

# Getting Started in Hidden Transmitter Hunting



Dale Hunt WB6BYU

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# Introduction

- What is Transmitter Hunting?
- Why would we want to do it?
  - ELT searches
  - Locating sources of interference
  - Locating balloon / rocket payloads
  - Fun / recreation / sport
- Why am I the one standing up here?

# Transmitter Hunting Summary

- Transmitter hunting has practical uses, but mostly we do it for fun.
- Doesn't require expensive equipment (but specialized equipment can make it easier.)
- Equipment often can be home-built.
- Transmitter hunting is a skill that requires practice.
- Knowing how to use the equipment you have is more important than having fancy equipment.
- Primarily VHF (2m), but can be on other bands.

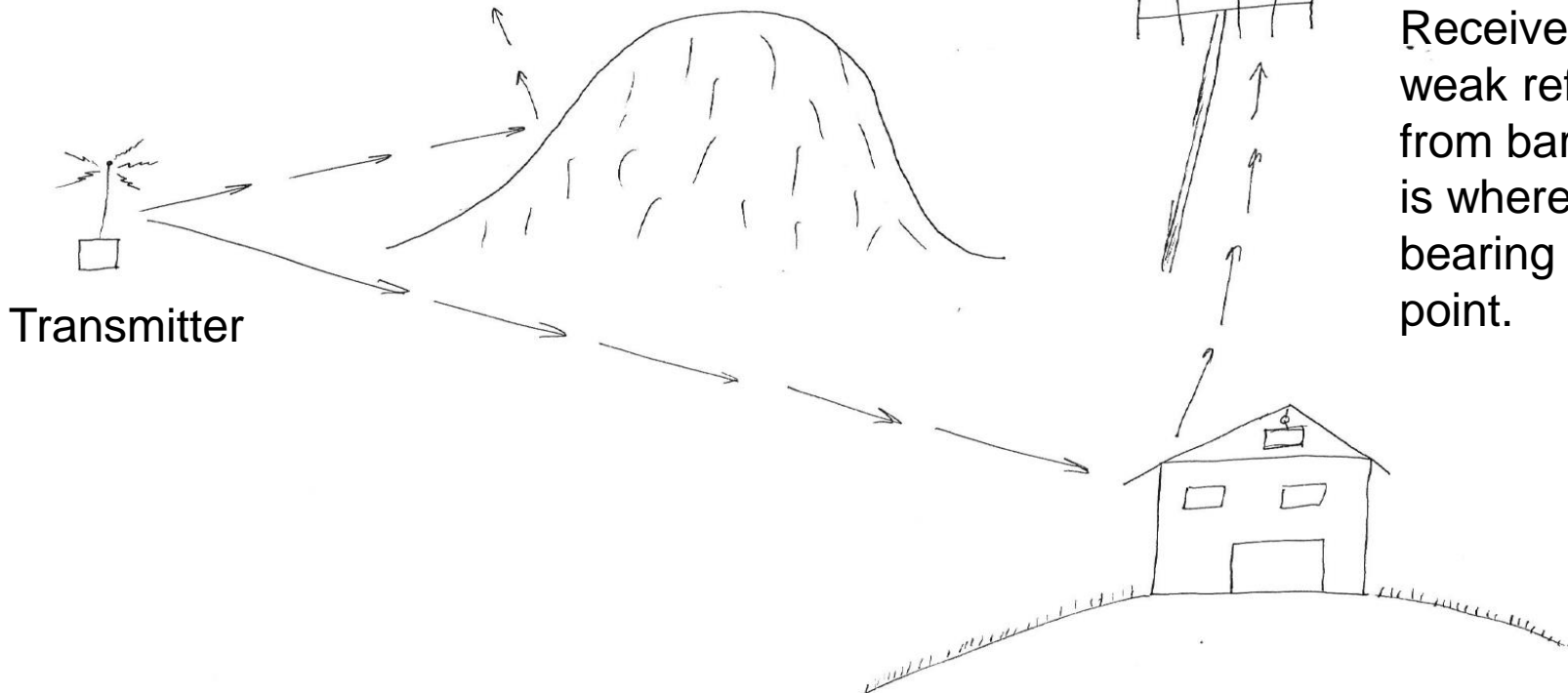
# Radio Propagation Principles

- Signals travel in a straight line until reflected or absorbed.
  - Reflections and blockages make RDF more difficult, especially on VHF/UHF.
- Signals get weaker the further they travel.
  - Strength increases as you get closer.
- Signals lose strength at a reflection.
  - Put more trust in the strongest signals.

