Alaska DXpedition Antenna Considerations and the Rhombic Loop Twofer

Maggie DeLoach, KK6DZS and Jim DeLoach, WU0I in Haines, Alaska

Jim DeLoach, WU0I
15 October 2021

Introduction

- How do you mount an Alaska Field Day DXpedition having never visited the site, with all equipment squeezed into a Subaru Impreza, and with all the antennas wedged into a 29“ x 18“ x 11“ Pelican case?
- By using **wire antennas**, understanding what the **goals of the antennas** are, and **bringing lots of antenna choices to choose from**!
- Today I describe the tools used to choose several possible wire antennas, how we transported the antennas & supplies 3,000 miles to Alaska, how we deployed the antennas, and the antenna we settled on: the '**Rhombic Loop Twofer**'

Our car ‘Buzz’

All antennas, transmission lines, and associated equipment fit in one Pelican 1650 case

Background

Why Alaska, and Why Field Day?

- For years, the XYL (Maggie, KK6DZS) and I had wanted to drive the Alaska-Canadian 'ALCAN' Highway to Alaska, then take the 'Alaska Marine Highway' ferry back
- We planned to leave right after Maggie's school was out in June 2017, and it would take us about 2 weeks to get there, so arrival by late June
- Late June ≙ Field Day!

But Where in Alaska to do Field Day?

- We needed to terminate the driving portion of our trip at one of the port towns where we could get on the ferry – either Haines or Skagway
- We had heard Haines was a ‘real town’, very different from touristy Skagway, so we decided to try to make Haines our base
- I first looked for a local club station that I could join for Field Day, but finding none in Haines, we decided to bring a station and set up our own Field Day at a vacation rental

An Alaska Marine Highway ferry runs between Bellingham WA and Skakway, AK in summer, stopping in Haines and other Panhandle towns

Finding the Perfect Vacation Rental

- For optimal Field Day operation, our vacation rental needed to have:
  - A clear view to at least some of the main North American population centers, preferably overlooking the water
  - Enough space for wire antennas
  - Tall trees to hold them up
  - And of course a beautiful Alaskan setting (this part was easy!)
- After searching online and checking Google Maps, with the help of a super-supportive reservation agent*, we found the Orca Cabin at Viking Cove south of Haines

Viking Cove, South of Haines, Alaska

Orca Cabin at Viking Cove

** Randa Szymanski, www.reservationsbyranda.com, 907-314-0466, randaszymanski@gmail.com. Randa's father Bud, KL7CQF (SK), was Haines' only ham for many years.*

The Orca Cabin at Viking Cove

- On the water overlooking the Chilkoot Inlet, looking Southeast towards the West Coast
- 15 to 25-meter-tall trees
- A big, nearby open field, with tall trees around it
- At the end of the road and at the end of underground power lines, so low RF noise
- Lovely, comfortable, and absolutely stunning views!

This way to the Field Day site!

View from Orca Cabin Window

Forming the Team

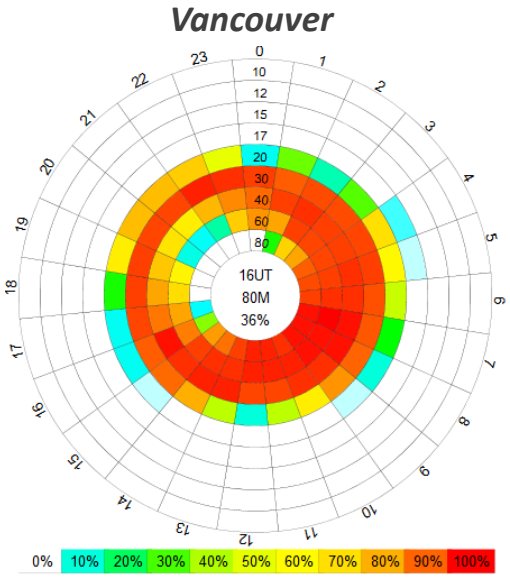
- I looked through FCC and qrz.com records to determine if any hams lived in Haines
  - Found only one, Lynn Hyder, KL7YXF
  - Reached out to Lynn, a retired farmer from Oregon, and he was happy to join us
  - So I, Maggie, and Lynn formed our ‘1A AK’ team!

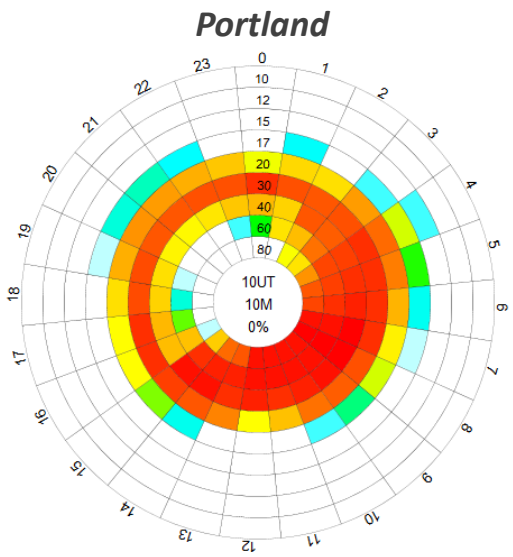
Jim, WU0I & Lynn, KL7YXF operating from the cabin

