VICTORIA FLYING CLUB

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- Bookings, Questions

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Instrument Flying

- Review Instruments and Human Limitations
- Definition and Motivation
- *Basic* **Instrument Flying**
- **Full Panel**, **Partial Panel**, **Unusual Attitudes**
- *Basic* **Radio** and **Satellite Navigation**
- Summary and Questions
- Pre-Flight Briefing

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Review Human Limitations

- How do visual, vestibular and kinesthetic senses provides us with cues for orientation?
- Explain the mnemonic IMSAFE and how individual components affect our flying performance?
- How does hypoxia affect our flying performance and what can be contributing factors?

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Definition and Motivation

- Flying by **reference** to **instruments** *only*
- Human **senses** are prone to **miss-interpretation**
- Instrument flying overcomes human limitations
- Essential skill for higher ratings and flight in IMC

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Basic Analog Instruments

- **Control** Instruments – Pilot **Input** (Attitude & Power)
- **Performance** Instruments – Aircraft **Response**
- *Attitude plus Power equals Performance*
- **Navigation** Instruments – **Lateral** and **Vertical**

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Glass Cockpit Instrumentation

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Radial Scan

- Adjust **attitude** and **power** for *estimated* **performance**
- Scan **performance** instruments for actual response
- Re-adjust and **trim controls**, and **scan** *systematically*

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Attitudes and Movements

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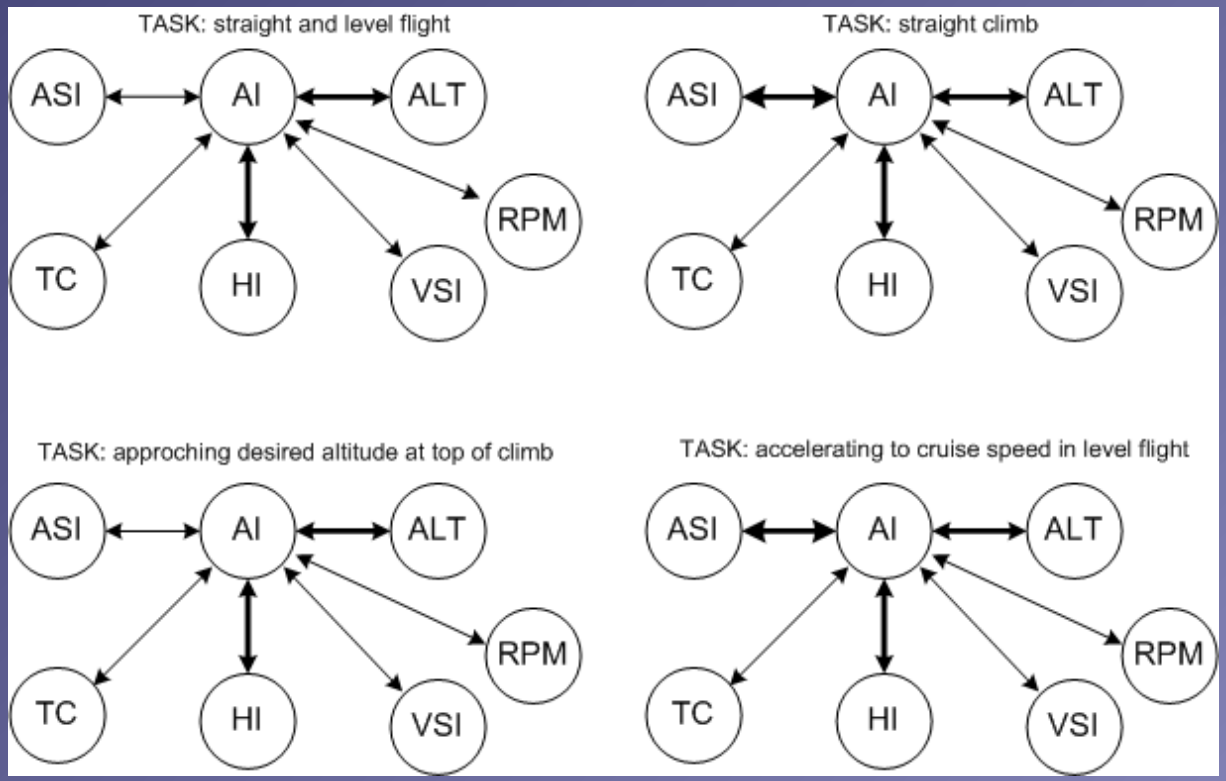
Review Instruments

- Which are the standard instruments that are driven by gyroscopes and how do gyroscopic instruments they operate?
- What errors can be expected with gyroscopic instruments and how do they occur?
- Which are the standard instruments that rely on air pressure and how do they operate?
- What errors can be expected with pressure instruments and how do they occur?

Selective Radial Scan – Definition



- Each maneuver requires *particular* **performance**
- **Scanning** pattern should **prioritize** *accordingly*
- Selective scan should *not* lead to fixation

