



Radio Orienteering/ARDF



- The Sport of Radio Orienteering, ARDF
- Orienteering – What is it?
- Topographical Maps
- RO/ARDF - different from Orienteering
- Courses and events
- Getting Started on the Cheap
- Receivers for 2M and 80M
- Directional Antennas
- Attenuators
- Foxes for 2M & 80M
- Misc. Equipment - Maps and Compass

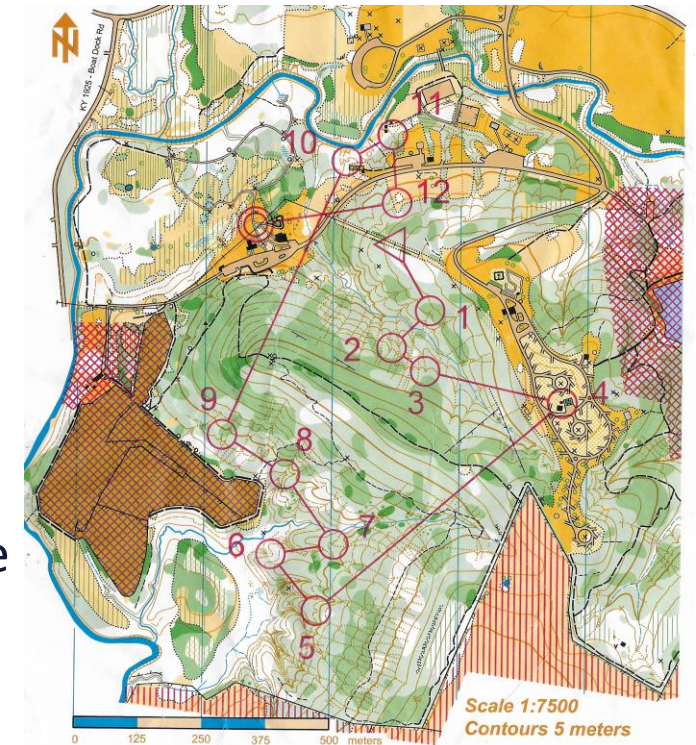




The Sport of Radio Orienteering



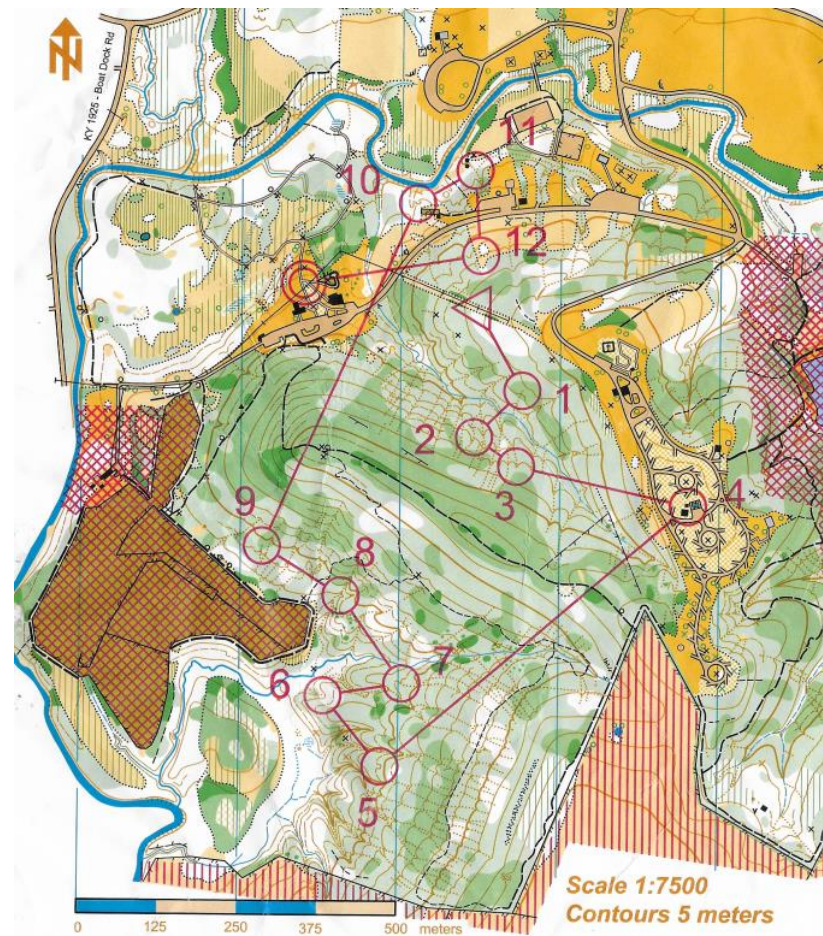
- Radio orienteering combines the skills of Orienteering, the equipment and expertise of Radio Direction Finding and the athleticism of cross country running and combines them into a fun and competitive sport.
- **Orienteering:** Orienteering is a sport in which orienteer's use an accurate, detailed map and a compass to find points in the landscape. It can be enjoyed as a walk in the woods or as a competitive sport.
- A standard orienteering course consists of a start, a series of control sites that are marked by circles, connected by lines and numbered in the order they are to be visited, and a finish. The control site circles are centered around the feature that is to be found; this feature is also defined by control descriptions (sometimes called clues). On the ground, a control flag marks the location that the orienteer must visit.



Orienteering Basics



- Topographical Maps
- Colors
- Scale
- Orienteering Lines
- Contour Lines
- Features – Descriptions
- Control Descriptions
- Compass Training



Orienteering – A thinking Sport

Orienteering



Detailed Maps – Loaded with information

— Orienteering Map

- Very detailed **topographic** map. (contours)
- Uses international standard colors and symbols



Map Scale

Orienteering maps

- Have a ***scale***
- tells you ***distance***



Scale 1:10,000

Map Scale – How far is it

Scale

- Scale of **1:10,000**
- 1 of **any unit** on the map equals 10,000 of the **same units** on the ground. So 1 cm on the map = 10,000 cm, or 100 meters on the ground.



Scale 1:10,000

Map Scale – Smaller Area

Scale

- At a scale of 1:5000, 1 cm on the map is how far on the ground? Divide 5000 by 100, and you get 50. So at 1:5000, 1 cm is only 50 m on the ground.



