



# Getting on 24 GHz Now What?

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# Review



- IN 2018 TWO APPROACHES TO GETTING ON 24 GHZ WERE PRESENTED
- CIRCULATOR AND WAVEGUIDE STATION ARCHITECTURE
- COAXIAL CABLE COMPONENT ARCHITECTURE WITH RELAY TR SWITCHING
- PROPOGATION
- OBJECTIVES AND TRADES
- REQUIREMENTS
- TESTING

# Objectives Review

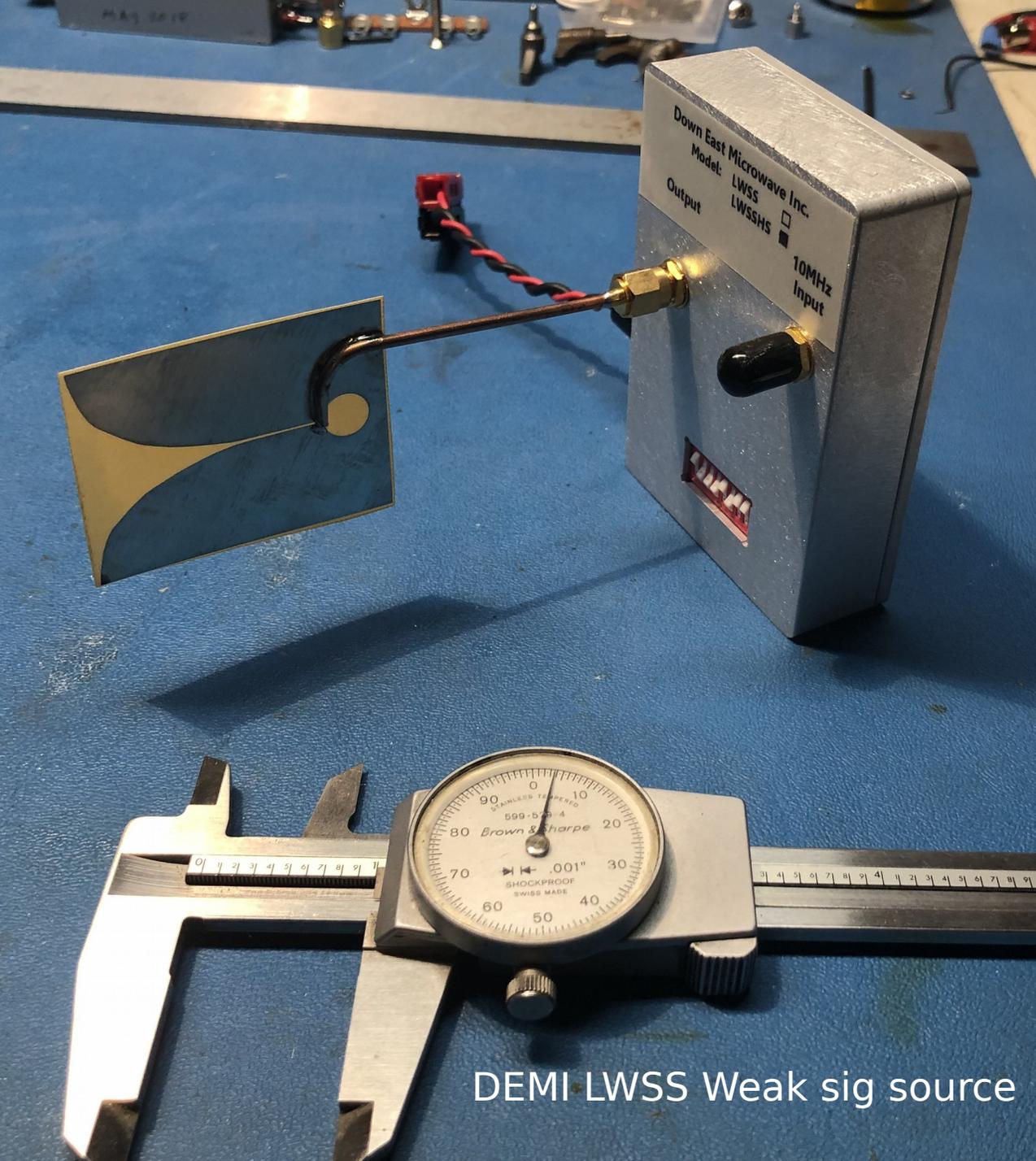


- COMPETITIVE PERFORMANCE
- DUAL BAND (10 AND 24 GHZ)
- FREQUENCY PRECISION
- ROBUST MECHANICAL DESIGN
- SINGLE PERSON CARRY
- RAPID SETUP/BREAKDOWN
- MULTIMODE (CW, SSB, FM AND DIGITAL)
- ACHIEVABLE WITHIN “ONE YEAR” RADIO BUDGET
- PARTICIPATE WITH 10/24 CAPABILITY IN 10+ GHZ CONTEST IN 2018
- INTEGRATE EXISTING 10 GHZ COMPONENTS

# Future Growth 2018



- ✓ VERIFY DX CAPABILITY BY COMPLETING 24 GHZ VUCC
- ✓ VERIFY KEYING AND SEQUENCING IMPROVEMENTS REPAIR 24 GHZ LNA
- ✓ VERIFY ISOLATION OF DUAL BAND FEED BETWEEN 10 AND 24 GHZ (NEED 30 DB, MEASURED 34 DB)
- ✓ INTEGRATE 10 GHZ HARDWARE