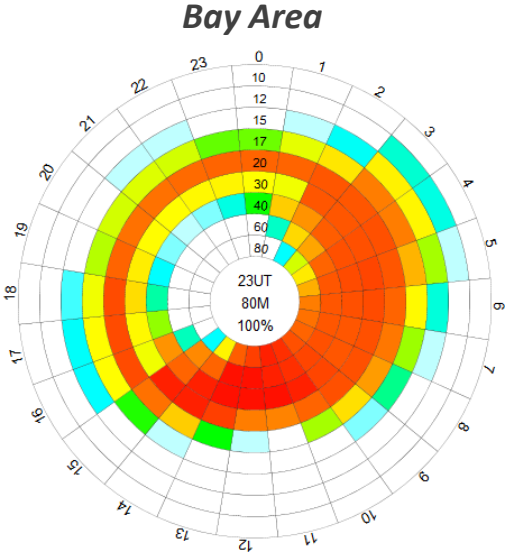
Designing the Antennas

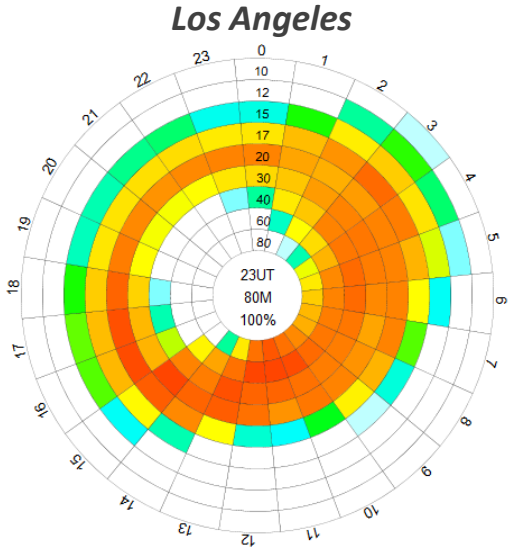
Identify Which Bands Would Work Best

- I used the excellent VOACAP web site (https://www.voacap.com/hf/index.html) to predict the best bands from Haines to the West Coast
- As expected, at the low ebb of the sunspot cycle, 20 and 40 meters were the go-to bands in the day, and 40 and 80 meters at night