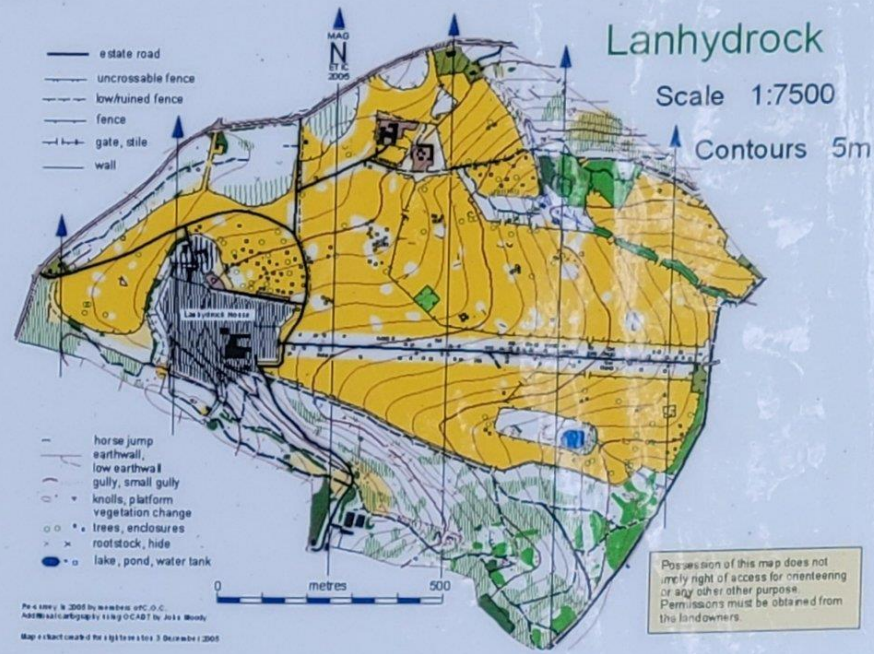
Scale 1:5,000

Which way is North – Orientation

Orienteering maps

- Also have ***north lines***

- tells you which direction is ***magnetic north***



Contour Lines – Hills and Valleys

Contour lines

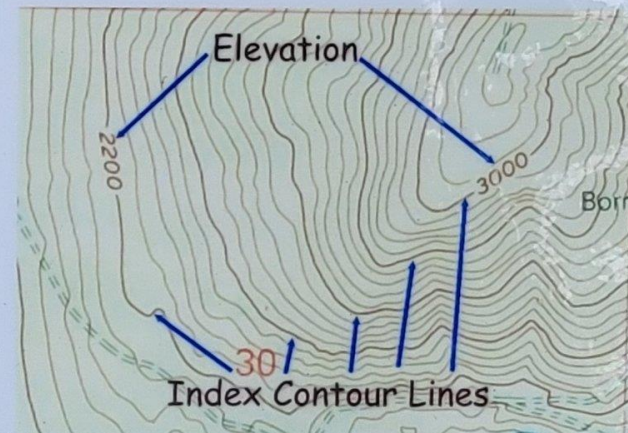
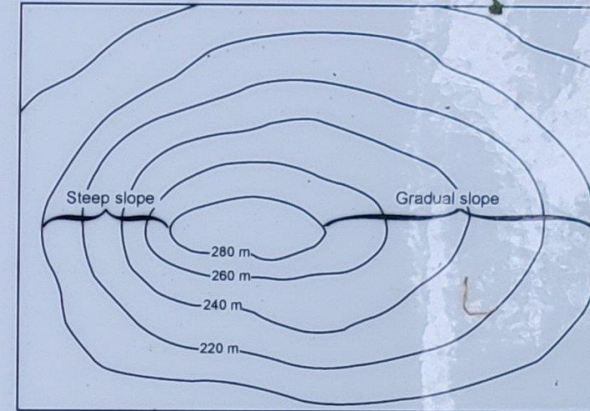
- Show ***elevation***
- Show ***shape of the land***
- Every point on the same contour line is at the same elevation.
- The difference in elevation between two lines is called the ***contour interval***



Contour Lines

Contour lines

- Contours close together = steep slope
- Contours far apart = gentle slope
- Every 5th contour is an ***index contour***
- Orienteering maps usually do not show elevation numbers



Orienteering Maps - Lots of Colors

Map Colors and symbols

- Purple or red – course symbols
- Blue – water
- Black – manmade or rock
- Brown – land features and contours
- Yellow – open land, fields, meadows
- Green (and white) – forest

Purple or Red







Purple



- Start – triangle
- Control – circle
- Finish – double circle
- May also show
 - Drinking water
 - First aid
 - Out of bounds areas
 - Dangerous areas
 - Mandatory route or crossing point
 - Forbidden route

Blue - Water

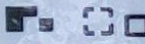






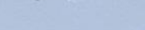
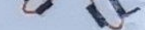

Blue: Water Features

-  Lake, Pond
Lac, Mare
-  Uncrossable river
Rivière infranchissable
-  Stream, Small stream
Ruisseau, Petit Ruiss.
-  Seasonal stream
Ruisseau saisonnier
-  Uncrossable marsh
Marais infranchissable
-  Marsh, Indistinct marsh
Marais, Marais indistinct



Black – Man Made & Rocks


Black: Man-Made & Rock

-  Building, Ruin
Bâtiment, Ruine
-  Paved road
Chemin pavé
-  Road
Chemin
-  Vehicle track
Chemin de charrette
-  Footpath, Small path
Sentier, Sentier étroit
-  Indistinct path
Sentier indéfini
-  Ruined stone wall
Mur en ruine
-  Cliff, Passable, Impass.
Falaise, Falaise difficile
-  Boulder, Large boulder
Roche, Rocher
-  Boulder field, Boulder grp.
Champ rocailleux, Roches

