



Rocky Mountain Ham Radio – New Mexico Overview

September 21, 2024

Brian Milesosky N5ZGT – President, RMHAM-NM
Ed James KA8JMW – Technical Director, RMHAM-NM

Who We Are



- Rocky Mountain Ham Radio (RMHAM) was established in Colorado (1993) and expanded expanded into New Mexico (2014)
- We are a 501(c)(3) tax exempt public charity, an ARRL-affiliated club, have ~115 members, and value partnerships with other amateur radio clubs
- Our membership is composed of people across New Mexico, Colorado, and other states who bring a broad range skills, expertise and backgrounds:
 - Business
 - Scientific
 - Engineering
 - Technical program management
 - Information technology
 - Education
 - Trades

Who We Are



- RMHAM has two primary focus areas:
 - **Develop capabilities** that enable and benefit the broader amateur radio community
 - Facilitate **technical education** across the broader amateur radio community

Our Focus on Capability Development



- RMHAM provides microwave IP and/or network connectivity to partnering clubs and repeater organizations across New Mexico and Colorado for the purpose of enabling or expanding their capabilities (*more about this shortly...*)
- We own and operate DMR, D-STAR, and AllStar repeaters and APRS i-Gates for use by any amateur radio operator
- We provide communication support at public service events (operational assistance or use of equipment/assets)

Our Focus on Technical Education



- RMHAM organizes two annual conference-style events intended to teach amateur radio operators about a variety of technical topics:
 - The New Mexico TechFest (each February in New Mexico)
 - NerdFest (each January in Colorado)
- We provide multiple short courses on technical topics for the amateur radio community in the winter and spring months (RMHAM University)
- We offer and conduct forum presentations on technical topics at Hamfests
- All events are open to any existing or aspiring amateur radio operator