# Sources of Confusion

Hill blocks direct signal from transmitter

Receiver



Transmitter

Receiver hears weak reflection from barn. This is where the bearing will point.

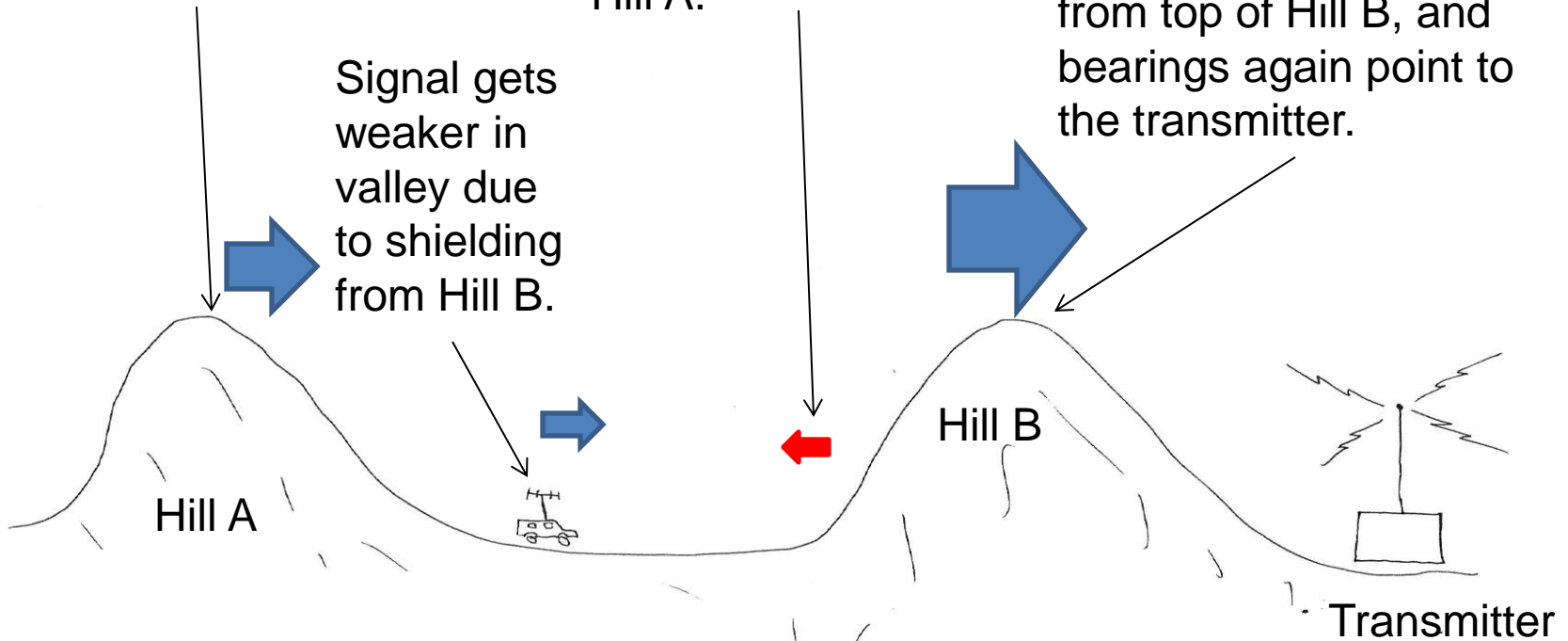
# A Common Problem

From top of Hill A, bearing points to transmitter with good strength.