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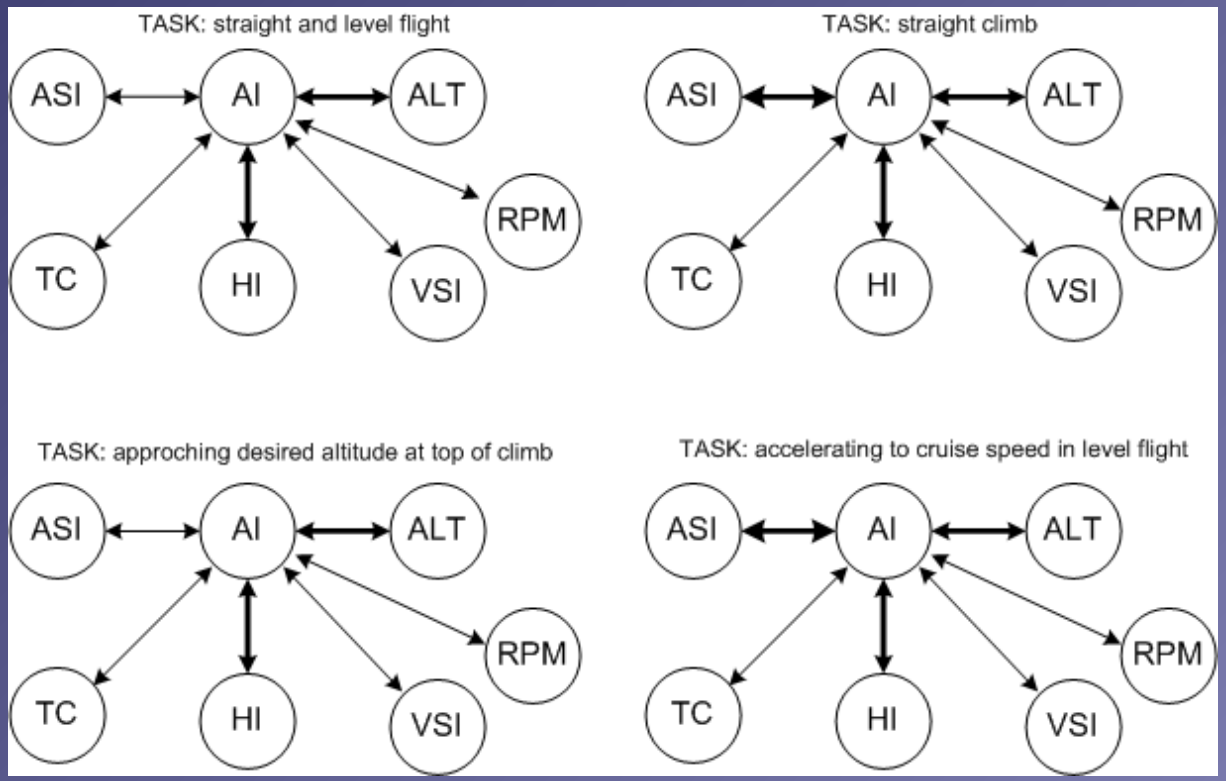
Selective Radial Scan – Method



- What **information** do I need?
- Which **instruments** give me the needed information?
- Is the information **reliable**?

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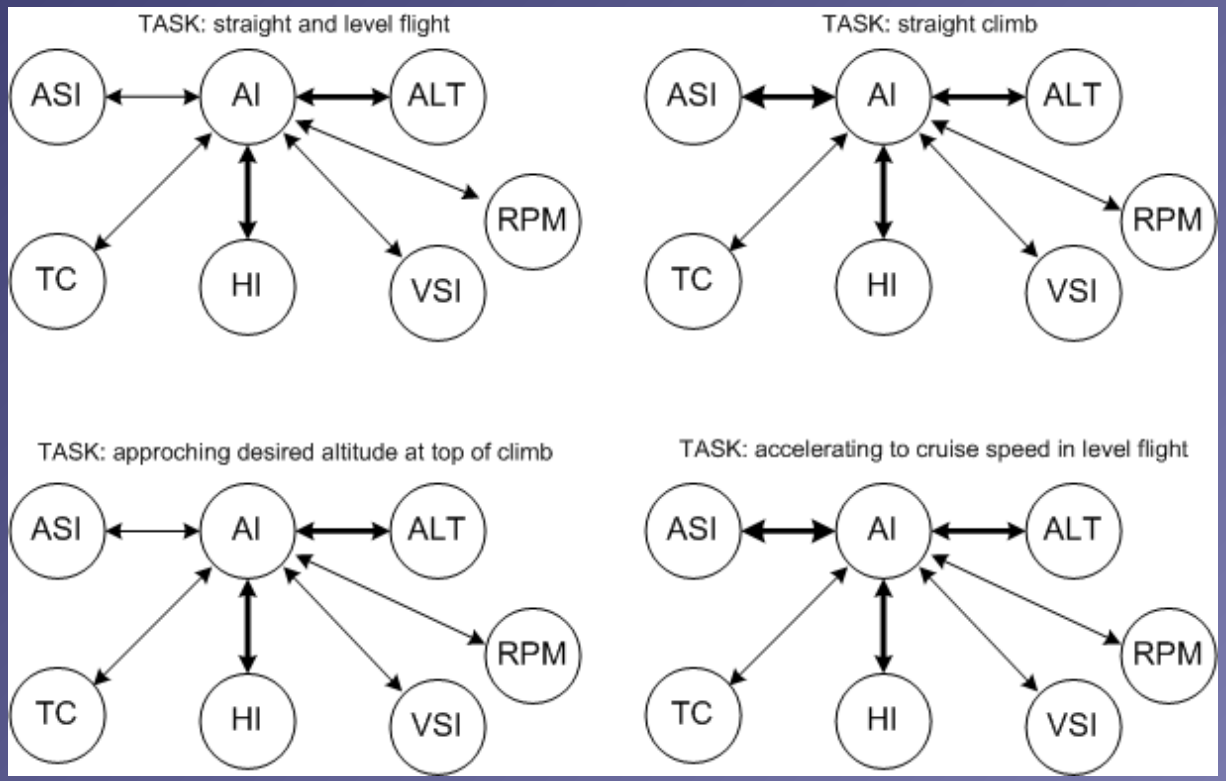
Selective Radial Scan – Method



- Which instruments need to remain **constant**?
- Which instruments need to **change** and at what **rate**?
- Which instrument **lag** can be expected?