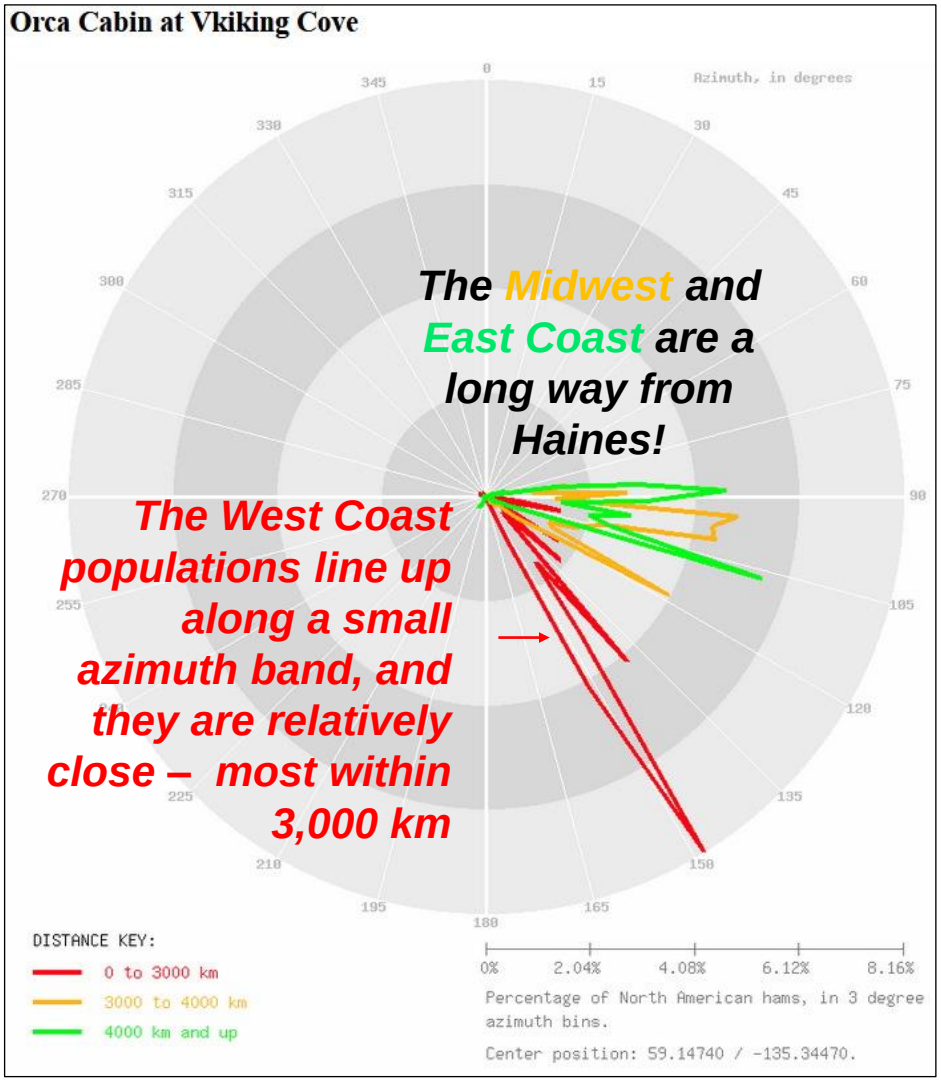






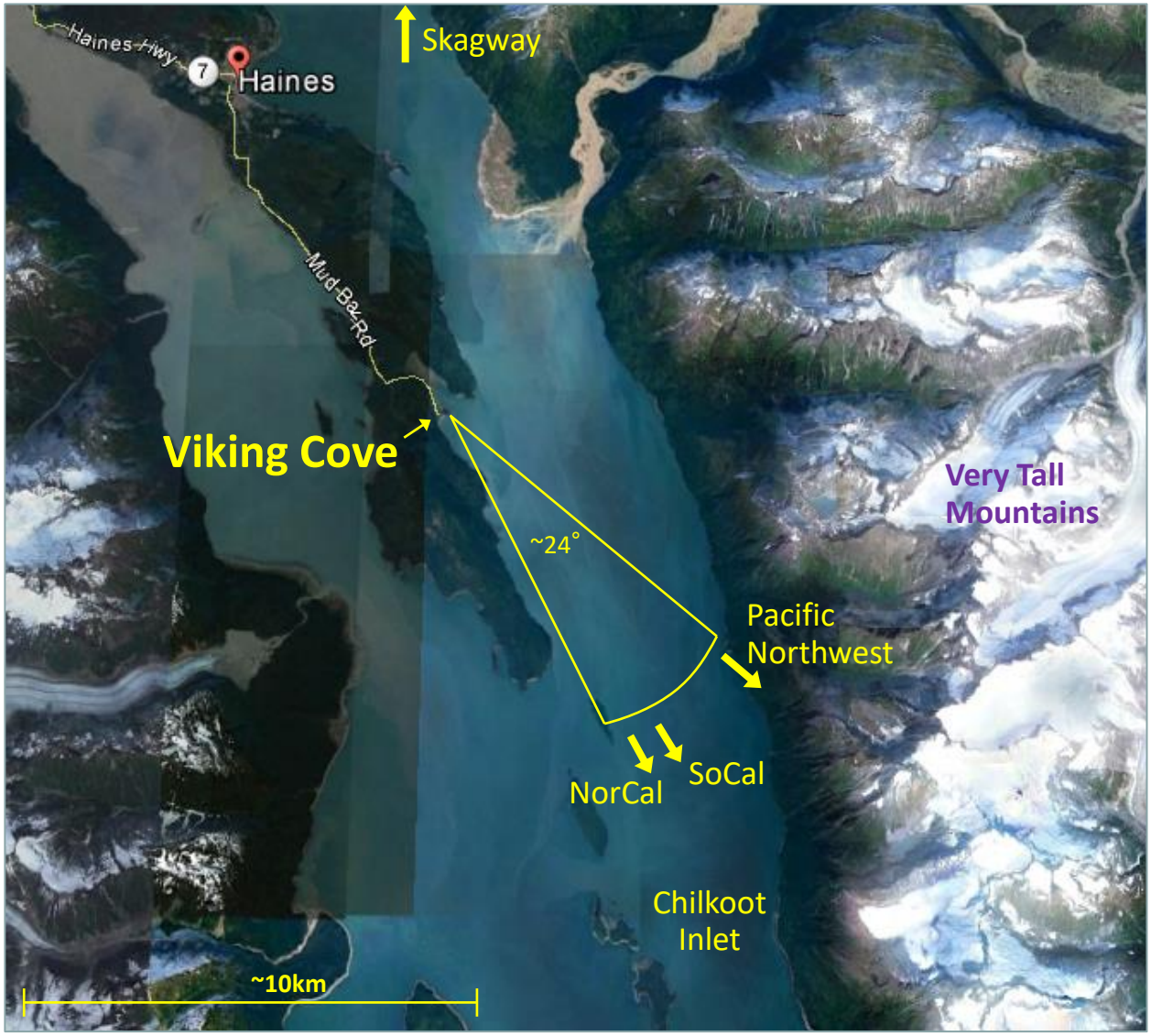
Where to Point the Antenna for Field Day

- To get a feel for where other North American hams were relative to Haines – in what directions and in what concentrations – I used my "**Point Your Field Day Antenna**" web site: http://www.deloach.net/PointYourFieldDayAntenna/index.htm



Where to Point the Antenna for Field Day – the West Coast was the Play

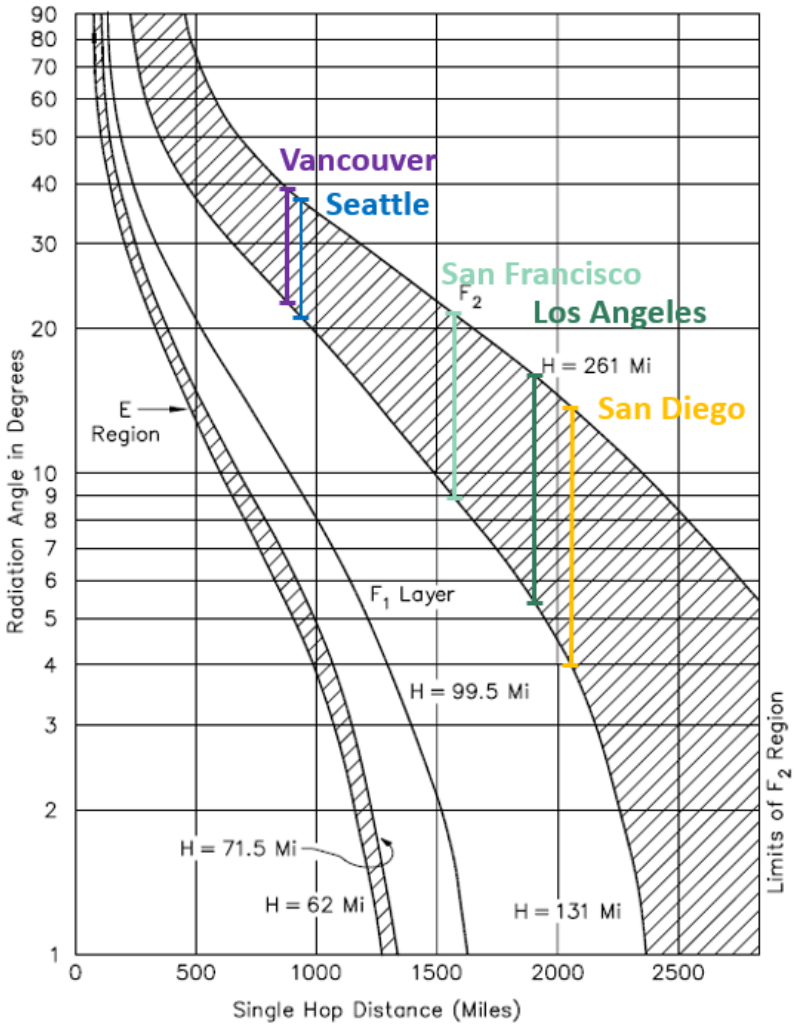
- Chilkoot Inlet is enclosed by tall mountains, but the inlet itself is pointed more-or-less towards the West Coast
- Midwest and Eastern North America would be difficult due to steep mountains and distance
- So Western North America was the play



Optimal Antenna Elevation Angles

- To get a rough sense of desired antenna elevation angles, I used the *Radiation Angle vs. Single Hop Distance plot* from the ARRL Antenna Book*
  - Assumed single hop F2 layer would be the primary mode for West Coast communication
  - Looked at the range of takeoff angles for several population centers
  - **Elevation angles between about 5 and 45 degrees** with a broad pattern seemed optimal

