Chain Home Receiver emulation – a user's guide

Peter Ward, June 2020

About the Chain Home Receiver emulation

The Chain Home Receiver emulation is a simplified version of the equipment that a Chain Home operator would have used during 1940. Our aim is to show how challenging it would have been to detect incoming raids and make accurate reports to Fighter Command.

The equipment varied from one station to another and was in constant rapid development all through the war. We have chosen the elements that are most typical of the period and relevant to our purpose.

Running the Chain Home Receiver emulation

Supported systems

This has been tested on and works fine using Safari, Chrome and Firefox browsers on MacOS X, and with Chrome, Firefox and Microsoft Edge browsers on Windows 10.

It **does not work** with Internet Explorer 10 on Windows 10. It will probably not work with older browsers and older versions of Windows.

It also works on iPad with iOS 13.4 or higher.

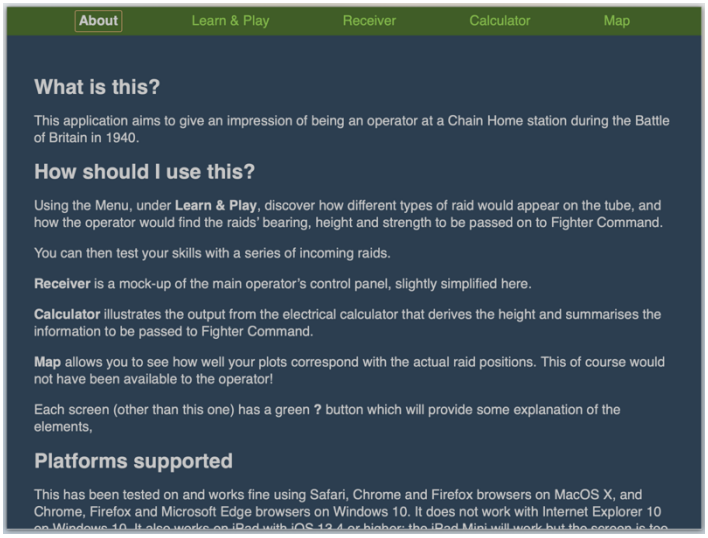
It will load on an iPhone or an iPad Mini, but the screen size is impractical.

Other tablets have **not** been tested; feedback is welcome, especially if you can verify whether it works or not, but we are unable to provide support.

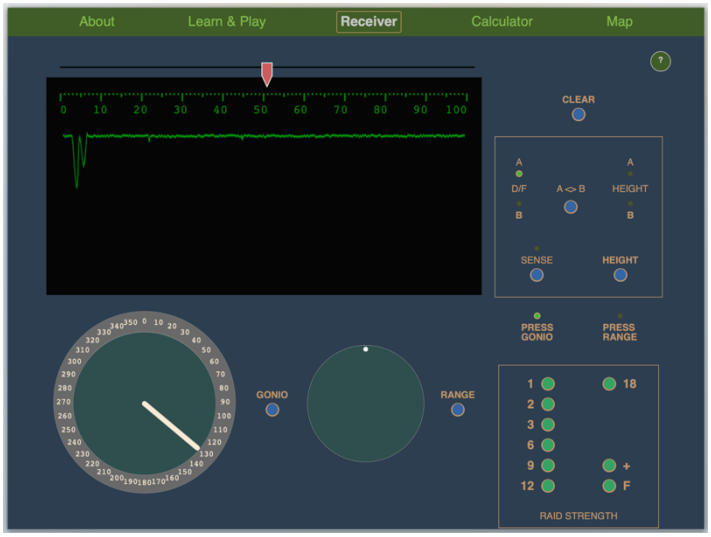
How it should appear

It's best to run your Internet browser full screen at 1024 x 768 resolution.

The loading page will appear with some explanatory text.



There is a green menu bar across the top. The menu options are described later. If you click on Receiver in the middle, you should see this.



