Satellite Portable Backpack Expedition – Lost Coast

Activating the rare grid square CM79 for the satellite ham radio community

Dave Palmer – KB5WIA
Dave KB5WIA

- Been a ham since 1992
- Work in Biotechnology
- Live in Fairfield, CA
- Antenna Restrictions
- HF Mobile, QRP VHF+
- Contesting, Hilltopping
- Satellites are main mode of activity now
KB5WIA Home Satellite Station

- Full-Duplex FM/SSB/CW
- Radios:
  - 2 x Yaesu FT-817ND (5W)
- Antennas:
  - 15 el UHF Yagi
  - 7 el VHF Yagi
  - G5500 Az/El Rotator
- Computer:
  - Desktop Windows 7
- Power:
  - Astron SS-30M
KB5WIA Portable Satellite Station

- Full-Duplex FM/SSB/CW
- Radios:
  - 2 x Yaesu FT-817ND
- Antenna:
  - Elk Dual-Band Log-Periodic + Duplexer
- Computer:
  - Netbook Windows 7
- Power:
  - K2 Energy LiFePO4 battery
  - PowerFilm Solar Panels
Inspiration: KB8U CM79 Trip

- QST Article
- 2010: Russ KB8U backpacks into rare grid square CM79
- Russ activated the grid corner on 6-meter band
- Enabled completion of FFMA award #2
Rare Grid Square CM79

- 488 Grids in continental USA
- CM79 is one of the rarest grids
- Not too far from CM88!
- Maybe I could activate CM79 for the satellite community???
Rare Grid Square: CM79

- CM79 is on the California “Lost Coast”
- Less than 1 sq mile
- Almost all water
- No roads, houses, power, not even trails
- Slopes steeply towards Pacific Ocean
Grid CM79: Topography

Wailaki Campground: 2.5 miles away on other side of mountain

Chemise Mountain
Grid CM79: Topography

- Grid CM79 is on west side of Chemise Mountain ridge.
- CM79’s northeast corner is 70 feet downhill from ridge.
- Ridge runs north-south.
- The ridge blocks radio signals to the east!
Operating from CM79: Multi-Grids

- Opportunity: can work four grids at once!
  - VUCC Rules state area occupied by station must be on intersection

- Challenge: how to steer antennas, operate radios, get signal over the ridgeline, and still occupy four grids (or at least CM79??)

ARRL VUCC Rules:
"... the total area occupied by the station's physical setup, including operating position(s), power source(s), and antenna(s), must occupy some portion of each of the two/four grid squares simultaneously."
Operating from CM79: Precedent

- Russ accomplished this feat on the 6m band in 2010
- Used remote head for radio, remote antenna; operator on ridge
- Radio and battery on the intersection of the four grids
Operating from CM79: KB5WIA Plans

- Problem: Satellites are moving targets!
- Have to steer antennas and operate radios, and still comply with Rules
- My Plan: radios, antenna, and operator on ridge; battery at intersection
- Published plans on my blog
Trial Run – Death Valley DM17

- Tested portable satellite station with solar power
- 3 days backroading / camping
- 14 satellite passes successfully worked
  - AO-51, FO-29, SO-50, VO-51, AO-07
- 40 Satellite QSO's
- Solar power worked well!!
Trial Run – June VHF Contest

- ARRL VHF Contest
- Mt Diablo: CM97
- 6m, 2m, 70cm QRP-portable
- Tested ability of flexible solar panels to keep up with load.
- 40 watts of solar panels was more than enough!
Trial Run – Lassen Forest CN90

- Lassen Nat’l Forest / Eagle Lake in Northern California
- Tested full system, remote solar, remote power, and manual tuning.
- 54 QSOs on 5 Satellites:
  - AO-51, FO-29, SO-50, AO-07, VO-52
Notification Sent Out on AMSAT-BB

• Arrive Saturday, August 6th
• Camp near Shelter Cove on the remote northern California Lost Coast
• Operate on Sunday, August 7th and Monday, August 8th
• Work FM and linear satellites: AO-51, SO-50, SO-67, ARISSAT-1, AO-27, VO-52, FO-29, and AO-07
• Provided list of possible pass times
• Due to remote location, no plans to operate after dark!!
• Real-time GPS Tracking
• Return on Tuesday, August 9th.
T -3 Days: Plans Change!

