O Radio, Radio, Wherefore Art Thou Radio

apologies to Bill S.

A Presentation on Transmitter Hunting
North Fulton Amateur Radio League
April 19, 2011
Mike Roden / W5JR
So, Just What is “Transmitter Hunting”
Facets of T-Hunting

• “Fox” Hunting
• “Fox’ Hiding
• Radio Orienteering - ADRF
• Orienteering (uses GPS, hey, that’s a radio!)
• Interference Hunting
Back in The Day…

• My First T-Hunts were on 75m
• Also hunted on 10m and 2m
• My 1968 ARRL Antenna Book has Receiving Loop Antenna designs
• Same 28 Mc (!) design in my 1991 and 2008 ARRL Antenna Books
• Ingenious “Foxes” were hard to find
  – Loading a railroad siding on 75m
  – Running a ¼ kW on 2m
Practice, Practice, Practice

• Several local clubs held T-Hunts, almost every weekend and a few during the week

• Honed skills on diverse bands and targets
  – Daytime       Nighttime
  – 75m  10m  6m  2m  70cm (440)
  – Continuous key & intermittent key
  – Stationary & mobile (extra tough w/intermittent key)
  – High power     low power     changing power
  – Unknown Freq – find that first, then the Fox
Thought I was Pretty Good

• Started getting reputation for finding & hiding
• Used skills to hunt down stuck radios on local repeaters
• Used skills to hunt down jammers on local repeaters
• Used skills to hunt down spurious interference on local repeaters
• Then the Statewide Challenge was thrown down...the best meets the best...
The Day Arrives

• TX-VHF FM Society Summer Meeting, Aug 1977 in San Antonio TX
• All “contestants” gather in Brackenridge Park, engines revving, maps of the city open & ready
• The rules sheet is passed out - What?
  – Transmitters (yes, plural!!) **ALL** located within the park
  – Unknown number of transmitters, all on same frequency
  – Random keying, all the same ID but different letter at end
  – Match “letter” to “symbol” on transmitter black box
  – Timed event, most # of correct letters/symbols in 2 hrs
The Park – How Hard Can it Be?
Roughly ½ mi x ¾ mi
Equipment

- Team Arlington - Manual Class
  K5FOG  W5ETG  WA5TKU  WA5UOB (me!)
- 4 element 2m yagi to radio w/S-meter
- Switchable attenuators
- Maps w/clear overlays & grease pencils
- 4 walkie talkies for close in or foot traffic
- Yagi worthless – transmitters keying on top of each other
Reinvent Ourselves

• Toss all previous experience out the window
• Calls for a new approach
• Determine the likely # of transmitters
  – Seems like 5, A thru E but notice “C” missing
  – “C” transmitter ID has failed with dead air for ID
• Expect them to be “scattered” in park
• An hour goes by before finding 1st transmitter – tension rises on the team
• Next 3 in 35 min, including silent “C”
• Review map to guess general area of last one & rush over
• Arrive at final TX just as 1st “automated” entrant arrives
• 5 minutes to spare!!
FIRST PLACE
TEXAS CHAMPION TRANSMITTER HUNT
MANUAL CLASS
SAN ANTONIO, TEXAS
AUGUST 5, 1977
WA5UOB
Hooked Yet? How Do You Get Started?
Hundreds of approaches and articles written

- ARRL http://www.arrl.org/direction-finding
- Homing In (KØOV) http://www.homingin.com/
- Hudson Valley Direction Finding Association http://www.n2ki.com/HVDFA/Index.htm
  Great Tips for Hunters – Body Shielding, tuning off frequency, listening to 3rd harmonic (UHF band for 2m Foxes), Gear for hunting from car or on foot
- Albuquerque Transmitter Hunters http://www.wb8wfk.com/
- WB2HOL RDF Pages http://theleggios.net/wb2hol/projects/rdf/rdf.htm
- N6QAB RDF Site http://www.qsl.net/n6qab/
- PicoDopp http://www.silcom.com/~pelican2/PicoDopp/PICODOPP.htm
Joe’s (KØOV) Book
Model 146/437-10WBP

Arrow Antenna
Yagi + Attenuator

- Need Radio with S-Meter
- Need Radio with built-in Attenuator
- Probably need external Attenuator for close in
- Option to use 3\textsuperscript{rd} Harmonic (UHF) if on 2m
- Can Tune off frequency as signal gets stronger
My Hamfest T-Hunt Radio

- Folks are puzzled how I find 2m Hamfest Foxes with this radio
- Standard C-628A
- UHF & 1200 MHz ONLY
- Use 3\textsuperscript{rd} and 9\textsuperscript{th} Harmonics
- Beats ‘em every time
- I can get REALLY close
It Really is a UHF & 1200 ONLY Radio
May 1993 QST
Ultra simple RDF Project

Build the HANDI-Finder!