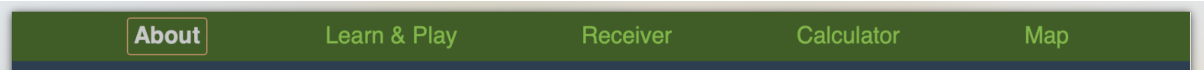
If you do not see the green wavy line in the black rectangle, then your WebGL support is disabled or not up to date. Please check the list of supported platforms above.

If you do not see the numbers around the knob at the lower left, then your SVG support is disabled or not up to date. Please check the list of supported platforms above.

You should be able to click on the large circles lower left and centre and rotate them by dragging the mouse while holding the left mouse button down.

Basic navigation with the menu bar

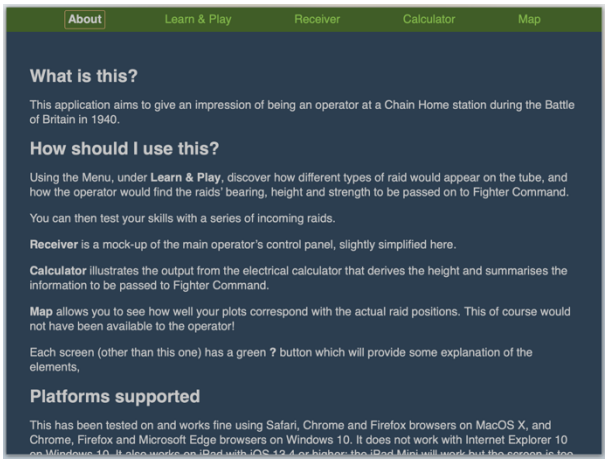
As you've already seen, the green menu bar across the top lets you switch between five pages. The active option is in white bold text with a border around it; other options are in pale green.



Just move the mouse to position your pointer over each option and click once.

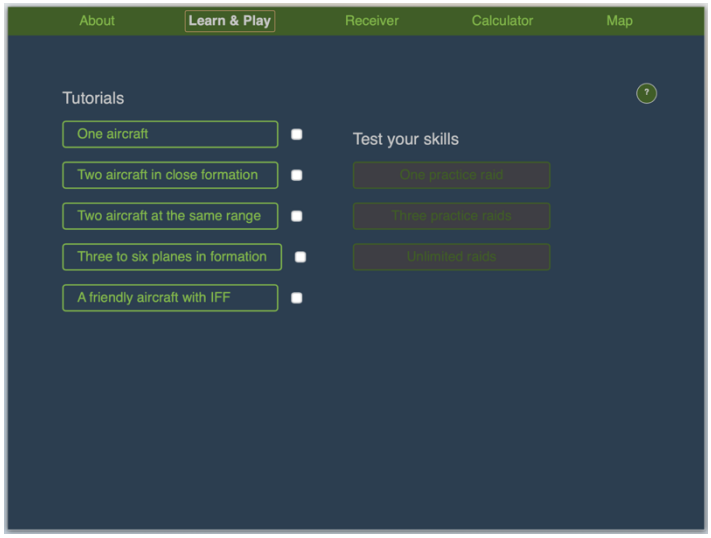
The main screens

The About page



The **About** page does nothing other than provide some background information and a summary of what is in this guide.