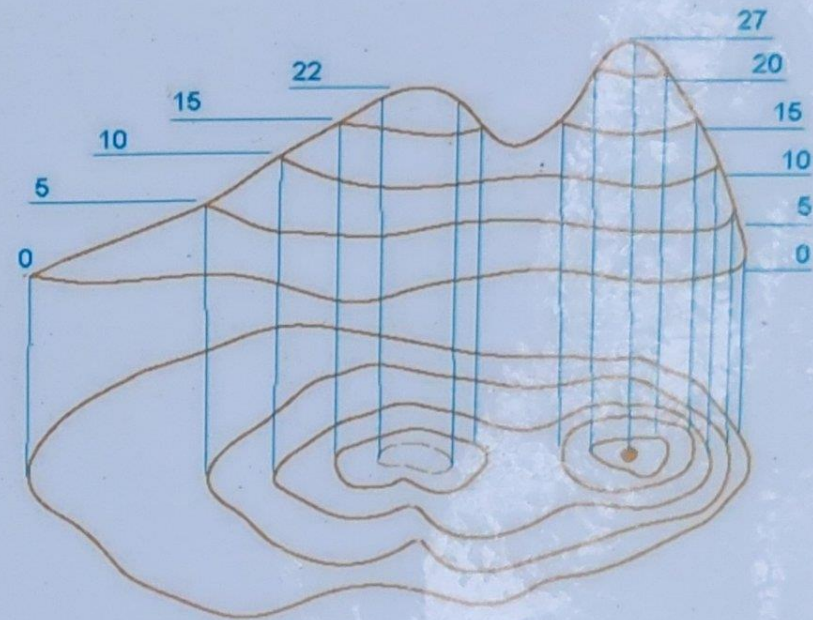


Brown – Contour Lines

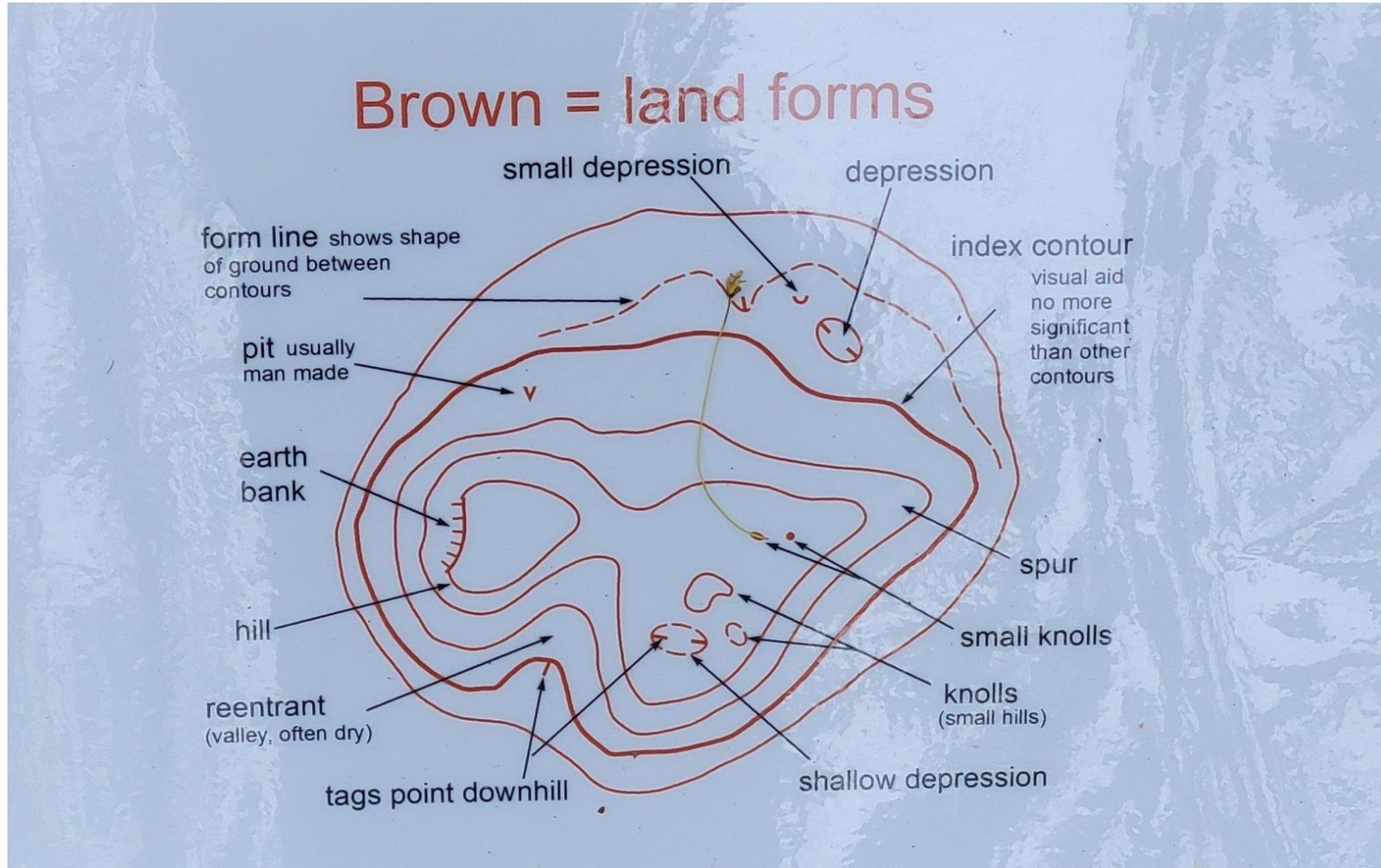
Brown: Shape of the Land

-  Contour, Form line
Courbe; de niveau
-  Earthbank, Beaverdam
Talus, Barrage de castor
-  Knoll, Small knoll
Monticule
-  Depression, Small
Dépression, Petite

Contour lines
represent elevation in
the landscape.



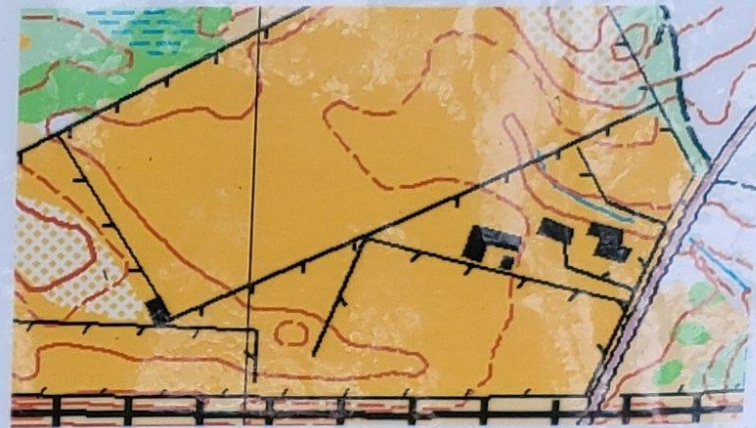
Brown – Also Land Forms



Yellow – Open land – Cut Grass

Yellow: Open Land

-  Open land
Zone ouverte
-  Open land with trees
Zone ouverte avec arbres
-  Rough open land
Zone ouverte difficile
-  Rough open land & trees
Ouverte difficile & arbres



Runnable Forest




White: Open Forest

○ Forest: run
Forêt: course



Green – Slow going

Green: Thicker Vegetation

-  Slow run
Course lente
-  Difficult to run
Course difficile
-  Impassable
Impassable



Course Tips

Doing the course

- Look at the map
- What is the feature?
- Check description and code
- Choose fastest, easiest way to get to the control.
- Keep the map oriented as you go.



Course Tips

Doing the course

- Choose the **fastest** and **easiest** route from one control to the next.
- Straight line might be shortest but often is not fastest or easiest.
- You might want to go around
 - Buildings or fences
 - Swamps or lakes
 - Steep hills or deep gullies
 - Areas of thick vegetation

Course Basics

An Orienteering Course...




Consists of a **start (triangle)**, a series of **control sites (center of each circle)** to be visited in order, and a **finish (double circle or bullseye)**.



Control descriptions

Control descriptions

- Usually on your map
- Tells what you are looking for.
- Code (second column) is important. It must match the control you are looking for.

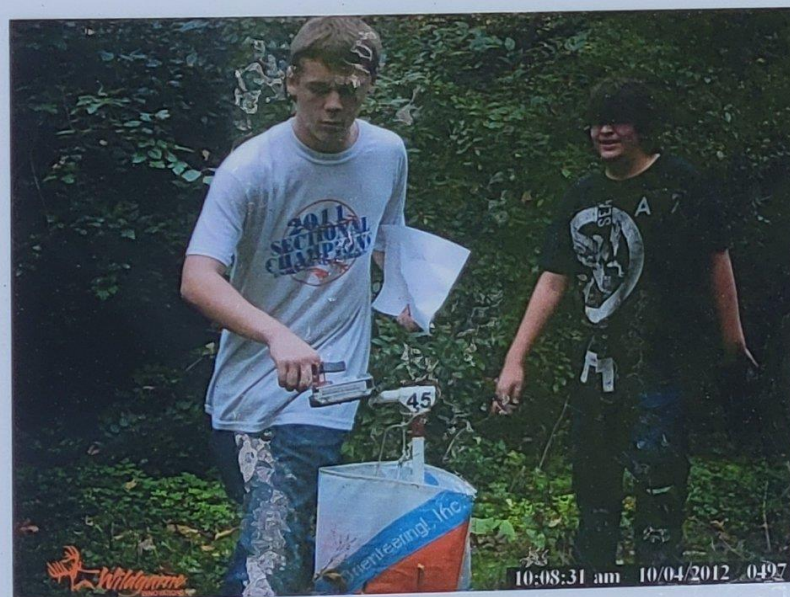
Union County Schools 2010		
Course E	1.2 km	
		Flagpole
1	31	Distinctive tree
2	38	Sign, south side
3	35	Distinctive tree
4	34	Building, West side
5	51	Flagpole
6	44	Copse (Clump of trees)
7	32	Distinctive tree
8	60	Light pole
	60 m	

Proof I was There

At the control

- Check that the code number is correct!

There will be many controls. Not all of them are on your course!

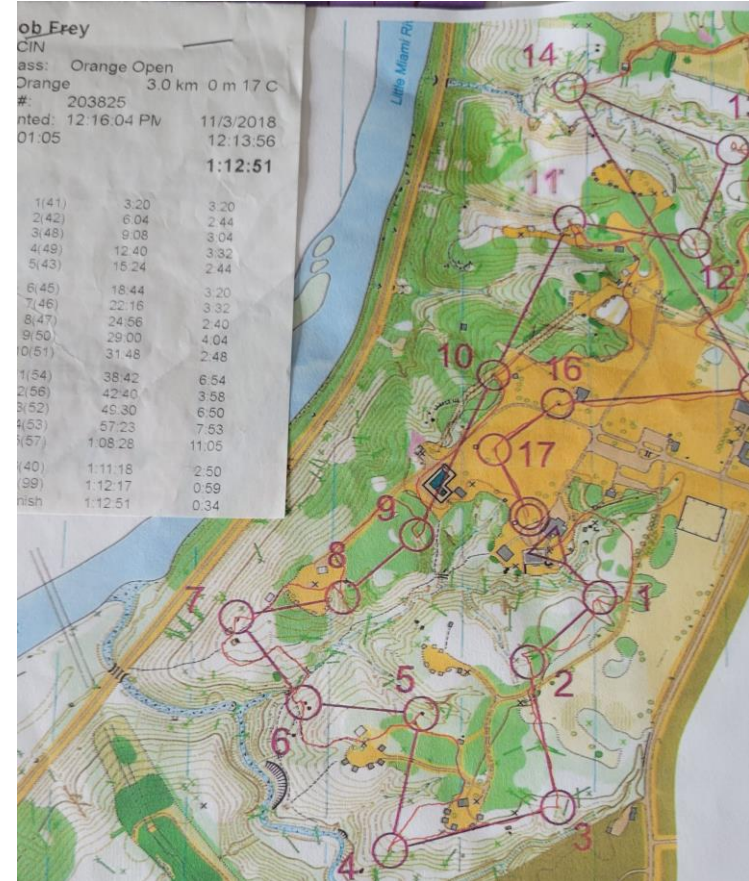


Was I there? Manual and ePunch Devices.