- Email from ARRL HQ Awards Branch
- VHF group had reviewed the plans published on my blog...
- Not sufficient to have just power source at grid intersection
- Must have transmitters at intersection as well
T -2 Days: A New Plan!

- Radios and operator now at grid intersection
- Two antenna locations depending on pass
- “Remote” antenna for western and overhead passes
- “Local” antenna for eastern passes
Submitted New Plan for Approval

- Full station set up directly over grid square intersection. Specifically, I'll use the standard setup that I have used before, consisting of two Yaesu FT-817ND radios hanging from a photographic tripod, with the 6.4Ah LiFeP04 battery right next to the tripod. The antenna is an Elk antenna on top of the tripod. The area of the grid intersection will be marked with a ground tarp, and will be determined with better than 20' accuracy with WAAS-GPS. Photo and video will be used to document the station, GPS receiver, and surroundings.

ARRL HQ approved the revised plan

- Since the view to the east is blocked by a ridge, 70' uphill, for easterly passes I will use the exact same station as above, except that the Elk antenna will be relocated to a second photographic tripod perched on the ridge. The Elk will be connected via 100 feet of LMR-400 coax, and I will use a preamp at the antenna to help overcome the signal loss on the 70cm downlink. As above, all station operation will be from directly over the grid intersection, including tuning, transceivers, and power source. The Elk can be re-aimed once or twice through the satellite pass to more or less keep up with the sat as it moves.
Putting the Plan into Action!

• Extra supplies needed:
  – 100’ of LMR-400 coax
  – Pre-amplifier with separate power supply
  – Second tripod for antenna
  – Bigger backpack!!

• Last-Minute Testing:
  – Remote antenna in backyard at end of 100’ coax
  – Pre-amp between Elk and Coax

• Results:
  – Signals weaker but QSO’s were possible!
Last-Minute Additions

• Figured extra power on uplink would help
  – Removed FT-857D (20W UHF output) from truck
  – Another five pounds to carry

• Need to power the extra radio
  – Packed a second battery
  – Only had lead-acid available
  – Six more pounds to carry!
Lots to Pack up the Mountain!

- FT-817ND radio
- FT-817ND radio
- FT-857D radio
- LiFePO4 battery
- SLAB battery
- 2 photo tripods
- 100’ LMR-400 coax
- 150’ red/black cable
- 6 solar panels (60W)
- Netbook computer
- Headset
- Voice Recorder
- Preamplifier
- Amp batt pack
- Camp chair
- Bug spray
- Bear spray
- Water
- Food
- Clothing
- Book
- Green tarp
- HF antenna
- Ant tuner
- Camera
- GPS
- Compass
- Cell phone
- SPOT Messenger
- Logbook + Pen

...I’m gonna need to take two trips!
The Trip Begins

- Left Fairfield, CA in CM88 Saturday morning, August 6
- Arrived Chemise Mtn in CM89 Saturday afternoon
- 5.5-hour drive
Hiking Chemise Mtn: Saturday PM

- Set up camp, then packed half of equipment up to CM79
- Thick forest!
Hiking Chemise Mtn: Saturday PM

2.5 miles, 800’ up, 300’ down, 1.5 hours hiking
Hiking Chemise Mtn: Saturday PM
Hiking Chemise Mtn: Saturday PM

- Found grid intersection
- Dropped equipment off
- Hiked back down mountain
Grid CM79+ Sunday AM

- Another trip up and over the mountain…

- Arrived just after sunrise
Grid CM79+ Sunday AM

- Set up the full station
- Remote antenna
- Waited for Oscar 7
Grid CM79+ First Sat Pass

- 7:00am: Oscar 7, SSB
- Eastern pass, remote antenna, FT-857D
- Very faint and distorted
- One contact: KO4MA in Florida
- Remote antenna system works but barely!
Grid CM79+ Second Sat Pass

- 7:20am
- Oscar 51: FM
- Western pass
- Local antenna
- Heard nothing!!!
Grid CM79+ Things aren’t working!

- Extra power from FT-857D radio didn’t help on uplink
  - Distortion
  - No computer control
  - Couldn’t hear downlink

- UHF downlink signals too faint under forest canopy
  - Couldn’t hear strong AO-51 at all
CM79+ Making it Work

- Fix #1: Go back to the twin FT-817ND radios
- Forget using the FT-857D since the problem is with receiving the downlink, not powering the uplink.
CM79+ Making it Work

- Fix #2: Aim antenna through “hole” in foliage
- Wait for satellite to pass through
CM79+ Making it Work

- Fix #3: Use preamplifier on all UHF downlink passes
- Even when using “local” antenna
CM79+ Finally Making Contacts!