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Straight and Level Flight

- *Attitude plus Power equals Performance*
- Remember the **power curve** for adjustments
- Scan **altimeter** and **heading** indicator *more frequently*

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Climbing and Descending

Straight Climb / Descent

- Climbing – **attitude**, **power**, **trim** (**APT**)
- Descending – **power**, **attitude**, **trim** (**PAT**)
- Scan **airspeed** and **heading** indicator *more frequently*

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Leveling Off

- Scan **altimeter** and **heading** indicator *more frequently* when approaching desired altitude
- Increase **airspeed** indicator scan during transition to straight and level flight

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Turns

- Perform standard – **rate one** – turns at ***3 °/s***
- Establish and adjust bank angle at ***IAS / 10 + 7***
- Lead the desired heading using ***half bank angle***

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Safety Considerations

- Check **airspace clear** with instructor before maneuvers
- Particularly ensure clear during instrument **turns**
- Student: *“All clear left (right)?”*
- Instructor: *“All clear left (right)!”*

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Full Panel – Summary / Quiz

- What instrument *directly* indicates an immediate attitude change?
- How do the altimeter and airspeed indicators *indirectly* indicate nose-up / down attitude changes? Why do these instrument not serve as primary indicators for attitude changes?
- How does apparent precession affect the heading indicator and how it has to be corrected?

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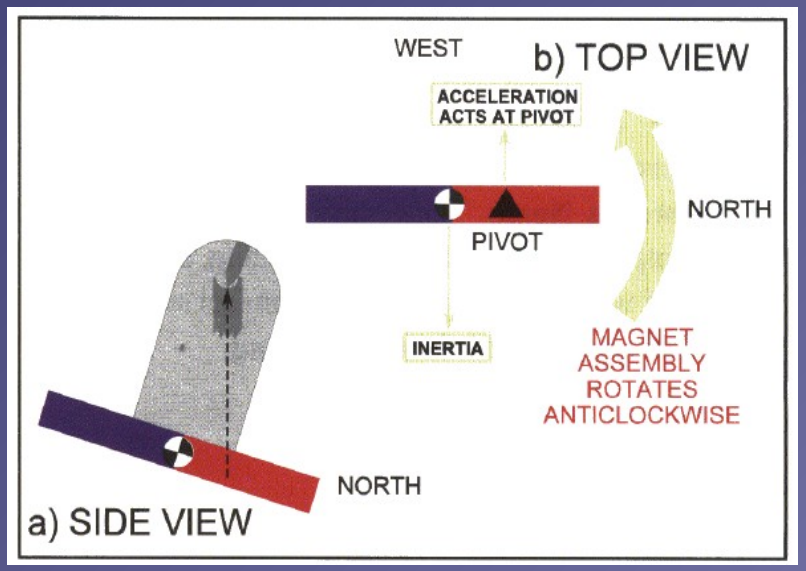
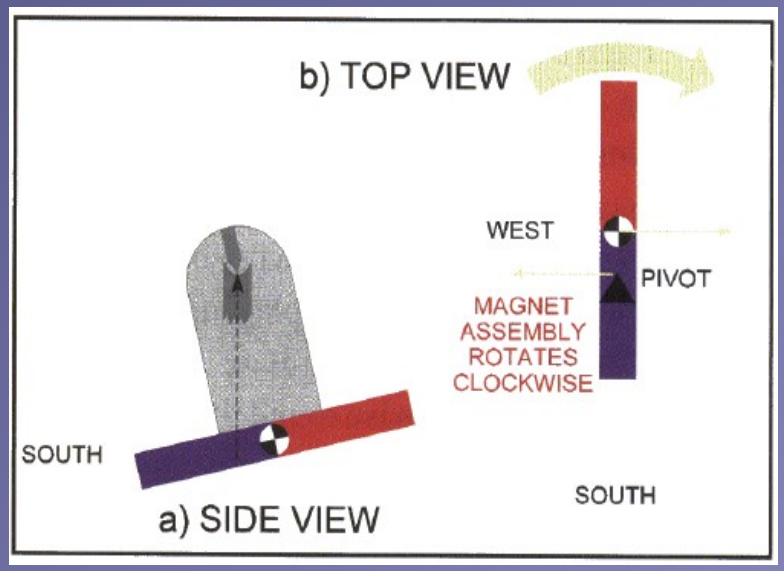
Partial Panel

- **Attitude** and **heading** indicator *not available*
- *Indirect* attitude and more attention to **TC** / **TBI** and **MC**
- Focus on **timing** in turns due to **magnetic dip** errors

Magnetic Dip





- Magnetic dip is the reason for dip errors (acceleration / deceleration, turning)
- Magnetic dip shifts the **pivot** point away from the magnet's **center of gravity**

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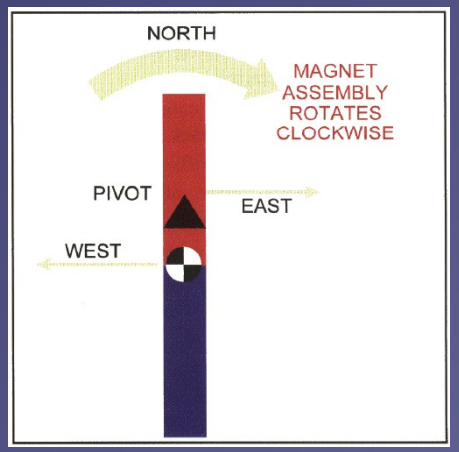
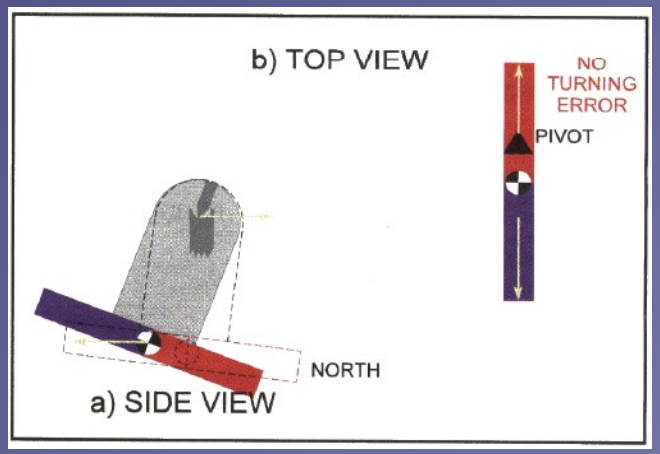
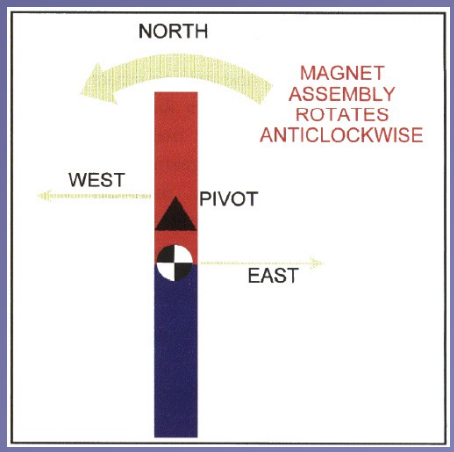
Acceleration/Deceleration Errors







