Using the HSI and RMI

Presentation Outline

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ADF/RMI Overview

An overview of the Radio Magnetic Indicator (RMI)

Using the ADF

- The ADF head always points directly to the station
  - This is the bearing to the station, relative to the nose of the aircraft
    - 000 = directly ahead 
    - 090 = off the right wing 
    - 180 = directly behind 
    - 270 = off the left wing 

- To determine the magnetic bearing to the station:
  - MH + RB2 = MB2
    - **M**agnetic **H**eading of the aircraft
    - + **R**elative **B**earing TO the station
    - = **M**agnetic **B**earing TO the station

Evolution of the ADF

1. ADF with Fixed Card
   - Displays only the relative bearing to the station
2. ADF with Movable Card
   - Movable card "calculates" the magnetic bearing for you when manually set to the aircraft's heading
     - Card needs to be adjusted every time you change heading
3. Radio Magnetic Indicator (RMI)
   - The "movable card" is linked to the heading indicator
     - The head always shows the magnetic bearing to the station
     - The tail always shows the magnetic bearing (radial) from the station
   - Also referred to as a "bearing pointer", because it always points to the magnetic bearing to the station

Reading an RMI

- RMI head = Magnetic bearing <u>to</u> station
- RMI tail = Magnetic bearing (radial) <u>from</u> station

CDI/HSI Overview

An overview of the Horizontal Situation Indicator (HSI)

Evolution of the CDI

1. CDI
   - Displays the relative position of a selected radial to/from the aircraft
   - Subject to reverse-sensing

2. HSI
   - CDI overlayed on the DG
   - Like an overhead view of the course to fly
   - Eliminates reverse-sensing in most cases

Reading an HSI

- HSI is like an overhead view of your magnetic course to/from the station
  - Selected course rotates with the heading card

Comparison of Navigation Indicators

ADF/RMI, CDI/HSI

ADF vs RMI

ADF

- Head points directly to the station, relative to the aircraft
- Displays the absolute relative bearing to the station
  - Requires some mental math to determine the magnetic course to fly

RMI

- Head still points directly to the station, relative to the aircraft
- Displays the magnetic bearing to the station
  - The course to/from the station is directly read off the instrument

CDI vs HSI

CDI

- When course is set correctly, shows the position of the selected radial relative to the nose of the aircraft
- Prone to reverse-sensing if set incorrectly

HSI

- Behaves like an early form of the GPS moving map, showing an overhead view of the aircraft relative to the selected course
- Since the course is shown directly on the heading indicator, it's much easier to avoid reverse sensing

RMI vs HSI

RMI

- Useful for overall situational awareness
  - Directly points to where the selected station is, relative to the aircraft
- Lack of a course selection bug means slightly more mental effort required to track a course

HSI

- Useful for determining intercept angles to a course, and for visualizing the wind correction angle
- During strong crosswinds, the CDI will not be near vertical so it may seem harder to track a course
  - Picture it as an overhead view, like a GPS moving map display

Practical Example

Example Overview

1. Intercept the 210 radial to a station, starting south-west of the radial
2. Track the 210 radial to the station
3. Cross over the station
4. Track the 030 radial from the station (reciprocal of 210/TO)
5. Turn to intercept the 090 radial from the station
6. Track the 090 radial outbound

- Wind: from 120 @ 25 kts
- TAS: 110 kts

1) Intercepting TO a station

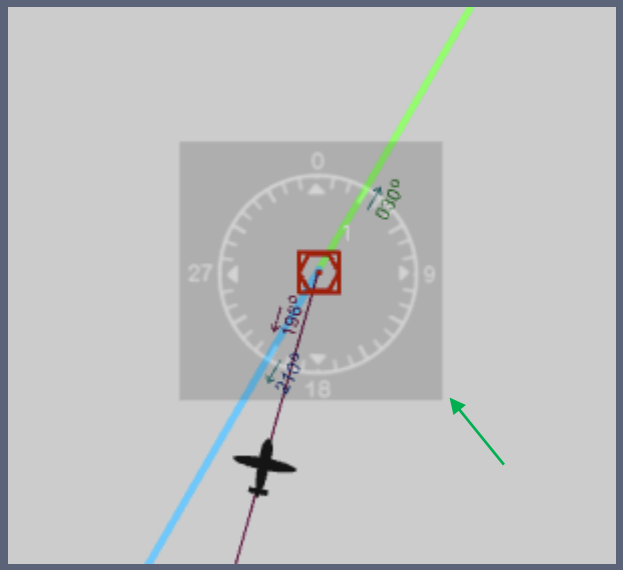
On the 195 radial, intercept the 210 radial inbound