RMHAM in Action



RMHAM-sponsored network IP and routing class



Microwave link installation with Taos ARC partners

RMHAM in Action



Annual RMHAM-sponsored New Mexico TechFest

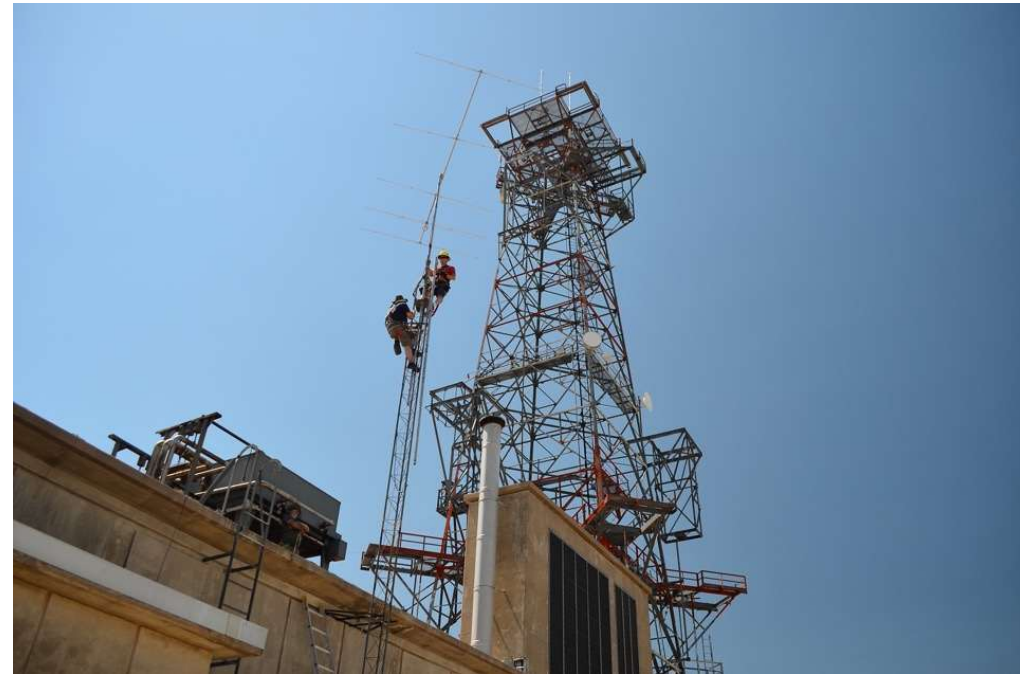


ARRL Field Day near Datil, NM

RMHAM in Action



RMHAM donation of repeater to student members of TARA

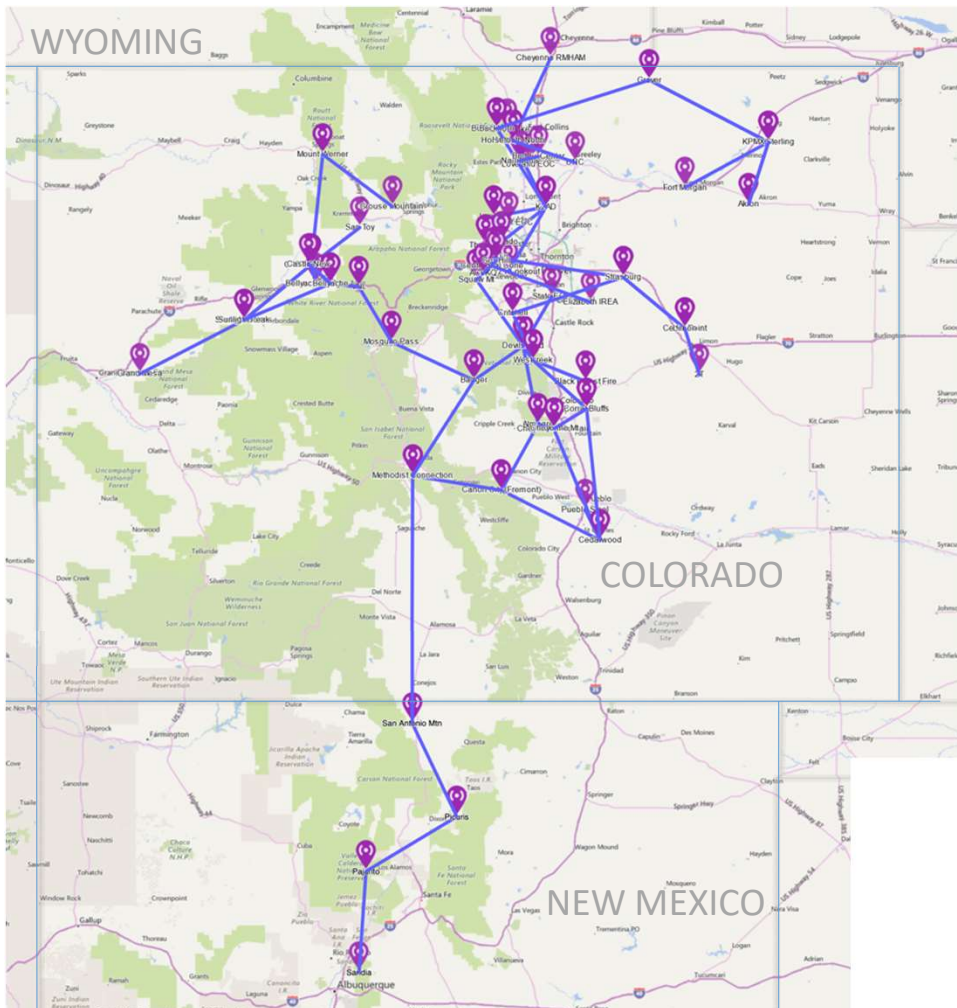


June VHF Contest in southern Colorado



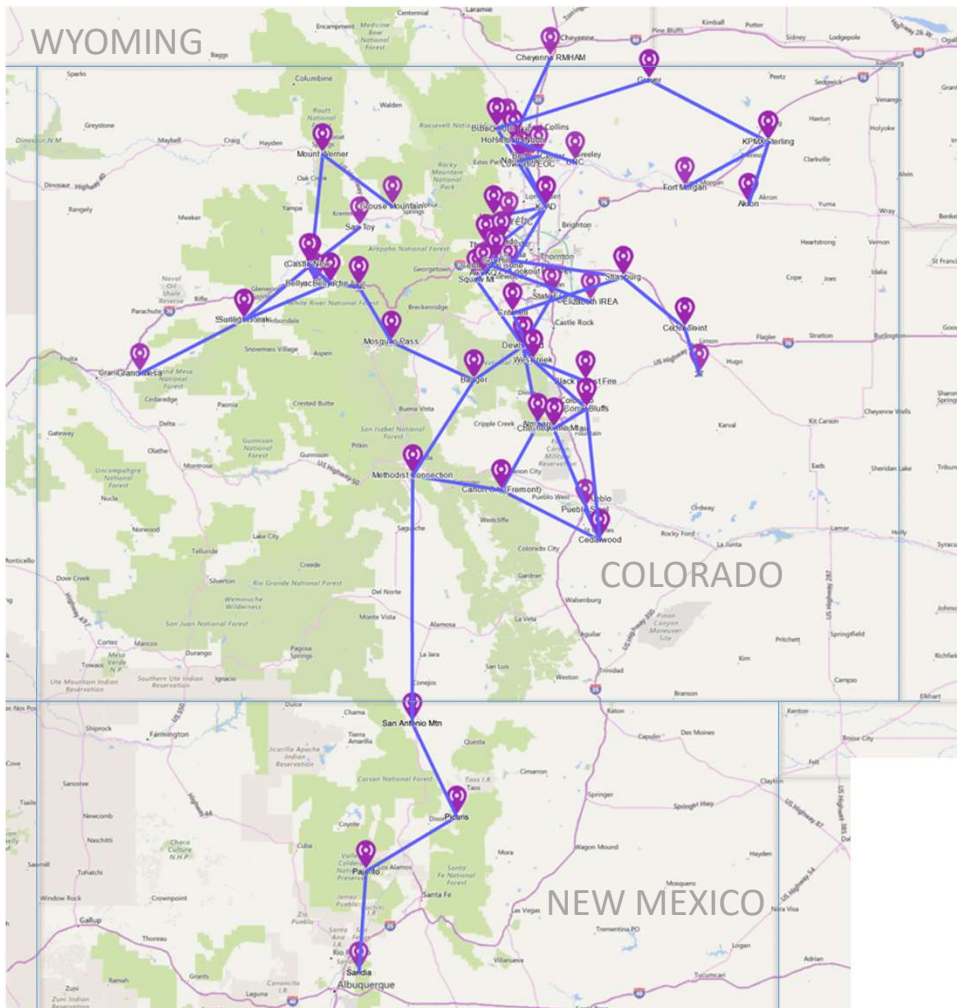
RMHAM Microwave Network Overview

RMHAM's Microwave Network



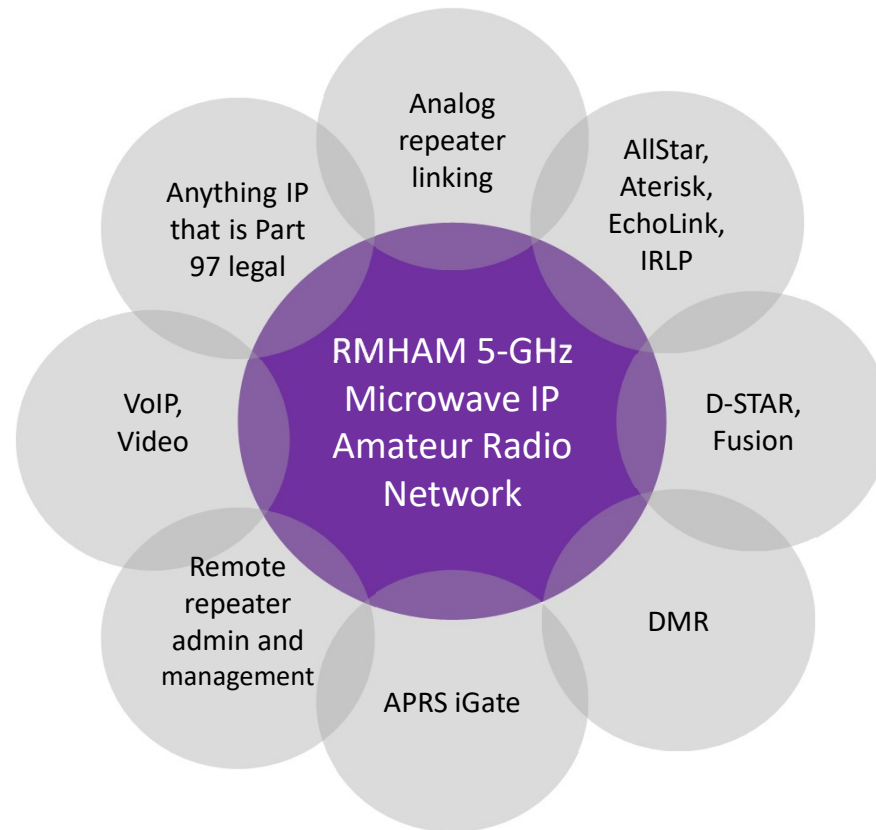
- RMHAM has built and operates a fully-managed IP-based microwave backbone network spanning Cheyenne, Wyoming down to Albuquerque, New Mexico and across Colorado's western slope
- It was purposefully created to be an infrastructure that enables partnering clubs and repeater organizations to expand their capabilities (repeater linking, repeater troubleshooting and administration, any IP-based application that is Part 97 compliant, etc.)
- It is built from reliable COTS 5-GHz networking and microwave equipment configured to operate on Part 97 amateur radio spectrum
- It does not rely on the internet...however it does have several internet taps for automatic fail-over if an RF link goes down

RMHAM's Microwave Network



- It is secure, firewalled, and accessible only by physical (wire/fiber) or microwave connection through RADIUS authorization and authentication
- It is managed and monitored 24x7x365 by a dedicated network operations team and a suite of tools/protocols
 - DevDB, Observium, RADIUS, Smokeping, OSPF, and automated email/Telegram alerts
- Throughput averages 100-Mbit/sec across the network
- RMHAM's network consists of (as of June 5):
 - 108 point-to-point and point-to-multipoint microwave links across New Mexico and Colorado
 - 822 devices (routers, repeaters, RTCMs, power controllers, PTZ cameras, VoIP phones, etc.)