- ✓ REPURPOSE PRESENT 10 GHZ DISH, FEED, TR SYSTEM AND SEQUENCER
- ✓ COMPLETE WEIGHT REDUCTION OF 10/24 GHZ STATION
- ✓ COMPLETE VUCC (5 GRID CONTACTS FROM A SINGLE LOCATION)
  
- COMPETE IN THE 2018 10 GHZ AND UP CONTEST



# Future Growth 2018

NEW TOOLS ALONG THE WAY

DEMI LWSS Weak sig source

Frequency	Switch Selection							
	1	2	3	4	5	6	7	8
28.100								
50.100								
70.100	X				X	X		
144.100						X		
222.100	X	X				X		
432.100		X				X		
435.100	X		X			X		
902.100		X	X			X		
903.100	X	X	X			X		
915.100			X			X		
1275.100	X			X		X		
1296.100		X		X		X		
1420.000	X			X		X		
2304.100	X	X		X		X	X	
2401.000		X				X	X	
3400.100	X	X				X	X	
3456.100			X	X			X	
5760.100	X		X	X			X	
10368.100		X	X	X			X	
24192.100	X	X	X	X			X	
47088.100			X			X	X	

Back view

# Future Growth 2018

NEW TOOLS

# LNA Repair Details

- ✓ CONFIRMED THROUGH BENCH TESTS THAT THE MKU LNA 243 CS2 PREAMPLIFIER HAD FAILED
- ✓ REPLACED FAILED 24 GHZ PREAMPLIFIER.
- ✓ NOIO REPAIRED THE FAILED UNIT!