The tutorial and practice menu

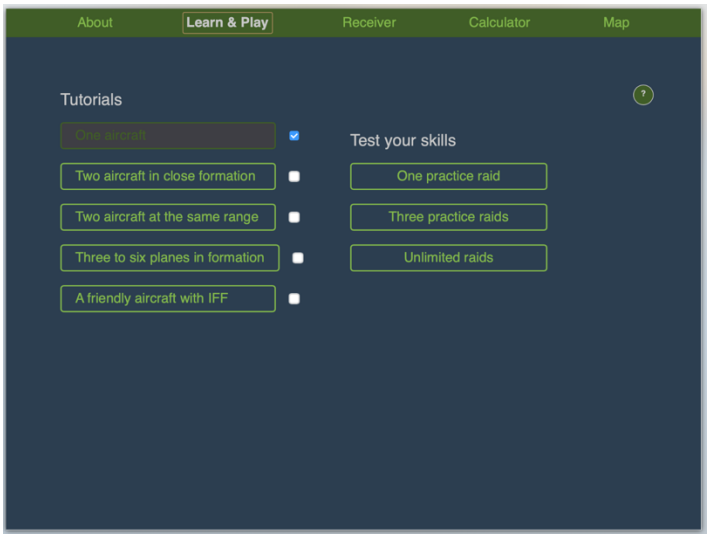


The second option is **Learn & Play**. This lets you access tutorials and run the Receiver in practice mode.

There are two columns of buttons on this page.

The left-hand column, headed **Tutorials**, accesses five tutorials that explain the basic operation of the Receiver. The next chapter in this guide talks more about the tutorials.

To the immediate right of each tutorial button is a small white square. When you have completed a tutorial, a tick will appear in this square. If you are confident that you do not need a tutorial, you can tick the box yourself by clicking with the mouse.



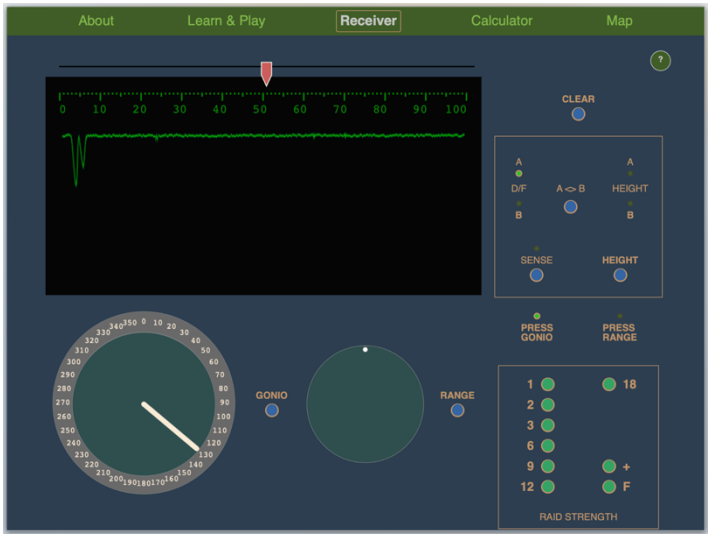
The central column, headed **Test your skills**, allows you to put into practice what you have learned from the tutorials. These buttons are dulled and will not work until you have completed at least one tutorial.

When you complete a tutorial, the button for that tutorial will become dimmed. This does not prevent you from repeating the tutorial.

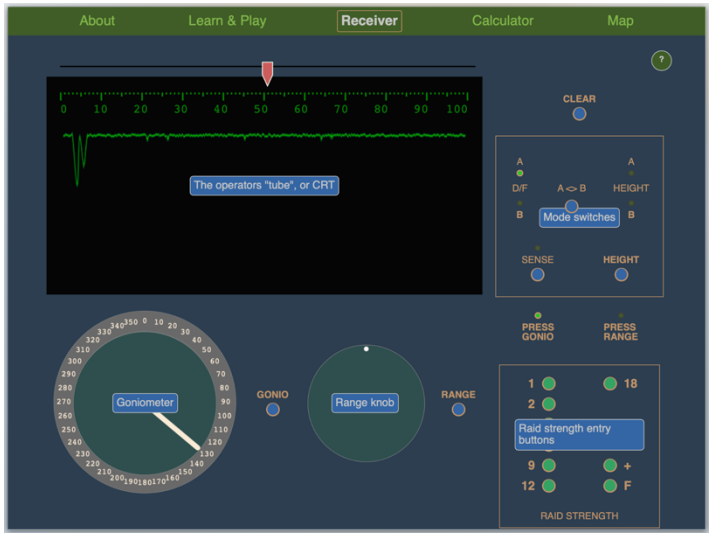
Finally, clicking the question mark in the green circle at top right will provide some brief explanatory text to appear. Click again to remove the text.