Signal is blocked by Hill B. Bearings **reverse**, pointing to the reflection from Hill A.

Signal is much stronger from top of Hill B, and bearings again point to the transmitter.

Signal gets weaker in valley due to shielding from Hill B.



# Tips for taking bearings

- **Height is good.** Even a freeway overpass can make a big improvement.
- **Find a clear spot,** without a lot of buildings or metal objects around.
- **Try multiple locations.** Just moving a few feet can often make a difference.
- **Go somewhere else** when bearings seem confusing or erratic.

# Following Clues

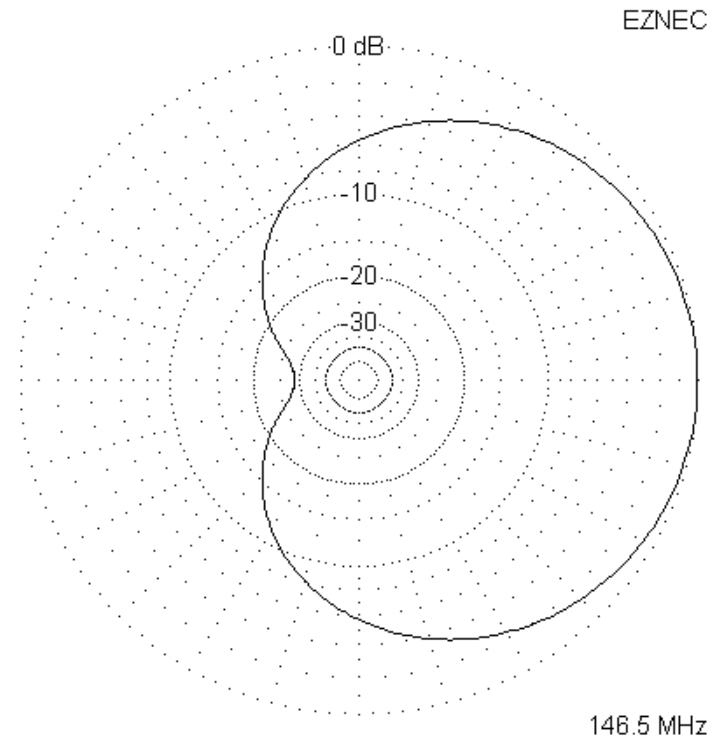
- Finding the transmitter is a process of following clues to the source of the signal. Important clues include:
  - Direction
  - Signal Strength
  - Rate of change in direction
  - Rate of change in signal strength
  - Terrain shadowing
  - Non-radio clues: keep your eyes open!

# Tools for Determining Direction

- Antenna with directional pattern
- Some way to measure signal strength
- Some way to reduce signal strength as you get close to avoid receiver overload
  - “Attenuator”

# EXAMPLE: “Body Shielding”

- Directional antenna:
  - Use your body as a reflector
  - Hold radio close to your chest.
  - Signal is weakest when your back is to the transmitter, so your body is shielding the radio.



# Body Shielding (continued)

- Some way to measure signal strength
  - If receiver has no meter, listen to the background noise when the signal gets weak.
  - Background noise increases as signal gets weaker.
  - When signal is weak enough, squelch will close and the noise will disappear

# Body Shielding (continued)

- Some way to reduce signal strength
  - “Waveguide Beyond Cutoff” attenuator
  - Cardboard tube coated with aluminum foil.
  - Add a string to clip onto the radio.

