

## **DIRECTION-FINDING (DF)**

Direction Finding Hunts are similar to MASS START orienteering events. You need to find as many of the transmitters as possible in the allotted time.

### **ORIENTEERING CONTROL**



### **DIRECTION-FINDING TRANSMITTER**



There is nothing to see on arrival at a transmitter other than a “triffid”, a camouflaged upside-down plastic bottle containing numbered tags on a hook.

## **A TYPICAL MULTI-TRANSMITTER EVENT**

There are ten transmitters to find in a maximum of 2½ hours, following a mass start. Events are free to enter and a handicapping system favours newcomers. Equipment loan is by prior arrangement. Multi-Transmitter DF attempts to provide opportunities to have a laugh rather than produce a clinical, strict rule competition.

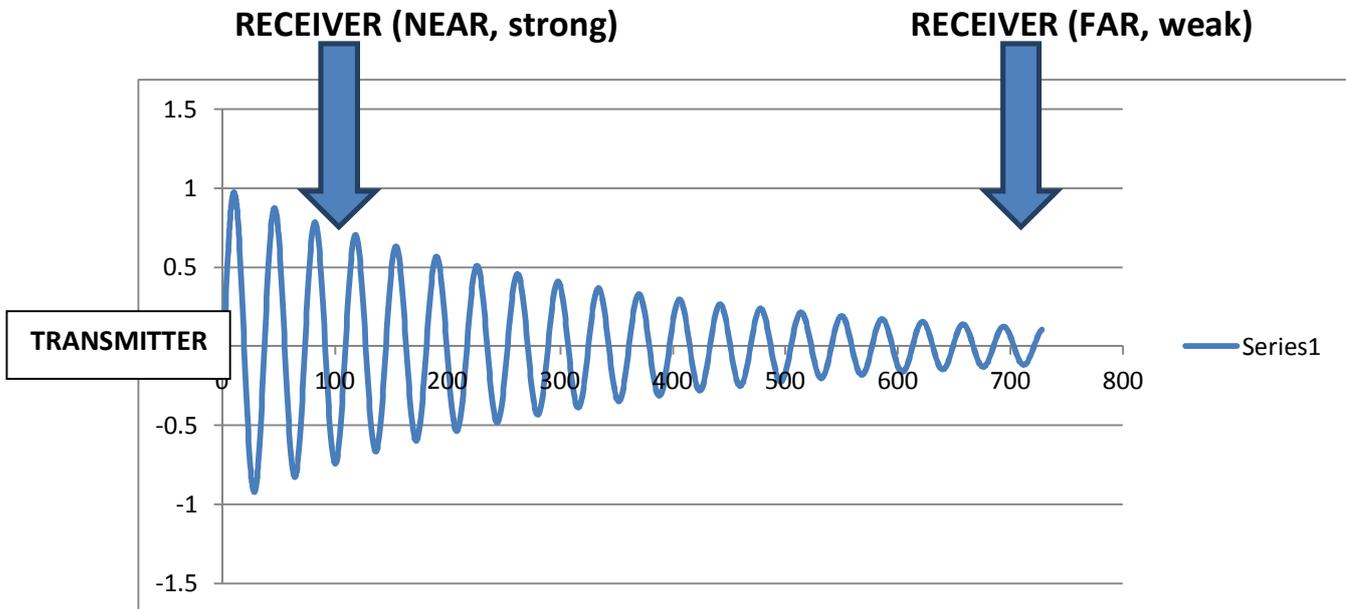
### **HOW DO I HOME IN ON A TRANSMITTER?**

To find the transmitters you will need to carry a portable receiver, called a DF set, which has a directional aerial. This will guide you towards the transmitter. However you will need to know how to interpret the signal heard and how to determine the direction of the signal source.

### **RADIO WAVES**

Radio waves spread out in all directions from a transmitter rather like the ripples on a pond. We can assume that the waves take a straight-line path between transmitter and receiver.

## SIGNAL STRENGTH



The height of the waves decreases with distance from the transmitter.

**SIGNAL STRENGTH** is an indication of how far away the transmitter is.

**MUST BE VERY CLOSE!!!**



**A LONG WAY AWAY ??**



So the loudness of the signal is an indication of signal strength  
and also how far away the transmitter is.

Some DF sets also have a meter to help see how strong the signal is.

## **USING SIGNAL STRENGTH TO DETERMINE DIRECTION**

We can use **relative signal strength to determine the direction** of a transmitter's signal.

This requires a **comparison of signal strengths** either by careful listening or by meter indication when the DF set is rotated (and also when the "sense" is operated – see later).