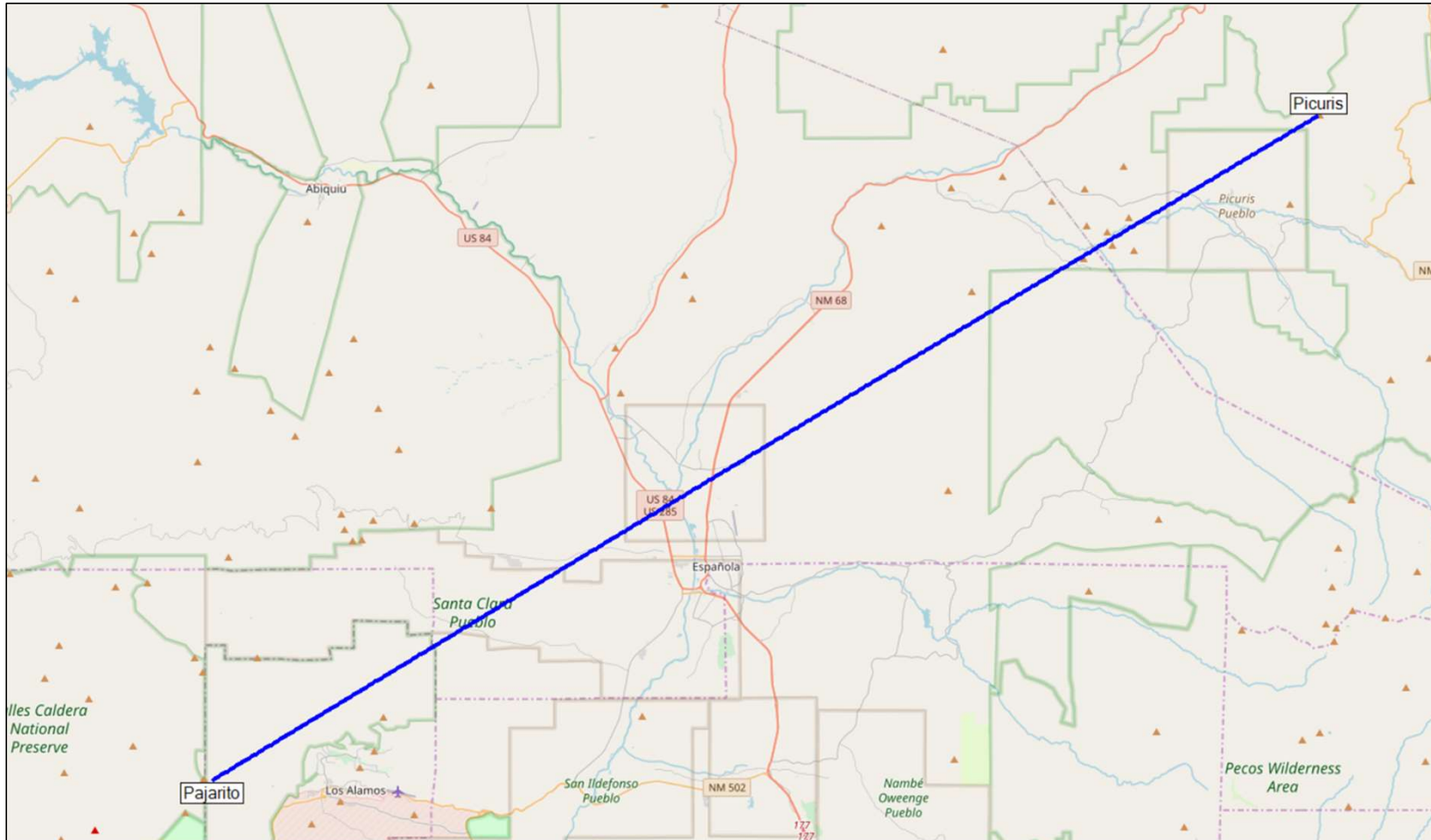
RMHAM Microwave Network – Application Space