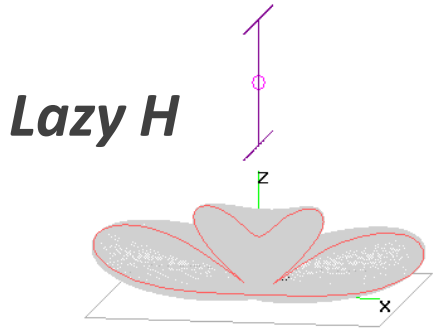
Radiation Angle vs. Single Hop Distance

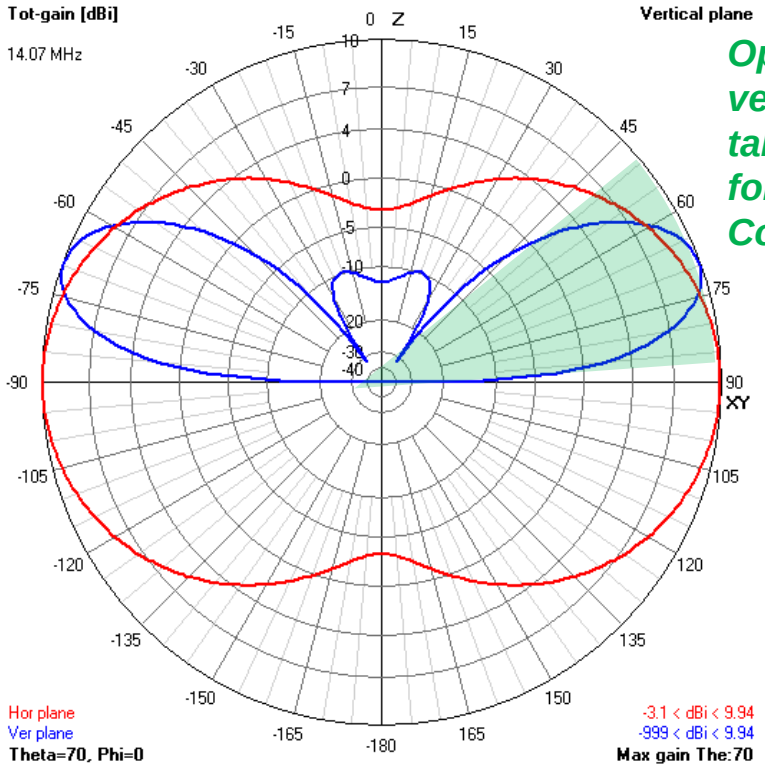


** ARRL Antenna Book for Radio Communications, 23rd Edition, Figure 4-29, page 4-34.*

4NEC2 Used to Model Antennas

- Modeled properties of numerous wire antennas using **4NEC2**
- Focused not just on horizontal gain properties to the West Coast but also elevation angle qualities:
  - Broad pattern across target elevations without nulls
  - Invulnerability to height variation, since I did not know how tall the trees would be





Came Prepared with Seven Wire Antennas

- Having never visited the site, it was impossible to know ahead of time which wire antenna(s) would work with the trees and open spaces available
- Consequently, I designed and built a variety of different simple wire antennas so I would be ready for many possibilities
- I planned to use balanced transmission line with a tuner, so antenna impedance was less of a concern and losses were minimized

Antennas Prepared for the DXpedition

In the end, I prepared the following antennas:

Antenna	Bands	supports	Qualities / Deficits
Horizontal Lazy-H	20, 15	2	Reasonable gain. Dimensionally unfussy. Height insensitive.
48-meter-length doublet	80, 40	2	Solid 40m gain. OK 80m West Coast coverage and strong local coverage. A bit height sensitive.
40-meter sloping dipole or ¼-λ vertical w/ radials	40, 20	1	Decent gain and broad low angle patterns on both bands (nearby seacoast helps!) Height insensitive.
80-meter ¼-λ Vertical w/ radials	80	1	Very solid low angle performance with only 2 radials near sea water
Rhombic Loop Twofer	80, 40, 20, 15	4	Solid gain on 40m & up. 80m solid locally but not good to West Coast. Surprisingly, not too height sensitive. Big disadvantage: 4 supports minimum needed in more-or-less the right spots.
20-meter horizontal loop	20, 15	2	Unfussy backup for other antenna solutions. More height sensitive than I expected.
20-meter dipole	20, 15	1 or 2	Quick, indestructible backup for other 20m solutions. Height sensitive when mounted horizontally.

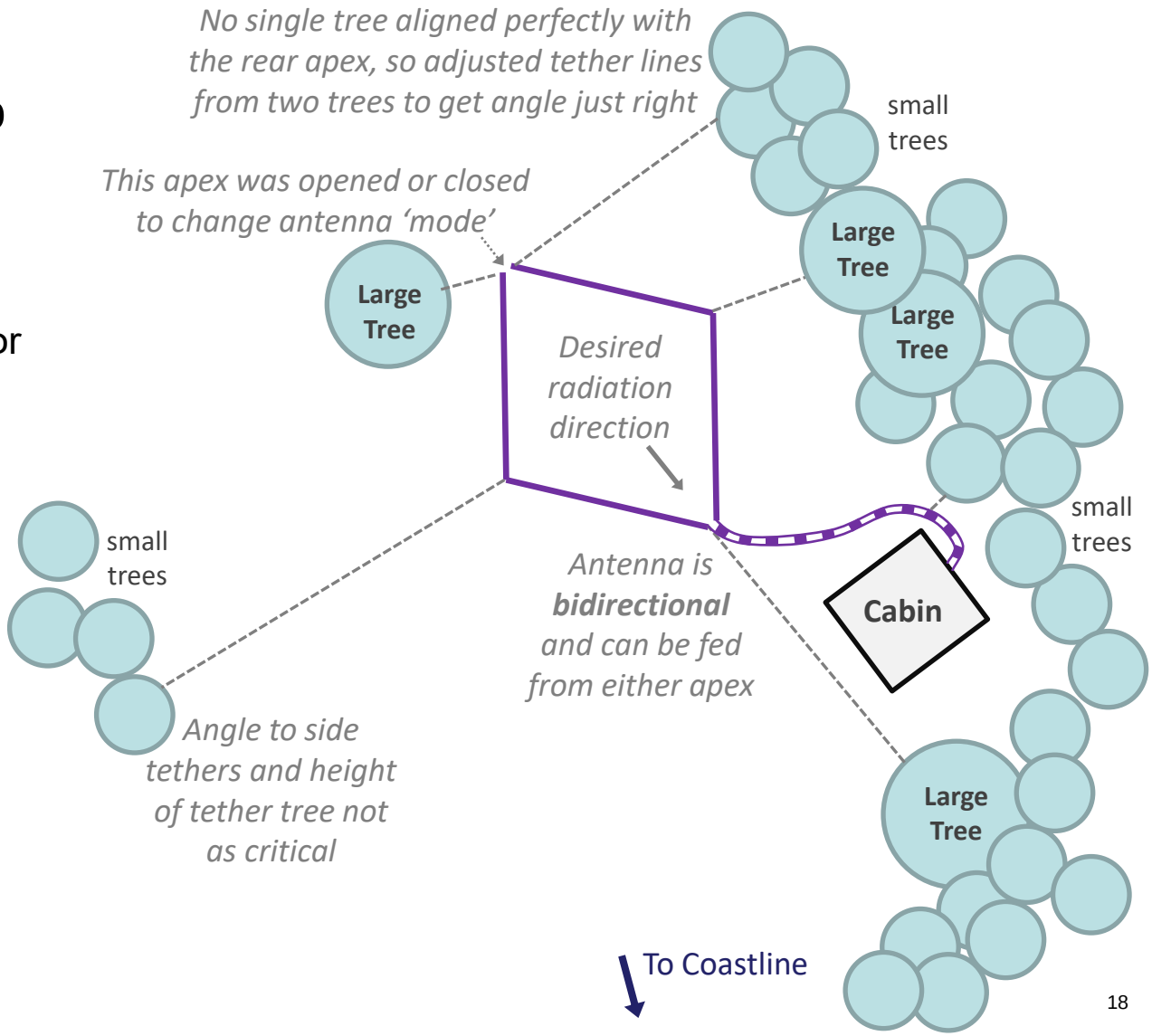
Transporting the Wire Antennas & the Equipment to Deploy Them