Bob Frey
 OCIN: Orange Open
 Class: 3 Orange 3.0 km 0 m 17 C
 SI #: 203825
 Printed: 12:16:04 PM 11/3/2018
 11:01:05 12:13:56
1:12:51

1(41)	3:20	3:20
2(42)	6:04	2:44
3(48)	9:08	3:04
4(49)	12:40	3:32
5(43)	15:24	2:44
6(45)	18:44	3:20
7(46)	22:16	3:32
8(47)	24:56	2:40
9(50)	29:00	4:04
10(51)	31:48	2:48
11(54)	38:42	6:54
12(56)	42:40	3:58
13(52)	49:30	6:50
14(53)	57:23	7:53
15(57)	1:08:28	11:05
16(40)	1:11:18	2:50
17(99)	1:12:17	0:59
Finish	1:12:51	0:34



Make sure it is the right Control

The code number on your description card must match the code number on the control!

Union County Schools 2010		
Course E		1.2 km
▷		Flagpole
1	31	Distinctive tree
2	38	Sign, south side
3	35	Distinctive tree
4	34	Building, West side
5	51	Flagpole
6	44	Copse (Clump of trees)
7	32	Distinctive tree
8	60	Light pole
○<	60 m	>◎





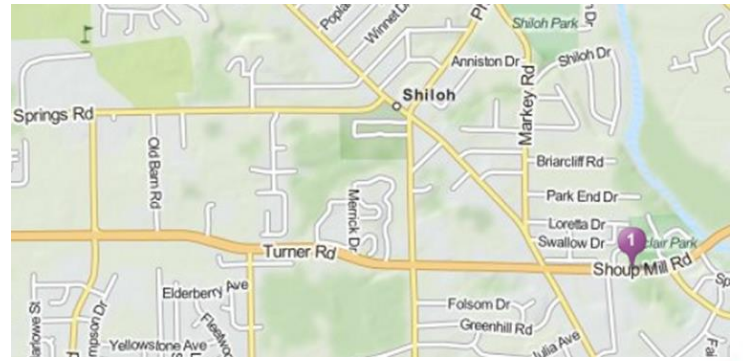
Classic Mobile hunts



Mobile Hunts

To get started you need:

- A receiver with an S meter
- A directional antenna





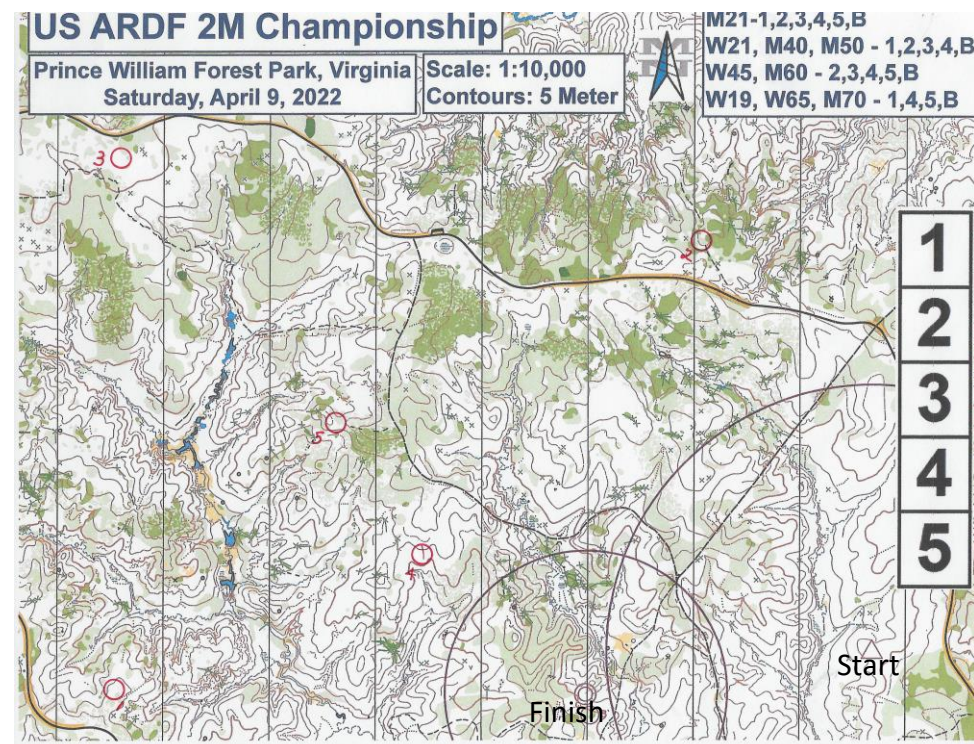
Radio Orienteering



Classic Orienteering - A standard orienteering course consists of a start, a series of control sites that are marked by circles, connected by lines and numbered in the order they are to be visited, and a finish.

Classic ARDF, Radio Orienteering Differences:

1. Only the start and finish are marked on the map.
2. Five Radio beacons are placed on the course and transmit their location for one minute repeating at five minute intervals.
3. Transmitters are all on the same frequency.
4. Competitors can find the transmitters in any order.





Radio Orienteering Events



Radio Orienteering - Four different Competitions

1. Classic 2M Radio Orienteering
2. Classic 80M Radio Orienteering
3. Fox-O, combination of Orienteering and Radio direction finding
4. Sprints – Short Fast paced event





Radio Orienteering Events



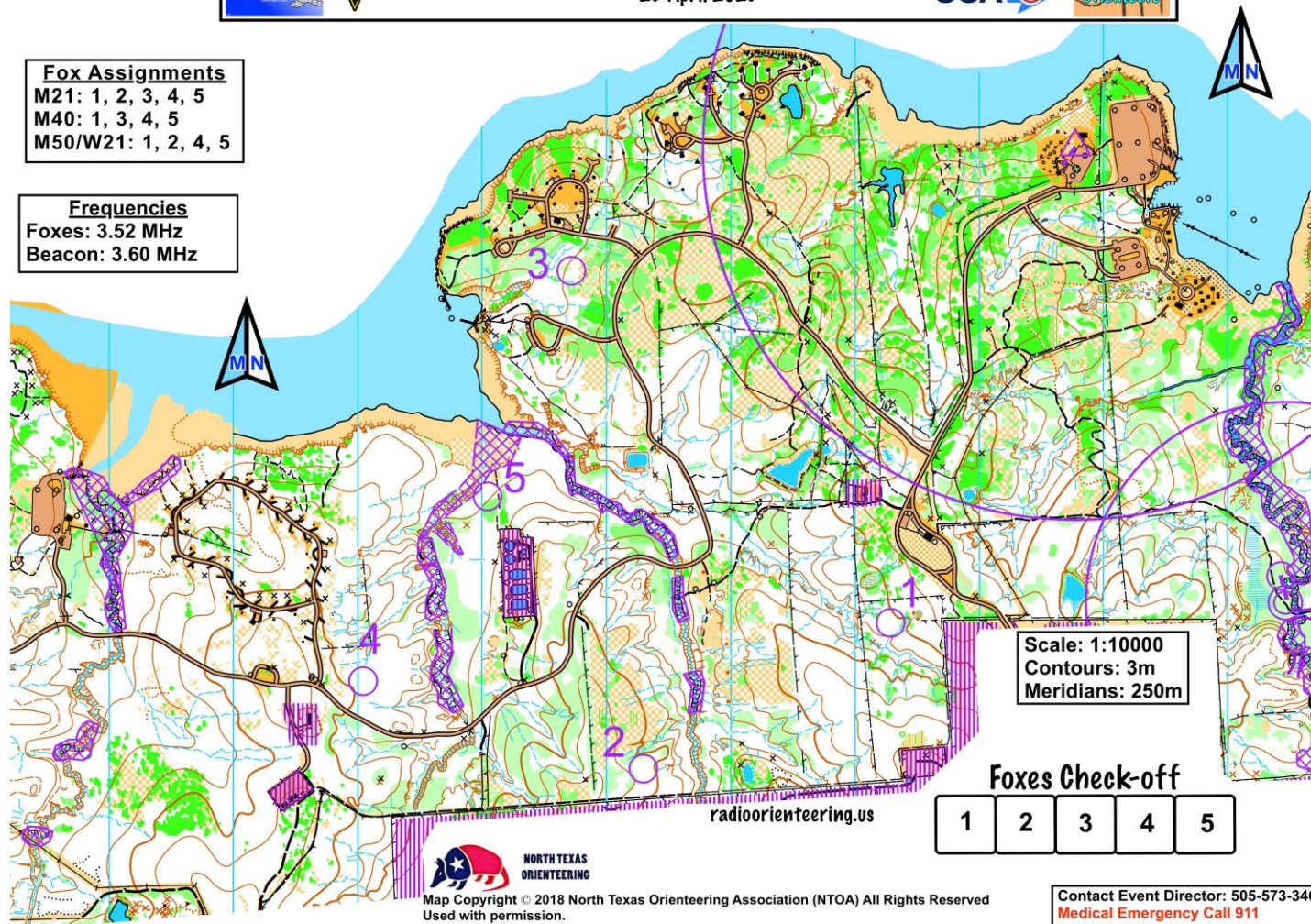
US Nationals are held yearly.
This year they were in Sulphur
Springs, Tx in late April.