- **A**ccelerate **N**orth **D**ecelerate **S**outh (**ANDS**)
- Opposite behavior on the southern hemisphere
- *More* pronounced on easterly / westerly headings
- *Less* pronounced on northerly / southerly headings

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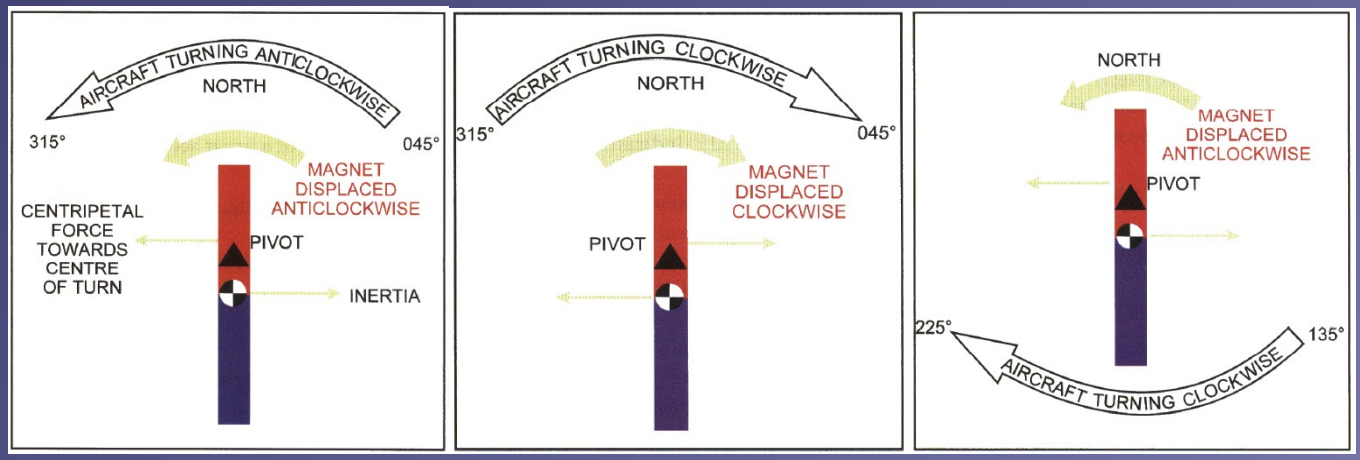
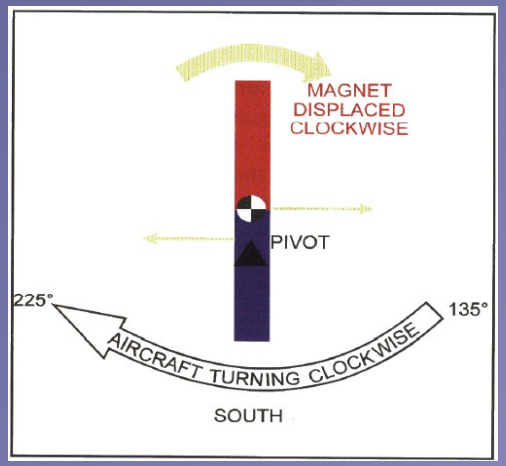
Turning Errors





- **U**ndershoot **N**orth **O**vershoot **S**outh (**UNOS**)
- Opposite behavior on the southern hemisphere
- *More* pronounced on northerly and southerly turns
- *Less* pronounced on easterly and westerly turns

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Partial Panel – Straight and Level

- Maintain **coordinated** and **straight** with **TC** and crosscheck **MC** *occasionally*
- Scan **altimeter** and **VSI** *more frequently* (level)

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Partial Panel – Climbs and Descents

- Maintain **coordinated** and **straight** with **TC**
- Scan **airspeed** indicator *more frequently* (stable)

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Partial Panel – Leveling Off

- Maintain **coordinated** and **straight** with **TC**
- Scan **altimeter** *more frequently* (desired altitude)
- Increase **airspeed** indicator scan during transition

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Partial Panel – Turns

- Scan **altimeter** and **airspeed** indicator *more frequently*
- Timed **rate one** turns – ***3 °/s***
- ***360° → 120s, 180° → 60s, 90° → 30s, 45° → 15s***

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Partial Panel – Summary Quiz

- What instruments are not available in a partial panel and what type of error might be the cause?
- During a turn from south to east you notice what type of magnetic compass error and why?
- Mentally perform a straight climb with partial panel and describe all observations and required actions.
- Mentally perform a 90° coordinated rate one turn with partial panel and describe all observations and required actions.

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Unusual Attitudes Recovery

- Nose-Up Attitude
  - **Full Power**
  - **Forward Pressure**
  - **Wings Level**
- Nose-Down Attitude
  - **Power Idle**
  - **Wings Level**
  - **Back Pressure**

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Unusual Attitudes – Summary Quiz

- Which instruments should be disregarded during the recovery from unusual attitudes and why?
- Mentally determine and perform a recovery from an unusual nose-up attitude and state all observations and required actions.
- Mentally determine and perform a recovery from an unusual nose-down attitude and state all observations and required actions.