This hand-held direction finder is great for "fox hunting"! Simply connect it to the antenna input of your H-T or FM scanner and you can locate AM or FM sources over the range of 45 to 470 MHz.

By Bob Leiskovec, K8DTS
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Inevitably, every Amateur Radio community experiences its share of repeater jammers. Tempers flare. A new generation of hams gets interested in direction finding. Car roofs start sprouting outlandish antenna arrays, looking more like tuna boats with every antenna addition. Fox hunts are scheduled for practice—and the jammers quickly become more evasive!

When that happened in our area a few years back, Rich James, N8FIL, of the Cuyahoga Amateur Radio Society (CARS), organized members from several area clubs into the "Bozo-Busters," and I resurrected four DOP-SCAN units¹ supplied by the Lake Erie Amateur Radio Association (LEARA). A few dedicated hams soon found themselves getting called out at all hours and driving all over town. When the gasoline bills started mounting up, we figured there had to be a better way!

Thought: Instead of a few hams outfitted with special equipment, why not have many hams equipped with simple direction finding equipment? The radio would have to be founded on.
HANDI Finder Circuit

Except as indicated, decimal values of capacitance are in microfarads (μF); Resistances are in ohms; k=1,000.

IC pins not shown are unused.

See text for details.

<table>
<thead>
<tr>
<th>Freq</th>
<th>R1</th>
<th>C1</th>
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<tbody>
<tr>
<td>400 Hz</td>
<td>10 k</td>
<td>0.056 μF</td>
</tr>
<tr>
<td>1000 Hz</td>
<td>10 k</td>
<td>0.02 μF</td>
</tr>
<tr>
<td>1200 Hz</td>
<td>47 k</td>
<td>0.01 μF</td>
</tr>
</tbody>
</table>
HANDI-Finder

- Uses Audio rate (~1000 Hz) antenna switching
- Null produced when both antennas receiving target signal “in phase”
- Uses TDOA (Time Differential of Arrival) principle
- Works without need for S-meter or attenuators
- Suitable for many different VHF/UHF bands
- Many modern commercial systems based on similar design
The HANDI-Finder is a HANDheld Direction Finder which can be used to localize both AM and FM carrier-based sources using a single connection to the antenna input of an AM receiver tuned to a frequency of interest in the range of 45 to 470 MHz.

It has been designed for low power consumption, simplicity, and economy. Because it is both an easy-to-build kit for the beginner and a convenient basis for further experimentation by those with more experience, it makes a great club project! Overall, it is a quick, inexpensive way to introduce the principle of direction finding, and provide something ready and compact to keep on hand for locating sources of interference.

Except for adding a handle, fabrication is minimal, because two open-loop antennas are bent into a "U" shape and mounted directly to the board as illustrated.

The core drivehead is connected to an FM receiver. The unit is switched on (L1) and tuned for a null in the audio tone heard on the receiver. The direction is perpendicular to the plane of the antennas. The 180-degree ambiguity is not a problem in actual use since multiple bearings must be taken anyway. Refer to the extensive discussion in the manual. The switch is moved DOWN to stop the tone for receiver and survey purposes or to the CENTER position to shut off the unit.
All “Good” Projects get Modified!!

http://www.homingin.com/hfinderfix.html

• Adds a “sense” mode to solve the 180° bi-directional signal

• Antenna redesign using two vertical dipoles

In this view looking down from the sky, the bidirectional HANDI-Finder unit (a) has two nulls, each perpendicular to the plane of the antennas. The added sense mode (b) has a single null on the Antenna #1 side.
By Mike Kossor, WA2EBY

A Doppler Radio-Direction Finder

Part 1: A radio-direction finder (RDF) is useful in locating repeater interference (intentional or unintentional) and transmitter “fox hunting.” Join in the fun with this VHF/UHF Doppler RDF project!
Great & Simple Antenna Design

Figure 5—Assembly drawing of one of the four Pop Top Mag-Mount antennas.
PicoDopp – The Project

http://www.silcom.com/~pelican2/PicoDopp/PICODOPP.htm
ARDF – For the Sport of It

• 2011 IARU Region II ARDF Championship to be held in Albuquerque Sept 16-18 of this year

• World Wide competition - Hams & non Hams

• Also known as Radio Orienteering
Orienteering

- GA Orienteering Club
- Can be Foot, Bike, Canoe, Ski, Radio, Car
- Teaches Navigational skills
- Some versions use GPS to find “cache”
Finding Interference

• A full night’s topic by itself
• I’ve hunted “professionally” in current job and advise local engineers on locating interference
• Tracked recent Interference impacting NFARL repeaters (444.475 & 147.06)
• Tracked down 2 GHz microwave interference
• Tracked down HF interference
Commercial Equipment

National VHF Vector Finder

http://www.nationalrf.com/index.htm

National HFDF Vector Gun