0900: AO-7 low west:  3 contacts!
0930: VO-52 overhead: 2 contacts!
1115: VO-52 low west: no one else on!
1230: AO-27 shallow east: very faint...
1415: AO-27 high east: 7 contacts!
1505: FO-29 low east: 4 contacts!
1515: AO-51 low east: 8 contacts!
1600: AO-27 low west: 4 contacts!
1630: SO-50 high east: 3 contacts!
1700: AO-51 overhead: 9 contacts!

Signals very marginal but contacts were possible!
CM79+ Sunday Evening

- Hike the hour and a half back to camp
- Carried all “extras” back.
- Get some rest for the next day of radio!
CM79+ Monday Morning

- Yet another trip back up to CM79.
- Cold and foggy!
CM79+ More contacts on Monday

0730: AO-07 mode A: 1 contact!
0830: VO-52 shallow East: 1 contact!
0930: AO-07 low west: nothing heard.
1000: VO-52 overhead: no one else on!
1345: AO-27 low east: 8 contacts!
1430: AO-51 shallow east: too faint.
1530: AO-27 west: 5 contacts!
1600: FO-29 high east: tuning problems
1615: AO-51 high east: 16 contacts!

With patience, contacts were possible!
Waiting for Passes

• Plenty of time to recharge the battery pack
CM79+ Photo Documentation

- ARRL VUCC rules require photo of GPS showing location
- Must show error of less than 20 feet
- Must show both GPS and Station
- Video is preferable
CM79+ Video Site Tour

- Tour starts at station on grid boundary
- Goes up to antenna over ridge
- Along trail
CM79+ Photo Documentation

[Diagram showing various labeled devices and their connections, including CM79, CN80, CM89, and Radios.]
CM79+ Packing Up

- One more trip down the mountain…
- Finally can see the ocean!
After the Expedition
...Dear David many thanks for the fantastic QSO on VO52, just 3 degrees for me ...beautiful signal for 5 w wwwwwwwwwwww !!!! You made my day...

...First and foremost, thanks from the satellite community for going to such a remote location to put on your grid expedition...

...a bunch of the Memphis gang sure appreciate working you...

...Thanks for the 4 grid contacts. Here’s my log. Please QSL. That was the most popular operation I can remember...

...KB5WIA showed up and I had a qso with him from the truck, the high point of the demo...

...Hope you have near as much fun as those of us out here did working you... what a blast! And four great grids to boot! --- Can it get any better?...

Many nice emails and QSL cards!
Lessons Learned

- Be prepared to change your plans!
- Not everything is going to work out!
- Persistence helps!
- Plan to operate multiple days!
Acknowledgements

- KB8U
- WD9EWK
- K8YSE
- NC1L
- AMSAT Group
- KA6SIP
- XYL Melanie
Questions??

- Dave Palmer
- kb5wia@amsat.org
- QRZ.com -> KB5WIA
Extra Slides Follow
Satellite Portable Backpack Expedition – Lost Coast

- Background
- Ham Satellites
- CM79 Grid Square
- Trip Preparation
- The Expedition
Background: Ham Satellites

- Many ham radio satellites can relay voice signals
- Near-polar orbits
- Two sets of 2-3 “passes” a day
- Sats first go by to the east, then come by again to the west about an hour and a half later

Video: WikiPedia
Background: FM Satellites

- Three satellites carry “FM Repeaters”…
    - 2m up, 70cm down
  - SO-50 (2002)
    - 2m up, 70cm down
  - AO-27 (1993)
    - -2m up, 70cm down

Photos: amsat.org
Background: SSB/CW Satellites

• Three satellites carry linear transponders and can relay SSB (voice) or CW (code) conversations:
  – VO-52 (2005)
    • 70cm up, 2m down
  – FO-29 (1996)
    • 2m up, 70cm down
  – AO-07 (1974)
    • 70cm up, 2m down
    • 2m up, 10m down

Photos: amsat.org
Background: Working Satellites

- Full-Duplex is best
  - One radio+antenna for uplink
  - One radio+antenna for downlink
- Hear your own audio as well as the other stations
  - Ensures you’re making it to the sat
  - Minimizes QRM
- Computer-controlled tuning of the radios for Doppler shift
- Computer also tells where to point the antennas