## RESULTS

	Noise Figure (dB @18C)	Gain (dB)
As Delivered	2.3	28
Repaired	2.4	26

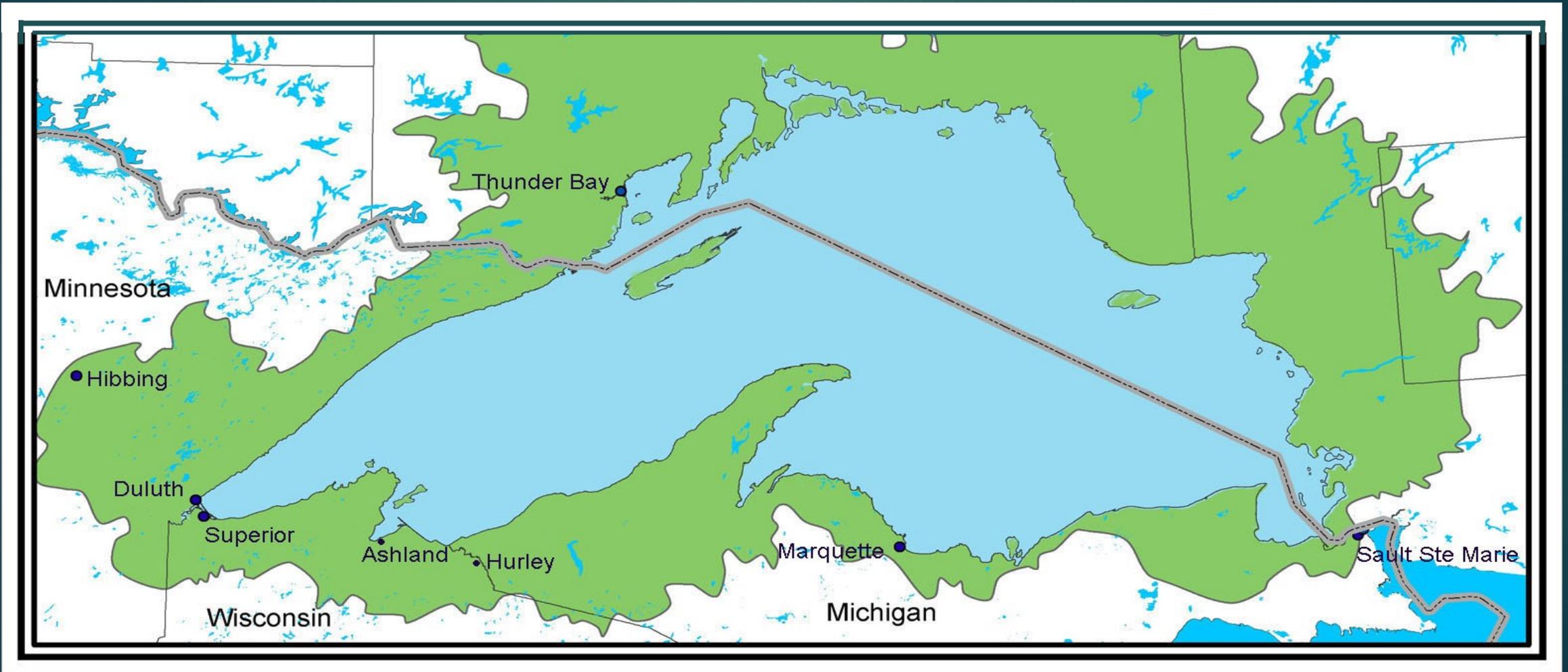
# 10 GHz Integration

- CONFIRM RF ISOLATION BETWEEN 24 GHZ TRANSMIT AND 10 GHZ RECEIVE EXCEEDS 30 DB
- MOUNT DEMI TRANSVERTER
- MOUNT DEMI AMPLIFIER
- MOUNT SMA TRANSMIT/RECEIVE RELAY
- CONNECT RF PATHS WITH UT-141 SEMI RIGID COAX
- WIRE DC AND CONTROL CIRCUITS
- FUNCTION TEST

# 2018 ARRL 10+ Contest Objectives

- COMPLETE 10 AND 24 GHZ CONTACTS ACROSS LAKE SUPERIOR
- LEARN AS MUCH AS POSSIBLE
  - COORDINATION
  - NAVIGATION AND POINTING
  - EVALUATE PROPAGATION
  - OBSERVE EXPERIENCED OPERATORS
- RECORD THE HIGHEST SCORE POSSIBLE

# The Big Lake



# Choices



- Keweenaw Peninsula selection factors
  - Centrally located
  - North shore operation required rapid setup after movement
  - Opportunity for long unobstructed paths

# A Few Contest Rules



- Categories -- 10 GHz only or 10 GHz through visible light
- Contest split into two weekends: August 17<sup>th</sup> and 18<sup>th</sup> then September 21<sup>st</sup> and 22<sup>nd</sup>
- Distance based scoring
- Exchange is callsign and 6 digit grid square
- Each unique (new callsign) QSO counts 100 x distance in Km
- Each contestant may contact previously contacted station if either station has moved 16 Km or more. Subsequent contacts scored as 1 x distance in Km

# 2018 ARRL 10+ Contest

- Most operators organized around Lake Superior in four general areas:
  - Minnesota North Shore from Duluth MN to the Canadian border -- 14 operators, 13 possible locations
  - Ontario Canada near Marathon -- 5 operators
  - Keweenaw Peninsula Michigan -- 9 operators, 3 possible locations
  - Grand Marias, Michigan -- 3 operators, one location