### **DIRECTIONAL AERIALS**

A Direction-Finding Receiver (DF set) has an aerial which produces different signal strengths when placed at different angles to the transmitter. We rotate the set slowly and listen carefully for changes in the signal strength.

**There are two types of directional aerial, FERRITE ROD and FRAME.**

#### **FERRITE ROD**

Minimum signal when the rod is in-line with transmitter.

Maximum signal when rod is broadside on to transmitter.

#### **FRAME AERIAL**

Minimum signal when the coil windings on the frame are broadside to transmitter.

Maximum signal when the coil windings on the frame are in-line with the transmitter.

## DIRECTION FINDING TECHNIQUE

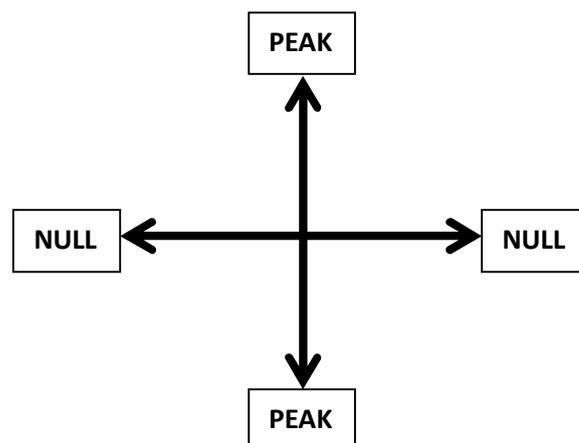
Listen to the transmitter you are trying to find. Select the correct frequency and tune-in to the signal – experience helps, so someone may assist you to do this.

As you rotate your DF set through  $360^\circ$  (a full circle) slowly you should notice that there are TWO peaks in signal strength and TWO NULLS (dips in signal strength) between the two peaks.

Note: The NULLS are much “sharper” (better-defined) than the peaks so there is less uncertainty of the indicated direction when using NULLS. The two peaks are always mid-way between the two nulls.

### VIEWED FROM ABOVE

ROTATE DF SET ABOUT A VERTICAL AXIS



## AMBIGUOUS ?

If there are TWO peaks and TWO nulls then how do we know which way to go? There is a 50% / 50% chance of guessing correctly and we may even go in the opposite direction from the transmitter instead of towards it!

## SENSE

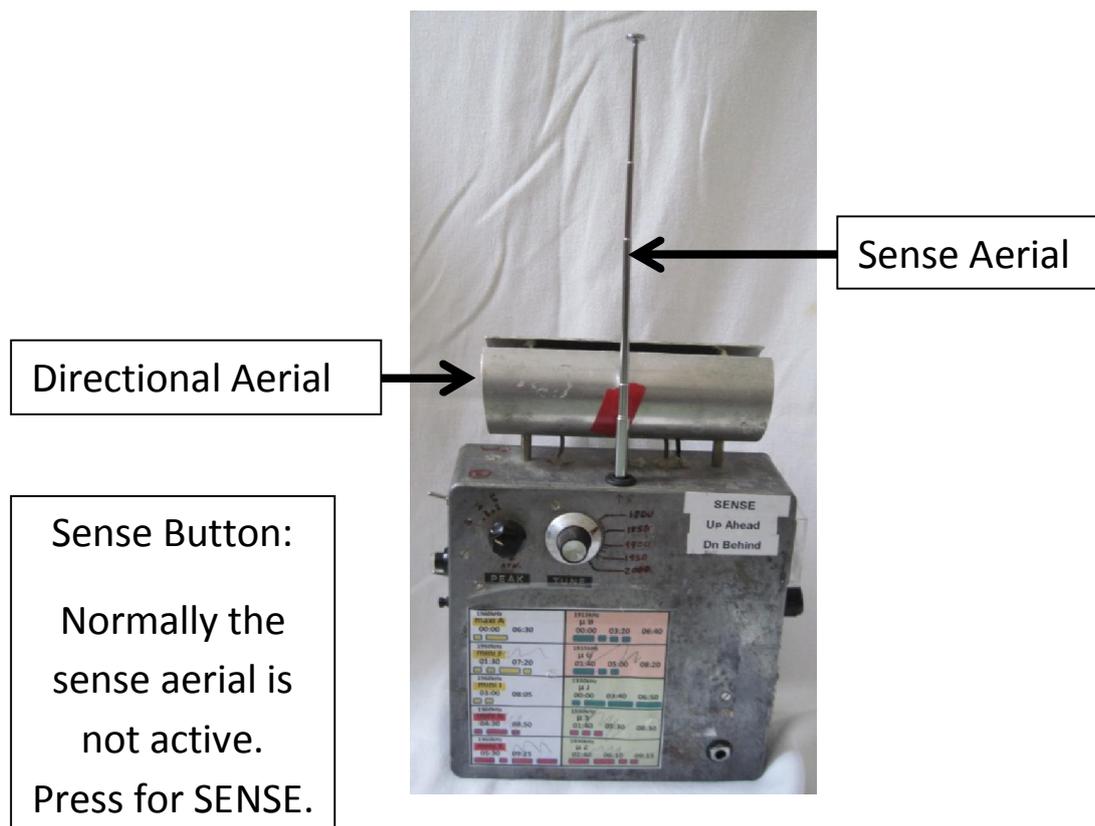
( not common SENSE ! )