RB = 004

004 + 011 = 015

MB = 015

MH = 011



OBS = 030 (TO)

2) Tracking TO a station

Tracking the 210 radial inbound

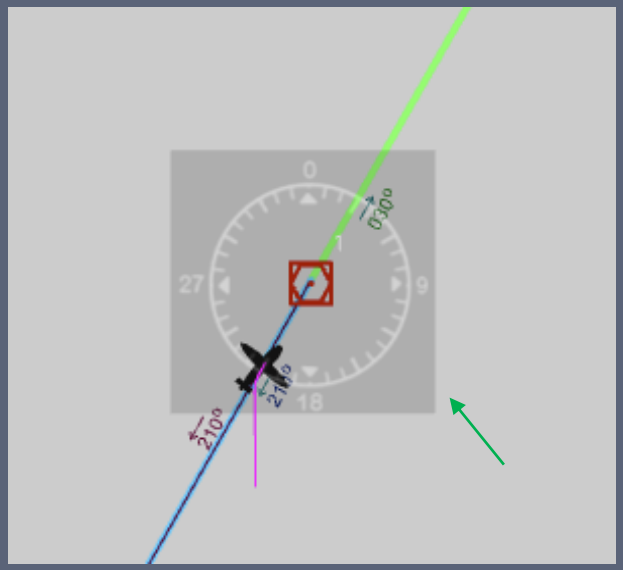
RB = 347 (-13)

347 + 043 = 390

390 - 360 = 030

MB = 030

MH = 043



OBS = 030 (TO)

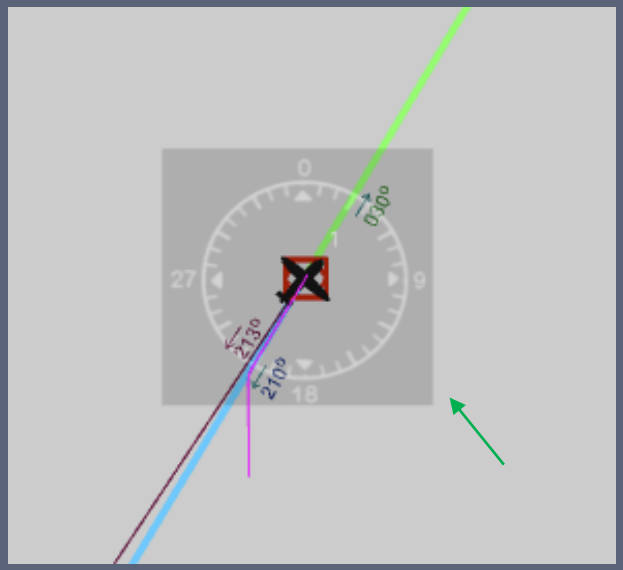
3) Crossing a station

Crossing over the station

No direct indication of crossing the station

MH = 043

Cone of confusion



NAV flag when crossing the station

4) Tracking FROM a station

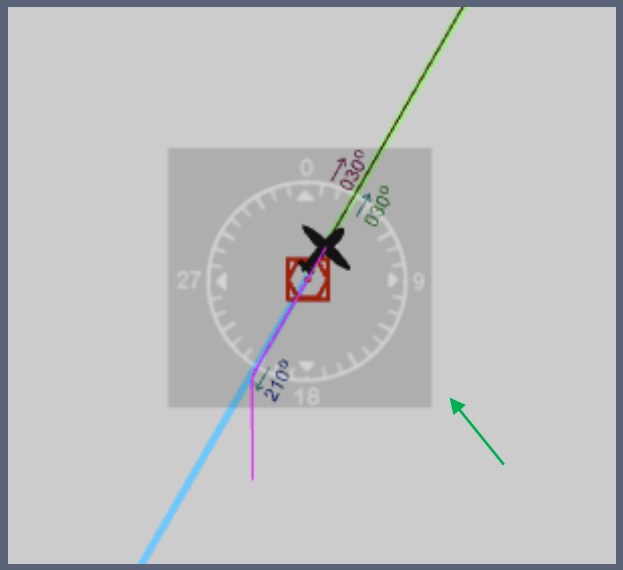
Tracking the 030 radial outbound

RB = 167

167 + 043 = 210

MB = 210

MH = 043



OBS = 030 (FROM)