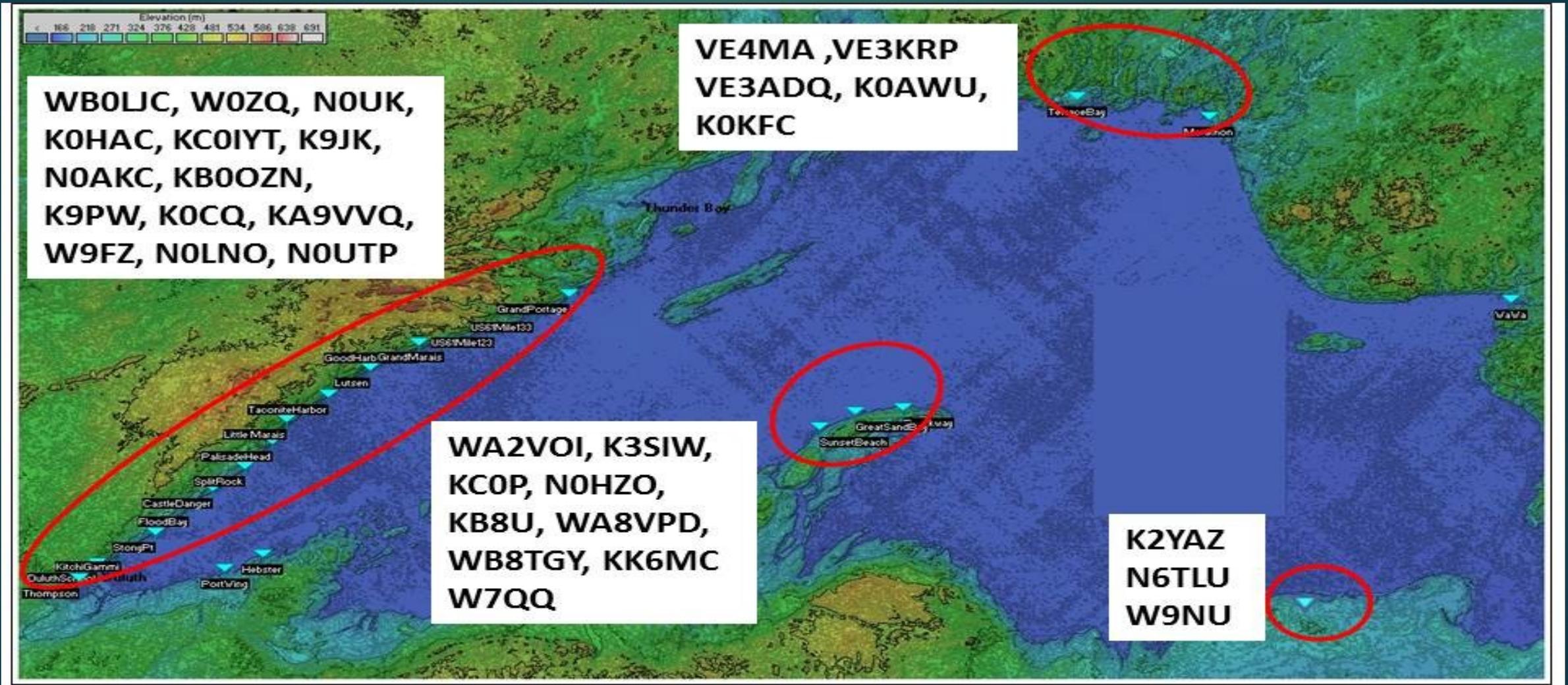
# Contest Operation Philosophy

- ▮ Large group of 14 stations moves along the Minnesota North Shore with stops about every 10 Miles.
- ▮ Two smaller groups operate from the Upper (Keneewaw) Peninsula, Michigan
- ▮ North Shore group goes north on Saturday, stays overnight near the Canadian Border then goes South on Sunday with a shift in UP group of about 20 miles

# Contest Operation Philosophy

- ▮ North Shore group splits into 2 groups to facilitate setups at space limited sites, and to promote a smoother flow of stations to work the upper peninsula group
- ▮ Small group of stations at Marathon Ontario Canada equipped with 10, 24, 47 and 78 GHz
- ▮ Small group of 3 stations at Grand Marais, Michigan with 10, 24 and 47 GHz. Only available path is Marathon ON.