- Every part of the station had to be transported over rough ALCAN Highway roads for weeks in a Subaru Impreza, so no towers or masts!
- All wire antennas had to be suspended between trees
- A good solution for getting tether lines into trees was absolutely essential – used the ‘Air Boss’ compressed air system
  - Bill Olah, KR4LO, made a special version for me that broke in to two pieces for transport in a shipping case

All antennas, transmission lines, and all other equipment needed for deployment including a disassembled Air Boss had to fit into one Pelican 1650 case

Which Antenna Ended Up Fitting Best?

- Surprisingly, it was the **Rhombic Loop Twofer** that fit the space & trees best
  - The large trees just didn't line up right for the other antennas
- The Air Boss worked great – getting my many tether lines exactly where I needed them!



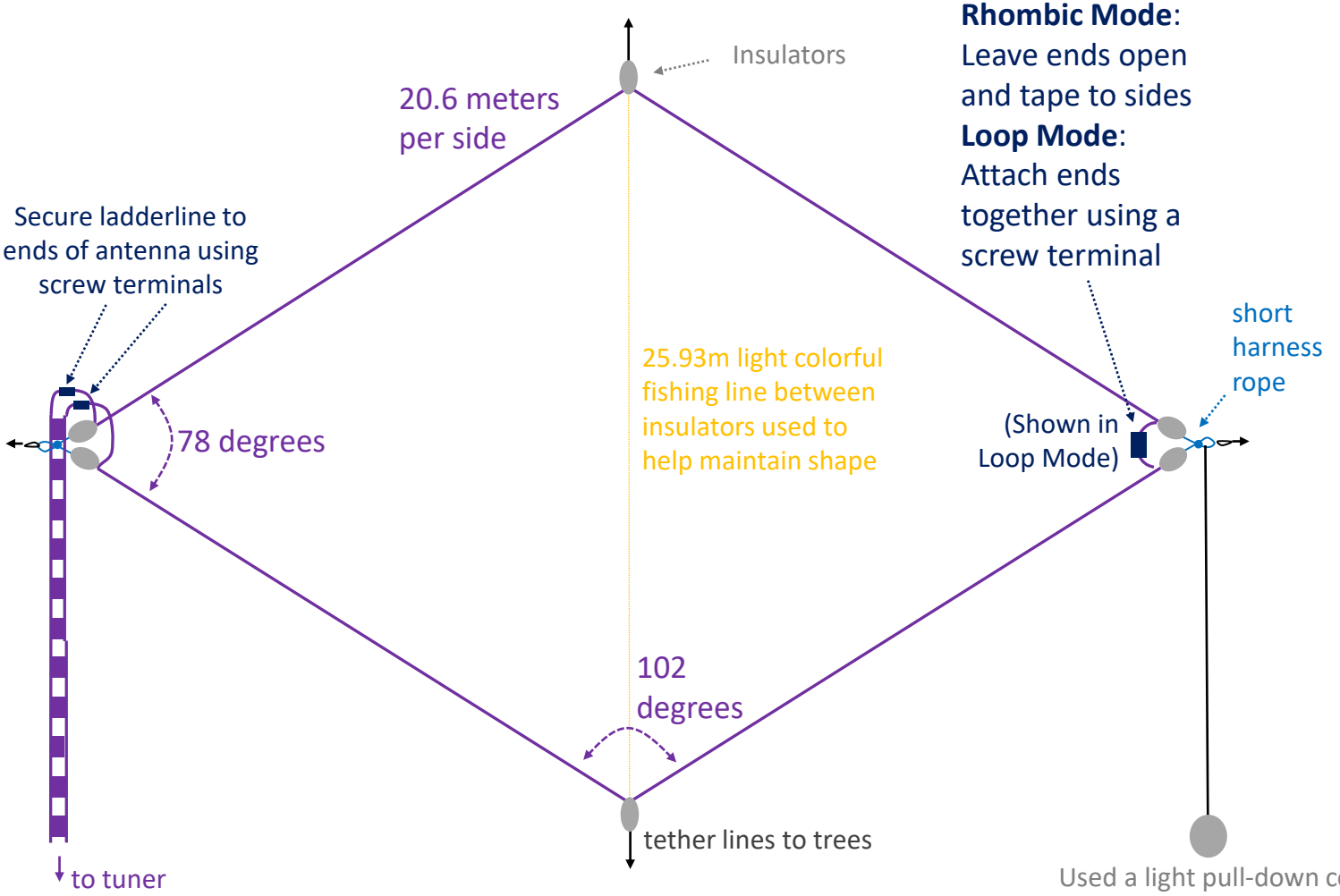
Rhombic Loop Twofer Properties

- The Rhombic Loop Twofer is two antennas in one – a small but potent rhombic[1] by day, and a Loop Skywave[2] by night
- The 'mode' of operation is controlled by connecting or disconnecting apex:
  - When the wires at the apex are disconnected, it's a 'small' rhombic – a high gain, bidirectional, naturally broad-banded, dimensionally un-fussy antenna on 20 meters and up
  - When the wires at the apex are connected, it's a 'Loop Skywave' – a horizontal full wavelength loop with near-vertical incidence skywave (NVIS) properties on 80 meters, with decent bidirectional gain on 40 meters
- More information about the Rhombic Loop Twofer, including the NEC files can be found at www.deloach.net/RhombicLoopTwofer or in my June 2017 QST article

[1] The ARRL Antenna Book, http://www.arrl.org/shop/Antennas/, provides a good discussion of the theory behind rhombics and other 'traveling wave' antennas.