The Receiver control panel

The Receiver page is the focal point. It contains the main elements of the controls that the operator used to detect and interpret RDF signals.



Notice that there is a question mark in a green circle at top right. Clicking this will reveal some brief text that labels each element.



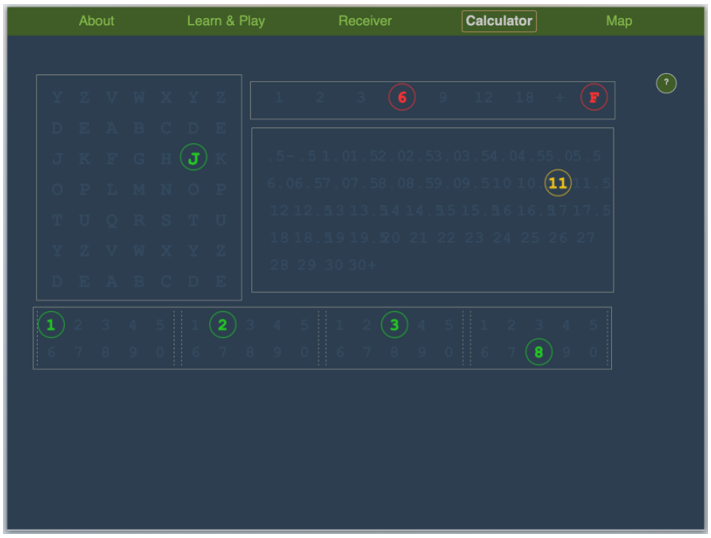
Clockwise from top left, these are:

The operator's "tube" or CRT	Where the returned radio signals appear.
Clear	Clear any values stored in the calculator.
Mode switches	Control the detection modes of the station.
Press Gonio & Press Range	Prompts for the operator.
Raid strength entry buttons	For recording how many aircraft in a raid.
Range knob	For determining the distance to a raid.
Goniometer	Used to work out the bearing and height of a raid.

A later section will explain each of these in more detail. Working through at least the first tutorial will also help to understand how these are used.

The Electronic Calculator

The operator's readings are fed into an "Electronic Calculator" that will convert the various readings of range, bearing and elevation into an approximate grid position and height. It displays these, along with the raid strength, to be "told" to the Control rooms.



In this illustration, there is a raid in map square 'J', coordinates 12 east and 38 north within the square, at 11,000 feet. There are six craft in the raid, and it is designated as Friendly.

This page also has a question mark in a green circle that will when clicked display some explanatory text.

The Map

The Map page would not have been available to the operators. There would be a map in the control room, using this RAF grid, on which the raids were plotted.

The station is shown by the red dot in square M. The yellow dot indicates the raid in square J.

As this is a simulation, we can ask the computer to show us the raid track, so we can see how accurate our plot was.

In this case, it was very good. The large blue dot is where the raid was when we made the plot, the smaller blue dots show its movement by the minute.

The Receiver

The operator's "tube" or CRT	In real life, this is a cathode ray tube (CRT) that shows radio signals returned from aircraft within the range of the station. Imagine the station's transmitter to be at the left end of the line and the right end of the line is 100 miles away. Notice the range scale above the line. This allows the operator to see the range of a raid based on the accurate timing of the returned signal. The red pointer on the range scale is moved by turning the Range knob. A returned signal appears as a dip in the line. The large dips at the left are caused by large fixed objects near the station such as buildings or hills. The operator learns to ignore these, but they may hide real signals. The line is never still, as there are always atmospheric disturbances, echoes from birds, boats, rain and so forth, and a background jiggle from the sensitive electronics that have to amplify the very faint signals.
Clear	The Clear button will remove any entries currently in the memory of the Electronic Calculator. Entries are stored when the operator presses the Gonio or Range button or one of the Raid Strength buttons.

