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Navigation using ADF (Automatic Direction Finder) or VOR 2 (VHF Omni Radial) equipment

Many of the planes have an automatic heading card for the ADF. That is, the dial of the instrument rotates as you turn and displays the Actual Heading under the Index at the top of the case. For DC-3 Airways, this includes: N1776 TR2; the DDA PH-DDZ and the N1776 TR1 (using the yellow needle in the Radio Magnetic Indicator (RMI) gauge).

Some planes have a manual heading card. With these, you can manually rotate the current Actual Heading to the top of the case. These include: N1776 TR1 (the ADF gauge in the lower left of the instrument panel) and NATS 50819. This one is difficult to use since you must continually rotate the card manually to keep up with the Actual Heading.

And, if you think that one is tough, I've flown older instruments that have a FIXED card. No way to rotate it, so the nose of the airplane was always 0 (zero) degrees and all calculations were relative. That's a lot of math to do in your head.

N1776 TR2 and DDA PH-DDZ have a VOR 2 needle (green) in the RMI instrument. All information about using the ADF also applies to this VOR 2 needle.

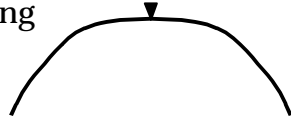
The automatic card makes it easier to solve inbound or outbound radial interception problems.

What is a radial? Radials radiate OUTBOUND from the station so be careful of the terminology. If you want to track outbound on the 045 degree radial, you need a heading of 045 degrees from the station.

To track inbound, you need the reciprocal of the radial. Example: track inbound on a heading of 090 degrees directly to the station. Set 090 as the heading to track, but you are actually flying inbound on the 270-degree radial.

Legend

Top of instrument (ADF or RMI case) with Index (triangle) for the Actual Heading



Tail of
Needle



Head of
Needle



Actual
Heading

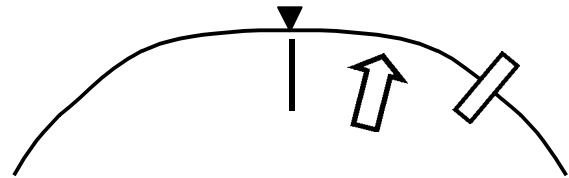
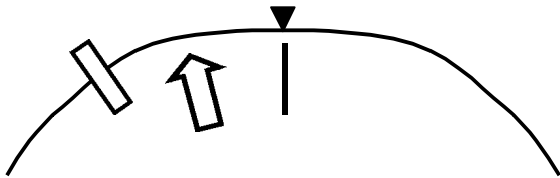


Desired
Heading

**Inbound to the Station**

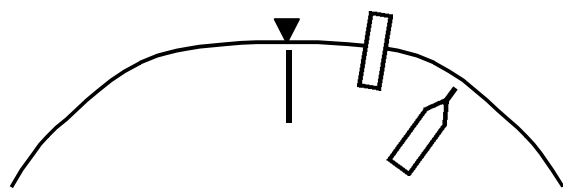
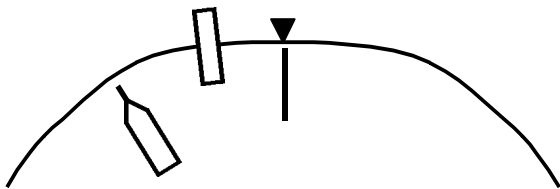
Turn to place the **Head** of the needle **between** the **Desired Heading** and the **Actual Heading**

OR

**Outbound from the Station**

Turn to place the **Desired Heading** **between** the **Tail** of the needle and the **Actual Heading**

OR



On Course: When the Tail (outbound) or Head (inbound) of the needle reaches the Desired Heading, turn to the Desired Heading. You should be tracking the correct radial to or from the station.

Why do I need to be able to track a radial?

Anyone can put the ADF (or the VOR 2) needle on the nose and aim for the station. But, what if ATC issues different directions. ATC may direct you to fly an airway defined as a radial, locate an intersection or destination, etc.

Sometimes it's the only way to locate a destination that has no navigation aid. Your directions may be: track outbound on the 045 degree radial from the XYZ NDB (Non Directional Beacon) for 24 NM (nautical miles). The ADF needle will tell you when you pass the XYZ NDB. Now you intercept the 045-degree radial and fly for, how long? Assume you're IAS (Indicated Air Speed) is 115 knots and you are at a low altitude. You could add about 5 knots to your IAS and get the True Airspeed (TAS). TAS is a no-wind Ground Speed (GS). GS is then 120 knots or two miles per minute. Twenty-four miles would take you 12 minutes. Sure I made the math easy. For more information about TAS and GS, see my monograph on that subject.

What intercept angle should I use?

Inbound and outbound (except for the following paragraph): if you are near, not sitting on top, of the station, you can use 30 to 45 degrees of intercept. You may need more if you must be on the radial before you can -- proceed, descend to a lower altitude, etc.

Station passage, Outbound: Since you are very close to the station, 10 to 15 degrees should put you on the radial in a reasonable time.

How do I roll out on the proper course?

This depends on your distance from the station and how fast the needle is moving. Anticipate the turn and try to arrive at the Desired Heading as the needle (head or tail) reaches that heading also. If you have a large intercept angle, 60 to 80 degrees, cut the intercept angle down when the needle is within 30 or 40 degrees of the Desired Heading.

How do I remember what to put between what?

Try the mnemonics **DNA** (genetic information) and **ADT** (company that sells business and home security systems in the U.S.).

INBOUND: DNA - put the **N**eedle between the **D**esired Heading and the **A**ctual Heading.

OUTBOUND: ADT - put the **D**esired Heading between the **A**ctual Heading and the **T**ail of the needle