# We Used Our Tools

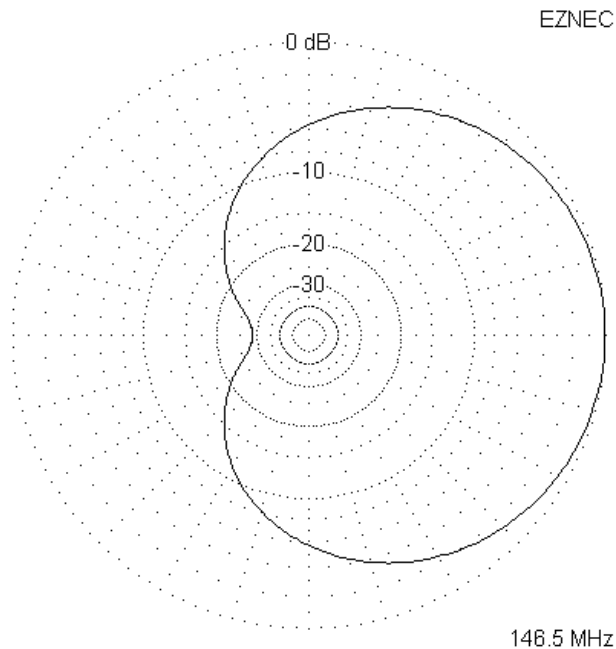
- Antenna with directional pattern
- Some way to measure signal strength
- Some way to reduce signal strength as you get close to avoid receiver overload
  - “Attenuator”
- This gave us a bearing to the transmitter.

# Receiver Choices

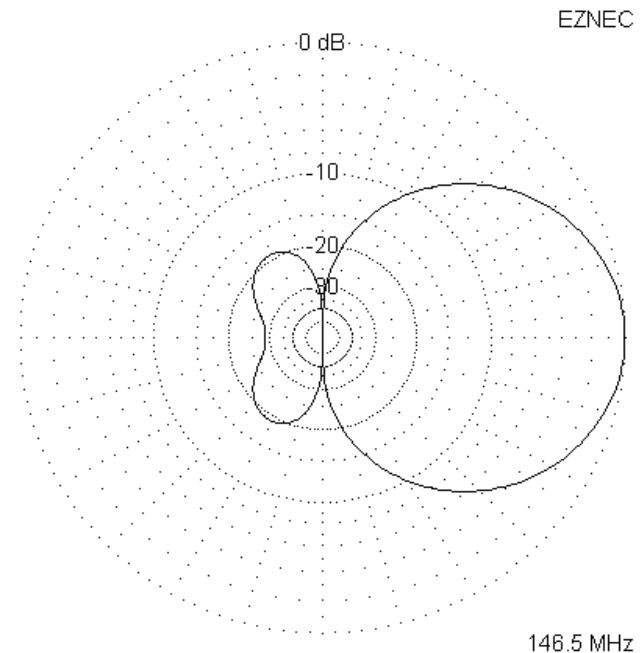
- Receiver/transceiver for frequency
  - Meter is useful, not required
  - Mobile rig in a car may be a simple choice
- Wideband receiver
  - SSB/CW best for very weak signals
  - Allows harmonic sniffing
- Specialized receivers
  - L-Per
  - VK3YNG “Blue Box”

# Directional Antennas

- Know the pattern of your antenna



Rotate for null (weakest signal)



Rotate for strongest signal

# Types of directional antennas

- Yagi
  - Most standard designs will work
  - Taller than a quad for vertical polarization
- Quad
  - Less height for vertical polarization
  - More awkward
- Loop antennas typically used at HF
- Many other options for specific situations

# 6-Element Yagi for 450 MHz



Made with wire and PVC pipe.