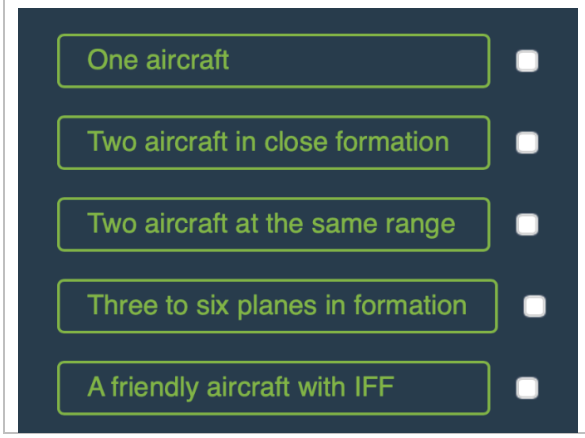
Mode switches	The operator can control which of several combinations of transmit and receive antennae are used. There is an ‘A’ system and a ‘B’ system. The ‘A’ system is better (more sensitive or more accurate) at detecting raids further away and near the horizon; the ‘B’ system is better for raids that are closer and higher. The central ‘A<>B’ button switches between these systems. The Receiver itself can work in ‘D/F’ mode, where the operator is trying to determine the bearing or azimuth of a raid, and Height mode where the operator is trying to determine the elevation and hence height of a raid. The Height button at bottom right of this panel toggles between the two modes. The four lights indicate the current combination of A versus B and Height mode versus D/F mode. Last on this panel, the ‘Sense’ button enables reflectors that will distinguish a signal out at sea from one overland (“behind”) the station. This is somewhat like cupping your hands behind your ears.
Press Gonio & Press Range	These two lights remind the operator which of the Gonio or Range entry buttons should be pressed. The buttons are those to the immediate right of the Gonio and Range knobs.
Raid strength entry buttons	From the size, shape, and behaviour of the dips on the line, the operator can determine approximately how many aircraft are in a raid. This is covered in part by the various tutorials. The ‘+’ button indicates that there are more than the number itself suggests. The ‘F’ button means that the returned signal is from an aircraft know to be friendly as it is using ‘IFF’ to highlight the signal on the tube. This is covered in a tutorial

Range knob	The Range knob allows the range pointer to be aligned with a returned signal such that its position on the range scale gives the range in miles from the station, and this can be entered into the calculator by pressing the RANGE button (but only when “Press Range” is lit).
Goniometer	The Goniometer (or “Gonio”) gives the bearing (azimuth) of a raid when in D/F mode (see “Mode switches” above). This works by blending signals received from two sets of aerials set at right angles; the operator rotates the gonio until the signal on the line disappears. The bearing is then stored by pressing the GONIO button (when the “Press Gonio” light is lit). The operation is similar in Height mode. The gonio blends signal received from antennae at different heights on the masts.

The tutorials

The Learn & Play page, as mentioned earlier, gives you access to five tutorials, each showing a distinct type of raid that the operator would encounter, and how to deal with them.

The five tutorials



One aircraft is a simple dip in the line.

Two aircraft make the dip move up and down

Two aircraft may not be close together

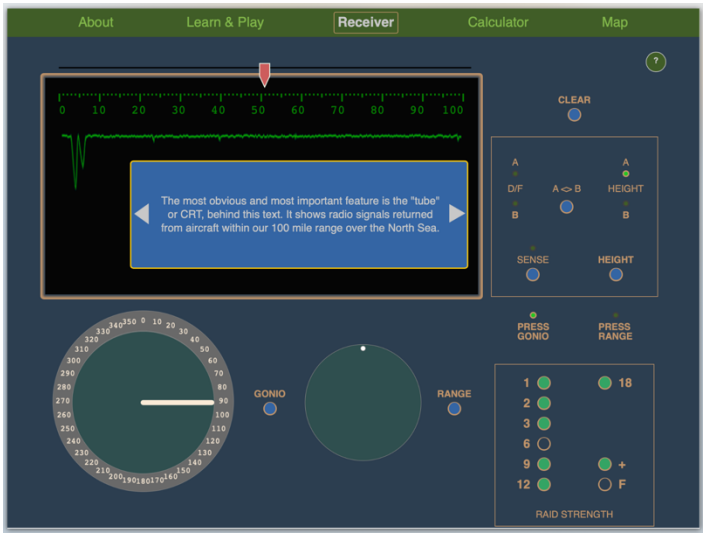
Groups will make the line “jiggle”

