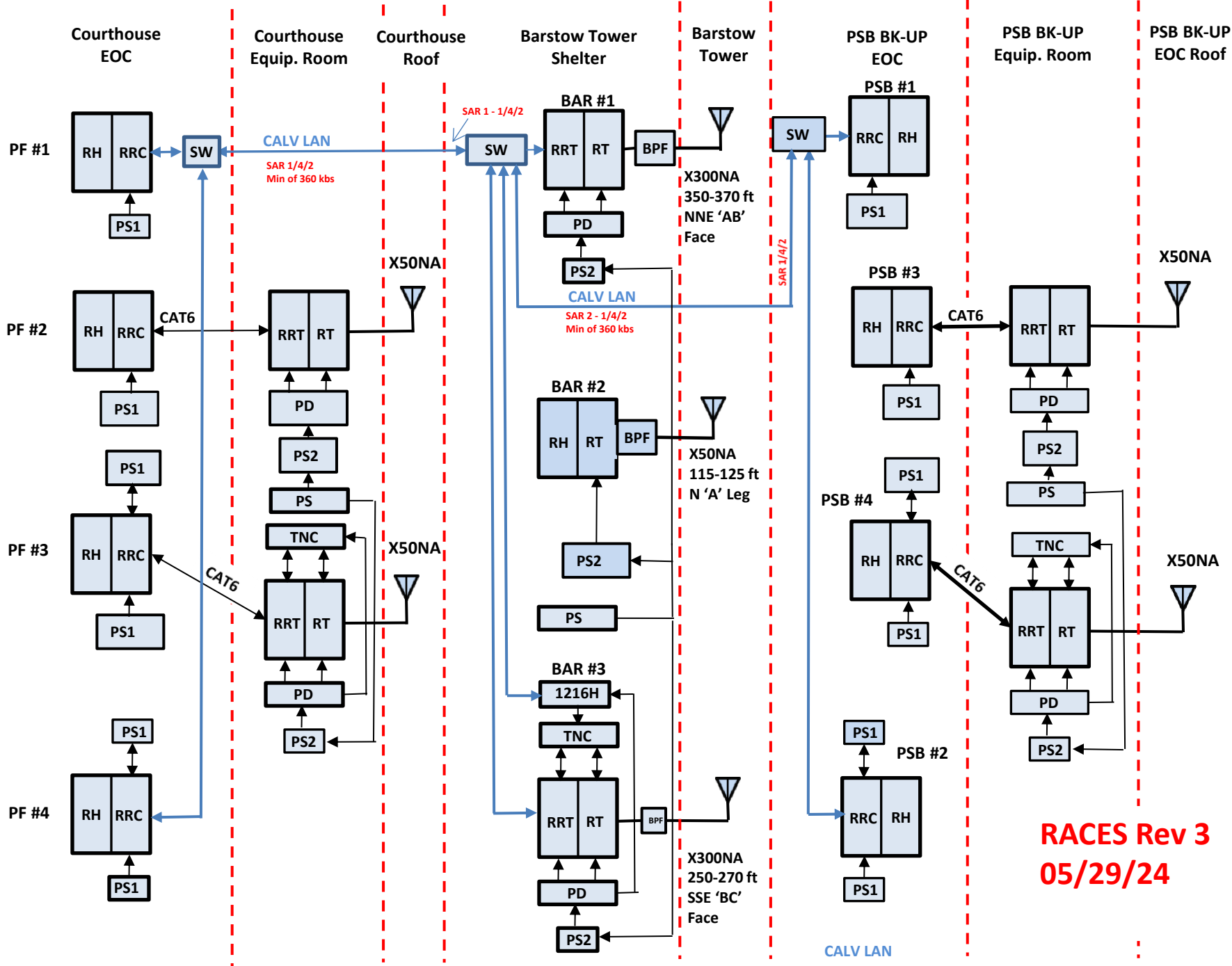
RACES Rev 3
05/29/24

Drawing Legends

- RH   Radio front panel (radio head) for RT
- RT   Radio RF deck TM-V71A
- RRC   RemoteRig radio control panel interface, p/n 1258MkIIs-Con
- RRT   RemoteRig radio RF deck interface, p/n 1258MkII-Rad
- PS1   RRC power supply "wall wart," p/n 1258-PS-US
- PS2   13.8 vdc power supply for radio, RRT and TNC. Samlex SEC-1235M
- PD   Fused power distribution panel – RigRunner 4005
- SW   Ethernet Switch – Netgear GS105Ev2
- TNC   Terminal Node Controller – Kantronics KPC-3+
- PS   Surge Protected Rack Mounted Power Strip - TrippLite
- 1216H   RemoteRig model 1216H web controlled power relay unit
- BPF   DCI 144/440MHz bandpass filter

Not specifically identified on the drawing are:
  – DB-9 RS-232 cable and USB converter between RRC's and PC's
  – DB-9 null modem cable between RRT and TNC
  – DC power distribution cables with mating connectors for PD's, RRT's, TNC's
  – Audio cables between TNC's and RT's (microphone and speaker outputs)
  – Microphones , speakers and headsets at EOC positions
  – Any customized audio distribution equipment at EOC positions to select radio-to-headphone connections

Antenna Summary

(County paid for, and owns, antennas, feedline & Polyphasers listed below)

Location	Stn # on Dwg	Ant #	Antenna Type	Freq. (MHz)	Height AGL	Orientation	Primary Function	Secondary Function
Calvert RACES Tower Loadings and Antennas								
Mt Hope	-	26	Telewave ANT150F6-2	144 - 148	280' -300'	SE 'BC' Face	146.985 MHz Voice Repeater	