[2] See J. Hallas, W1ZR, "Another Look at the Full-Wave HF Loop Antenna," QST, May 2016, pp 42-45, for a good description of loop antennas and the Loop Skywave.

Rhombic Loop Twofer Design

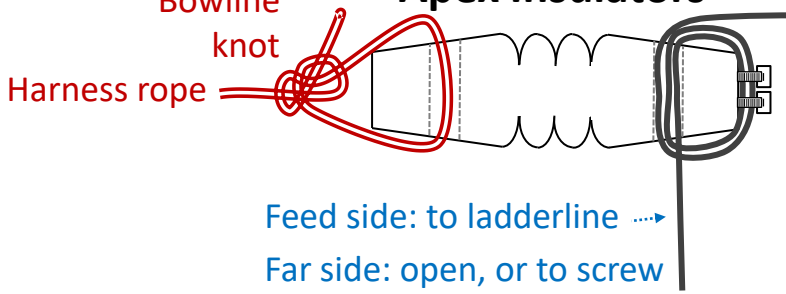


Antenna impedance varies greatly by mode and band and can be quite high – ladderline and a balanced tuner worked well.

Insulator & Component Details

I really like light Poly STEALTH™ 18-gauge, 19-strand, copper-clad steel wire for medium-power temporary antennas

Apex Insulators



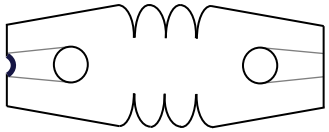
Wrap antenna wire through insulator two times, then secure with two small cable ties

Allow 6” extra antenna wire for looping

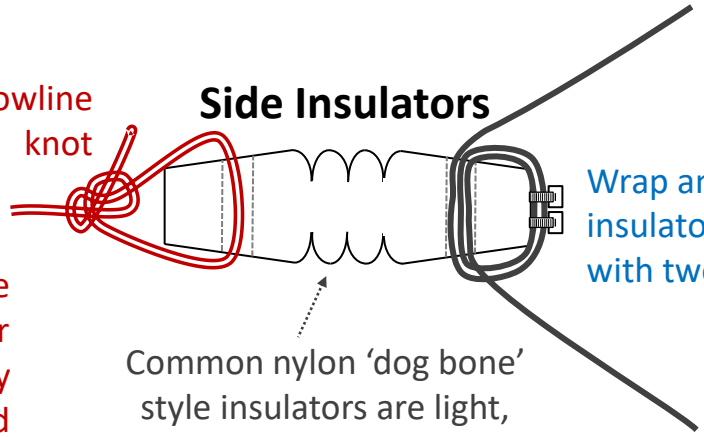
Feed side: to ladderline

Far side: open, or to screw terminal, depending on mode

File a small channel on one end for looped wire to sit in



Side Insulators



Wrap antenna wire through insulator two times, then secure with two small cable ties

I like DX Engineering’s Mastrant MP02100 rope for the feed point tether and other heavier duty lines, and ‘micro-paracord’ for lighter duty tethers and the apex pull-down cord

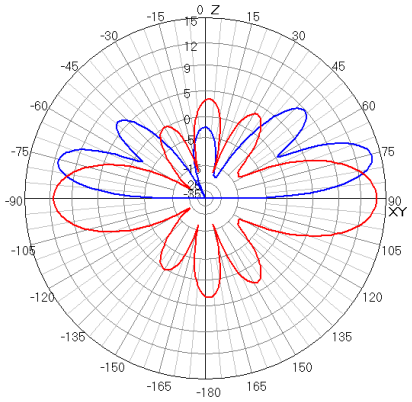
Common nylon ‘dog bone’ style insulators are light, cheap, easy to file, and sufficiently strong

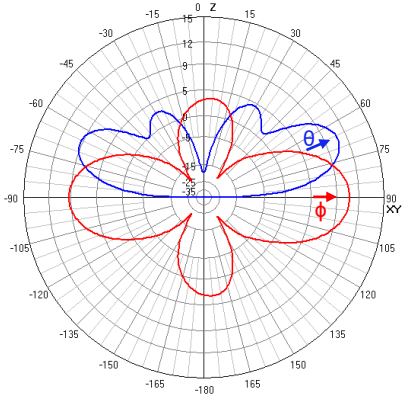
4NEC2-modeled Rhombic Loop Twofer Patterns

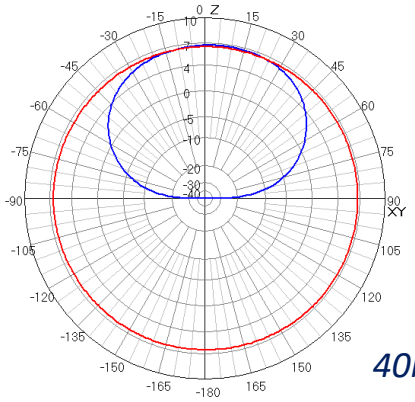
Sadly, 15m never opened up

20m Rhombic Mode was rocking it to the West Coast!