# Contest Operation Philosophy Summary



# The Canadian Side

MARATHON ONTARIO GROUP



# North Shore MN Group

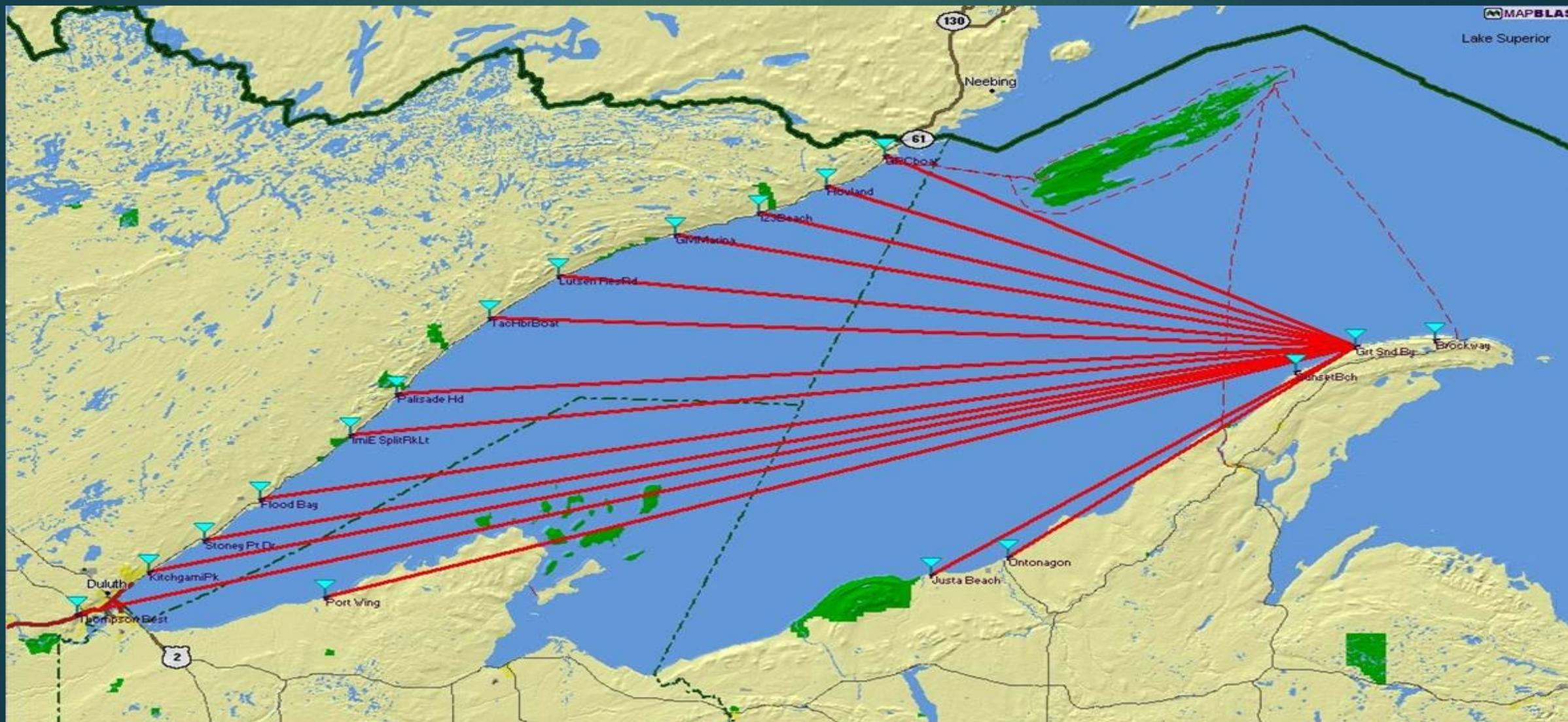
14 STATIONS AND 13 SITES



# 2018 ARRL 10+ Contest

- Organization -- Each location has a coordinator. Function include.....
  - Assemble contestants at the operating site each day
  - Ensure that each contestant has an opportunity to contact stations in other locations
  - Limit unintentional QRM
  - Coordinate any moves or band changes
  - Maintain time management
  - Coordinator for the Upper Peninsula group was Donn WA2VOI

# The Land of Opportunity



# 2018 ARRL 10+ Contest

- Keweenaw Peninsula Environment
  - ▮ Prolific copper and Iron deposits affect magnetic compass navigation
  - ▮ Visual references beyond lake horizon -- unusable
  - ▮ Lake temperature 42 degrees F
  - ▮ Foggy mornings and warm sunny afternoons