IFF makes the dip blip regularly

The flow of a tutorial

All tutorials use the same method. A blue box will explain what you should see or do. The relevant part of the Receiver is surrounded by a box (here it’s the CRT).

You can step forward or backward through the tutorial with the arrows to left and right of the text in the blue box.

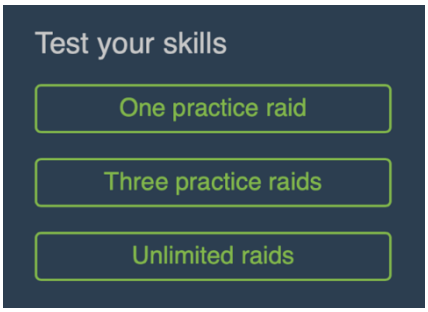


When a tutorial is complete, the box alongside will be ticked, and the button will be dimmed. You can repeat the tutorial even when the box is dimmed. You can click the white square to remove (and replace) the tick if you do not want that type of raid to appear in your practice.

Practising what you have learnt

Selecting types of raids

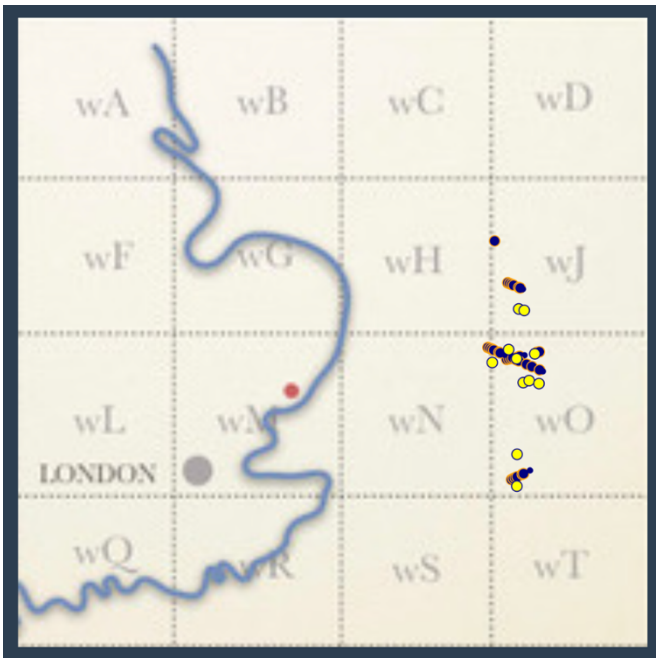
As we have mentioned, completing each tutorial means that the adjacent box will be ticked, and that means in turn that that type of raid will appear in your sessions. You can also tick or untick each raid type manually, to select what you want to practice.



You must have at least one type of raid selected for the buttons to be enabled.

Selecting one, three or many raids

As the text suggests, you can practice with a single raid, with three raids arriving with short intervals between them, or an unlimited number of raids, also arriving at short intervals.



As raids arrive, you should try to make an initial plot. You should return to each raid every minute or so and try to make further plots. This will allow you to see your plots on the Map, compared with the actual locations of the raids. You may find this become quite a challenge.

In general, the range reading is accurate, but the bearing information less so, and height even less. This shows the value of the Filter Room combining information from multiple stations.

DOCUMENT ENDS