15m **20m** **40m** **80m**



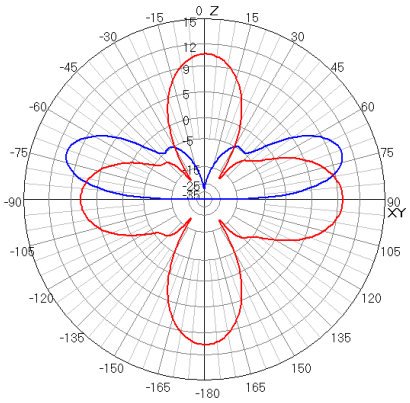


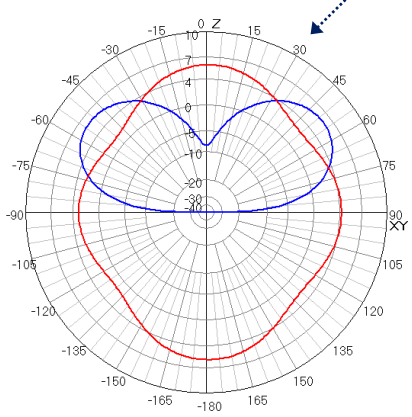


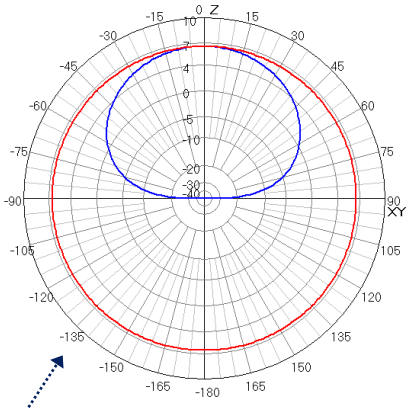
Rhombic Mode

40m Loop Mode had enough gain and a low enough takeoff angle to work quite well to the West Coast

Loop Mode







KEY:

Horizontal Pattern (at elevation Theta)

Vertical Pattern (at azimuth Phi)

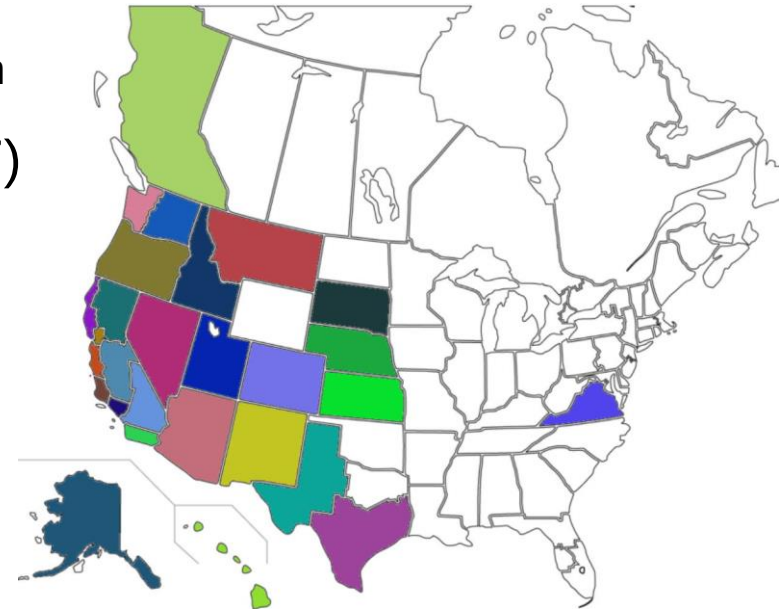
My 4NEC2 files are available at: www.deloach.net/RhombicLoopTwofer/.

80m Loop Mode worked great to Alaska but takeoff angle was too high for much of the West Coast

How Did the Rhombic Loop Twofer Get Out?

- Alaska is a ***long way away*** from most North American stations
  - Link margins are lower, and beams are rarely pointed North, so it is difficult to break through
- PSK31 was useless (no FT8 yet in 2017)
- SSB did not work at all except for the few local low-band stations
- But what worked well was CW!
  - Once I got up the courage to dive in, QSOs started flowing – modestly given my rusty CW
  - A real CW op would have cleaned up – this same antenna in the hands of a real CW operator – Andreas, K6AKW – had over 900 contacts in the 2018 Field Day from a SB QTH
  - 20-meters and 40-meters CW worked best (15 never opened up)
  - 80-meters CW did not work well to the West Coast due to high takeoff angle, and I didn't have time to get up another 80m antenna

As expected, we mostly got out to Western North America



ARRL Sections worked

How Did Our Field Day Do?

- We scored 1,608 points, with 92 QSOs, mostly CW, coming in 2nd in Alaska, almost beating the big 2A Juneau club with 1,638 points and 48 participants
- So how did our puny 92 QSOs do so well? Bonus points!
  - √ **100% Emergency Power** &
  - √ **Natural Power QSOs** – *2 deep cycle batteries / solar*
  - √ **Media Publicity** – *article in local paper and on radio!*
  - √ **Public Information Table** – *ARRL handouts*
  - √ **SM & NTS Messages** – *HF Winlink messaging is so easy!*
  - √ **W1AW Message** – *W1AW iffy but K6KPH MFSK16 boomed in*
  - √ **Satellite QSO** – *easy when so far North!*
  - √ **Elected Official Visit** – *local councilman*
  - √ **Educational Activity** – *program on satellites*
  - √ **Social Media** – Maggie's Facebook page
  - √ **Safety Officer** – Maggie has First Aid certifications
  - √ **Submitted via Web**

Serving Haines and Klukwan, Alaska since 1966

Chilkat Valley News

Volume XLVII Number 24 Thursday, June 22, 2017 $1

Ham radio event set for weekend

By Natalie Helms

A group of Haines and California residents are learning to set up and operate ham radios this weekend to connect to the outside world in case of an emergency power failure.

Lynn Hyder of Haines and members of the Snaptrack Amateur Radio Club of Santa Clara, California will spend Saturday and Sunday at a cabin in Viking Cove for the annual Amateur Radio Field Day.

Field Day coordinator Jim DeLoach said over 35,000 people from across the country will use ham radios that day for an emergency preparedness exercise. The Haines group will quickly assemble three ham radios without existing infrastructure, using only battery power and stringing wires through trees.

"You have no power, you need to be able to quickly establish communication when power has failed," DeLoach said.

DeLoach said it could take several hours to a full day to get the systems running before reaching out and talking to as many people as possible through the machines.

"It's kind of a contest for us, the more people you talk to, you win," DeLoach said. "It's a way to get hands on practice setting up that emergency station and work through all the kinks involved."

Although DeLoach said he didn't know how many participants would be there, guests are invited to watch at 2 p.m. Saturday, June 24. Call 408-691-1349 for more information.

