Primary Flight Display (PFD)

I. Before you read:

What information do pilots need to monitor during different portions of flight?

II. Read the text quickly and answer the question: What is PFD and what is its role?

A PFD presents information about primary flight instruments, navigation instruments, and the status of the flight in one integrated display. Some systems include **powerplant** information and other systems information in the same display. Flight instrument presentations on a PFD differ from conventional instrumentation not only in format, but sometimes in location as well. Airspeed and **altitude** indications are presented on vertical tape displays that appear on the left and right sides of the primary flight display. The vertical speed indicator is depicted using conventional analog presentation. Turn coordination is shown using a segmented triangle near the top of the **attitude** indicator. The rate-of-turn indicator appears as a curved line display at the top of the heading/navigation instrument in the lower half of the PFD.
The PFD is not intended to change the fundamental way in which you scan your instruments during attitude instrument flying. The PFD supports the same familiar control and performance, or primary and supporting methods you use with conventional flight instruments. For example, when using the primary and supporting method to maintain level flight, the **altimeter** is still the primary instrument for pitch, while the attitude indicator is a direct indicator and the vertical speed indicator provides supporting information. However, you need to train your eyes to find and interpret these instruments in their new formats and locations.
The primary flight instruments that appear on a PFD are driven by instrument sensor systems that are more sophisticated than conventional instrument systems. The attitude of the aircraft may be measured using microelectronic sensors that are more sensitive and reliable than traditional gyroscopic instruments. These sensors measure pitch, roll, and yaw movements away from a known reference attitude. Aircraft heading may be determined using a magnetic direction-sensing device such as a **magnetometer** or a magnetic **flux valve**.
Attitude and heading systems are typically bundled together as an attitude heading reference system (AHRS), which contains not only the sensors used to measure attitude and heading, but also a computer that accepts sensor inputs and performs calculations. Some AHRSs must be initialized on the ground prior to departure. The initialization procedure allows the system to establish a reference attitude used as a **benchmark** for all future attitude changes. As in any navigation system, attitude heading reference systems **accumulate** error over time. For this reason, AHRSs continually correct themselves, using periods of stable flight to make small corrections to the reference attitude. The system's ability to correct itself can be **diminished** during prolonged periods of turbulence. Some AHRSs can be reinitialized in flight, while others cannot. The pilot must become familiar with the operating procedures and capabilities of a particular system.
Information on altitude and airspeed is provided by sensors that measure static and ram air pressure. An air data computer (ADC) combines those air pressure and temperature sensors with a computer processor that is capable of calculating pressure altitude, **indicated airspeed**, vertical speed, and **true airspeed**. An air data attitude heading reference system (ADAHRS) combines all of the systems previously described into one integrated unit.

III. Read the text again and decide if the following statements are true or false. Be ready to justify your answers.

1. All PFDs display information about engine parameters. T / F
2. The PFD aims to completely transform the fashion in which pilots use the instrument data. T / F
3. The instrument sensors systems used with PFDs are more intricate than the traditional ones. T / F
4. Gyroscopic instruments are as dependable as microelectronic ones. T / F
5. AHRS's only role is to display the information about the attitude and heading. T / F
6. Turbulent weather conditions may have a negative influence on the AHRS's ability to fix itself. T / F

IV. Looking back at the text label the PFD of a Boeing 737-300 with the following items:

tape display for airspeed tape display for altitude turn coordination
rate of turn vertical speed

V. Match the words in bold in the text with the following definitions.

1. _____ - an engine and related parts supplying the motive power of a self-propelled object
2. _____ - the position of the aircraft in the air in relation to the horizon
3. _____ - a point of reference from which measurements may be made
4. _____ - the vertical distance between an aircraft, or a point or a level, and mean sea-level
5. _____ - to increase gradually in quantity or number
6. _____ - the speed of the aircraft relative to the airmass in which it is flying
7. _____ - airspeed used for controlling the aircraft during taxiing, takeoff, climb, descent, approach or landing
8. _____ - a radio instrument for measuring vertical distance or altitude
9. _____ - to become or to make something become smaller, weaker, etc.
10. _____ - an instrument used to detect the presence of a metallic object or to measure the intensity of a magnetic field
11. _____ - a sensitive detector that receives an electrical signal from the earth's magnetic field and directs it to an amplifier and then into a gyro-stabilized compass indicator

VI. Complete the sentences with some of the words from the previous exercise. You may need to change the form of the word.

1. Angle of attack will vary with changes in engine speed and aircraft _____.

2. By replacing the Rotax engine with a four-stroke Jabiru _____, the aircraft designers claim the aircraft will be provided with more power and increased all-round performance.

3. _____ is the true measure of aircraft performance in cruise, thus it is the speed listed in aircraft specifications.

4. The pilot looked at the _____ to check the altitude.

5. Ice seems to be _____ on the leading edge of the wing.

VII. Speaking

Discuss the role of the PFD on modern aircraft and its advantages and disadvantages.