By itself, the directional aerial cannot tell us which way to go.

To determine the correct direction we use a SENSE aerial.

Unlike the directional aerial, this vertical aerial always receives exactly the same signal whichever way we rotate the set.

When combining the signal received by the sense aerial with the signal received by the directional aerial, the signals will combine differently according to the true transmitter direction.



## **VARIATIONS**

DF sets vary slightly but all will have a button or switch to enable the sense aerial.

Each DF set has a prescribed method for which way to view the set when taking “sense” and how to interpret the difference in strengths to determine the actual direction of the transmitter.

An experienced helper will explain the way your particular DF set works.

## **SUMMARY PROCEDURE**

### **TUNE-IN, IDENTIFY THE SIGNAL AND FIND NULLS**

Tune-in / hear the target transmitter.

Identify the station. Is it the target transmitter ?

Slowly rotate the set with "sense" off. Mentally note where the two null positions are (roughly).

### **SENSE (1)**

Rotate the DF set mid-way between the two nulls (either way). The signal strength will be maximised. Put the "sense" on, listening carefully for a change in strength. Use DF set-specific instructions to determine the correct direction. Put the "sense" off.

### **SENSE (2) (OPPOSITE DIRECTION – Simply to Confirm)**

Rotate the DF set though 180°. Again, the signal strength will be maximised. Put the "sense" on, listening carefully for a change in strength. Use DF set-specific instructions to determine the correct direction. Put the "sense" off.

### **MAKING SENSE OF IT ALL**

If the strength went up in stage 1 then it will have gone down in stage 2 and vice versa. The two stages should be complementary and should serve to reinforce correct direction determination. Make a mental note of the true direction (rough).

## **ESTABLISH ACCURATE DIRECTION**

Facing the direction indicated roughly above, rotate the DF set to obtain a null in that direction. The null position will pinpoint the way more accurately. Note the direction, either by observation of distant objects or by taking a compass bearing.

## **NOW MOVE**

Travel in that direction and keep set in the null whilst on the move (swing the DF set slightly from side to side listening for null between the two limits of swing) and let the set's null guide you in the right direction.

## **KEEP GOING**

The transmitter you are looking for may cease transmissions for a while (while other transmitters take their turn). Be careful to ignore transmissions from other co-channel transmitters! To make progress, continue moving in the direction you were following when the transmission was active.

## **CHECK PROGRESS**

Occasionally turn set through 90° for the maximum signal – check the strength to see if it is getting stronger. At distance, any change may not be discernible. As you approach a transmitter the increase becomes more obvious.

## **CLOSING IN**

There will become a point when the signal is too strong to cope with. The set has a strong signal whichever way it is turned. When this occurs use the “RF Gain” or “Attenuation” control on the DF set. This will reduce the signal to a useable level.

## TRANSMISSION CONTENT

### What will you hear?

Transmitters send a constant signal for most of the time – you will hear a continuous note / whistle. They interrupt this to send morse code (dots and dashes).

There is, occasionally, fast morse code for station identification (a legal requirement). Ignore this completely. Then there is **slow morse – a single letter** repeated at intervals, used to identify the transmitter for us. You will be told which letters are being used and what the morse code for these letters is.

## OUR EXERCISE EVENT

Remember: Help is on-hand to tune-in your set. This is only necessary at the start of each stage.

**Stage 1:** We will start by using a close transmitter (tune to **1900**) to become familiar with the features of the DF set and to practice tuning-in and peaking up. It will be sending continuously and **we will tell you where it** is so that you can relate the set angles to the target transmitter.

In your own time, **practice finding the peaks and nulls** with your DFset. When you are happy about the peaks and the nulls practice using the **SENSE aerial to establish the true direction**. Move your position and repeat.