Tower Top 355' AGL	-	7	Diamond X300NA	144/440	330' - 350'	SE 'BC' Face	VHF/UHF Packet Digipeater	APRS
	-	15	Diamond X50NA	144/440	140' -150'	S 'C' Leg	420.050 MHz link to SHA Tower in Prince Frederick	Repeater Control
Barstow	3	21	Diamond X300NA	144/440	250' - 270'	SSE 'BC' Face	EOC VHF/UHF Packet	Calvert simplex voice
Tower Top 403' AGL	1	12	Diamond X300NA	144/440	350' - 370'	NNE 'AB' Face	EOC to Davidsonville CRN	Calvert simplex voice
	2	107	Diamond X50NA	144/440	115' - 125'	N 'A' Leg	Backup Cross-Band from EOC to Davidsonville CRN	Calvert simplex voice
Lusby	-	64	Diamond X300NA	144/440	205' – 215'	SSE 'BC' Face	Future Remote Receive for 146.985	TBD
Tower Top 449' AGL	-	15	Diamond X300NA	144/440	235' – 245'	NNE 'AB' Face	Link from Remote RX to Mt Hope	Future packet digipeater
Courthouse EOC	2	-	Diamond X50NA	144/440	~ 25'	West Roof	Access to 146.985 & 444.950 Repeaters	Backup voice to Davidsonville CRN using Cross-Band Repeater at Barstow (Barstow Station #2)
	3	-	Diamond X50NA	144/440	~ 25'	West Roof	Packet, direct or via CARA digipeaters	Backup voice to Davidsonville CRN using Cross-Band Repeater at Barstow (Barstow Station #2)
PSB Bk-Up EOC	3	-	Diamond X50NA	144/440	~ 25'	Alt EOC Roof	Access to 146.985 & 444.950 Repeaters	Backup voice to Davidsonville CRN using Cross-Band Repeater at Barstow (Barstow Station #2)
	4	-	Diamond X50NA	144/440	~ 25'	Alt EOC Roof	Packet, direct or via CARA digipeaters	Backup voice to Davidsonville CRN using Cross-Band Repeater at Barstow (Barstow Station #2)