# 3-Element Tape Measure Yagi

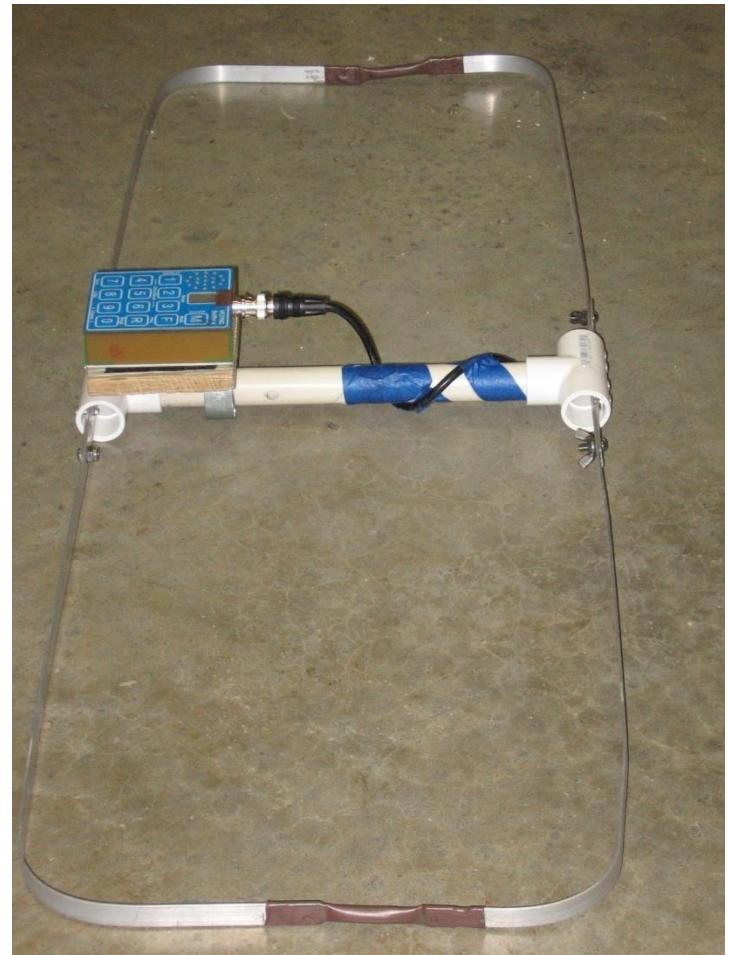


DF receiver is attached directly to the antenna.

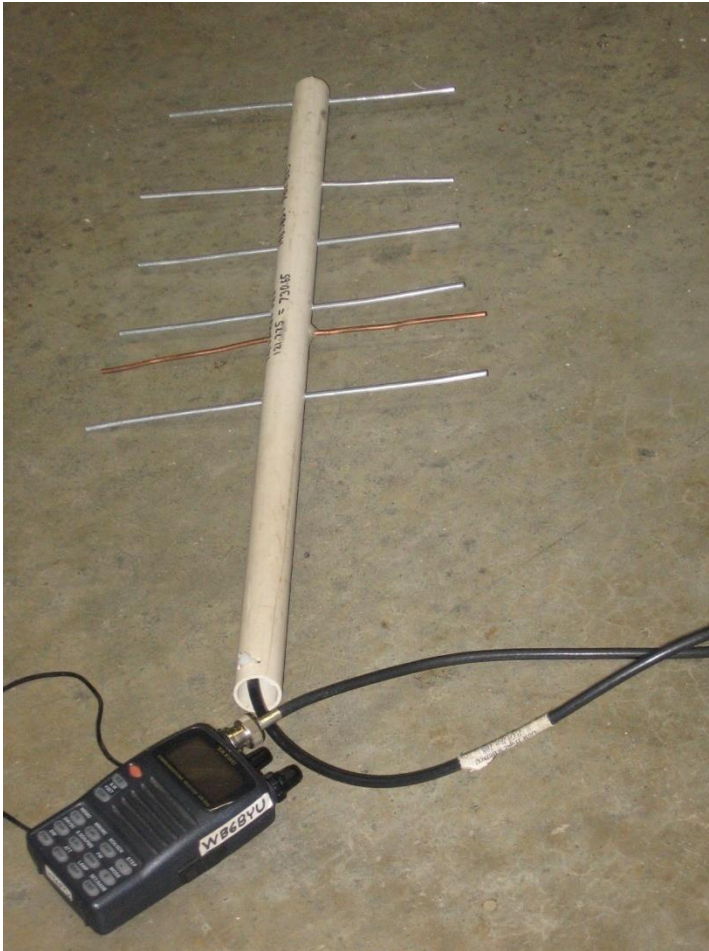
# Moxon Antenna for 2m

Short form of yagi antenna.