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Review NDB Radio Navigation

- How do Non-directional Radio Beacons (NDBs) support en-route navigation?
- How do we determine whether or not a NDB station is serviceable?
- What errors can be expected when using NDBs?

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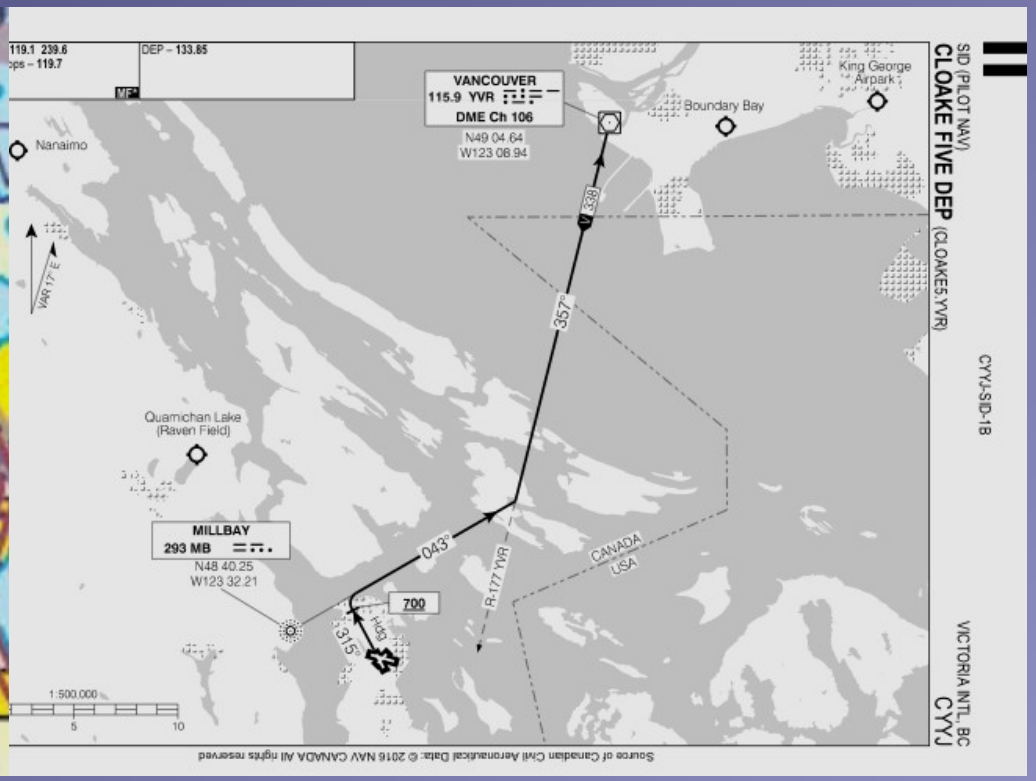
Motivation



- Navigational Support / Backup and Procedures
- *Homing*, *Tracking*, *Intercepts*, SIDs, STARs

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Using the NDB Overview

- ***190*** to ***1750 kHz*** – LF/MF *non* line-of-sight propagation
- Sensitive to aircraft position and heading
- Indicates **relative bearing** on the *fixed card* **ADF**
- **Tune** in **frequency** and **Identify** station **morse code**
- **Check relative bearing** to (**BTS**) or from (**BFS**) the station

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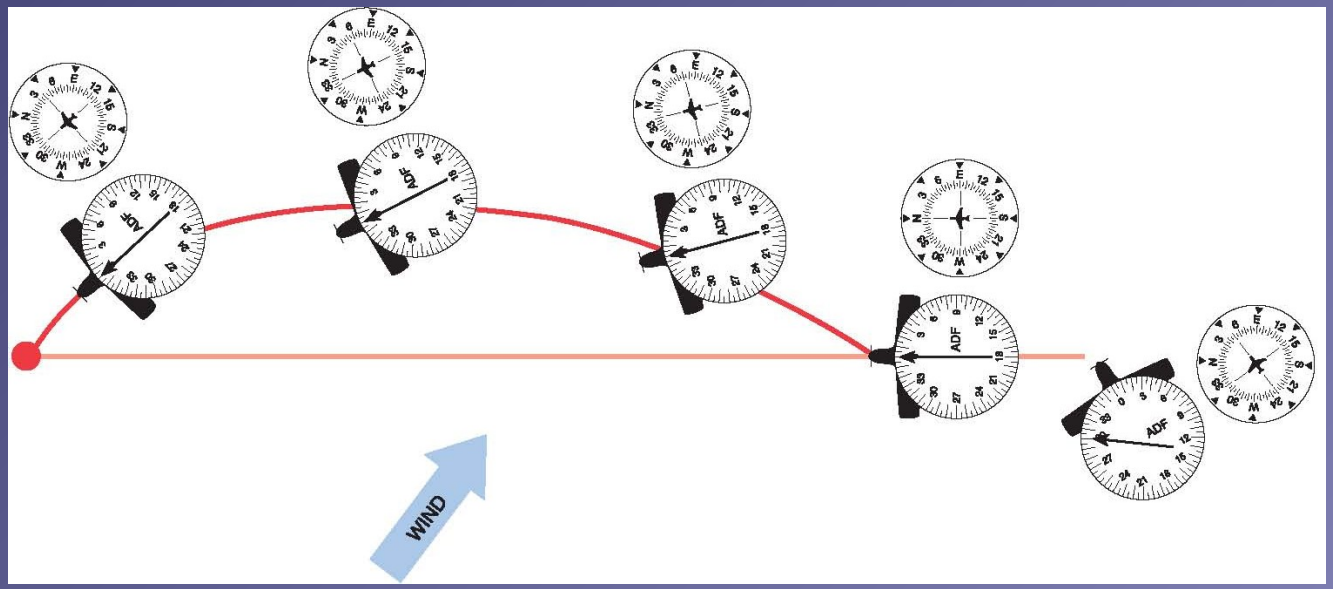
NDB Homing