# 2018 ARRL 10+ Contest

- Great Lakes Evaporation Ducting
  - Water temperature 40 to 45 degrees F
  - Air temperature 60 to 80 degrees F
  - In August 2018 evaporation duct was very tall and very strong for 10 GHz
  - Too much water (relative humidity) for 24 GHz and above

# 2018 ARRL 10+ Contest

- ▶ Copper Harbor Michigan
  - ▶ Population 108 (seasonal visitors made it feel like more)
  - ▶ One restaurant open for breakfast
  - ▶ Another open for dinner -- both excellent
  - ▶ Good lodging variety available. Early reservations recommended



# 2018 ARRL 10+ Contest

Mt. Brockway EN67al



# 2018 ARRL 10+ Contest

Saturday Morning 17 August 2018 -- Mt. Brockway 726 feet above lake level

- Immediately determined that there were strong 10 GHz signals from the Minnesota North Shore and Ontario

- What a thrill!! QSO tempo was fast and furious

SSB contacts made with every available North shore and Ontario station on 10 GHz at distances from 110 to 250 miles

- Observed low morning stratus clouds across the lake

500 to 2000 ft above lake level

- No 24 GHz contacts made..... Not a peep

# 2018 ARRL 10+ Contest

Saturday Afternoon 17 August 2018 Mt. Brockway 762 feet above lake level

- While watching stratus cloud dissipation another 24 GHz attempt was made

- After 10 GHz initial contact, three strong SSB 24 GHz contacts were made with Ontario Canada stations at 110 miles

- KK6MC made two nice SSB 24 GHz contacts with Ontario stations as well. 110 miles 20 dB horn and 1 watt

# 2018 ARRL 10+ Contest

- ▶ Saturday  
Summary
- ▶ 69 contacts  
on 10 GHz
- ▶ 3 contacts on  
24 GHz



# 2018 ARRL 10+ Contest

Sunday Morning -- Great Sand Beach EN57vk



# 2018 ARRL 10+ Contest

Sunday Morning 18 August 2018 Great Sand Beach est.  
100 feet above lake level -- EN57vk

No line of sight path to Ontario due to tree blockage

Again observed low stratus clouds in all directions

North shore crew at their closest point 75 miles  
across the lake

Strong 10 GHz signals building

2 very weak CW contacts on 24 GHz with K9PW and  
W0ZQ in EN57ex at 75 miles

1 24 GHz SSB contact With WA9VOI at 11 miles



# 2018 ARRL 10+ Contest

Sunday

# 2018 ARRL 10+ Contest

Sunday Afternoon 18 August 2018 Great Sand  
Beach est. 100 feet above lake level -- EN57vk

Low stratus cloud dissipation

10 GHz signal strength booming at S9+40 dB but  
that did not translate to success on 24 GHz

2 more very weak CW contacts on 24 GHz again  
with K9PW and W0ZQ in EN47hf -- 150 miles,  
longest 24 GHz QSO recorded during the weekend.