2023 USAROC 80m Classic Master Map
 Cooper Lake State Park, Texas
 23 April 2023
 


Fox Assignments
 M21: 1, 2, 3, 4, 5
 M40: 1, 3, 4, 5
 M50/W21: 1, 2, 4, 5

Frequencies
 Foxes: 3.52 MHz
 Beacon: 3.60 MHz



Foxes Check-off

1	2	3	4	5
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NORTH TEXAS ORIENTEERING
 Map Copyright © 2018 North Texas Orienteering Association (NTOA) All Rights Reserved
 Used with permission.

Contact Event Director: 505-573-3468
 Medical Emergency Call 911

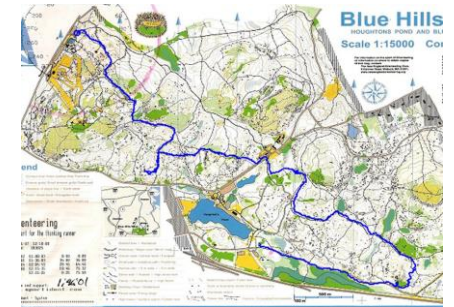
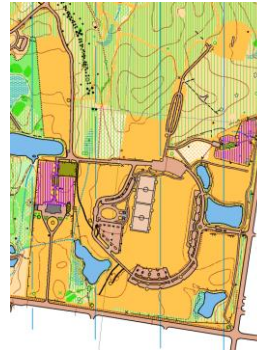




What you need – The Basics



1. 2M receiver and/or Attenuator
2. 80M Receiver/Antenna and/or Attenuator
3. A Directional Antenna
4. Compass
5. Map





My 1st 2M event

Getting Started on the Cheap

Directional Antenna - \$10



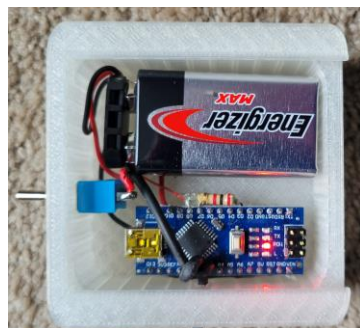
Attenuator- \$10



2M Receiver with S Meter



The Fox – A controller and a Transmitter





2M ARDF Receivers



Ron Graham, RX1 2M Receiver



VK3YNG, Sniffer 4



DF1FO 2M Receiver



Handheld with Passive/Active Attn



RigExpert Foxrex 144





80M Receivers

80M Receivers – Past to present



Altai 3.5 – USSR – 194?



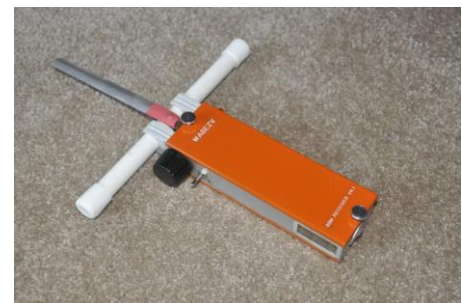
DL3BBX



OE6GC Receiver - 2002



Czech Republic
OK2BWN – 1993?



DF1FO - 2014



WB6BYU,
Dale Hunt 2003



Vadim afonkin, KB1RLI
Receiver - 2016



Chinese PJ80,
R3500D



RigExpert 3500
2018

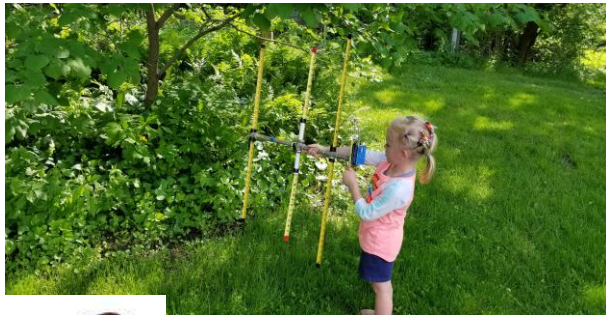




Directional Antennas for 2M

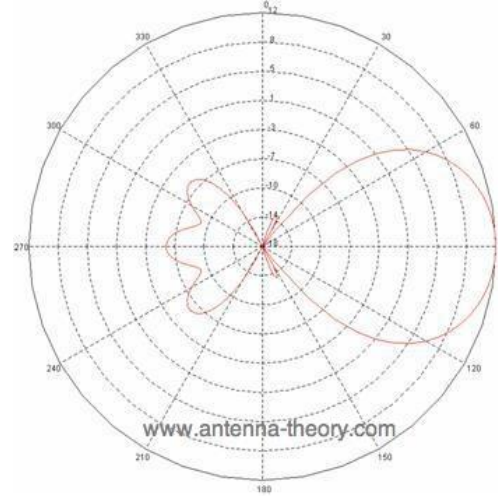
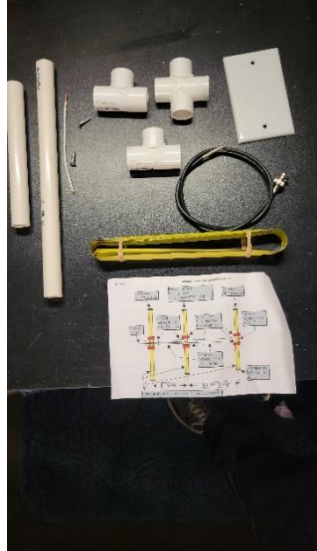
Beam, Yagi, Antennas, 2, 3, 4 Elements and More.

1. Have a broad (30-60 degree) peak
2. Have sharp nulls on sides
3. Practical sizes have limited gain and directivity: 5-7db gain, 20 db f/b
4. Limited gain and f/b ratio mean you have to be sensitive to small amplitude changes
5. Relatively easy to build, inexpensive, light weight
6. Narrow effective bandwidth
7. Can be more difficult to transport in car and deploy
8. Good gain for distant transmitters
9. Require attenuation to use when closer to transmitters

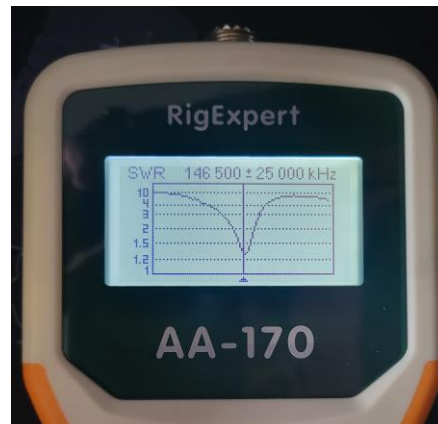
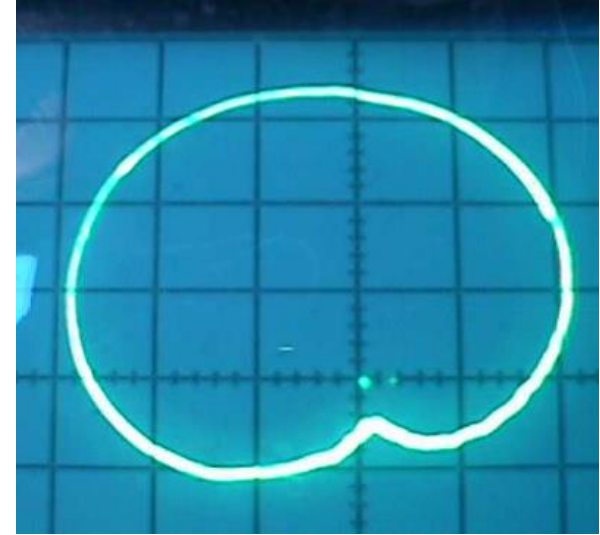