- **Tune** station **frequency**
- **Identify** station **morse code**
- **Turn** to (*RB = 0*) station (*MB = RB + MH*) – project onto HI
- **Correct** heading as necessary to **maintain RB**
- *Chase the arrow*

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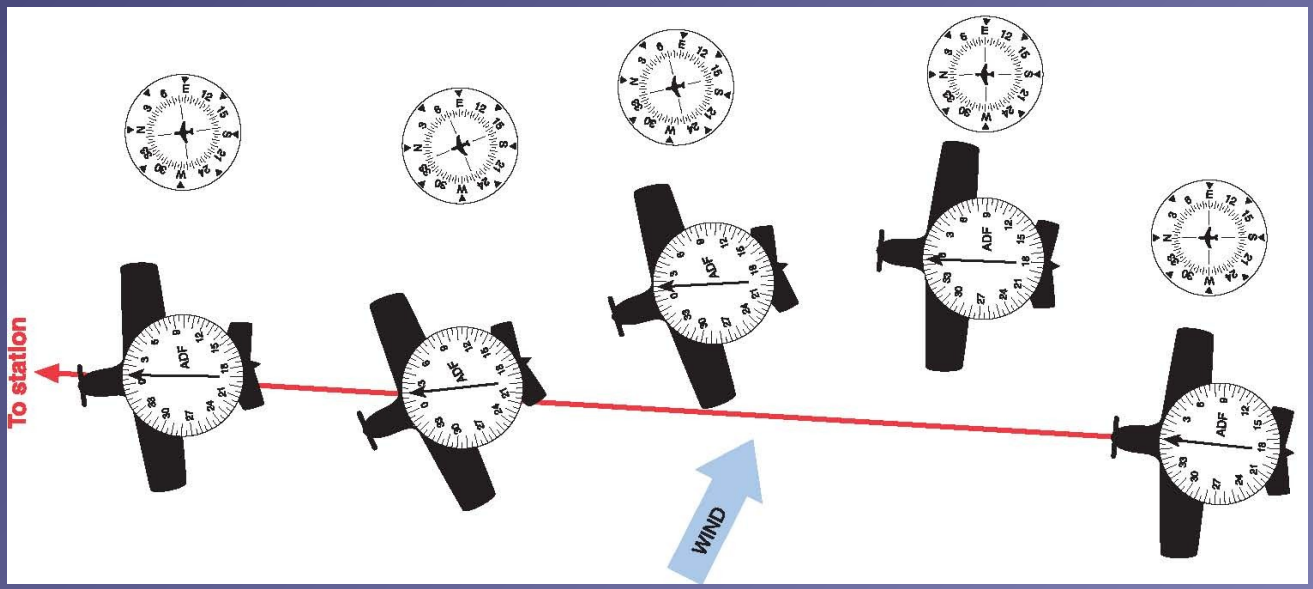
NDB Tracking



- **Tune** station **frequency**
- **Identify** station **morse code**
- **Turn** to (***RB = 0***) / from (***RB = 180***) station (***MB = RB + MH***)
- **Correct** heading as necessary to **maintain MB**
- *Push the arrow* (inbound), *pull the tail* (outbound)

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NDB Intercepts

- **Tune** station **frequency**
- **Identify** station **morse code**
- **Turn** parallel to *desired* **magnetic bearing** (BTS, BFS)
- **Crosscheck** inbound or outbound intercept
- *Push the arrow* (inbound), *pull the tail* (outbound) to *desired* **magnetic bearing** using **intercept angle** (***90°***)
- **Turn** onto *desired* **magnetic bearing** and continue **tracking**

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NDB Intercept 180 BTS Inbound

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NDB Intercept 360 BFS Outbound

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Review VOR Radio Navigation

- How do VHF Omnidirectional Radio Ranges (VORs) support en-route navigation?
- How do we determine whether or not a VOR station is serviceable?
- What errors can be expected when using VORs?

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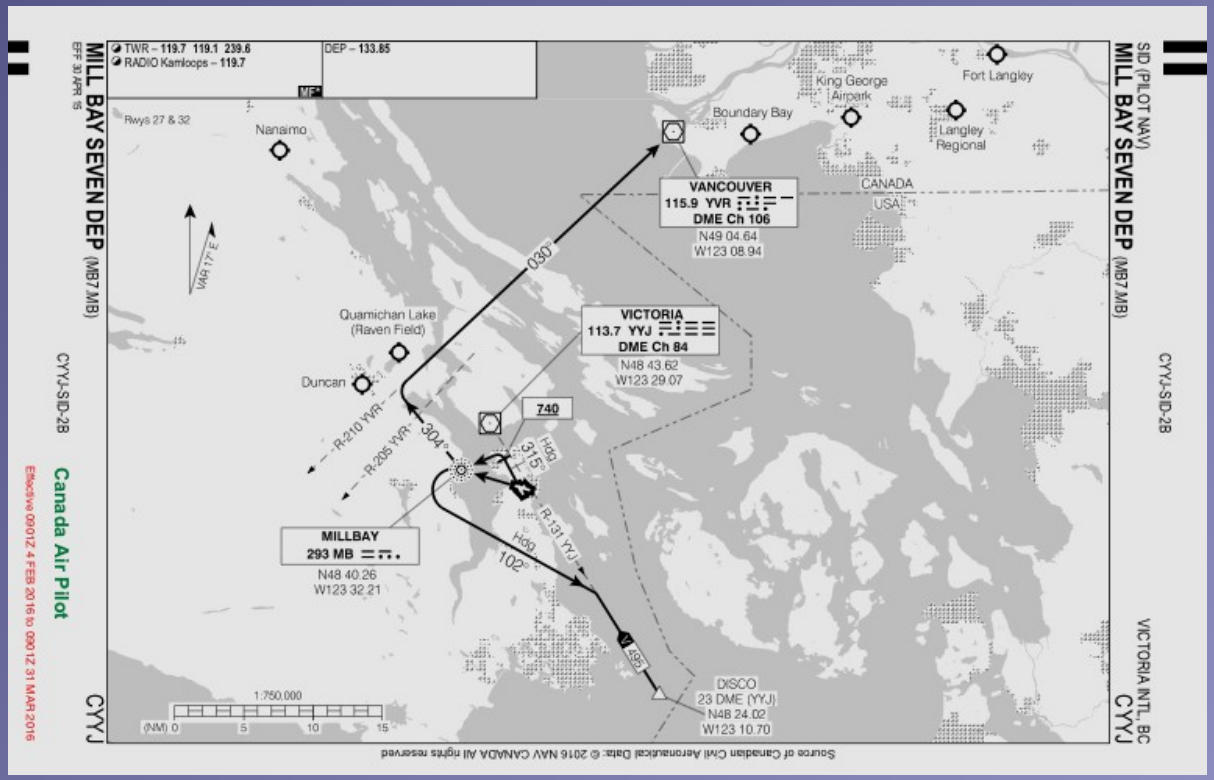
Motivation