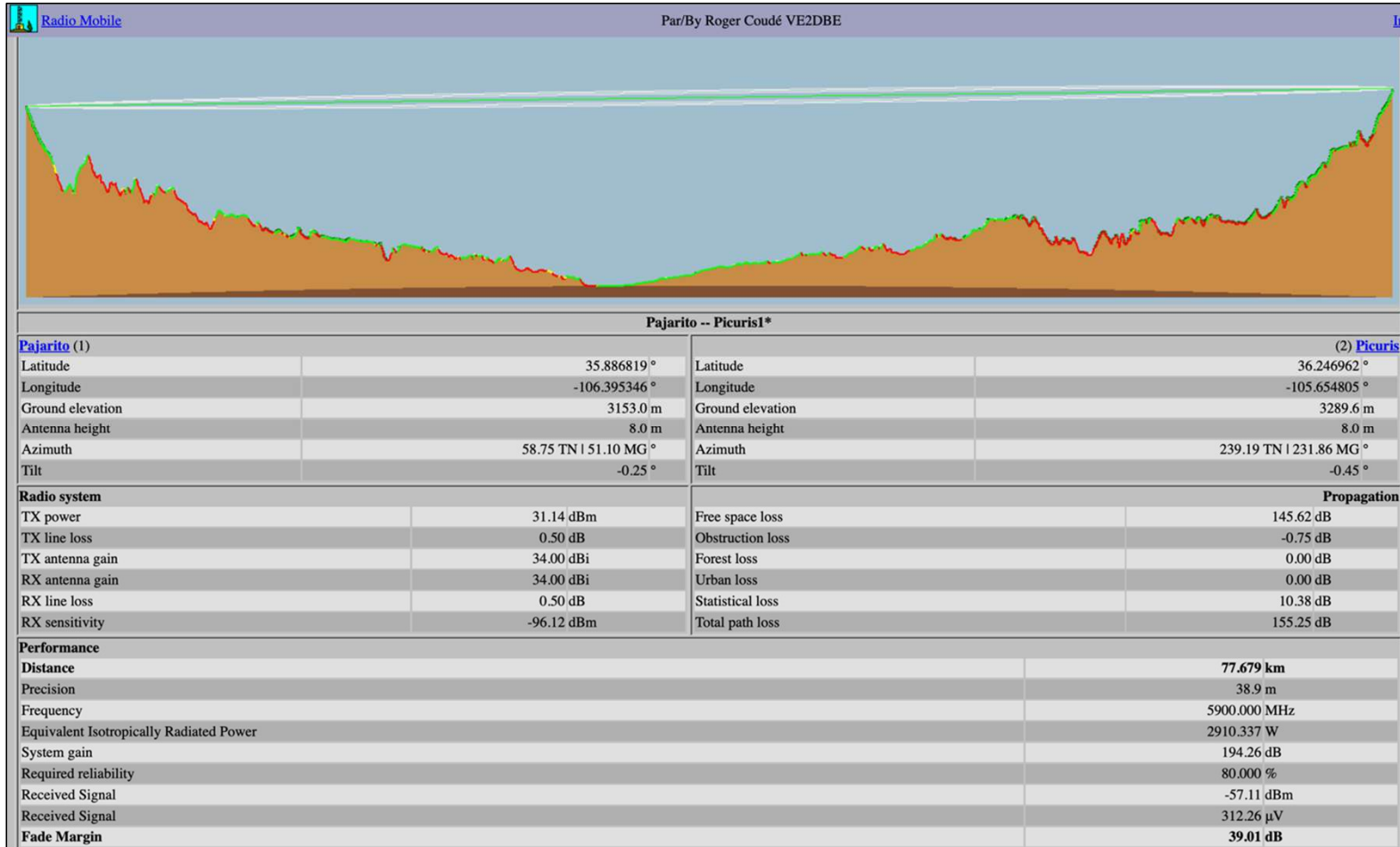


A Closer Look

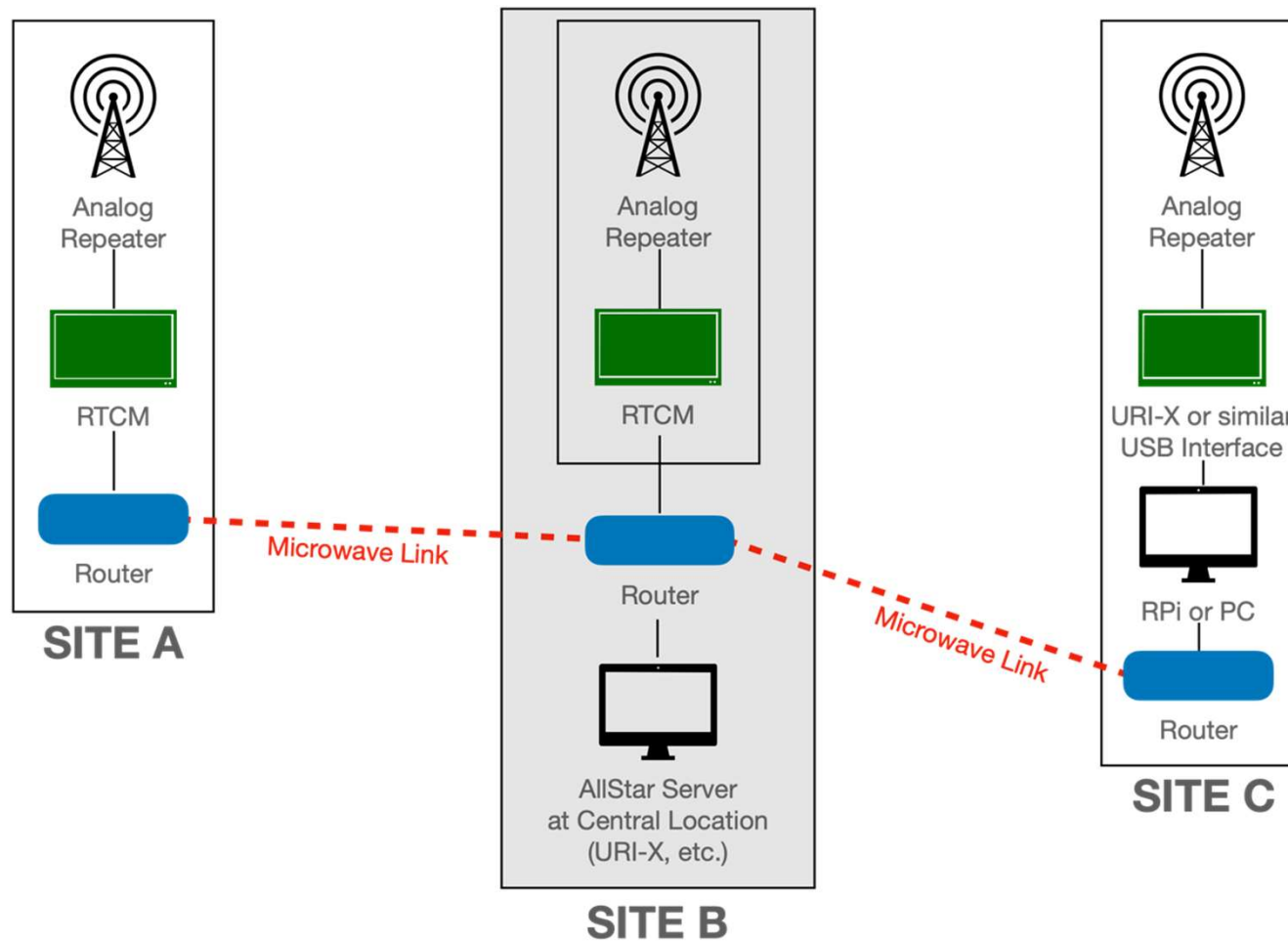
It Begins with Link Modeling...