2M Yagi – Antenna Pattern



E-plane Gain
(x-z plane)



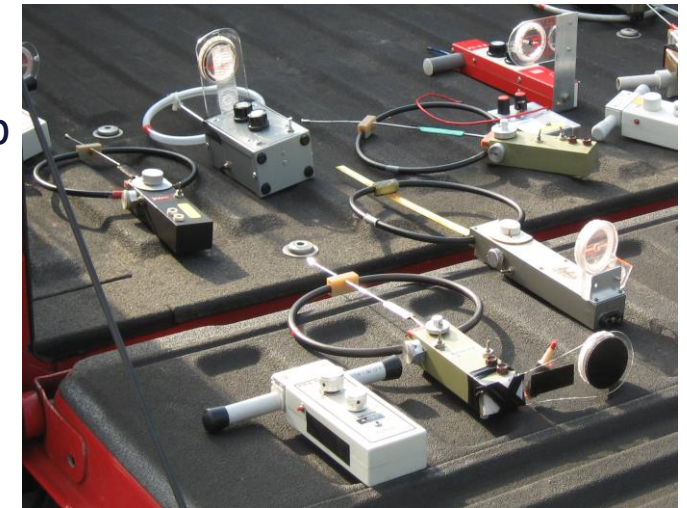


Directional Antennas for 80M



Using loop or Ferrite Rod antennas for 80 Meters

1. Wide bandwidth
2. Give a sharp null, sharper than beam peak
3. Null is at right angles to the plane of loop (through the loop)
4. Doesn't resolve 180 degree bearing ambiguity
5. Require more precision in construction
6. Fairly large amplitude change in null compared to beam peak - 30-40db
7. Small size and convenient to use and transport
8. Relatively deaf (10-15 db down from beam or whip)
9. Need attenuation when close to transmitter to prevent swamping



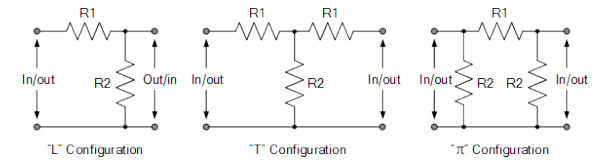


Attenuators – Signal Dampening

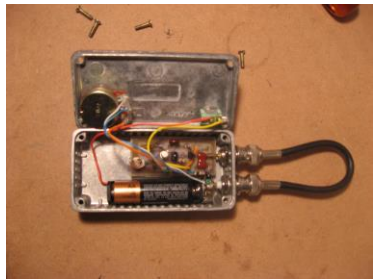


Attenuators are used to control signal overload, receiver saturation, and can be useful in determining the relative distance to the transmitter.

- Body fade or Antenna Shielding
- Passive Attenuators – Resistor Network
- Active Attenuators
- High End Automatic Ramping



500KHz Offset Active



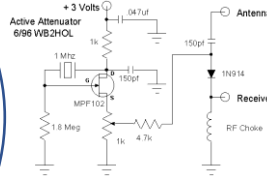
Automatic Ramping



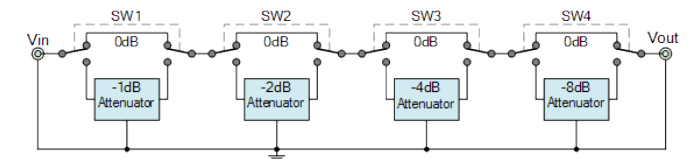
Passive



Active



4MHZ offset Active





Attenuators



Body Fade: The most elementary way is called the "body fade" or "body shield" technique. Hold your HT tight against your chest and turn around slowly, looking for the direction at which your body blocks the signal most effectively (the signal null). At this point, the signal is coming from behind you. Walk in the direction of the null, taking bearings at regular intervals, and observe the signal strength get stronger.

When the signal is so strong that you can't find the null, tune 5 or 10 KHz off frequency to put the signal into the skirts of the receiver's IF passband. If your hand-held is dual-band (144/440 MHz) and you are hunting on two meters, try tuning to the much weaker third harmonic of the signal in the 70 cm band while performing the "body shield."

Disconnecting the HT's "rubber duck" antenna will knock down the signal even more. Hearing the signal with antenna off is usually a "You are here!" indicator. Some foxtailers wrap aluminum foil around their HTs to attenuate the signal even more.

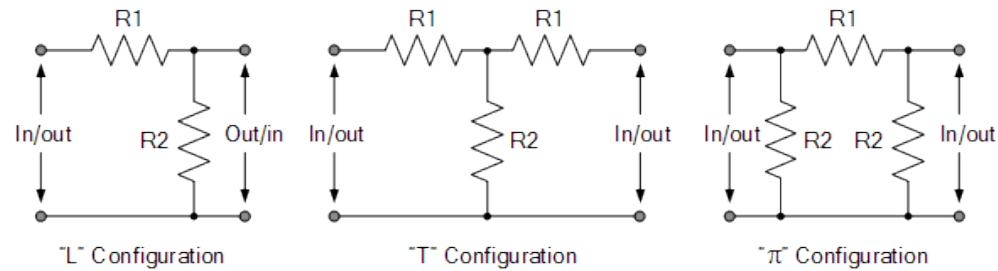


Attenuators - Passive



Passive Attenuator: An attenuator is a two port resistive network designed to weaken or “attenuate” (hence their name) the power being supplied by a source to a level that is suitable for the connected load.

A *passive attenuator* reduces the amount of power being delivered to the connected load by either a single fixed amount, a variable amount or in a series of known switchable steps.

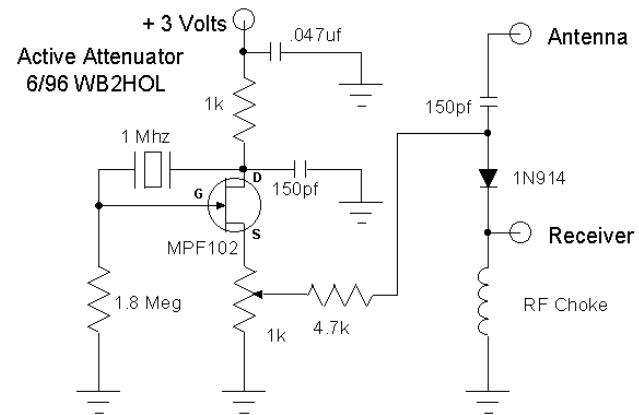




Attenuators - Active



Active Attenuator: Sometimes the signal is so strong that the RF will leak straight into the radio, connections and other equipment making the antenna useless. The solution is to use an offset attenuator. The circuit consists of a small RF generator, in this case 4MHz, which will mix with the incoming fox signal (such as 146.52MHz) and produce new signals at plus and minus the fox signal (142.52Mhz and 150.52Mhz). A potentiometer on the board changes the injection level of the RF generator which in turn attenuates the incoming mixed signal to your radio to a level where tracking can continue.



500kHz and 4MHz Attenuators

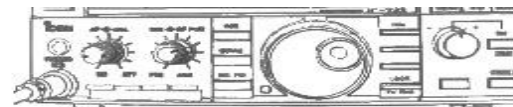




Attenuators - Active



**3rd Planet Solar /
KC9ON**



Amateur Radio and Electronic Hobby Kits, Parts, and Accessories

The circuit consists of a small RF generator, in this case 4M Hz, which will mix with the incoming fox signal (such as 146.52M Hz) and produce new signals at plus and minus the fox signal (142.52M hz and 150.52M hz). A potentiometer on the board changes the injection level of the RF generator which in turn attenuates the incoming mixed signal to your radio to a level where tracking can continue.