Article about us in the local paper

Lessons Learned

- The research and preparation really paid off – things went smoothly on nearly every front
- Having lots of wire antenna choices was key – we were able to pick one that fit the tree resources available
- Also key was the Air Boss for getting tether lines where needed
- Field Day operation from Alaska is tough – you are far away from most other North American stations, and they are not looking for you
  - Thus, more link margin is necessary
  - And CW is the mode of choice
- I wish I had had time to deploy an additional low-angle 80-meter antenna solution – 80-meters would have been really fun at night

Acknowledgements

- Jon Griffiths, W6PI and Jim Peterson, K6EI for help designing and publishing the Rhombic Loop Twofer
- Russ & Bobbi Haskins, KM6EOQ / KM6PQG for their generous hospitality at their cabin QTH along California's Coastal Range – where the Rhombic Loop Twofer was built and tested in two Field Days
- Andreas Wachter K6AKW, for showing us what the Rhombic Loop Twofer could do in the hands of a truly skilled CW operator

Dedication

- Our Alaska Field Day operation was dedicated to the hams who supported the Alaska1964 ‘Good Friday’ earthquake response, including Harold ‘Bud’ Hopper, KL7CQF (SK), long-time resident of Haines, Alaska
  - For an unforgettable, chilling recording of these hams in action, check out: https://www.youtube.com/watch?v=rw9HZMagcb8
  - The Old Valdez Exhibit in Valdez, AK has fascinating coverage of the 1964 Good Friday Earthquake
- These hams showed us how to serve, and why we do emergency preparedness activities like Field Day

Bud’s QSL card

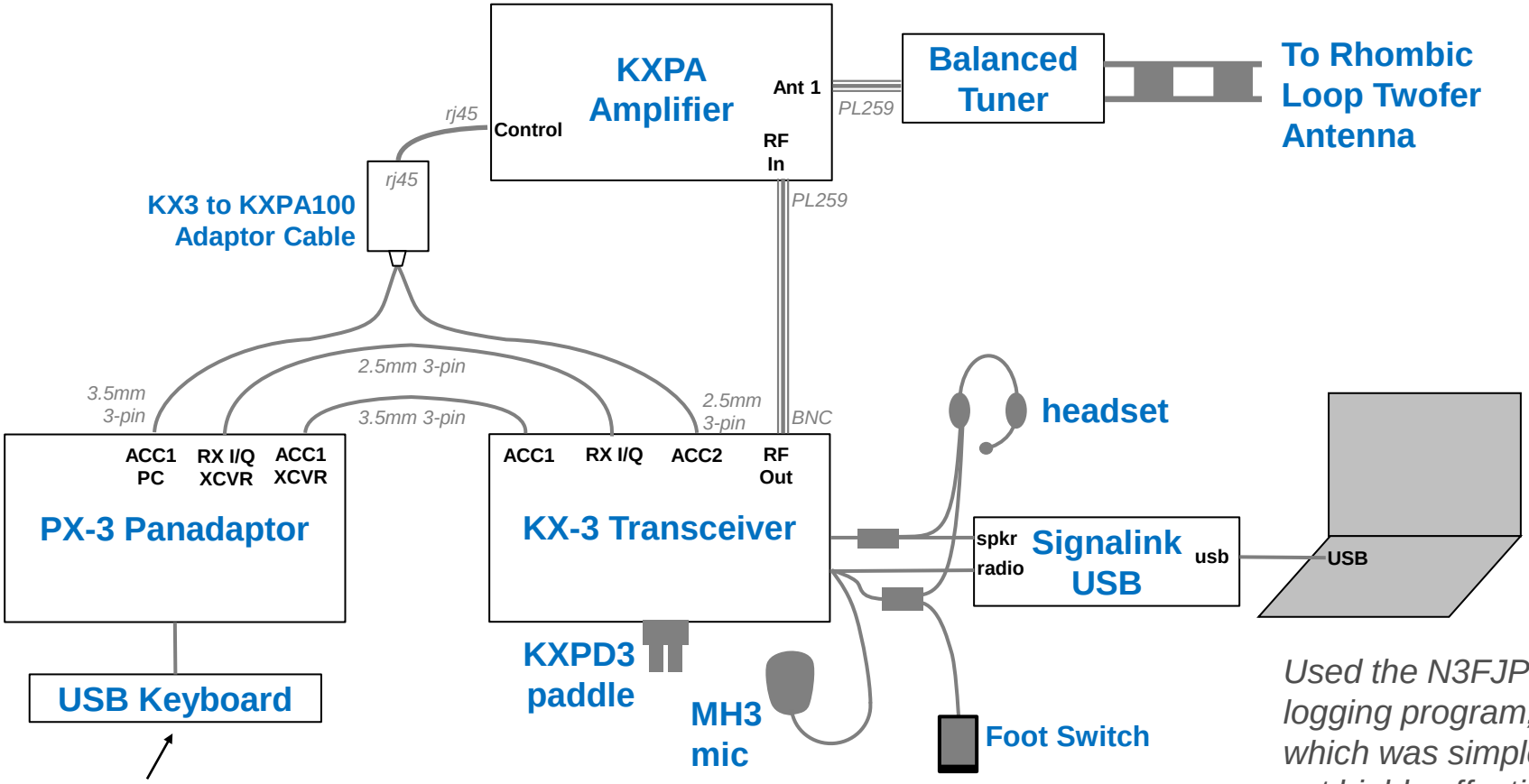
ARRL Public Service Award presented to Bud for his service in the ‘Good Friday’ Earthquake

Questions?

Jim DeLoach, WU0I
jim@deloach.net
https://www.deloach.net/Alaska.htm

Supplemental Material

The HF Station



A USB keyboard connected directly to the PX-3 works surprisingly well for sending CW. Since the PC was only used for logging, it could be powered form AC when in CW mode.

Used the N3FJP logging program, which was simple yet highly effective.

Came prepared for digital, CW, and SSB

Satellite Operation

- Satellite operation in the North is a joy
- With ham density in the North so low, making FM satellite QSOs on Field Day is easy
  - Made the contact on SO-50 on the first try
- We in fact made FM satellite contacts the whole way up the ALCAN Highway, activating some rare grid squares

Field Day satellite QSO from Viking Cove

Satellite QSO from Radium Hot Springs, BC