It Begins with Link Modeling...



Interfacing Analog Repeater



Observium



OBSERVIVIUM
network management and monitoring

🌐 Devices ▾
 🖨️ Ports ▾
 📊 Health ▾
 📦 Apps ▾

+
-

	Total	Up	Alert	Ignored (Dev)	Disabled / Shu
Devices	278	272 up	1 down	5 ignored	1 disabled
Ports	2254	1413 up	724 down	113 (12) ignored	117 shutdown
Sensors	863	840 ok	0 alerts	23 ignored	0 disabled
Statuses	290	158 ok	2 warnings	130 ignored	0 disabled

Eventlog

3m 47s	radio-namaqua	🖨️ radio-namaqua Device status cha
3m 52s	router	🖨️ Ether10-K2AD Interface Up: [ifOp
8m 58s	router.nv0n	📊 Processor Frequency Processor a
23m 24s	router.nv0n	📊 Processor Frequency Processor a
39m 33s	router	🖨️ router.weldeoc Device status cha
45m 57s	router	🖨️ router.akron Device status chang
46m 8s	power	🖨️ power.picuris Device rebooted: a
47m 18s	router	🖨️ router.weldeoc Device status cha
49m 57s	router	🖨️ router.akron Device status chang
1h 3m 34s	radio-unc	🖨️ radio-unc Device status changed
1h 3m 43s	router.nv0n	📊 Processor Frequency Processor a
1h 8m 27s	radio-unc	🖨️ radio-unc Device status changed
1h 14m 7s	router.nv0n	📊 Processor Frequency Processor a
1h 19m 12s	radio-unc	🖨️ radio-unc Device status changed

	Ok	Fail	Delay	Suppress	Other
Alerts	8305	1	1	4	5

Groups

🖨️ Device ▾
🖨️ Port ▾
📊 Processor

🖨️ Memory
📊 Sensor

Alert Status

Device	Entity	Alert

Observium 23.3.12599 (rolling)

Observium



- Devices
- Ports
- Health
- Apps

Search

Hostname	Sandia Crest NM [35.2088	Select OS	Select Hardware	Select Vendor	Select Groups
sysName	Location	Select OS Version	Select Featureset	Select Device Type	Hostname
sysDescr	Description / Purpose	sysContact	Select Distro	Serial Number	<input type="checkbox"/> Search

Devices Basic Details **Status** Graphs Disable Pagination Hide Search Hide Header Reset

Device/Location		Device Uptime	Memory Usage	Processors	Traffic
aux.sandia.nm Sandia Crest NM [35.208889,-106.446944]					
dstar.sandia.nm Sandia Crest NM [35.208889,-106.446944]					
radio-kf5chh.sandia.nm Sandia Crest NM [35.208889,-106.446944]					
router.sandia.nm Sandia Crest NM [35.208889,-106.446944]					



How We Partner With Clubs

How Does RMHAM's Microwave Network Help Clubs?