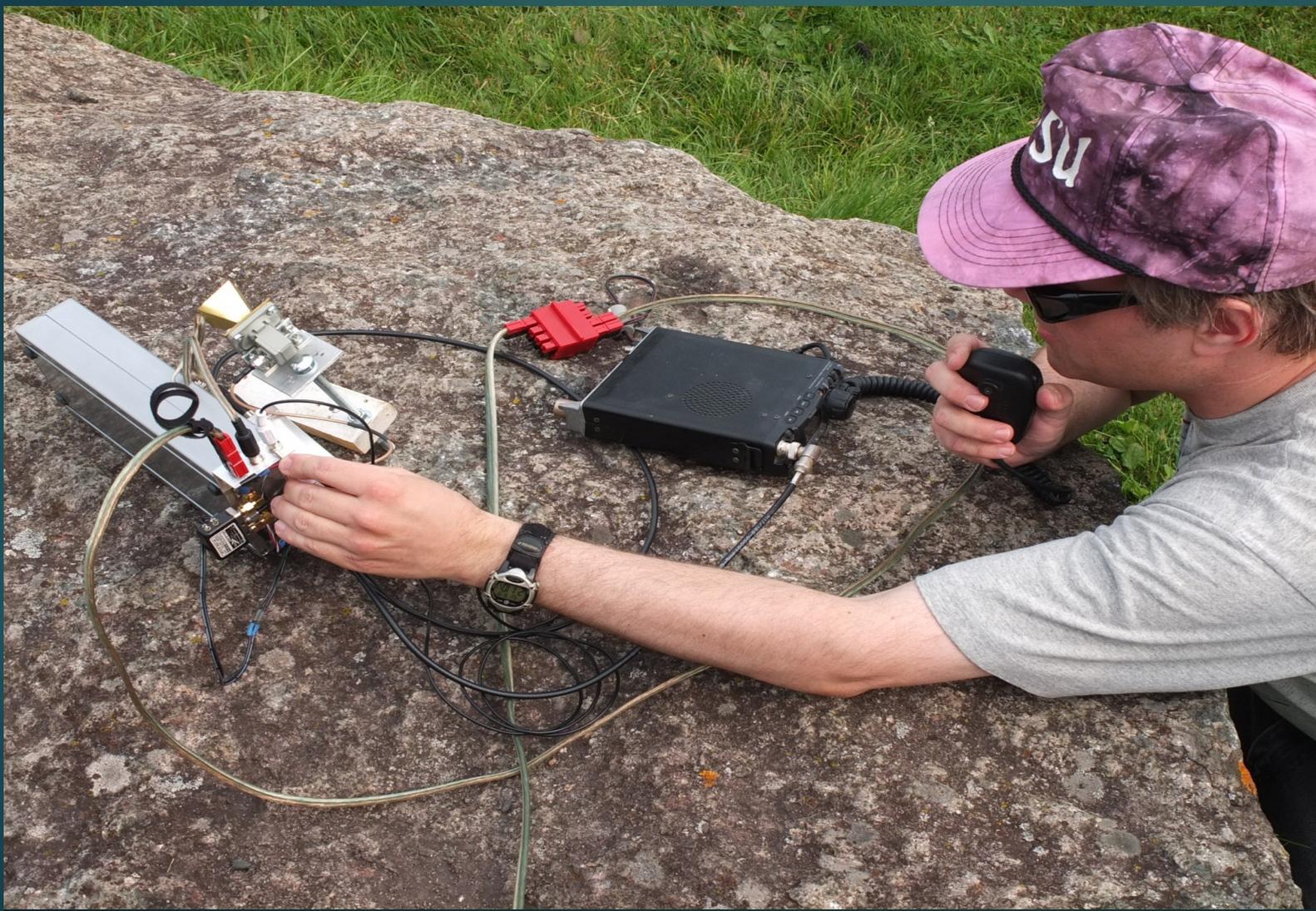
# 2018 ARRL 10+ Contest

- Contest Summary
  - ▮ 174 QSOs on 10 GHz
  - ▮ 7 QSOs on 24 GHz
  - ▮ 48,403 Points
  - ▮ Finished in the top 10