- Navigational Support / Backup and Procedures
- *Tracking*, *Intercepts*, SIDs, STARs

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Using the VOR Overview

- ***108.1*** to ***117.95 MHz*** – VHF line of sight propagation
- Sensitive to aircraft position but *not* aircraft heading
- Indicates radial deviation and sector – **CDI**, **TO/FROM**/OFF
- **Tune** in **frequency** and **Identify** station **morse code**
- **Select** desired (magnetic) **radial** using the **OBS**

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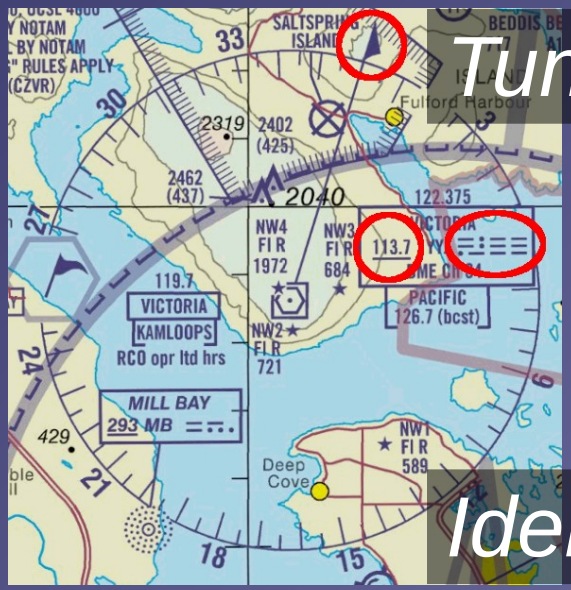
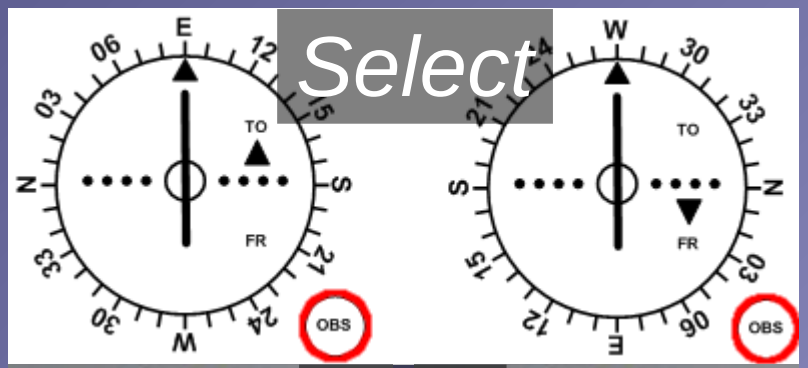
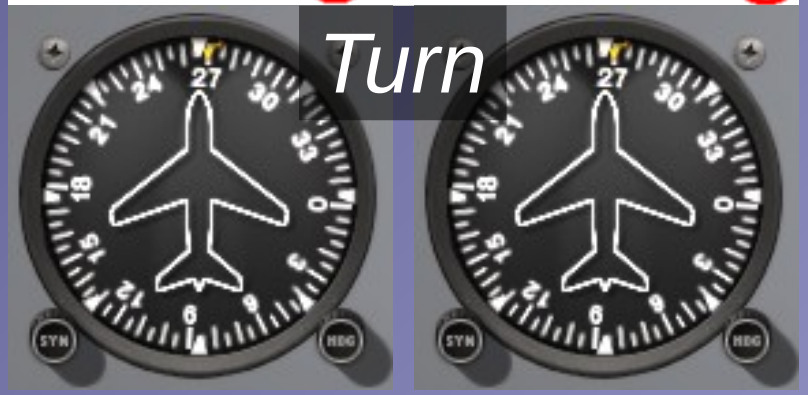
VOR Tracking







- **Tune** station **frequency**
- **Identify** station **morse code**
- **Select** **OBS radial** for **centered CDI** with **TO** / **FROM** indication
- **Turn** to / from station using found **OBS radial** *inbound* / *outbound*
- **Correct** for wind depending on method – **homing** or **tracking**