This one is made from  $\frac{1}{2}$ " aluminum flat stock and has a DF receiver mounted on the boom



# 732 MHz Yagi for Harmonic Sniffing



High frequency allows a very sharp pattern in a physically small antenna.

Use to pick up harmonics of the transmitted signal when the fundamental is very strong.

732 MHz is the 5<sup>th</sup> harmonic of 144 MHz and the 6<sup>th</sup> harmonic of 121.5 MHz.

# 2-Element Quad Antenna



Made from PVC pipe and copper wire.

# 4-Element Quad for 465 MHz



Improvised from PVC pipe, wood dowels and copper wire in about half an hour to track interference to Sheriff radio system.

# How to tell a radio geek...



3-Element quad for 121.5 MHz mounted through the sun roof on my van.

# Attenuator

- Why do you need one?
  - Signal gets too strong, pins meter in all directions
- Types
  - Waveguide beyond cutoff
  - Resistive attenuator
  - Offset / active attenuator
- May be built into sophisticated receivers.

# Other types of equipment

- Time Difference of Arrival (TDOA)
  - Uses a pair of antennas
  - Sometimes indicate LEFT/RIGHT
  - Convenient to use, confused by reflections
- Doppler
  - Array of 4 or 8 antennas in a circle
  - Ring of LEDs or digital readout
  - Good on fairly strong, vertically polarized signals
  - Gets confused by reflections

# Steps in a transmitter hunt

- Signal acquisition
- Triangulation
  - Plot bearings on map to get an estimate
- Homing
  - “follow your nose”
- Sniffing
  - Up close and personal

# Types of transmitter hunts

- Mobile
  - Mostly from a vehicle
  - Can be up to several hundred miles
- On foot
  - Fun for a club picnic
  - International competitions (ARDF)
- Fixed
  - Triangulation using multiple fixed stations

May require different types of equipment

# ARDF or “Radio Orienteering”

- Done on foot in a large park or forest using map, compass, and DF receiver.
- Course lengths may be 2 to 5 miles with up to 5 transmitters.
- Competitions held on 2m and 80m.
- US Championships held every year.
- Region and World Championships held every other year.
- Equipment optimized for use while running.