Note: Antenna # refers to the antenna number on the official Motorola tower loadout spreadsheets

Courthouse EOC Station Function Descriptions

- Station PF #1
  - Connects to BAR #1 (Antenna on Barstow Tower at 350')
  - <u>Primary</u>: Voice to CRN & Outside County
  - <u>Secondary</u>: Simplex voice within Calvert
- Station PF #2 (Antenna on Courthouse Roof)
  - <u>Primary</u>: Access to Calvert voice repeaters
  - <u>Secondary</u>: UHF simplex link to the Barstow VHF/UHF crossband repeater in the event of RemoteRig equipment failure or County LAN link failure

Courthouse EOC Station Functions, continued

- Station PF #3 (Antenna on EOC Roof)
  - Primary: Packet/Winlink digital messaging within Calvert County either by simplex or using digipeaters
  - Secondary: Backup UHF simplex link to the Barstow crossband repeater in the event of RemoteRig equipment failure or County LAN link failure.

Station Functions, continued

- Station PF #4
  - Connects to BAR #3 (Antenna on Barstow Tower at 250')
  - <u>Primary</u>: Provide direct VHF/UHF packet/Winlink peer-to-peer messaging communications to adjacent counties and jurisdictions
  - <u>Secondary</u>: Calvert voice simplex

PSB EOC Station Functions

- The EOC at the Public Safety Building in Barstow is basically a repeat of the Courthouse EOC but the station number sequence on the diagram is different (to match station numbering in Altairis meeting minutes of May 27, 2017)

Status & Open Issues
(as of Dec 2024)

- All antennas, feedlines and Polyphasers have been installed at both EOC's, Barstow, Lusby and Mt Hope

- Courthouse EOC and Barstow radios controlled by the Courthouse EOC are fully operational (voice and packet/Winlink)

- Crossband TM-V71A installed at Barstow

- PSB EOC and Barstow radios controlled by the PSB EOC are fully operational (voice and packet/Winlink)

- Need to acquire spare equipment
  - RemoteRigs and TM-V71A (but V71A discontinued)
  - Have two spare V71 RF decks but no more front panels
  - No spare RemoteRigs

Status of Other Calvert RACES Infrastructure

Mt Hope Status

- 146.985 repeater is located at the new Mt Hope tower
  - County paid for antenna, hardline and installation
- DMR repeater on new Mt Hope tower using UHF portion on one of the Diamond X300NA's
  - 2M radiator not currently in use
- Lower Diamond X300NA currently not in use
  - future UHF link to Lusby to link 2M and 70cm repeaters

Prince Frederick Status State Highway Tower

- Decibel DB-224 2M dipole array and Decibel DB-416 70cm dipole array and/or feedline highly suspect

- K3CAL-1 digipeater on 145.070 currently operational at PF using abandoned DNR VHF antenna

  – Good commercial grade VHF antenna & hardline

CalvertHealth Hospital

- W3PQS 6M repeater transmitter installed
  - 6M antenna, link antennas, repeater and voter property of W3PQS
  - 52.170MHz input; 53.170MHz output, PL 100
  - RX sites at N3AE, N3PPH & W3PQS with voter at TX site
- CARA-owned Diamond X300NA installed with 2M section available (VARA Gateway Planned)
- Investigating stability of WiFi internet access at roof equipment room

Lusby/Appeal Site

- Two Diamond X300's and hardline installed on tower
  - County paid for and owns
  - 205 ft facing SSE
  - 235 ft facing NNE
  - Both antennas & jumpers recently
  - CARA 444.950MHz repeater installed & operational using the higher antenna
  - CARA owns the repeater/controller/duplexer
- Also have a VOIP capable LAN channel from Lusby tower shelter to Mt Hope tower shelter
  - UHF radio link as primary or backup using lower antenna
- Required VOIP equipment NOT in the County purchase
  - Would be a CARA responsibility

Looking for a Couple of Good Used Kenwood TM-V71A Transceivers