- It facilitates point-to-point repeater linking
 - Analog links generally only support the audio of a single repeater
 - A single microwave link can support the linking of numerous repeaters
- It turns standalone analog repeaters into systems that can link to multiple repeaters across New Mexico, the United States, or worldwide (AllStar, Echolink, IRLP)
- It provides IP connectivity and linking for digital repeaters (DMR, D-STAR, Fusion) as well as APRS I-Gates
- It enables remote repeater troubleshooting and management (remote power-cycling, remote configuration, link performance, statistics, etc.)
- It enables Part 97-legal IP-based applications (VoIP, web cameras at repeater sites, SIP telephones, etc.)

Clubs Currently Leveraging RMHAM's Network



▪ **New Mexico:**

- Los Alamos Amateur Radio Club – DMR repeater linking
- Mesilla Valley Radio Club –D-STAR repeater linking
- Pecos Valley Radio Club –D-STAR repeater linking
- Sandoval County ARES – Technical advisement for repeater linking
- Santa Fe ARES – Microwave connectivity between ARES sites, D-STAR/Fusion repeater linking
- Socorro Amateur Radio Association – D-STAR repeater linking
- Taos Amateur Radio Club –DMR, D-STAR repeater linking
- Valencia County Amateur Radio Association – Analog repeater linking

Clubs Currently Leveraging RMHAM's Network



■ Colorado:

- Colorado Connection – Linking of 12+ repeaters across state
- Aurora Repeater Association – Repeater linking
- Colorado Repeater Association – Repeater linking
- Cheyenne Mountain Radio Group – Repeater linking
- Estes Valley Amateur Radio Club – Repeater linking
- Longmont Amateur Radio Club – Repeater linking
- Northern Colorado Amateur Radio Club – Repeater linking
- Ski Country Amateur Radio Club – Repeater linking
- WWV Amateur Radio Club – Repeater linking

■ Wyoming:

- Wyoming DMR – DMR Repeater linking

How We Partner to Make it Happen



- RMHAM provides all necessary hardware to tie the club's RF site into the RMHAM microwave network
 - *Microwave radios, dishes, tower mounting hardware, router, lightning protection, remote power management unit, ethernet cables, equipment rack if needed, etc. (RMHAM purchased and owned)*

- The partnering club/repeater organization furnishes any hardware that may be necessary to interface its repeater(s) or other Part 97 appropriate devices to the network
 - *Radio thin client module (RTCM) to interface analog repeater(s), video, etc. (Club purchased and owned)*
 - *RMHAM would provide assistance through technical advisement, network configuration, installation (if available), and network performance monitoring*



RMHAM is Expanding its Microwave Network

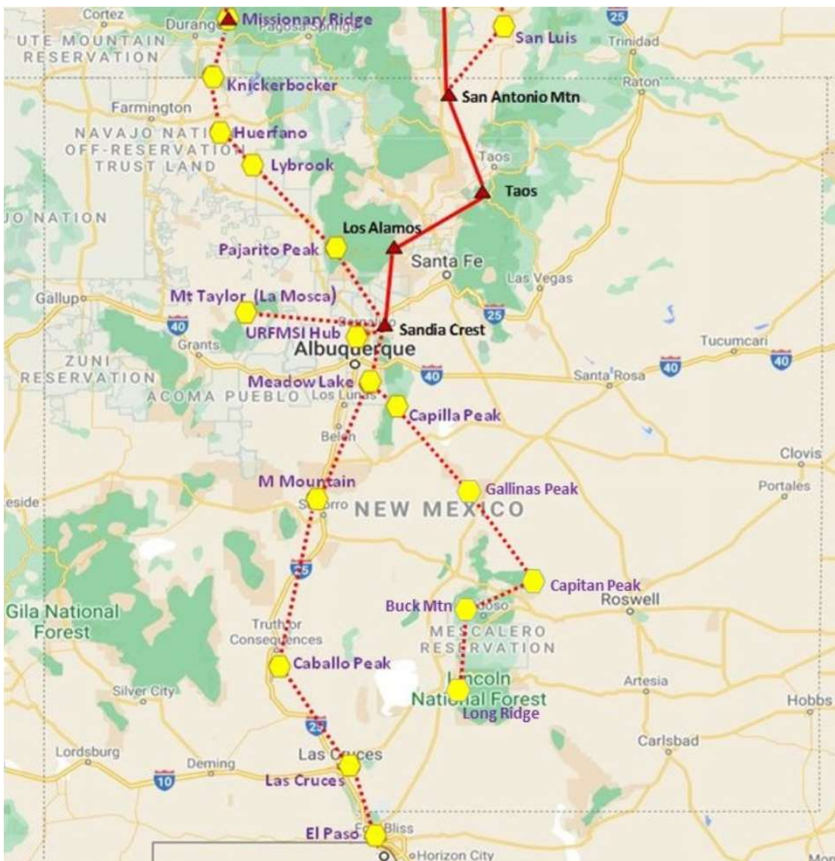
RMHAM is Expanding its Microwave Network