5) Intercepting FROM a station

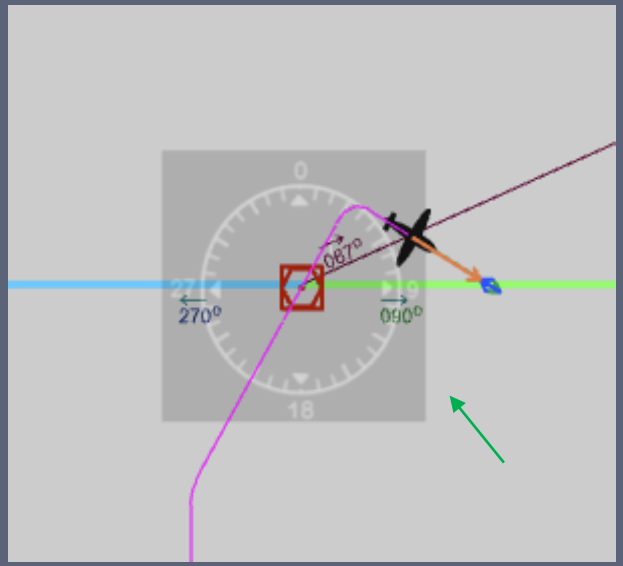
From the 030 radial, intercept the 090 radial outbound

RB = 120

120 + 120 = 240

MB = 240

MH = 120



OBS = 090 (FROM)

6) Tracking FROM a station

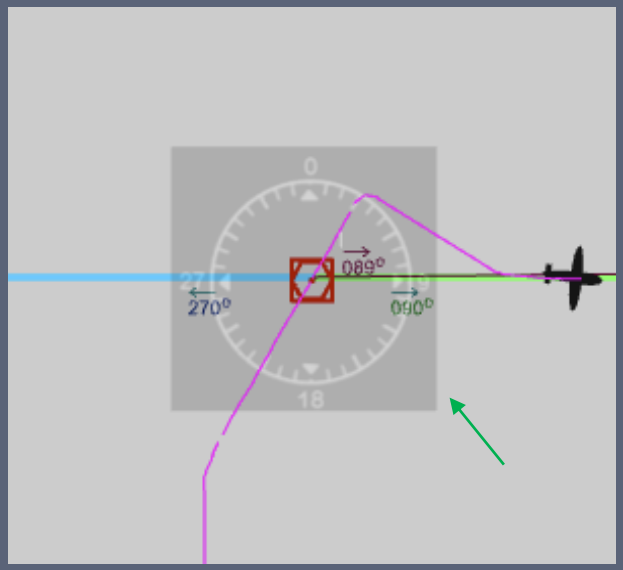
Tracking the 090 radial outbound

RB = 173

173 + 097 = 270

MB = 270

MH = 097



OBS = 090 (FROM)

Garmin GI-275

GI-275 HSI with Bearing Pointers

Garmin Profiles with Bearing Pointers

Profile	Bearing Pointer 1	Bearing Pointer 2
Simple	-none-	NAV 2
Advanced	GPS 1	NAV 2
Full	NAV 1	NAV 2
SVT Simple	-none-	NAV 2
SVT Advanced	GPS 1	NAV 2
SVT Full	NAV 1	NAV 2

- Bearing pointer 2 always points to the #2 NAV
  - In the case of 07B, there is no #2 NAV CDI, so a bearing pointer is the only way to get a cross-radial
- HSI can use the #1 GPS or NAV, or #2 GPS or NAV as its source
- Bearing pointer source is independent from the HSI source