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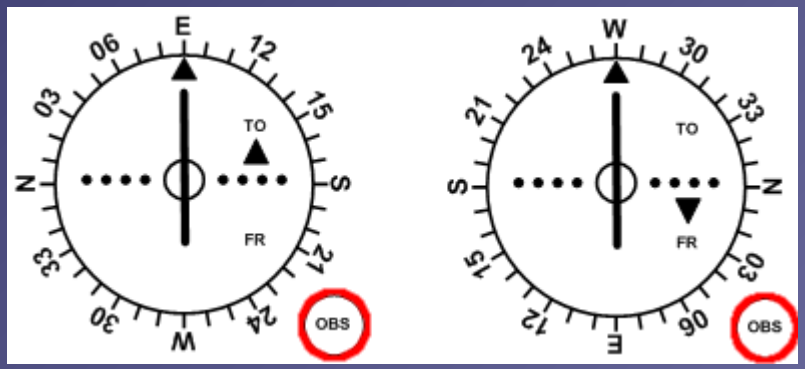
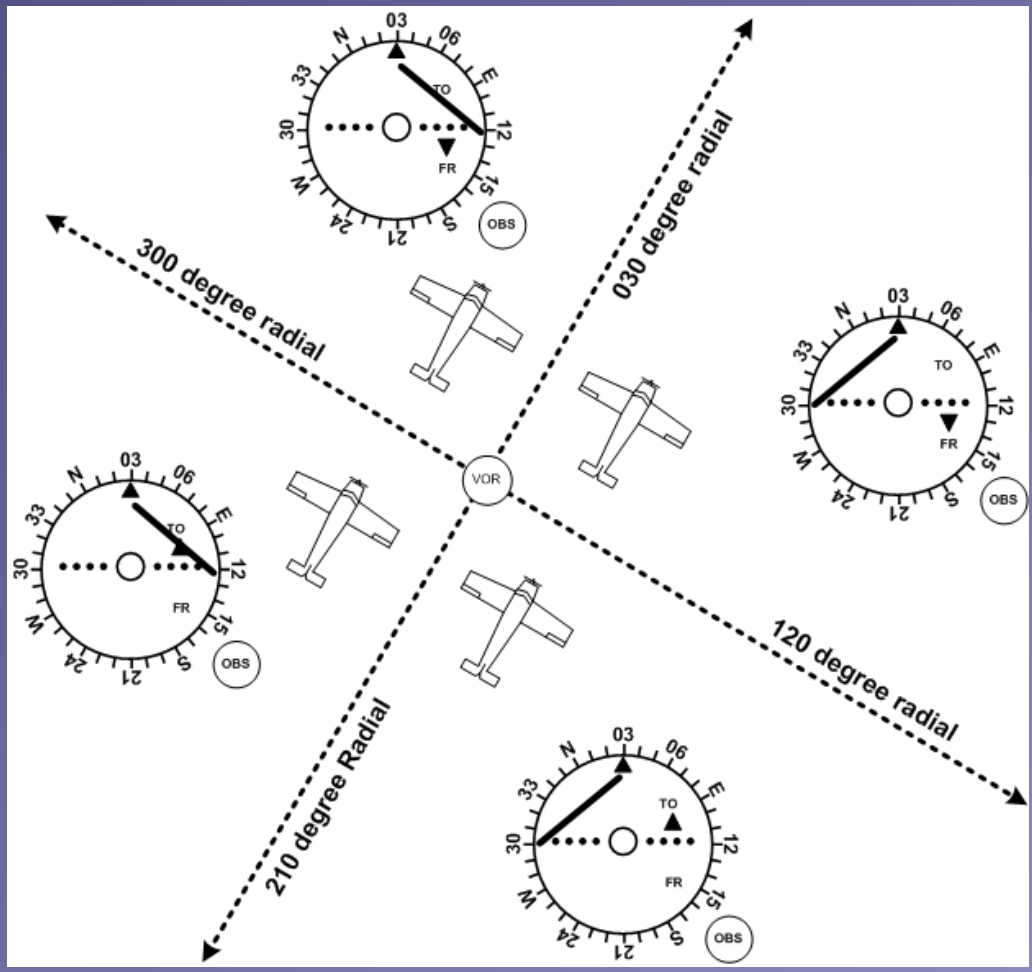
VOR Intercepts





- **Tune** station **frequency**
- **Identify** station **morse code**
- **Select** **OBS intercept radial** *inbound* or *outbound*
- **Check** **CDI** *left* or *right* and *subtract* or *add* **intercept angle**
- **Turn** to **intercept heading**
- **Check** **CDI** *alive* and anticipate **turn** onto **intercept radial**

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VOR Intercept Radial 360 Inbound

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VOR Intercept Radial 180 Outbound

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Satellite Navigation

- Modern GNSS receivers provide *many* functions – always consult the applicable user manual
- **Direct-To**, **Flight Planning**, **Reversal**, **Radials**
- Always ensure correct **database** and **navigation source** for your navigation instruments

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G530 Direct To Function (1)

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G530 Direct To Function (2)

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G530 Direct To Function (3)

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G530 Direct To Function (4)

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G530 Direct To Function (5)

VICTORIA FLYING CLUB

G530 Direct To Function (6)

VICTORIA FLYING CLUB

G530 Flight Planning (1)

VICTORIA FLYING CLUB

G530 Flight Planning (2)

VICTORIA FLYING CLUB

G530 Flight Planning (3)

VICTORIA FLYING CLUB

G530 Flight Planning (4)

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G530 Flight Planning (5)

VICTORIA FLYING CLUB

G530 Flight Planning (6)

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G530 Flight Planning (7)

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G530 Flight Planning (8)

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Learn and Practice

- Get NAV/GNNS **simulators** and learn playing with the features – *www.garmin.com*
- Knowing the features makes you a more proficient pilot and causes *less* **distraction** in the cockpit
- Let NAV/GNNS support you not distract you
- Visual navigation remains your primary means of navigation – *always* **maintain VFR**

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Satellite Navigation – Summary / Quiz

- What are the most common functions of a GNSS user interface?
- Why has the database of a GNSS receiver to be up-to-date?
- The GNSS user interface can be complex and distracting. What are the consequences for using it as a navigational aid?
- How do we check and predict the GPS integrity?
- Why is it important to always check the correct navigation source?

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Pre-Flight Briefing

- Exercise
- Training Area
- Departure and Arrival Procedures
- Weather Briefing / NOTAMs
- Aircraft and Documents
- Time and Fuel Requirements
- Safety Considerations and Responsibilities

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Instrument Flying (Ex. 24, LP. ?)

- Objective
- Review
- Motivation
- Howto
- Summary / Questions
- Preflight Briefing