Flight Lesson: Advanced Four Fundamentals

Definitions:

- ***Four Fundamentals*** : Straight-and-Level, climbs, descents, turns

Objectives:

1. To understand the instruments, the functions they perform, and how to use that information to perform the four fundamentals precisely.

Justification:

1. The instruments are used for many maneuvers required for the Private Pilot checkride.
2. In cross-country flights, students must fly headings, and altitudes precisely using the instruments.

Schedule:

Activity	Est. Time
Ground	0.75
Preflight/Taxi	0.25
Flight	1.0
Debrief	0.25
Total	2.25

Recommended Readings:

PHAK	Chapter 4: 4-1 to 4-22
	Chapter 7: 7-1 to 7-11, 7-15 to 7-26
AFH	Chapter 3: 3-13 to 3-19

Elements Ground:

- Explanation of instruments
  - airspeed indicator
  - attitude indicator
  - altimeter
  - turn coordinator
  - directional gyro (heading indicator)
  - vertical speed indicator
- how will each of the four fundamentals look?

Elements Air:

- straight-and-level
- climb
- descent
- turns (left and right)
- mix and match

Completion Standards:

1. When the student is able to transition between the four fundamentals, using and understanding the instrument readings, with minimal assistance from the instructor.

Common Errors:

- student focuses on instruments too much

Presentation Ground:

Explanation of Instruments

1. airspeed indicator
   (1) *:instrument that indicates how fast the aircraft is moving through the air*
   (2) This instrument "lags" behind real time (as do all pitot-static instruments). It is the #2 lagger.
   (3) Relationship to 4 F's
      i. Can indicate climbs or descents
      ii. If power has not changed, and the airspeed has or is changing, this indicates a change in attitude. It can be either a climb or descent.
2. attitude indicator
   (1) *:gyroscopic instrument that provides a visual representation of the aircrafts attitude with respect to the horizon.*
   (2) The property of a gyroscopic instrument is that it maintains rigidity in space. Therefore, the little plane moves around the horizon.
   (3) Mini-plane on mini-horizon. brown = ground, blue = sky
   (4) Relationship to 4 F's
      i. during turns it gives an accurate reading of bank angle. This will be necessary for maneuvers later.
      ii. If the mini-plane is level on the mini-horizon, and the mini-plane is adjusted correctly, then the real plane is actually level, or close to it.
3. altimeter
   (1) *:instrument that measures the height of the aircraft above a given reference plane, such as Mean Sea Level (MSL)*
   (2) reads in 100's, 1000's, (and 10,000's)
   (3) gives a near real-time indication of altitude above sea-level is set properly.
   (4) This instrument is a pitot-static system instrument, and thus lags, but does so the least of all P-S system instruments.
   (5) Relationship to 4 F's
      i. If needle is not moving, the aircraft is level
      ii.if reading is increasing you are in a climb, if it's decreasing you are in a descent.
4. turn coordinator
   (1) *:gyroscopic instrument that displays the aircraft's rate of turn and quality of turn (amount of rudder and aileron coordination)*
   (2) ball indicates quality of turn (coordination)
   (3) miniature plan indicates "bank angle" and rate of turn
   (4) Relationship to 4 F's
      i. indicates level attitude (laterally), and indicates amount of bank (to a certain extent)
5. directional gyro (heading indicator)
   (1) *:gyroscopic instrument that indicates the aircraft's heading with respect to a 360-degree compass azimuth card*
   (2) Relationship to 4 F's
      i. When the plane is coordinated and the DG is not moving, the plane is level to the horizon (in terms of bank)
      ii. Indicates turns (or lack of)

iii. To figure out which way the plane is turning, imagine the DG as a view from above, and the card is the land rotating below.

6. vertical speed indicator

(1) *:pitot-static instrument that measures and displays the rate of change in altitude*

(2) Reads in 100's of feet. Climb is up, descend is down

(3) This instrument is a trend instrument. It lags behind real time the most.

(4) Relationship to 4 F's

i. indicates climb and descent trends, and rate of climb or descent

How will this look?

1. give examples of certain attitudes. both from the window view, and instrument view.

2. Primary instrument is the instrument which you use to check for a certain attitude confirmation. It is the instrument that remains constant.

(1) straight-and-level

i. *primary* straight - DG

ii. *primary* level - Altimeter

iii. *supporting* level - VSI

(2) climb

i. *primary* straight - DG

ii. *primary* climb - airspeed indicator (Vy)

iii. *supporting* climb - altimeter, VSI

(3) descent

i. *primary* straight - DG

ii. *primary* descent - VSI

iii. *supporting* descent - altimeter

(4) turn

i. *primary* bank - attitude indicator

ii.*primary* level - altimeter

iii. *supporting* level - VSI

iv. *supporting* turn - DG

3. **Remember** that the focus is still visual references to during maneuvers. The instruments are useful to back up what we see out our windows.

Presentation Air:

1. straight-and-level
   (1) Use instruments as well as visual references to continue straight-and-level.
   (2) note how instruments look (the six pack)
2. climb
   (1) pitch - climb attitude
   (2) power - full
   (3) trim - to hold climb attitude
   (4) note instruments as well as visual references (the six pack)
3. descent
   (1) power - 2100 RPM
   (2) pitch - let nose fall
   (3) trim - if necessary
   (4) note instruments (the six pack)
4. turns (left and right)
   (1) note instruments as well as visual references
   (2) watch coordination and bank especially
5. Mix and Match
   (1) climbing turn
   (2) descending turn