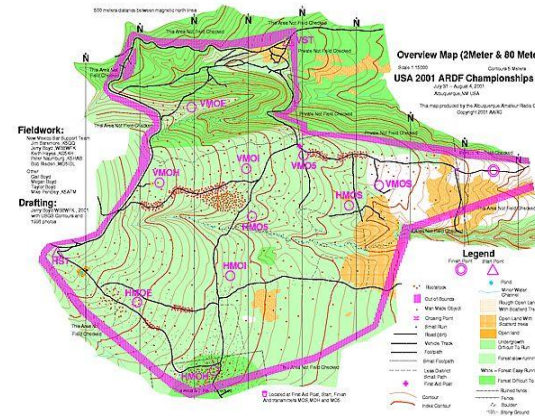
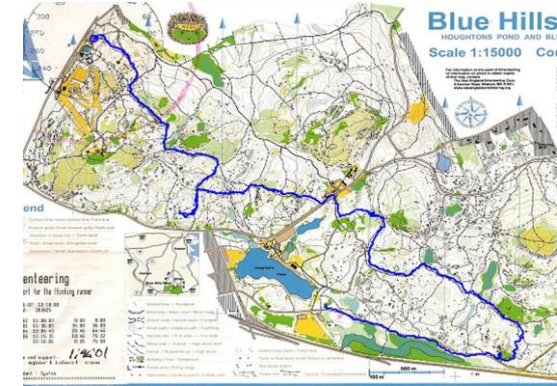
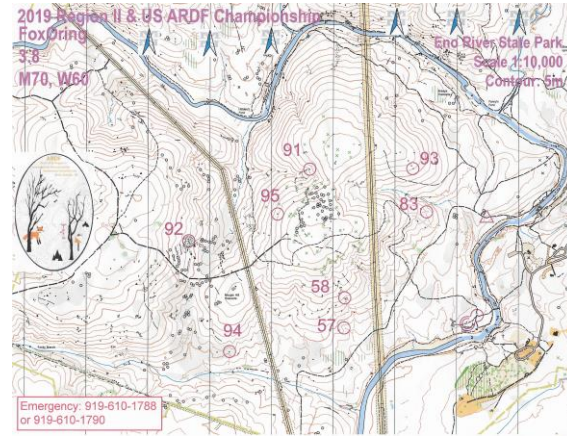


4MHZ offset Attenuator for \$10





Misc. Equipment – Maps, Compass





Foxes for 2M and 80M



Transmitters – Just a Few Examples



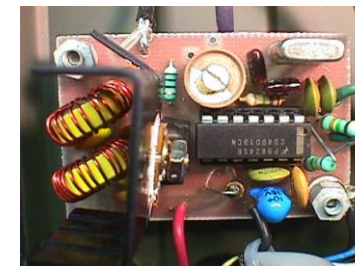
OK2BWM – micro Fox



TRO-2 G0ZOI, .75W



ATX-80 G0ZOI, 3W



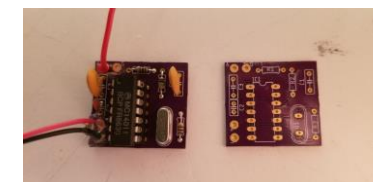
ON7YD, Rik Strobbe, 3W



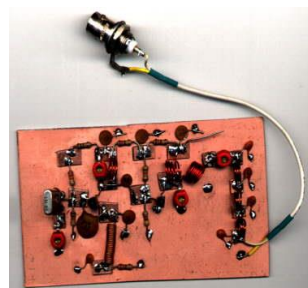
Micro Fox 15 mw, Byonics.com



Red Fox, 3500 and 144



80M, 10 mw Pulsar



40 MW 2M Continuous Carrier, WB2HOL



Breadboard, 10 MW





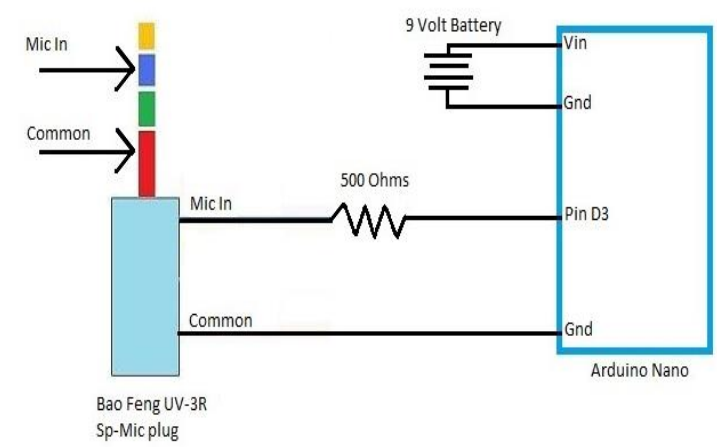
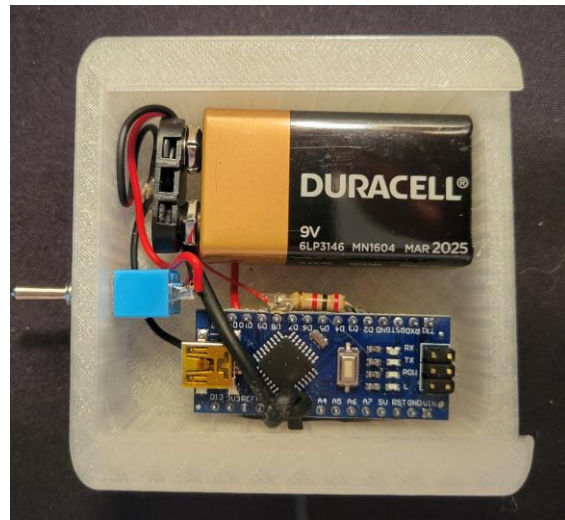
A 2M Fox and Controller



Cheap ARDF Controller for BaoFeng HTs. Based on an Arduino Nano.