# What was Learned?

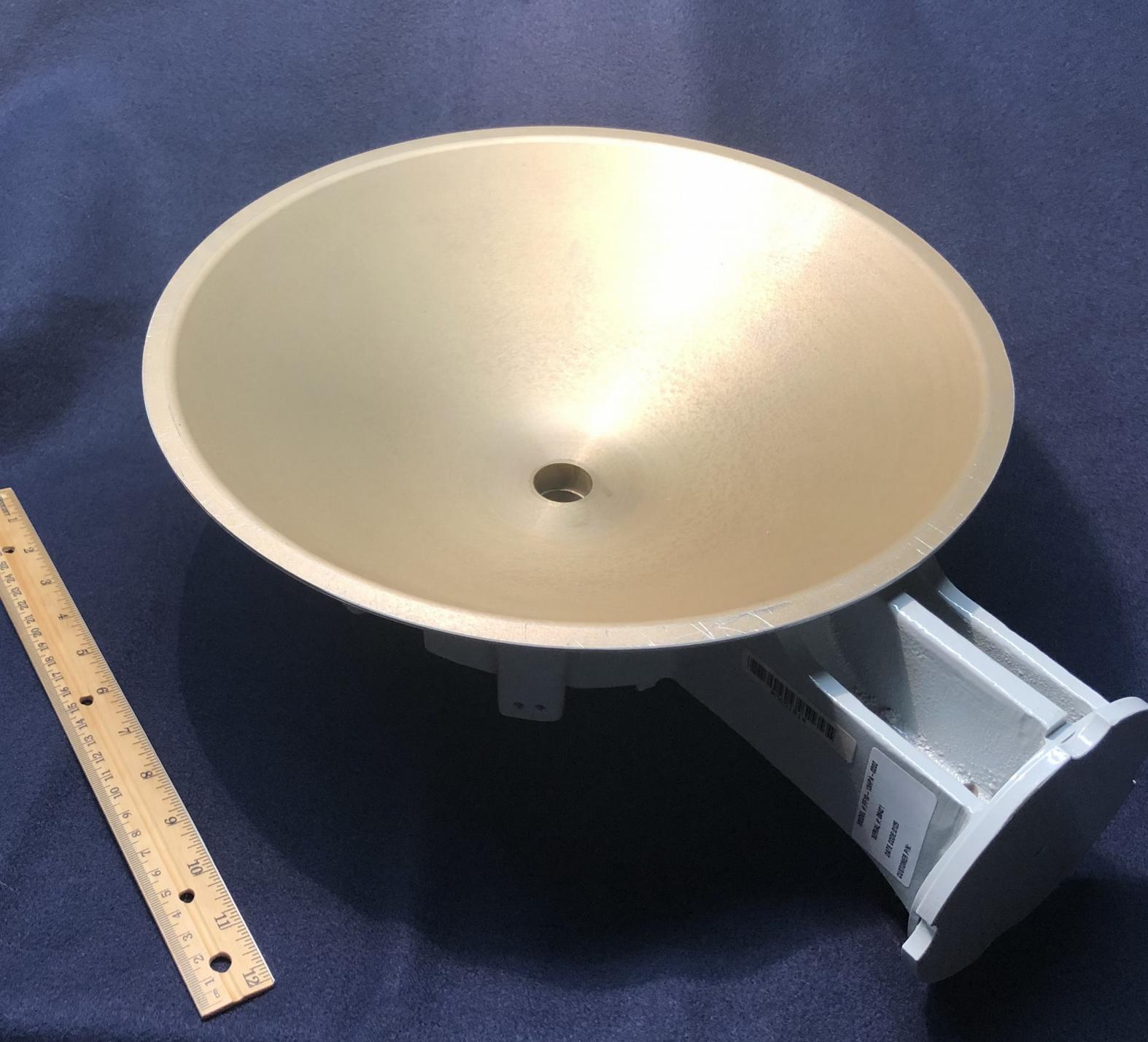


- Preparation was good; equipment worked perfectly
- It's confirmed: 24 GHz IS harder.... water vapor absorption rumors are true!
- I was pleased with my station's performance on 10 and 24 GHz.
- Because of 10 GHz signal strength, navigational quirks were not an issue
- It was not possible to both learn well and score well. A choice must be made.
- I was surprised by the contest pace. There was no idle time to experiment, relax, eat or sleep without score compromise. A good problem to have!
- Operating sites on the Keweenaw Peninsula are limited; especially for groups, due to limited road shoulder width, private access, trees and terrain.
- Telephone service around the Lake was not reliable -- coordination suffered.
- Organization and help from experienced ops was outstanding
- No contacts were made on 47 or 78 GHz across Lake Superior on any path



A “big”  
station is  
not required

KC0IYT 10 GHZ, 200MW, 7  
DB HORN 263 KM



# What's Next?

47 GHZ STATION  
DEVELOPMENT



# What's Next?

47 GHZ DEVELOPMENT

# Reference

2018 MICROWAVE UPDATE PROCEEDINGS ARTICLE BY BARRY MALOWANCHUK, VE4MA

- Operating from Lake Superior in the 2018 ARRL 10 GHz and above contest
- <https://www.dropbox.com/s/idozbd1s2lt32ug/Micro%202018%20whole%20book%20with%20index-thumb.pdf?dl=0>

DOWNEAST MICROWAVE --

- <https://www.downeastmicrowave.com/>
- LWSS weak Signal Source 50 MHz through 47 GHz

KENT BRITAIN WA5VJB

- [www.wa5vjb.com/](http://www.wa5vjb.com/)
  - Vivalde antenna used for weak signal testing

QUESTIONS?

DISCUSSION?

