

# Fundamentals of Instrument Flying

taken from: Indiana State University

*Modified by GA White*

# 3 Fundamentals of Instrument Flying

- Cross check (scan)
- Interpretation
- Aircraft Control
  
- Let's look at each in more depth



# Scan

- There are several methods to instrument scan- select the one which works for you
- Hub and spoke
- Left to Right- text style
- Combination of each



# Scan ctn.

- Some common errors :
- Fixation
- Omission
- Emphasis



# Interpretation

- Interpretation involves ascertaining exactly what the instrument is telling you
- A knowledge of how each instrument functions is helpful here ie:
  - Does an AI indication in the blue mean a climbing aircraft?
  - Does an altimeter which is unwinding indicate a nose down pitch?



# Control

- The physical step in instrument flying- can't happen without good cross-check and good interpretation.
- Instrument flying should be done with a light touch- two fingers and a thumb
- The three most important factors in aircraft control are: TRIM, TRIM AND TRIM!

# Two concepts common to instrument flight

- Primary/support concept- Traditional, FAA preferred.
  - 1 instrument provides the pilot with primary information along the three dimensions of pitch, bank, and power.
  - Other instruments support the primary instrument



# Two concepts ctn.

- The second method is the concept of control-performance.
  - Heavily used in the military and in the airlines when flying heavy aircraft
  - This method relies heavily on the AI
- The FAA does not advise this in most small aircraft due to the imprecise readings the AI provides





# Primary/support concept

- Divides the panel into instruments of:
  - Pitch
  - Bank
  - Power
- Each instruments vary from primary to supporting depending upon aircraft configuration



# Primary Instruments

- The instrument which provides the most essential information during a given flight condition
- The supporting instruments help maintain the indications on the primary instruments
- Best method for light aircraft as it best prepares a pilot for failure of one instrument (esp. the AI)
- The AI is always primary during transition from S&L flight



# Let's examine this concept further:

- In straight & Level flight Primary Pitch, Bank & Power is:
  - Pitch- Altimeter
  - Bank- Heading Indicator
  - Power- Airspeed Indicator

# S&L flight

- Supporting instruments (pitch, bank, & power):
  - Pitch- VSI, AI, ASI
  - Bank- TC AI
  - Power- Tach. MAP gauge
- It is important to note that despite AI fixation (which is a common error) the AI is not a primary instrument in S&L and is rarely a primary instrument



# Level Turning Flight

- Primary pitch, bank, and power is:
  - Pitch- Altimeter
  - Bank- TC
  - Power- ASI
- Supporting pitch, bank, and power is:
  - Pitch- VSI, AI, ASI
  - Bank- TC AI
  - Power- Tach. MAP



# Constant Rate Straight Climbs

- Primary (PBP):
  - VSI, HI, ASI
  - Supporting (PBP):
  - ALT, ASI, AI/ TC, AI/ Tach



# Constant Airspeed Straight Climbs

- Primary (PBP):
  - ASI, HI, Tach, MAP
  - Supporting (PBP):
  - AI, VSI, ALT./ TC, AI/ ASI



# Constant Rate Straight Descents

- Primary (PBP):
  - Pitch- VSI
  - Bank- HI
  - Power- ASI
- Supporting (PBP):
  - Pitch- ALT, ASI, AI
  - Bank- TC, AI
  - Power- Tach.



# Constant Airspeed Straight Descents

- Primary (PBP)-
  - Pitch- ASI
  - HI
  - Tach.
- Supporting (PBP):
  - Pitch- AI, VSI, ALT.
  - Bank- TC, AI
  - Power- AS



# Constant Rate Climbing Turn

- Primary (PBP):
- VSI, TC, ASI



# Constant Airspeed Climbing Turn

- Primary (PBP):
- ASI, TC, Tach



# Constant Rate Descending Turn

- Primary (PBP):
- VSI, TC, ASI



# Constant Airspeed Descending Turn

- Primary (PBP):
- ASI, TC, Tach.



# Identifying Failures

- Maintain Scan & interpretation- reject the erroneous one or group
- Carry covers
- Pitot Static system failures were covered in section A



# Gyroscopic Failures

- Can present in a variety of ways (often subtle):
  - HI or AI can begin to indicate a slow turn
  - May become erratic in their indications
  - Failures may be intermittent and therefore more difficult to catch
  - Can request “No Gyro” handling by ATC



# Partial Panel Flight

Whenever the term partial panel is used it typically refers to flight with no gyros.

- This typically leaves us with the ALT, ASI, TC, VSI, and the Mag. Compass
- When this happens, make slow changes, your transition instrument is lost
- Make all turns  $\frac{1}{2}$  standard rate on the TC





# Partial Panel Ctn.

- Establish turns with the TC
- Make pitch changes with VSI, ASI, & ALT
- Pitch control will be most difficult
- Remember not to fixate
- Increase your scan rate



# Unusual attitude recovery

- Nose High
  - Add power
  - Forward pressure on yoke
  - Correct any bank
  - Return to level flight



# Unusual attitude recovery ctn.

- Nose Low:
  - Reduce power
  - Level wings
  - Recover from dive
  - Return to level flight



# Partial Panel Unusual Attitudes

- Use the TC to indicate turn direction
- Use the Pitot-Static Instruments for pitch indications (passing through level flight when the indications reverse).
  - Hold pitch and wait for the indications to stabilize



# Partial Panel Stalls

- Reduce the Angle of Attack (AOA)
- Power to max. allowable
- Center the BALL!

# Control/Performance Method of Instrument Flight

- “Power + Attitude = Performance”
- Establish the desired pitch & bank attitude
- Set power as necessary (as per specific aircraft) to maintain performance
- Relies heavily on the AI as large aircraft have 1 to 2 back up AI's
- Modified for small aircraft to develop Power/Airspeed *presets* for Low Cruise, High Cruise, Cruise Climb & Descent, and Approach

# Control Performance Method (modified for small aircraft)

Flight Regime	RPM	ASI
Low Cruise		
High Cruise		
Low Cruise Descent		
High Cruise Descent		
Low Cruise Climb		
High Cruise Climb		
Climb ( $V_y$ )		
Approach		



QUESTIONS?