<https://www.qsl.net/w6dps/ARDF%20Controller.html>

\$10 Controller



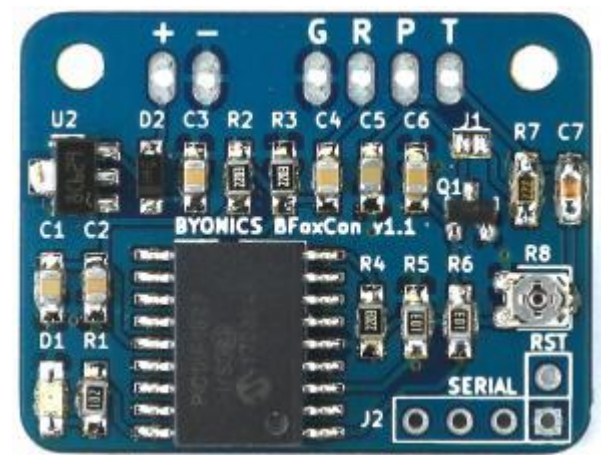


A 2M Fox and Controller

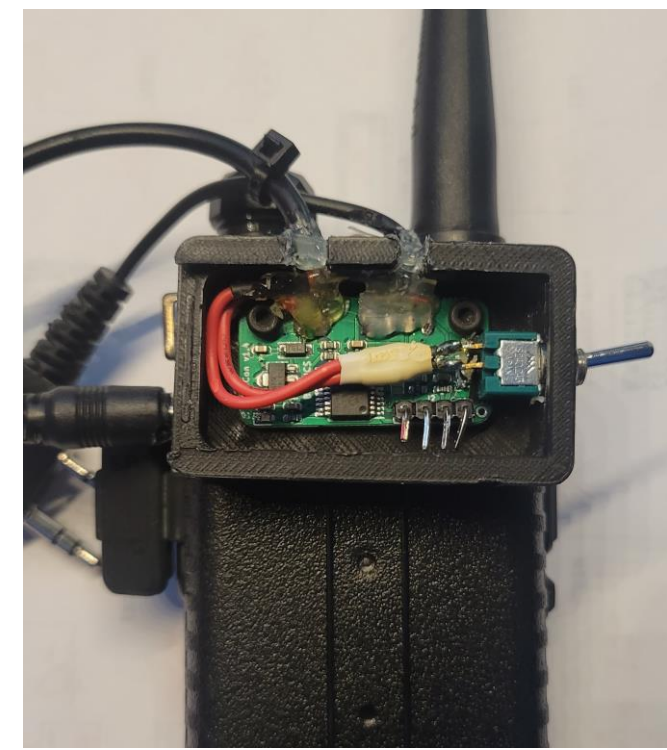


Remote controlled and programmable controller from Byonics.com/piccon

\$45 Controller

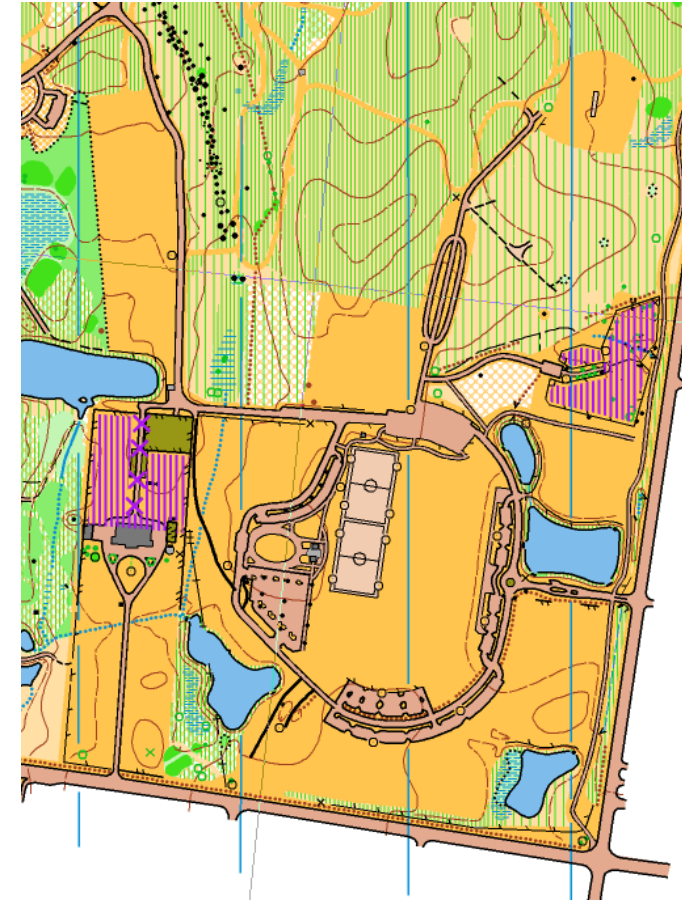
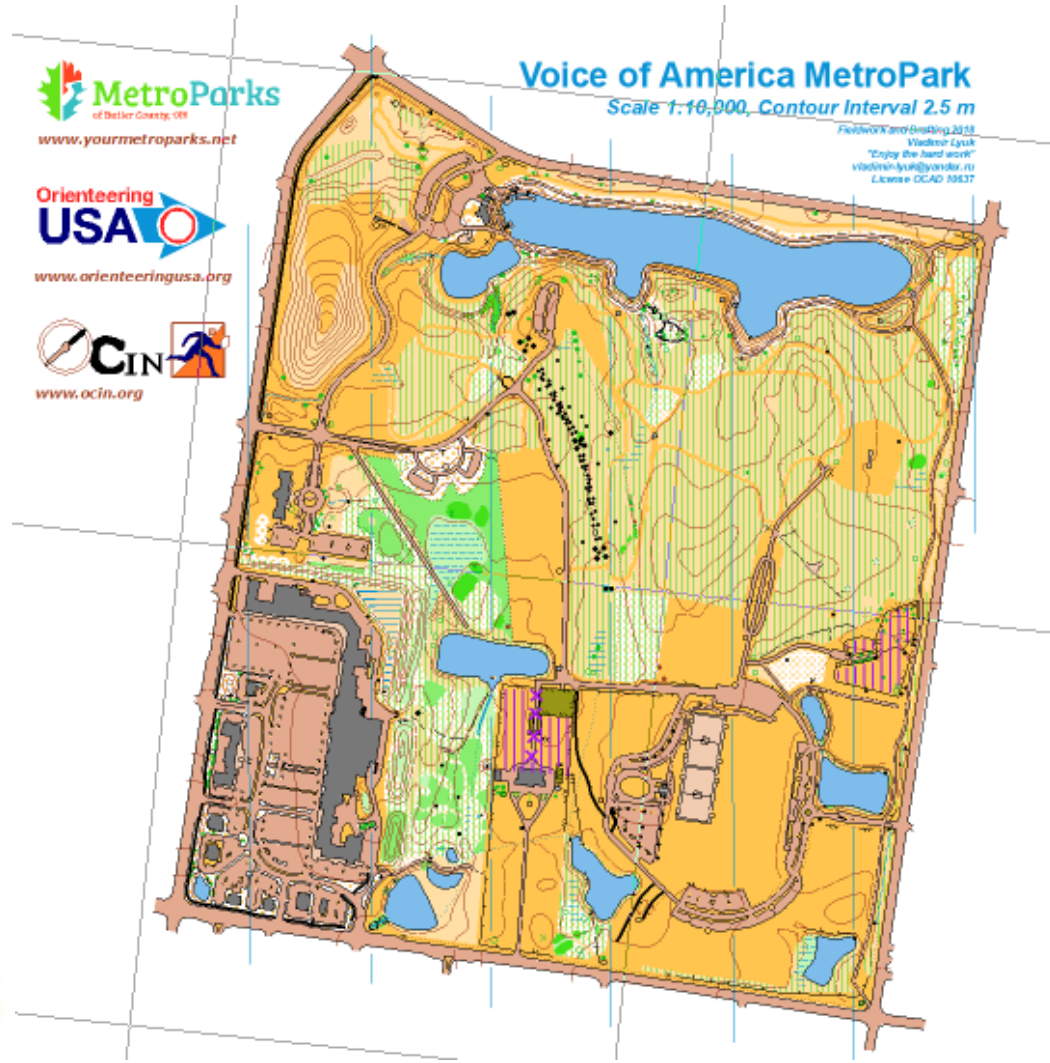


Baofeng UV-5R





VOA Park





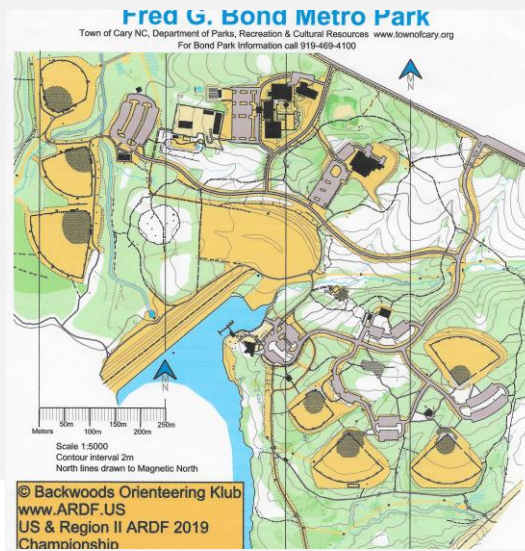
Practice Hunts – Getting Started



- **The Simple Hunt**

Low power, continuous carrier, short distance.

Great beginners hunt. Easy setup and fun for children.



- **Short 2M or 80M ARDF**

5 TX ARDF hunt

Participants can hunt between 1 and 5 TX all on the same frequency cycling at five minute intervals.
Good for small parks

For your first practice session: I suggest you pick a small area, and start with a single transmitter (continuous carrier). From there try either multi transmitter hunts or a progressive hunt. Gradually evolve into larger scale, full ARDF style events.





Practice Hunts – Stepping it up



- **2M or 80M ARDF Hunt**

Classic ARDF Hunts with 5 transmitters.

- Five transmitters that cycle in a five minute loop. All are on the same frequency.
- Larger area and Topographical maps normally used.
- Longer distance – 4 to 10 kilometers

- **Fox-O Hunt, 80M**

Great combination of Orienteering and ARDF

Any number of low power, 10 mw, transmitters are placed within 100 meters of control points on an orienteering map. Find in any order.

For 80M consider building some inexpensive, low power transmitters then doing either a short single transmitter hunt or Fox-O. This is also introduce people into the orienteering aspect of ARDF.





Foxhunt in the Park



De Larry Jacob, W7DBO 2018



Reference Sources



- Tape Measure Antenna, QRP Transmitters (Home Brew) – Joe Leggio
<http://theleggios.net/wb2hol/projects/rdf/rdf.htm>
- Equipment - <https://www.ardf-r2.org/equipment/>
- MK4 Sniffer – Brian Ackerly, VK3YNG - <http://www.foxhunt.com.au>
- Homing In – Joe Moell, K0OV - www.homingin.com
- ARRL - <http://www.arrl.org/amateur-radio-direction-finding>
- Transmitters, Controllers, Attenuators – www.bionics.com
- Orienteering Information, Local Clubs – www.orienteingusa.com
- Bob Frey, WA6EZV – WA6EZV@ARRL.NET