**Stage 2:** We shall introduce the concept of a number of **transmitters sharing the same frequency** by sending transmissions of 1½ minutes from each in turn.

Retune to **1930**. There are 3 transmitters, moderately close, transmitting sequentially. Each person will be allocated ONE of these transmitters to concentrate on. You must first **identify your transmitter** from the morse code letter (which will be written down for you in dots and dashes) or by using the time of transmission start in a 5-minute period.

Repeat the procedure as used in stage 1 ensuring that you **only direction-find on your allocated transmitter**. Walk towards and find this transmitter and **find it**.

### **Stage 3: A dummy DF event.**

We shall regroup and all start at the same time.

Retune to **1960**. There are **3 transmitters hidden within 250m**. Using the experience of stage 2, concentrate on one at a time and **locate as many as you can**.

When you find a transmitter, **collect the top numbered tag** from the “Triffid” at each transmitter you find. The competitor who has the highest aggregate score will be declared the winner.

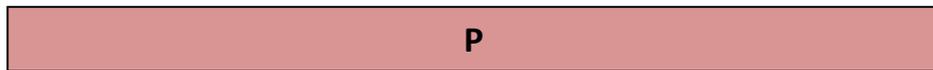
**For more information visit**

**<http://www.forjac.co.uk/df/multitx/multiexp.html>**

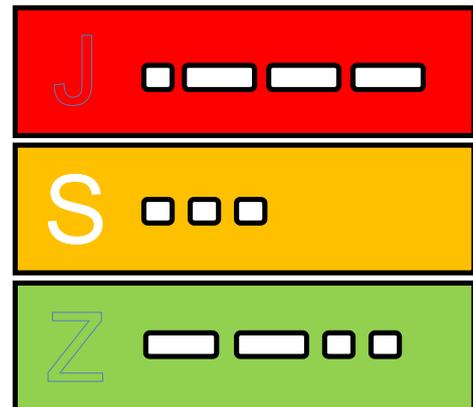
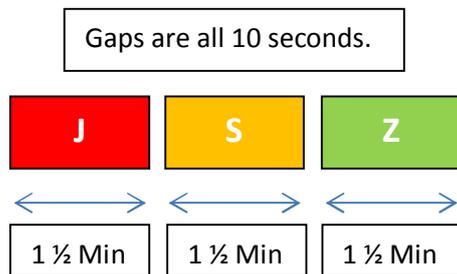
## TRANSMITTERS FOR TRAINING EXERCISE

TX For stage 1:                      NB: You will be told where this is!

Tx "P", 1900kHz, On continuously over 10-minute cycle.



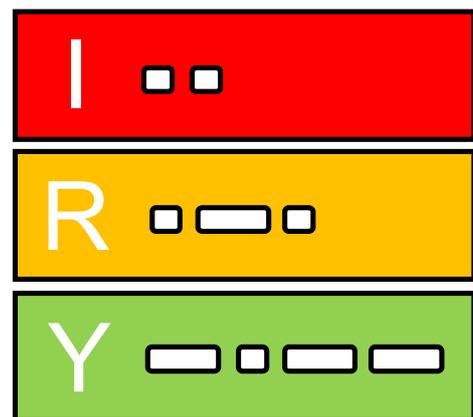
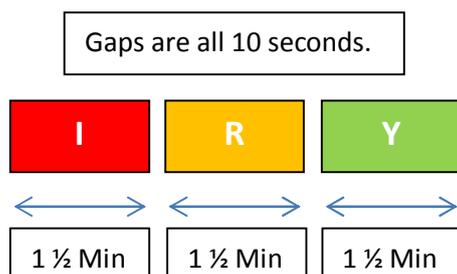
TXs For stage 2:



So time-wise:                      (where x is 10s of minutes, 0..5)

<b>J</b>	comes on at: time	mm:ss	x0:00 to x1:30	and	x5:00 to x6:30
<b>S</b>	comes on at: time	mm:ss	x1:40 to x3:10	and	x6:40 to x8:10
<b>Z</b>	comes on at: time	mm:ss	x3:20 to x4:50	and	x8:20 to x9:50

TXs For stage 3:



So time-wise:                      (where x is 10s of minutes, 0..5)

<b>I</b>	comes on at: time	mm:ss	x0:00 to x1:30	and	x5:00 to x6:30
<b>R</b>	comes on at: time	mm:ss	x1:40 to x3:10	and	x6:40 to x8:10
<b>Y</b>	comes on at: time	mm:ss	x3:20 to x4:50	and	x8:20 to x9:50