# Start of an informal hunt



# Fun For All Ages



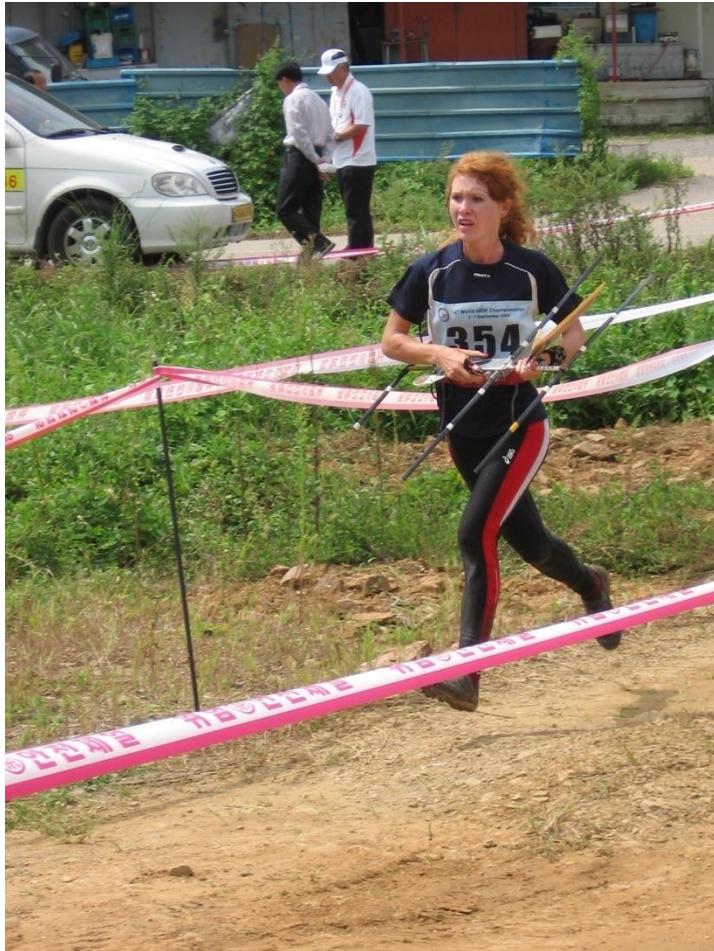
Flag is visible from 10' or more



# Casual or Serious



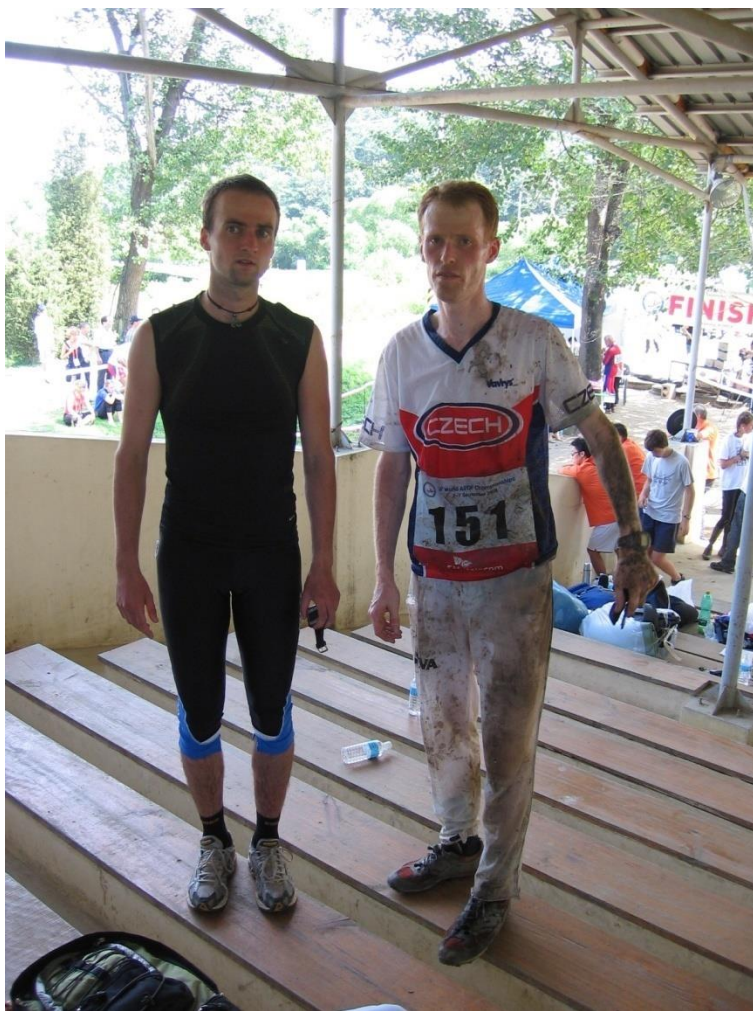
# Some Finish Fast



And others are happy just to get there



In spite of the mud, rain, etc...



# PRACTICE HUNT

- After lunch
- Where to meet
- Frequencies
- Equipment available to loan

# Summary

- Transmitter hunting is fun, can be useful.
- Doesn't require expensive or elaborate equipment (but specialized equipment can make it easier.)
- Equipment often can be improvised or home built to meet a specific need.
- Transmitter hunting is a skill that requires practice, to learn how to interpret the clues.

# Transmitter Hunting Resources

Many facets of transmitter hunting, with lots more links:

- <http://www.homingin.com/>

Offset Attenuator plans:

- <http://www.homingin.com/joek0ov/offatten.html>

ARDF as a sport in North and South America (with links):

- <http://www.ardf-r2.org/>

Commercial DF equipment:

VK3YNG “Blue Box” receiver: <http://www.foxhunt.com.au/>

L-Tronics direction finders: <http://www.ltronics.com/>

Contact me with questions: [wb6byu@arrl.net](mailto:wb6byu@arrl.net)