- RMHAM was awarded a \$375k financial grant from Amateur Radio Digital Communications (ARDC) to expand its microwave network across New Mexico and Colorado
- In New Mexico we plan to expand the network
 - ...from Sandia Crest south to El Paso along the I-25 corridor
(Sites of interest: Valencia County, Capilla Peak, M-Mountain, Caballo, Twin Peaks, Mount Franklin-El Paso)
 - ...from Sandia Crest north to Durango along Highway 550
(Sites of interest: Pajarito Peak, Lybrook Hill, Huerfano Mountain, Harris Mesa, Durango)
 - ...from Sandia Crest west to Mount Taylor



Project Scope – New Mexico



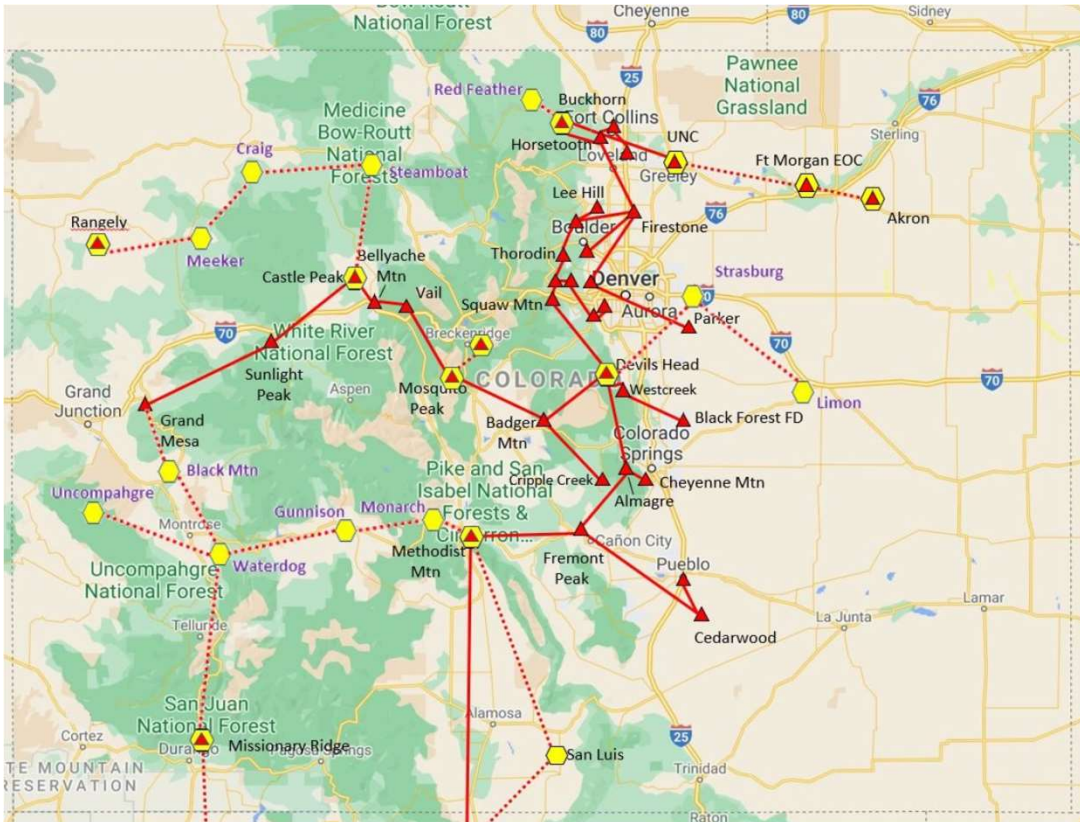
- Red solid line – Currently operational microwave link
- Red dotted line – Proposed/new microwave link
- Red Triangle – Currently operational microwave site
- Yellow Hexagon – Proposed/new microwave site

Project Scope – Colorado



- Add 23 new microwave sites
 - Denver to Burlington and northeast along I-76
 - Fill coverage gaps in southwest Colorado
- Expand DMR coverage along new microwave sites
- Upgrade state of the art DC-daylight comms trailer to support fun activities (contests, hamfests, recruiting event) as well as serious ones (public service and emergency comms)
- Project duration: 2-3 years

Project Scope – Colorado



- Red solid line – Currently operational microwave link
- Red dotted line – Proposed/new microwave link
- Red Triangle – Currently operational microwave site
- Yellow Hexagon – Proposed/new microwave site

Does Your Club Operate Where we are Expanding?



- We would like to visit with you about your club's/repeater organization's current capabilities and how microwave/IP connectivity could help it to grow/expand for the benefit of your members and users

For More Information



- Contacts:
 - **Brian Milesosky N5ZGT** – President, RMHAM-NM (bpmiles@gmail.com)
 - **Ed James KA8JMW** – Technical Director, RMHAM-NM (ka8jmw@gmail.com)
- Website: www.RMHAM.org

