

How to Intercept a Radial Outbound

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How to intercept a radial outbound

“ Takeoff runway 34. Fly runway heading to 5000, then turn left heading 065 to intercept the 228 radial of the XYZ VOR”.

Statements such as the one above will often be found in Aussie Star and other flight narratives. What does it mean to ‘intercept a radial’ and how do you do it? In this training resource we will look how to execute this navigational procedure and gain an understanding of the technology and the terminology relating to this aviation procedure. Whether you are flying IFR and wanting to fly towards a VOR or GPS waypoint, or flying VFR and you want to intercept the track you wish to fly to get to your destination or next waypoint, the procedure is essentially the same. The examples given in this article relate to glass cockpit operations.

VOR navigation

First of all a basic understanding of VOR navigation is needed to identify what a radial is. The Global Positioning System (GPS) is increasingly making inroads into aviation navigation and offers flexibility not available with either NDB (non-directional beacon) or VOR systems. However, it is supplementing these systems and at this stage, not totally replacing them. From a flight simulation point of view, VOR navigation still commands a valuable place. So what is the VOR system and how does it work? The basic principle the VHF Omnidirectional Range (VOR) navigation system is quite simple. The VOR facility transmits two signals at a time on a set VHF frequency. One signal is constant in all directions, while the other is rotated about the station. The airborne equipment, if installed, receives both signals, calculates the difference between the two signals, and interprets the result as a **radial from** the station. This is a very important point with VOR navigation. The radial signals of a VOR station **always point away from the station**. Therefore, if you are flying away from a VOR station you fly the heading of the radial. If you are flying towards a VOR station you fly the reciprocal heading.

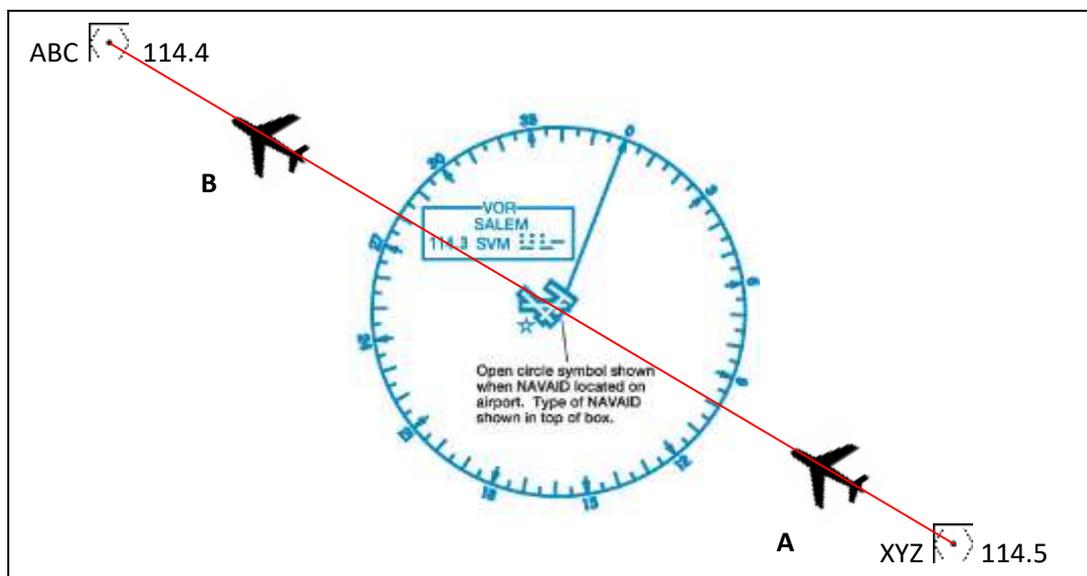


Figure 1: VOR radials Salem Airport

The blue VOR compass rose in figure 1 is for the Salem Airport VOR (SVM) which has a frequency of 114.3. The arrow points towards magnetic north.

Using this example, the aircraft shown in figure 1 is flying on a heading of 280°. If its nav radio was tuned to the Salem VOR, in position A it would be on the 100 radial. In position B it would be on the 280 radial. If

in position A it was tuned to the ABC VOR (114.4) it would still have a heading of 280°, but would be on the 100 radial of ABC; and so on.

Intercepting a radial outbound

Suppose you were flying from Melbourne (YMML) to Sydney (YSSY) departing runway 16. You have entered your flight plan into the GPS and first waypoint is the Eildon Weir (ELW) VOR, frequency 112.30 which is on the 048 degrees radial outbound from the Melbourne VOR. On takeoff your heading will be 161 degrees which will take you away from the outbound radial. So how do you get on track to get to ELW?

In setting up your navigation aids prior to takeoff, you use the course selector to have the Nav 1 needle point to 048 degrees, as shown in figure 2 below. This shows that you will need to make a left turn to fly towards the 048 degree radial.



Figure 2: Navigation settings prior to takeoff

On takeoff then, you climb to a desired altitude, let's say 2,000 feet, and make a standard left turn; but to what heading? If you turn to a heading of 048 degrees, that would take you on a direct track to the ELW VOR. But that's not what you want. You want the **radial** from the Melbourne VOR to the ELW VOR, so you will need to turn to a heading beyond 048. The idea is to intercept the radial at an angle of about forty-five degrees. So you would turn left to a heading of around 030 degrees. If you are on Autopilot at this stage, you would use the Heading Selector knob. See Figure 3



Figure 3: Heading selected as 030°

The GPS can help verify if you have made a turn to a suitable heading. The Course to Steer (CTS) window will tell you which heading to steer to intercept the

radial. In the example shown in Figure 4, the CTS is 023 degrees, as shown on the map below. The CTS will vary according to your distance away from the radial.



Figure 4: The Course to Steer (CTS)

Once established on the 023 degree heading, you can see the changes in both the Multifunction Display (MFD) and GPS windows. The green arrow needle points in the direction of the ELW VOR. The short green line represents the position of the 049 radial in relation to the aircraft. Therefore, in Figure 5 you are to the right or east of the radial. This mirrors what can be seen in the GPS window.



Figure 5: Changes in the MFD and GPS

When approaching the 048 radial you will see the radial location indicator needle move to the right. At this point you need to be ready to make a right turn to a heading of 049 degrees to intercept the radial just before the green lines align. The interception can be achieved by either turning the heading selector to 048 degrees, or, if you are on autopilot, changing from HDG to NAV.



You are now on the 049 radial on your way to the ELW VOR!